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A Study of Land Capital and Local Development Dynamics Within Rural Contexts

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Part I

Research Design and Framework

Chapter 1

Introduction

1.1 Land and Local Development

Does it make sense nowadays to consider land as a factor potentially capable of influencing local socio-economic development?

The answer to this question requires two preliminary steps. First, it is crucial to clarify the contemporary meaning of land by retracing how its concept and role have developed throughout the history of economic thought. Second, it is necessary to provide a brief framework on the key elements of the local development paradigm. Only then will it be possible to properly respond to this question. Let us begin by addressing the former point and leave the latter for a subsequent stage of the discussion.

Given its unique characteristics, raw land (see Definition 1) has played a significant role in certain phases of the development of the economic thought, representing a special economic category (Parrinello & Cecchi, 1982). In a world primarily driven by agricultural activities, the French Physiocrats, in the seminal works of François Quesnay (1758)¹ and Richard Cantillon (1755)², recognize it as the primary source of all the value³ created in the economic system, thereby regarding it as an essential resource for sustaining national economic growth and ensuring its continuous reproduction (Mazzucato, 2018; Parrinello & Cecchi, 1982).

After that, the socioeconomic and technological paradigm shift triggered by the First Industrial Revolution leads to considering additional fundamental factors of production. In fact, classical economists—Ricardo, Smith, and Marx—identify other two further ones besides land: namely, capital and labour. Although they exhibit modest divergences in their interpretation of the rules governing macroeconomic development, all classical thinkers agree in recognising raw land as a distinct economic category, associating with it a specific distributive variable: economic rent (see Definition 2). Thus, within the classical framework, land—separate from other factors of production—primarily emerges as what has been known since Ricardo onwards as Rent Theory.

In this way, it loses its role as the primary source of all value and instead assumes that of a mechanism for altering income distribution, which, in turn, may also hamper economic growth (Mazzucato, 2018). Specifically, land rent, according to Ricardo (1776c), is “*that part of the product of the land which is paid to the owner as compensation for the use of its original and indestructible powers*” (Ricardo, 1776c). Classical economists clearly

¹Quesnay, F. (1758). *Le Tableau Économique*. London, Macmillan.

²Cantillon, R. (1755). *Essai sur la nature du commerce en général*. London, Fletcher Gyles.

³At the heart of the Physiocrats’ concept of value lies the production of new goods and services (Mazzucato, 2018). In the words of Cantillon (1755), as cited by Parrinello and Cecchi (1982), “*land is the source or material from which wealth is derived ... wealth is nothing but the nourishment, comforts, and pleasures of life*” (Parrinello & Cecchi, 1982).

demonstrate that this surplus for landowners arises from the combination of land's fixed supply curve (owing to its non-reproducible nature) and the increase in its demand, mainly driven at the time by the growing request for agricultural foodstuffs. Landholders therefore do not directly contribute to this surplus; rather, it results from the erosion of a portion of the profit generated by the capitalist class.⁴ This dynamic, in turn, undermines capital accumulation, which is considered in classical thought as the primary driver of economic growth (González, 2015; Parrinello & Cecchi, 1982).

Definition 1. Raw Land

In the economic literature, land is commonly considered in its original state, as a raw material, a “*free gift of nature*” (Marshall, 1920/2013), with peculiar features. In brief, it can be defined as a natural agent with what Ricardo (1776c) presents as “*original and inherent*” properties. Specifically, it has an innate productive power, independent of human action (Ricardo, 1776c). It is indestructible, except in extreme cases (e.g. coastal erosion), and is also immobile and non-transferable (Serpieri, 1940). It is an original resource that is unproduced and non-reproducible (Ricardo, 1776c). Its availability is therefore fixed; in economic terms, it has an inelastic supply curve, which implies that increases in land demand may lead to situations of scarcity (Jacobs, 2010; Parrinello & Cecchi, 1982). Moreover, land is a source of material wealth (Christophers, 2020; Dale, 1997), and, as the physical space upon which life develops over time, it constitutes “*the primary condition of anything that man can do*” (Marshall, 1920/2013). In this sense, it is also the location of socio-economic organizations and the context of their spatial relationships (Camagni, 1998). From this point of view, according to different uses, it is a non-homogeneous asset, both in terms of its natural fertility—determined by diverse local organoleptic, biological, and morphological characteristics—and in terms of its spatial positioning, which relates to key socio-economic landmarks and surrounding elements (Camagni, 1998). Finally, it is a resource system that encompasses the natural resources, such as water or trees (Ostrom, 1990). Specifically, according to Georgescu-Roegen (1971)^a, as cited in Parrinello and Cecchi (1982), land is an *underlying elements*; that is, it is not inert but actively integrates other commonly referenced natural resources (usually considered *flow elements*) into productive and ecological processes.

^a Georgescu-Roegen, N. (1971). *The Entropy Law and the Economic Process*. Cambridge: MA, Harvard University Press.

With the development of neoclassical thinking—embodied in the works of Menger, Walras, Wieser, and Clark, among others, as cited by Dooley (1991)—this distinctive characteristic of raw land is weakened, suggesting a loss of identity for this factor within economic theory (Parrinello & Cecchi, 1982). In fact, the introduction of the time variable in the economic analysis demonstrates that all factors, including reproducible ones, can—under specific circumstances—receive a portion of their remuneration comparable to rent, at least in the short term. Neoclassical models therefore still continue to associate land with a

⁴In the classical political economy view, the capitalist class refers to those who own the means of production, primarily capital, and who, through production and accumulation, generate a surplus that takes the form of profit (Basile & Cecchi, 2001).

mechanism of alteration in income distribution, but emphasise that such properties, under specific conditions, may also be attributed to the other productive factors (Mazzucato, 2018; Mollard et al., 2001).

Definition 2. Economic Rent

Economic rent is the remuneration received by any asset or good with a limited, or nearly inelastic, supply curve above its production price (Camagni, 1998). Although Rent Theory has, since its origins, focused primarily on land, the latter “*is not a unique fact, but simply the chief species of a large genus of economic phenomena; and [...] is no isolated economic doctrine, but merely one of the chief applications of a particular corollary from the general theory of demand and supply*” (Marshall, 1920/2013, p. 523).

Despite this, Alfred Marshall (1842–1924), while developing the foundations of marginalist theory in his *Principles of Economics* (First Edition, 1890), reveals a certain continuity with the classical tradition (Dooley, 1991; Konzelmann et al., 2025). In doing so, he offers further insights into the economic conceptualisation of land. Specifically, in his view, land is still a *sui generis* factor—a permanent source of utility⁵—capable, along with the other productive factors, “*of contributing to the creation of the national income*” (Marshall, 1920/2013, p. 66). At the same time, while still grounding his reasoning in the classical distinction between factors—“*those material things which owe their usefulness to human labour being classed under capital, and those which owe nothing to it being classed as land*” (Marshall, 1920/2013, p. 120)—he blurs this clear-cut separation by showing how human interventions alter the nature of raw land. In addition to its original and inherent properties (i.e., those outlined in Definition 1), land also acquires artificial ones. Indeed, he notes that in his time—and even more so today—the contemporary shape of land is the result of human labour and improvements realised over time (Marshall, 1920/2013, p. 122). This transformation, in turn, affect the classical concept of rent, or what he refers to as *true rent*, which, becomes increasingly difficult to encounter in the strict sense, as we shall further explore in Chapter 2 (Dooley, 1991; Marshall, 1920/2013, p. 350).

This perspective demands deeper reflections to clarify the current nature of the explanatory variable under examination. Indeed, although some scholars have criticised these insights, pointing to apparent contradictions⁶ (McCaffrey, 2025), it is instead the author’s

⁵In the marginalist perspective, the value of a good lies in the utility it is capable of providing to the buyer or user. Accordingly, the price reflects this utility and, consequently, the value of the good itself (Mazzucato, 2018).

⁶We refer here chiefly to what McCaffrey (2025) describes as the Fetter–Marshall dispute. Without entering into the details of the discussion, as this lies beyond the scope of the present argument, and referring to McCaffrey (2025) for any further insights, it should be recalled that, in Fetter’s view, the Marshallian concept of land was criticised, among other aspects, for remaining too close to the classical narrative, but also

opinion that the suggestions of Marshall (1920/2013) enrich economic theory in interpreting the contemporary form of land and its role in development processes. More precisely, by adopting a broader and more dynamic view of socio-economic mechanisms, at the juncture between the classical and neoclassical perspectives, Marshall (1920/2013) underscores that land remains a key factor in the dynamics of socio-economic development, closely interrelated with capital and labour. In affirming this, the classical clear-cut separation between the productive factors is therefore nuanced and this opens the door to further reflections on the definition of land—as a natural agent no longer strictly separated from capital—and on its role in development processes. Given the lack of a structured scientific debate on this issue (Christophers, 2016), it appears necessary to further elaborate by addressing the following question: *What is the most appropriate concept of land for the current economic debate?*

Addressing this issue is crucial both to synthesise the current configuration of the elements under analysis and to strengthen economic theory, whose explanatory power ultimately rests on its ability to account for the diversity of real-world situations (Ostrom, 1990). This matter is examined in the following section.

1.1.1 From Land to Land Capital

Some theoretical and empirical evidence raises questions about the suitability of the traditional, classical notion of raw land, which is widely adopted in economic literature, to capture the complexity of land's contemporary form and, consequently, its role in current development processes. Let us take a quick look at some of these contributions.

As aforementioned, Marshall (1920/2013) observes that, already by the late 19th century, human action and labour had transformed the soil in the European *old settled countries*, softening the classical clear-cut distinction between land and capital. In this sense, he suggests that the current form of land owes much of its character to human intervention, and that “*all that lies just below [and above] the surface has in it a large element of capital*” (Marshall, 1920/2013, p. 122).

Similarly, even Marx (1867)⁷, as reported by Harvey (1982), explores the interaction between the application of capital to land. In doing so, he challenges the Ricardian view of rent as a payment solely for the “*original and indestructible*” powers of the soil. Indeed, he recognizes how the application of capital affects the productivity of land. Specifically, in an initial stage, this process blurs the distinction between interest on capital and rent, and

for the interconnections with capital that Marshall revealed.

⁷Marx, K. (1867). *Das Kapital: Kritik der politischen Ökonomie. Erster Band. Der Produktionsprozeß des Kapitals*. Hamburg: Verlag von Otto Meissner.

later, once the investment is amortised, the productivity engendered by capital coincides with land's natural productivity, hence swells the rent (González, 2015; Harvey, 1982).

Not only does Harvey (1982), building on Marx's analysis and his notion of *fictitious capital*, draw on these arguments to show how, in capitalist societies, land is increasingly conceived as a financial asset, to which financial interests and investment capital are progressively attached, thereby influencing its value. In this sense, a similar blurring between rent and interest can also be observed in the case of financial investments in land, not directly tied to productive dynamics, but shaped by (often speculative) expectations and manoeuvres concerning future land values (Christophers, 2016). From this perspective, Christophers (2016) argues that land, rather than being understood as a *fictitious* form of capital, can be more convincingly interpreted as a real one⁸(Christophers, 2016).

Another keen scholar, Carlo Cattaneo (1801–1869), writing in the mid-19th century about his homeland—Lombardy, Italy—observed that the land itself was no longer solely the result of nature but rather the product of human labour and investment, defining it more properly as an *artificial homeland* (Cattaneo, 1845/2019). On this point, Cattaneo (1845/2019) writes:

“The capacity of this land to feed a population, if referred solely to its natural and wild fertility, would amount to merely one-tenth of such a value. That land, therefore, for nine-tenths is not the result of Nature; it is the product of our hands; it is an artificial homeland” (Cattaneo, 1845/2019, p.32, translation by the author).

This transformation is further empirically confirmed by data on current land use and consumption. In Europe, for instance, although 40% of the land surface is covered by forests and semi-natural environments (European Environment Agency, 2024), only 3% of that area—equivalent to 1.2% of the total European land—can be classified as primary or old-growth forests, i.e., forests that follow natural dynamics, exist in their original condition, and remain largely untouched by human interference (Barredo et al., 2021).

⁸The idea of land as *fictitious capital* can be traced back to Harvey (1982), building on Marx (1867). In Marx's framework, fictitious capital primarily refers to financial capital, which are not directly invested in production (Christophers, 2016). Building on this, Harvey (1982) extends the concept to land, arguing that under capitalism land is increasingly intertwined with financial and credit relations (e.g. through its role as collateral in mortgage markets) and thus comes to resemble a financial asset (Harvey, 1982; Ryan-Collins et al., 2017). However, Christophers (2016) challenges this interpretation, arguing that land should not be understood as merely fictitious. Rather, despite its forward-looking valuation—which may depart from a classical understanding of value as rooted in human labour—land constitutes a form of real capital, as its value remains materially grounded and embedded in broader social and economic relations. From this perspective, the distinction between fictitious and real capital becomes less analytically useful for understanding the role of land in contemporary capitalism (Christophers, 2016).

The contemporary form of land thus appears to resemble that of a natural agent, with its own original and intrinsic characteristics (as discussed in Definition 1), while also incorporating permanent portions of capital represented by lasting land improvements and investments. These diverse betterments inherently result from interactions with human labour and progress, as land is, by definition, the space upon which life develops over time (Marshall, 1920/2013). This statement, with some exceptions, represented by extremely uninhabitable areas, such as deserts or polar regions, appears even more relevant when considering advanced economies, which are the main focus of this study. Recognising this, and in an effort to define a broader concept of land that reflects the multifaceted nature it has acquired over time, we intersect with the disciplinary framework of agricultural economics. At the heart of this tradition, in fact, lies the concept of land capital, which, as Serpieri (1940) explains, stems from the idea that:

“ [land] as soon as it ceases to be a collecting activity, i.e., gathering wild products, it is no longer raw land: it is land that has been more or less extensively transformed and endowed through the execution of permanent or long-lasting land works that represent savings immobilised in it, which we will call land improvements. [...] Then land is itself a product⁹. [...] Then, rather than speaking generically of land, one speaks of land capital” (Serpieri, 1940, 153–154, translation by the author)

The concept of land capital, thus defined as land—i.e., a natural agent with peculiar and original features— that embeds permanent portions of capital represented by more lasting land improvements and investments ¹⁰, constitutes, in our view, a coherent synthesis of what has emerged as the current shape of land.

The idea of land capital does not replace but rather enriches and expands the previous and classical notion of raw land by considering the forms of capital immobilised on it (including, in the contemporary context, those of a financial and speculative nature) as an implicit result of socio-economic dynamics themselves. Thus, such reflections do not concern solely the agricultural use of soil. As already noted, land is not merely a means of agricultural production, but the very foundation of human life; therefore, these reflections encompass all *“its uses and civilizational purposes”* (Serpieri, 1969).

⁹Land constitutes a form of capital that is also bought and sold on the market through property rights systems and, as such, is subject to exchange. Like other *commodities* that also function as forms of capital (e.g. machinery), land occupies a dual role, although important differences remain with respect to other *commodities*. For a detailed discussion of land as both real capital and a commodity, see Christophers (2016).

¹⁰Examples of land improvements include soil tilling and levelling, plantations, irrigation systems, buildings (such as houses or industrial infrastructure), roads, and machinery permanently attached to the ground (Dragoni, 1932; Serpieri, 1940).

1.1.2 The Local Development Framework: a brief overview

Let us now address the second argument that initiated the discussion in this section.

Within regional economic sciences, there is a well-established tradition of studies aiming to enhance the local dimension of socioeconomic phenomena (see, for instance, Basile and Cecchi, 2001; Becattini, 1979, 2004; Brusco, 1982; Cersosimo et al., 2018; Garofoli, 2002).

From this perspective, the local component not only defines the scale of analysis but also emphasises the territorial aspect of socio-economic processes (Becattini, 2001; Garofoli, 2002). The territory, indeed, understood as “*the geographical area where the natural environment and the accumulation of tangible and intangible historical heritage combine with the vicissitudes of a settled population*” (Bellandi, 2024) is considered to play an active role in shaping the scope and features of different development processes that can unfold locally. Specifically, it is the complex *territorial capital* (Camagni, 2008), rooted in a specific territory and comprising a diverse stock of both material and immaterial assets—such as knowledge and culture accumulated over time, together with the natural and infrastructural environment—which, if properly enhanced, provides those living in the area with the capacity and orientation to pursue growth and continuous enrichment over time (Becattini, 2015; Garofoli, 2002; Morretta, 2021). In this sense, a multiplicity of local development paths can be observed across different areas, stemming from the dynamic interaction of this unique “*genius*” of each place¹¹ (Becattini, 1990).

Alongside the local development approach, regional sciences also include other perspectives that explore various dimensions of socio-economic development at different scales, often proposing alternative analytical frameworks and models (Russo, 1994). In this sense, for instance, we may recall the stream of regional development (see, for example, Bailey et al., 2018; Beer et al., 2019; Capello, 2004; Capello et al., 2017; Rodríguez-Pose, 2013; Servillo et al., 2012), centred on a broader territorial scale, as well as that of territorial development (Torre, 2023). The latter enriches the analysis at the local scale by integrating land use dynamics, conflicts, and territorial planning measures (Darly & Torre, 2013; Torre, 2019, 2023), while also considering diverse trajectories of the real estate sector, built infrastructures and land rents (Crevoisier et al., 2025; Mollard et al., 2001; Theurillat et al., 2015), which provide particularly relevant insights for the objectives of the present analysis.

Within this integrated framework, places are therefore not homogeneous surfaces, but

¹¹This perspective is therefore consistent with forms of endogenous development paths, whereby each place can find the basis for its competitiveness within its own territory, drawing on the stock of assets that constitute its territorial heritage. Nevertheless, it should be recalled that an endogenous approach to local development does not exclude—but rather integrates—the action of exogenous forces in the accumulation, valorisation, and mobilisation of such local resources, thus adopting a *place-based* perspective on local development (Becattini & Rullani, 1993; Morretta, 2021; Russo, 1994).

potential bearers of distinct seeds of development (Bertolino, 1961). They represent diverse micro-cultural environments, potentially capable of shaping the character and behaviour of embedded actors, and, in turn, influencing different local economic performance (Becattini, 1984). In this sense, a place can be understood as “*a human group that expresses a specific sociocultural structure, which is interconnected with the local productive organisation*” (Becattini, 2015). The local progress takes therefore the form of a social productive process of economic development, whose reproducibility also depends on the ability to replicate such a socio-cultural structure within the productive system. This involves co-producing and readjusting the co-production of goods, values, knowledge, institutions, and the natural environment over time, in what Becattini and Rullani (1993) define as a *complete productive process*.

However, in this dynamic perspective, places can also serve as arenas for diverse, and often conflicting, projects and innovations, resulting from the actions of various local and external stakeholders (Torre, 2023). In this sense, the literature recognises the importance of coordination mechanisms to prevent possible lock-in effects or the exhaustion of development paths (Bellandi, 2021; Torre, 2023). In line with this, adjustments may emerge from quasi-automatic dynamics supported by social customs, such as informal norms, or community-based mechanisms (Becattini, 2015; Dei Ottati, 2003a), or may require the intervention of constructive agencies capable of handling such issues within territorial governance processes (Bellandi, 2021). The territorial governance is defined as “*a process of coordination between different types of actors with asymmetric resources, who meet around issues concerning their territory and contribute with tools and structures to the elaboration of a common joint project for the development of the territory itself*” (Torre, 2023).

Overall, the local development can be therefore understood as a process of territorial re-construction involving local productive structures alongside their societal, cultural, institutional and political dimensions (Becattini, 2015; Bellandi & Storai, 2022).

1.1.3 Land Capital as a potential resource of Local Development

We can now return to the opening question of this section, reformulated in light of the previous considerations as: *Does it make sense nowadays to consider land capital as a factor potentially capable of influencing local socio-economic development?*

From a macro-level perspective, the scientific literature supports a positive answer to this question. Land capital is recognised as an essential resource, and its use is considered a key policy area for promoting economic growth, environmental sustainability, and social inclusion (OECD, 2017; Vaño et al., 2026; WaFS, 2023).

Definition 3. Land Use Change

Land use refers to the specific ways in which land capital is employed, and land use change denotes a modification of that utilisation. It involves the shift from one land cover or usage category to another, with potentially significant environmental, social, and economic consequences. Such transformations may result from socio-economic processes including urban growth, deforestation, the expansion of agriculture, the construction of infrastructure, industrial development, as well as natural dynamics, such as reforestation associated with land abandonment phenomena (Sella et al., 2024).

In line with this, technological changes over recent decades have by no means abolished its role within socio-economic processes. On the contrary, they have contributed to redefining its relevance by accelerating shifts in the hierarchy of its valuable uses (see Definition 3, for land use change). In this regard, although historically associated with agricultural activities and food production, land capital has also, since the First Industrial Revolution, become increasingly interconnected with diverse industrial and manufacturing activities. Then, since World War II, its role has gradually shifted from being primarily a resource for production to functioning increasingly as an asset for the consumption of goods and services, with housing now representing its most economically valuable use (Brown & Nabi, 2024; Christophers, 2020; OECD/Eurostat, 2015; Ryan-Collins et al., 2017). Finally, increasing climate, social, and geopolitical challenges suggest an increasingly central role for land capital both in addressing environmental and novel social needs (Ay & Latruffe, 2017; OECD, 2017, 2022), and in serving speculative and financial purposes (Delladetsima, 2006; Gunnoe, 2014).

Definition 4. Landed Property

Land ownership generally refers to the set of conditions that determine “*the monopoly enjoyed by certain individuals to dispose of certain fractions of the planet as exclusive spheres of their private will to the exclusion of all other*” (Marx, 1987). Landed property concerns the architecture of titles (ranging from exclusive ownership to occupation and rights of use) over land capital within diverse property regimes (such as private, public, etc.) (Bromley, 1989; Schlager & Ostrom, 1992). At the same time, as will be extensively detailed in Chapter 2, landed property also encompasses the physical distribution of land capital within a given territory (Zangheri, 1981).

The diverse distribution of land capital within different landed property systems (see Definition 4) also appears to influence key economic and social processes. Land capital is a source of material wealth and power (Christophers, 2020), and its organisation across varied ownership structures determines access to and control over a scarce yet fundamental resource. This, in turn, can affect both individual and collective well-being through multiple channels, including wealth accumulation, savings, and income distribution, as well as

broader socio-cultural and political dynamics (Bromley, 1989; Dale, 1997; Zangheri, 1981).

Subsequently, the combination of ownership and uses of land capital can involve incomes derived from productive activities, but also remunerations in the form of land rent. Modern manifestations of land rent can play a crucial role in exacerbating both inter- and intra-territorial inequalities, as well as shaping wealth disparities and power coalition dynamics (Brown & Nabi, 2024; Mazzucato et al., 2023; Moulaert & Mehmood, 2025; OECD, 2017; Ryan-Collins et al., 2017; Stiglitz, 2015). OECD (2017) estimates that land capital¹² accounts for roughly 86% of the total capital stock in OECD countries. Changes in its value significantly impact individual wealth, either eroding or increasing it, depending on the circumstances (OECD/Eurostat, 2015). In OECD countries, the concentration of land ownership among wealthier and older households, combined with a general long-term increase in the real value of land and dwellings, has primarily benefited this specific social group at the expense of others, such as younger and poorer households (Christophers, 2020; Knoll et al., 2017; OECD, 2017). The latter have increasingly fallen into what Ryan-Collins et al. (2017) call the *rent trap*, in which rising private rents absorb a growing share of their wages, limiting their ability to save and access property ownership. Moreover, in these countries, landowners have increasingly favoured speculative over productive investments, thereby contributing to a broader trend of wealth accumulation driven by rising property prices and capital gains, rather than by profits generated through the production of goods and services (Ryan-Collins & Murray, 2023; Stiglitz, 2015). In turn, these dynamics intensify the attractiveness of land capital as a financial asset, as banks and financial institutions play an increasingly prominent role in the appropriation of land rents (Christophers, 2020; Mazzucato et al., 2023; Ryan-Collins et al., 2017). Such processes affect both farmland (Fairbairn, 2017; Gunnoe, 2014; Knuth, 2015) and other land-use types (Christophers, 2016; Delladetsima, 2006). The consequences of these patterns include, among others, challenges related to housing affordability and growing tensions over competing land uses (Ryan-Collins & Murray, 2023).

These dynamics also have a spatial dimension. If not properly managed, they tend to favour certain contexts over others, making them more attractive in terms of opportunities and appropriable rents, thereby contributing to the emergence and persistence of inter- and intra-territorial inequalities. A clear example of this pattern can be observed in the strong—and sometimes disproportionate—appreciation of real estate in certain areas (often specific neighbourhoods of so-called “*superstar*” cities), which affects local wealth distribution, benefiting some places while disadvantaging others, and reinforcing well-known centre–periphery patterns of spatial inequality (Edwards, 2025; Florida, 2017; Krugman,

¹²OECD (2017) in this case account for land and buildings.

2023; Veltz, 2025).

Based on this, a positive answer, therefore, emerges to the opening question of this section. Land capital appears to be potentially capable of influencing the key socio-economic and institutional dimensions of local development, and therefore of shaping the various processes of local territorial patterns. In fact, it intersects with local economic dynamics, including income and wealth distribution and patterns of consumption, while also connecting with political power and institutional configurations, thereby revealing underlying social phenomena.

Notwithstanding, how this may take shape at the local level through which specific mechanisms, and which varying characteristics of land capital may prove relevant in this regard, remains a largely overlooked topic in the scientific literature on local development. Conversely, studies on land capital have been fragmented across various scientific disciplines (Dale, 1997), each focusing on distinct aspects of the factor, yet without attempts to integrate them into a broader framework of local socio-economic development¹³. Beyond its scientific relevance, this topic has implications for national and global issues (OECD, 2017, 2022). In this sense, it is necessary to develop a comprehensive analytical framework capable of unveiling the complex relationships between the various dimensions of land capital and the multiple facets of local socio-economic development, in order to begin incorporating land-related aspects into the broader discussion of local development. Chapter 2 undertakes this task and represents the first substantive scientific contribution of the thesis.

Definition 5. Rural Context

The rural context is here defined as an area characterised by low population density and productive specialisations that are directly or indirectly linked to agro-forestry activities. More broadly, it refers to a mixed economic setting in which agriculture coexists with other sectors—such as craftsmanship, tourism, and industry—that tend to integrate with and maintain a balanced relationship with the natural environment (Iacoponi, 1998).

To address this first objective effectively, the scope of the study is deliberately limited to the rural context (see, Definition 5). This delimitation enhances the analytical focus by accounting for specific and different rural local conditions (Basile & Cecchi, 2001). Nonetheless, this choice does not exclude the possibility that the analytical framework

¹³For illustrative purposes, land capital is variously explored in institutionalist theory, in relation to the organisation of property rights and their implications for development (see, for instance, Banerjee & Iyer, 2005; Bromley, 1989; Ostrom, 1990; Ruttan, 2006); in rent theory, which focuses primarily on the dynamics arising from its demand and inelastic supply curve (see, for example, Brown & Nabi, 2024; Mazzucato et al., 2023; Ryan-Collins & Murray, 2023); or within the agrarian economic tradition, where it is treated in relation to its exclusive agricultural use (see, for instance, Brusco, 1979; Dragoni, 1932; Latruffe & Piet, 2014; Polidori & Rocchi, 2013; Serpieri, 1940, 1969).

could, *mutatis mutandis*, be extended to other local development settings, such as urban or industrial/manufacturing-based contexts.

On these grounds, the central research question guiding Chapter 2 is the following: *How does land capital interact with rural local development?*

1.2 Land Capital within Local Models of Development

The theoretical effort undertaken in Chapter 2 demonstrates the role of land capital in the broader dynamics of rural local development. More precisely, it shows how land capital stands as a key factor, continuously involved in local socio-economic, political, and institutional dynamics, shaping, through its various dimensions, the direction and form of rural *place-based*¹⁴ development in distinct way, and ultimately becoming part of the territory. This work therefore provides the foundations for considering land capital as a determinant of rural local development and its dynamics.

From this perspective, numerous studies in regional science recognise the role of certain factors in addressing diverse paths of development at the local level (Wong, 1998). These trajectories may refer to different forms of quasi-steady development (Becattini & Rullani, 1993), as well as diverse bifurcation dynamics between lock-in and re-routing paths (Hassink et al., 2019; Jeannerat & Theurillat, 2021; Torre, 2023). Local contexts indeed serve as arenas for a kaleidoscope of development paths, hosting different development models (Becattini et al., 2000, 2014).

Models of local development can be defined as framework of general *place-based* structural features coherent with specific techno-organisational configurations (Bellandi, 1996; Bellandi, Cecchetti, & Santini, 2023; Pagano, 1991). Specifically, based on the experience of the ideal-typical model of the Marshallian Industrial District (brought back to international attention by Giacomo Becattini in 1980s; see Becattini (1979, 2004)), these features can be made explicit through the local industrial organisation, socio-cultural relationships and land-tenure structures, institutional and governance structures, and forms of territorial networking (for an in-depth discussion, see Bellandi, Cecchetti, & Santini, 2023; Bellandi & De Propriis, 2017; Bellandi & Sforzi, 2003; Bellandi et al., 2025). Different local expressions of these *place-based* dimensions define distinct models of development and may combine in specific cycles and processes, producing diverse local pathways.

Based on this, factors affecting such dynamics — a representative list of which is shown in Table 1.1 — can constitute foundational elements of the models, for example, the organisation of local productive processes, or act upon these dimensions, such as

¹⁴Please, see Note 11.

Table 1.1: Key factors in local development dynamics

Factor	Description
<i>Productive dynamics</i>	The concept of development has long been inseparable from that of production within general economic theory. Likewise, local development theory regards both the diverse organisation of productive processes—within and between firms—and their varying degrees of embeddedness in local socio-cultural dynamics as key drivers of varied development paths (see, e.g., Becattini, 2001; Torre, 2023).
<i>Technological innovations</i>	A well-established body of literature views innovation as a central force in shaping development trajectories. From Schumpeter's concept of the innovative entrepreneur to the current and pervasive spread of digital technologies, innovation has long dominated and continues to define new models of production and dynamics of local development (see, e.g., Bellandi, Cecchetti, & Santini, 2023; De Propriis & Bailey, 2020; Jeannerat & Theurillat, 2021; Perez, 2010).
<i>Settlement and consumption patterns</i>	Places of residence no longer strictly coincide with those of production. A growing body of literature—within the broader framework of the <i>residential economy</i> —examines how diverse settlement and consumption patterns, together with residential activities and services associated with both temporary and extra-local populations, as well as permanent local populations (including residents, tourists, and visitors), act as drivers of distinct local development dynamics (see, e.g., Crevoisier & Rime, 2021; Crevoisier et al., 2025; Segessemann & Crevoisier, 2016).
<i>Demand, markets and economies</i>	Places are embedded in diverse multi-territorial frameworks comprising broader and more varied markets, demand structures, and value chains (e.g., global value chains), together with pools of technical and human resources. These elements concur to shape local productive organisations as well as forms of local division of labour, which in turn underpin varying degrees of local competitive advantage (see, e.g., Bellandi, 2011; Cersosimo et al., 2018; Chandra, 2023).
<i>Green transitions</i>	Places are increasingly facing environmental pressures. These can give rise to new top-down policies—such as the European Green Deal (European Commission, 2019b), or greener measures within the Common Agricultural Policy (European Commission, 2025)—that reshape local productive processes and lifestyles, or to bottom-up initiatives when needs arise locally, for instance after environmental disasters or due to negative environmental externalities generated by productive activities (see, e.g., Bellandi & De Propriis, 2021).
<i>Social and cultural changes</i>	Macro-trends in socio-cultural structures, such as ageing, can shape local dynamics. Mechanisms of social mobility and in- and out-migration processes likewise redefine the social fabric and the dynamics of local productive organisations (see, e.g., Brusco, 1982; Cecchi, 2001; Guercini et al., 2017).
<i>Health-related challenges</i>	The Covid-19 pandemic has highlighted the disruptive impact of disease on livelihoods, reshaping both social and productive norms of behaviour (see, e.g., Bellandi, Corpakis, & Donati, 2023).
<i>Governance approaches</i>	The role of governance is increasingly recognised in shaping local development paths (Bellandi, 2021; Hassink et al., 2019; Torre, 2023). Places have become arenas for diverse governance approaches, ranging from top-down, often place-blind initiatives centralised in the hands of the state, to place-based multi-level schemes tailored to specific local needs and engaging actors at multiple levels. Each approach carries distinct implications for local dynamics (see, for a fuller discussion, Barca, 2011; Barca et al., 2012; Ferrara et al., 2026; McCann, 2023).
<i>Geopolitical tensions</i>	The unfolding of disruptive geopolitical tensions impacts local contexts. The outbreak of recent wars (e.g., Russia–Ukraine or USA and Iran) has generated shortages in the supply of energy and raw materials along global value chains, increasing local production costs (The Economist, 2026). Even local dynamics, such as longstanding political affiliations, affect entrepreneurial initiatives and local socio-cultural traits (see, e.g., Brusco, 1982; Caprettini et al., 2021; Musotti, 2001).
<i>Academic, labour-union, civic and financial actors</i>	Paths of local development increasingly intertwine with multiple actors—from academia, banks and financial institutions to civic associations—giving rise to complex models of the quadruple and quintuple helix (see, e.g., Donati et al., 2023). For instance, trade unions can exert considerable influence over local productive organisations and their dynamics, as well as labour associations of employers and artisans (see, e.g., Bellandi, 2021; Brusco, 1982; Dei Ottati, 2003b).

Source: Author's elaboration.

technological innovations. Their nature can also be examined through the classical lens of the exogenous–endogenous dualism. However, a clear-cut distinction in this sense may prove inconsistent with the very dynamics of local development¹⁵ (Russo, 1994).

Definition 6. Governance

The governance is a decision-making arrangement characterised by both formal and informal collaborative structures of power and administration that have the capacity to alter existing institutions or create new ones (Beer et al., 2020).

In line with this, Chapter 2 therefore demonstrates the role of land capital as a driver of rural local development, extending the set of factors outlined in Table 1.1. Nevertheless, even when compared with other factors, limited attention has been devoted to the contribution of land capital to shaping distinct local development pathways over time, thus highlighting a further gap in the scientific literature. Namely, within the context of the present analysis, this gap concerns how the different elements of land capital interact with structural features and processes across different rural development models, giving rise to distinct local development dynamics.

Specifically, although these patterns can be ideally ascribed to the aforementioned land tenure organisation (Bellandi, Cecchetti, & Santini, 2023) within the general framework of local development models, the actual organisation and contribution of such a structure to local development pathways have not, to the best of our knowledge, been thoroughly examined in other contributions within the scientific literature. In fact, Bellandi, Cecchetti, and Santini (2023) introduce—but do not further elaborate or define—the concept, whereas contributions such as Brusco (1982) or Bellandi and Storai (2022) only indirectly refer to possible land interactions within specific manufacturing-based local development models. At the same time, for instance, Triantafyllopoulos (2008), analysing a specific rural development case study, focuses exclusively on land ownership structures, while Crevoisier et al. (2025) limits its scope to real estate and its primarily residential use alone in the development of cities and regions in Switzerland.

On this basis, it is therefore pertinent to further investigate different local development pathways by asking: *How does land capital shape and interact with the diverse models of rural local development, thereby influencing distinct rural development pathways?*

Chapter 3 addresses this question, and its answer constitutes the second scientific contribution of the thesis. Specifically, the analysis focuses on the role of land capital within

¹⁵As Russo (1994) reminds us, quoting Perroux (1987), “we cannot define once and for all what is endogenous and what is exogenous [in development paths], precisely because development redefines the set of variables within the conceptual scheme that is taken as a reference” (Russo, 1994, pp. 49, translation by the author).

different possible shapes of quasi-steady development paths, introducing—without exploring in depth—the issue of re-routing. This work therefore advances the understanding of different rural local development trajectories, driven and affected by their land-tenure organisation. It thus represents a further step forward in exploring the effects of the land dimension on specific local dynamics, while taking into account precise contextual elements of diverse rural contexts.

1.3 From Conceptual Foundations to Empirical Analysis

1.3.1 *Land-use management policies and rural development*

The work developed in Chapters 2 and 3 constitutes the first part of this thesis and lays the conceptual foundations for a clear and comprehensive theoretical framework on the role of land capital in shaping rural local development dynamics—an aspect that remains largely unexplored in the existing literature. In particular, this framework highlights the various interconnections—both direct and reverse—among the distinct components characterising land capital, as well as their interactions with other structural dimensions of *place-based* development. In doing so, this part of the work provides a conceptual and analytical lens through which to interpret local development dynamics across distinct rural contexts shaped by different configurations of the elements of land capital.

Building on these theoretical foundations, the second part of the work advances the investigation of these relationships by grounding them in empirical evidence. In particular, two theoretical relationships are selected—also in light of remaining gaps in the literature—and are further investigated through dedicated empirical analyses. This empirical approach not only provides support to the theoretical framework, but also refines it by offering a more structured understanding of the mechanisms through which land capital shapes local development dynamics.

Specifically, both analyses take into account land-related elements with governance mechanisms. More precisely, in the first case, the analysis starts from the recognition that land-use management can constitute a relevant policy domain for advancing socio-economic and environmental objectives in rural contexts (Delladetsimas & Katsigianni, 2023; OECD, 2017). In this regard, the direct relationship between governance interventions, land-use practices, and their effects on rural local development is identified and examined.

From this perspective, given the central role of the Common Agricultural Policy in shaping farmers' land-use decisions at the European level over time (Sotte, 2023), the analysis examines the local effects of a specific land-use measure introduced under Direct Payments scheme (Pillar I) during the 2014–2022 programming period. Indeed, the 2013

reform marks a decisive step in strengthening the environmental orientation of the policy by introducing a set of land-use requirements under the so-called *greening*. Among these measures, the policy includes crop diversification rules, requiring farmers to cultivate a minimum number of crops, with the explicit aim of countering monocultures typically associated with higher environmental pressures (Brutti et al., 2023). Through these mechanisms, the policy is expected to promote more sustainable land-use practices, thereby supporting farm competitiveness and the socio-economic performance of rural contexts by aligning productive strategies with sustainability-oriented development models (European Commission, 2013).

Beyond policy intentions, however, the effects of the *greening* regulation—including those related to the crop diversification measure—remain widely debated (European Court of Auditors, 2017; Vanni & Cardillo, 2013), with evidence pointing to mixed results. For this reason, Chapter 4 provides an ex-post assessment of the crop diversification (CD) measure, addressing the following research question: *What have been the local environmental, economic, and land-use effects of the CD measure?*

In doing so, the analysis also tries to strength the assessment of the environmental dimension of the measure. Given the existing limitations in directly evaluating environmental outcomes (Brutti et al., 2023), it contributes to the literature by proposing and assessing an innovative set of land use practices, namely crop rotation indicators, as a meaningful proxy for environmental performance. The construction of these indicators also enables an in-depth analysis of the relationship between crop diversification and crop rotation at the local level—an issue that remains largely under-explored, despite its potential policy relevance. This question is indeed particularly timely, as the debate surrounding crop rotation and crop diversification practices extends beyond the 2014–2022 programming period into the subsequent CAP reform cycle (2023–2027). In this regard, Chapter 4 also addresses the following question: *Would crop diversification have supported or hindered crop rotation practices?*

Overall, the paper therefore provides new empirical insights into the effectiveness of the crop diversification policy measure in shaping local land-use practices and their socio-economic and environmental implications for rural development, while also contributing to the empirical investigation of a selected linkage within the broader conceptual framework developed in the first part of the thesis, thereby offering further grounding to its practical application.

1.3.2 *Landownership patterns and land-use policy participation in rural development dynamics*

Interconnections between land-related elements and governance mechanisms also re-emerge in the second and concluding empirical analysis of the thesis, though examined from a different perspective from that adopted in the previous contribution. In particular, given the relevance of governance initiatives aimed at supporting specific land-use practices in order to achieve targeted socio-economic and environmental outcomes, Chapter 5, on the other side, investigates how some structural elements of local contexts- namely, those related to the organisation of land capital within distinct landownership configurations- may influence such actions and their outcomes. Specifically, it examines how different configurations of landownership structures in rural areas respond to locally implemented governance actions aimed at shaping land-use practices, by analysing patterns of participation within the Common Agricultural Policy framework introduced above, considering in this case the full set of Direct Payment measures under Pillar I.

More precisely, participation in 2014-2022 Pillar I Direct Payments is increasingly characterised by greater selectivity, driven by the need to comply with specific requirements which, beyond the *greening*, also entail additional environmental obligations (Sotte, 2023). In this regard, land capital organised through diverse landed property structures may emerge as a potentially decisive mechanism underlying such patterns. It is indeed a key productive factor within agricultural activities and its organisation within distinct landownership arrangements can affect the profitability of certain farming techniques (Dale, 1997; Latruffe & Piet, 2014; Serpieri, 1969) and condition the feasibility of comply with requirements of 2014-2022 Direct Payments. This, in turn, may result in different degrees of participation across rural contexts characterised by distinct landownership structures, with potential implications for the capacity of local farms to engage in more sustainable production strategies, and, consequently, for these territories to pursue and support more sustainability-oriented development models aligned with the policy's objectives.

Although of clear conceptual relevance, empirical research has so far paid limited attention to this issue. This is particularly the case with respect to Pillar I, whose design—at least prior to the 2013 reform—entailed relatively weak conditionality requirements and limited participation constraints, thereby attracting little interest from studies focusing on the structural determinants of policy uptake. Against this background, the analysis conducted in Chapter 5 aims therefore to address this knowledge gap by providing an in-depth empirical analysis of selected structural features of landed property, in order to understand their role in shaping participation in CAP Pillar I direct payments over the 2014–2022 period across different rural areas. The following research question therefore guides the empirical

analysis: *How do different local configurations of land ownership structures—particularly in terms of the physical organisation of landholdings—shape variation in both participation in and the intensity of participation in CAP Pillar I Direct Payments, within the 2014–2022 programming period?*

Chapter 5 thus contributes to advancing the literature by providing novel empirical evidence on the role of landownership structures in shaping participation in CAP Pillar I Direct Payments, while also offering a more structured understanding of the mechanisms underlying these linkages. In doing so, and in line with the general aim of the second part of the thesis, it further sheds light on the interconnections between land capital, governance actions, and rural development dynamics

In conclusion, it becomes increasingly clear that, in light of the arguments developed so far, the present thesis aims to contribute to a more comprehensive understanding of the role of land capital in shaping local development dynamics in rural areas—an aspect that remains largely overlooked in the existing literature, yet, as will be shown throughout the work, has significant implications for the development trajectories of different local contexts.

Against this background, the remainder of the thesis is organised as follows. Part II develops the broader conceptual framework linking diverse features of land capital with distinct elements of *place-based* development. It first establishes, in Chapter 2, the role of land capital and its main components as drivers of rural local development at large. It then deepens the analysis in Chapter 3 by examining these features in light of specific contextual elements across different local development models, thereby providing further insight into their implications for diverse rural development pathways. Building on this framework, Part III presents the empirical analysis of two selected linkages identified at the theoretical level. In particular, Chapter 4 evaluates the impact of land-use policies on local development performance, while Chapter 5 investigates how landownership structures may influence the implementation of such policies by analysing patterns of participation across rural contexts. Finally, Part IV concludes by synthesizing the main findings of the thesis and outlining their broader policy implications.

Part II

Conceptual Foundations

Chapter 2

Land Capital as a factor of Rural Local Development

Abstract

Land capital has the potential to influence local development dynamics, as it intersects with various local socio-economic phenomena. Nevertheless, there is no scientific evidence that explicitly identifies the different land aspects and defines their relationships within local development dynamics in a systematic conceptual framework. The present paper, deliberately limited to the rural context, seeks to overcome this gap by conducting an integrative review across different strands of scientific literature. The results show that land capital is a key driver of rural local development, repeatedly involved in its dynamics. Through the various articulations of its main dimensions—land-ownership structures, land uses, and rent— within distinct land tenure systems, it indeed shapes diverse local processes of value creation, capture, and distribution, thereby influencing the socio-economic, political, and institutional spheres of rural areas in multiple ways. When meaningfully enhanced, it therefore contributes to the direction and form of rural local development.

Keywords: Land Capital; Rural Local Development; Land Ownership Patterns; Land Rent; Land Uses.

JEL codes: Q15; O18; P14; R14; R52.

2.1 Insights and Gaps in Local Development Theory

In line with other elements acknowledged in the literature (see, for instance, Wong, 1998), land capital should be considered a fundamental factor shaping local development dynamics, owing to its interaction within local socio-economic, institutional, and political spheres. Let us briefly recall the fundamental concepts underlying this relationship, which is, therefore, the focus of our analysis (for an in-depth discussion, see Chapter 1).

- Within the framework of local development theory, the *territory* is understood as a geographical area that embodies and expresses a specific *territorial capital*—that is, a set of tangible and intangible assets accumulated over time¹—which provides those living in that place with the orientation and resources needed to pursue growth and continuous enrichment over time (Bellandi, 2024; Camagni, 2008; Garofoli, 2002). The local development dynamics are thus conceived as a process of territorial reconstruction of this heritage, engaging local productive structures along with their societal, cultural, institutional, and political components. Building on this perspective, a multiplicity of *place-based* development paths can be observed across different places, each shaped by its specific local heritage² (Becattini, 2015).
- In this dynamic perspective, places may also act as arenas where multiple—and often conflicting—development projects unfold. Accordingly, coordination mechanisms may arise from quasi-automatic dynamics guided by social customs or may require the intervention of constructive agencies within broader territorial governance processes (Bellandi, 2021). The territorial governance is here defined as “*a process of coordination between different types of actors with axisymmetric resources, who meet around issues concerning their territory and contribute with tools and structures to the elaboration of a common joint project for the development of the territory itself*” (Torre, 2023, pp. 5).

¹Territorial capital can be defined as a stock of assets and production factors with varying degrees of rivalry—both public and private—of a material and immaterial nature, encompassing natural and artificial, human, social, cognitive, and relational components that together represent the development potential of territories. In particular, in addition to four basic categories—natural, infrastructural, human, and social capital—it also includes impure public goods, relational capital, institutions, and models of territorial governance (Camagni, 2008).

²This perspective consistent with forms of endogenous development paths, whereby each place can find the basis for its competitiveness within its own territory, drawing on the stock of assets that constitute its territorial heritage. Nevertheless, it should be recalled that an endogenous approach to local development does not exclude—but rather integrates—the action of exogenous forces in the accumulation, valorisation, and mobilisation of such local resources, thus adopting a *place-based* perspective on local development (Becattini & Rullani, 1993; Morretta, 2021; Russo, 1994).

- From an economic perspective, the current form of land is captured by the concept of *land capital* which is here understood as (raw) land (see Definition 1), endowed with its “*original and inherent features*” (Ricardo, 1776a), and also encompassing the permanent portions of capital embodied in investments and lasting land improvements (see Chapter 1) (Serpieri, 1940). Land capital is structured through various land tenure systems—legal forms under which it is owned, occupied, and used (Ryan-Collins et al., 2017) together with its economic and physical organisation (Serpieri, 1969). More precisely, these systems encompass the different conditions that determine the capacity of land capital to serve as a basis for human life (Serpieri, 1940).

Considering this framework, several insights from the literature highlight—albeit often rather subtly—the role of land dynamics in local development processes. In particular, different land-tenure systems are associated with distinct productive dynamics—such as labour-market composition and the types of economic actors involved—as well as with diverse local socio-cultural and institutional features (Bertolino, 1927; Cecchi, 1992a; Ostrom, 1990; Triantafyllopoulos, 2008). In this sense, the words of Bertolino (1927), in his study of the Sicilian latifundium, are particularly illustrative, as he notes that this type of land regime functions as “*the dominant force in the social and economic situation, establishing a veiled form of feudalism that also has repercussions on the moral life of the farmer and his family*” (Bertolino, 1927, pp. 31, translation by the author). Different models of land tenure, such as the latifundium (see, for instance, Bertolino, 1927; Mariella, 2023), the metayage (see, for example, Musotti, 2001), or the distinctive Scottish Crofting system³ (see BiGGAR Economics, 2024, Crofting Commission, 2024), to name just a few, represent forms of land organisation that seem therefore closely interlinked with specific frameworks of productive and social dynamics, thereby shaping specific local development patterns (Banerjee & Iyer, 2005; Delladetsimas et al., 2022; Musotti, 2001; Ostrom, 1990; Triantafyllopoulos, 2008).

The mechanisms behind these influences seem to involve diverse traits of land capital. Inequalities in the distribution of land capital, such as cases of concentration in the hands of a few landowners, can hinder long-term progress of places, leading to lower economic growth rates and reduced human capital accumulation (Banerjee & Iyer, 2005; Mariella, 2023). Conversely, more evenly distributed land ownership structures tend to foster more dynamic paths of local development and, under certain conditions, may also support the

³Crofting is a unique land tenure system found only in the Highlands and Islands and in designated areas of Scotland. In brief, it is a form of renting, owning, and using pieces of land, here named crofts. Crofts are usually organised into small agricultural holdings averaging 5 hectares, often accompanied by a share in common grazing. For further information, please refer to the references cited in the text.

evolution of local productive specialisations. This is the case, for instance, of the island of Rhodes in Greece, as reported by Triantafyllopoulos (2008). Here, the widespread participation of the local community in land capital favoured the maintenance of a cohesive social structure, which reinvested the income generated through land ownership into the local productive system, facilitating—once a window of opportunity opened—a shift from an agrarian economy to one based on tourism (Triantafyllopoulos, 2008).

Certain land-use choices can then restrict space for alternative uses, generating competition and intensifying potential local conflicts over the resource (Darly & Torre, 2013; Merlo, 1984). Conflicts can negatively affect local development paths (Torre, 2023).

At the same time, rent flows passing through land capital constitute another key aspect shaping the configuration of local development patterns. From this perspective, Mollard et al. (2001) identifies different forms of rent that can emerge in rural areas, while Camagni (1998) distinguishes different urban development cycles depending on whether land rent functions merely as a mechanism of profit extraction or, instead, acts as a driver of innovation (Camagni, 1998, 2017). Likewise, the emergence of ungoverned rent-extractive behaviours in areas with a manufacturing vocation can reduce local productive investment and foster the rise of land elites within territorial governance (Bellandi & Storai, 2022; Buciuni, Corò, et al., 2023; Florida, 2017). In parallel, diverse trajectories of real-estate markets and landed-property development processes (d'Arcy & Keogh, 1997; Delladetsima, 2006; Healey & Barrett, 1990), which are themselves directly linked to local rental values (Theurillat et al., 2015), also shape distinct local development paths, centred on both productive and residential economies (Crevoisier et al., 2025).

Notwithstanding the above, to the best of our knowledge, there is no scientific evidence that paves the way for defining land capital as a key factor in local development, particularly by explicitly identifying and systematising the relationships between its diverse aspects—such as those outlined above—and local development dynamics within a broad and coherent conceptual framework. More specifically, this concerns how different land-related elements affect local socio-economic and institutional spheres, thereby shaping territorial dynamics. Indeed, although some components of land capital appear within the composition of Camagni (2008)'s notion of *territorial capital*—namely those related to natural and infrastructural capital—the literature still fails to address the role of land capital as a whole; that is, an understanding that also considers the component of raw land, which constitutes the local environment⁴ upon which these and other forms of capital rest and integrate. Given its theoretical relevance, as well as its potential importance in improving

⁴The local environment is conceived as the interconnection of physical and human elements that support development dynamics (Becattini, 1984; Musotti, 2000; Serpieri, 1969).

the governance of diverse local development dynamics, it therefore appears necessary to contribute to filling this gap.

The scope of the study is deliberately limited to the rural context⁵. This delimitation sharpens the analytical focus by allowing for the consideration of multiple specific and distinctive local conditions inherent to it (see, Annunziata et al., 2024; Basile and Cecchi, 2001; Mantino et al., 2023).

In light of this, the following research questions are addressed:

RQ1- How does land capital interact with rural local development?

RQ2- More precisely, what are the elements of land capital that affect rural local development, and how does this occur?

The novelty of this paper lies in proposing an innovative conceptual framework that explores the relationships among the different dimensions of land capital and its specific contribution as a driver of diverse rural development processes. This unfolds as follows. Section 2.2 details the methodology used to address the research questions. Sections 2.3, 2.4, 2.5 and 2.6 present the results and discussion of the main findings, while Section 2.7 concludes this chapter.

2.2 Research Methodology

The nature of the work is aligned with the implementation of an integrative literature review, i.e., a research methodology that “*critically reviews, synthesizes, and integrates representative literature on a given topic, ultimately contributing to the generation of new knowledge*” (Torraco, 2005, pp. 356). Unlike other approaches, such as systematic reviews, the integrative review process does not primarily rely on quantitative methods, such as meta-analysis or topic modelling techniques, for data analysis and evaluation, but is mainly based on qualitative methods. Indeed, the main idea behind the approach is not to cover all articles published on a topic but rather to combine and integrate different perspectives from the literature, synthesising them into a model or conceptual framework that offers a new perspective on the topic itself (Torraco, 2016). In this sense, a more creative process of data collection and analysis is considered essential to the process of theory-building, compared to explicit and systematic methods (Snyder, 2019).

The integrative review presented here is based on two large surveys. It begins with an

⁵The rural context refers to an area characterised by low population density and productive specialisations directly or indirectly linked to agro-forestry activities. More broadly, it describes a mixed economic setting in which agriculture coexists with other sectors—such as craftsmanship, tourism, and industry—that tend to integrate with and maintain a balanced relationship with the natural environment (Iacoponi, 1998).

initial exploratory survey using two databases: Scopus⁶ and Google Scholar⁷. While the latter offer wider coverage, the former enable closer examination of a more selected set of works. The definition of keywords, as well as the selection criteria for contributions, which will be discussed shortly, focuses on the intersection of studies addressing land dynamics and elements of rural local development. Specifically, in this first stage, with reference to land dynamics, the keywords primarily relate to “land” and “land capital”. In this way, both contributions referring to what was defined in Definition 1 as raw land⁸ and those addressing the broader concept of land capital have been included. The review has therefore focused on the combination of these keywords with those related to the core elements of local development, which are summarized here in its economic, socio-cultural, institutional, political, and governance dimensions (for more details, see the Appendix A.1).

This first step is preliminary to expanding knowledge on land capital and its various elements that may interact with rural local development. It enables the definition of more specific keywords that will be used in the second stage to further refine the review of the literature.

Indeed, the integrative review, as well as other qualitative research methodologies call for an iterative and auto-corrective data analysis (Finfgeld-Connett & Johnson, 2013). That is the coherence between data collection, analysis, and objectives is ensured when the researcher moves back and forth between the intended objectives—in essence, between data collection and interpretation (Morse et al., 2002). This iterative process is here ensured through the second survey, and it is further reinforced by the continuous use of the integrated catalogue “OneSearch”⁹, provided by the University of Florence. The catalogue is likewise accessed using keywords and is employed to support both stages, providing a tool for further exploration of possible interpretative pathways emerging from the integration of different results and perspectives. The iterative and self-correcting research process is also ensured by exploring references cited in the reviewed articles, particularly those deemed potentially relevant to the topic reviewed.

The second survey employs the same tools used in the first; the only difference lies in the

⁶Scopus Database, available at <https://www.scopus.com> (accessed on 27 August 2025).

⁷Google Scholar, available at <https://scholar.google.com> (accessed on 27 August 2025).

⁸We recall here briefly that, according to the economic literature, raw land can be defined as a natural agent with “*original and inherent properties*”, such as innate productive power, indestructibility and non-reproducibility (Parrinello & Cecchi, 1982; Ricardo, 1776a).

⁹The catalogue of Onesearch (available at <https://onesearch.unifi.it>) allows access to books (both modern and antique), journals, articles, e-books, digital objects, and various other types of materials (videos, microfilms, maps, geographical charts...). These resources are either owned by the libraries of the University of Florence or accessible online, either freely or through subscription, and originate from multiple systems, including catalogs, open-access archives, publisher platforms, and databases. For more details, see: <https://www.sba.unifi.it/p1478.html?newlang=eng>.

keywords used (see Appendix A.1). Greater familiarity with the topics allows for a more refined analysis, enabling the integration of different peculiarities on how the previously identified land-related elements interact with local socio-economic dynamics.

The review includes not only journal articles but also books and other published texts coming from different streams of scientific literature. The interdisciplinarity of the collected sources, made possible by the nature of the methodology itself, enhances the capture of different perspectives on a topic that, as seen in Section 1.1.3, is indeed dispersed across various streams of literature (Dale, 1997).

Starting with an initial review of the abstract, contributions categorized as retained are then reviewed in depth. The selection criteria are primarily based on the relevance of the resources in theoretically enriching the objective of the analysis. In particular, the selected sources must provide an affirmative answer to the following question: *Does the content (referring to land-related elements and characteristics), even indirectly, hold significance for rural local development?*

Once the data has been collected through the two surveys, its analysis aims at a critical synthesis of the various results and perspectives gathered to give rise to a coherent and logical conceptual framework. Nevertheless, the analysis of the data continues to be accompanied by and integrated with data collection whenever further investigation is needed. Given that, the data analysis focuses on identifying new themes, relationships, and perspectives on the topic under review. Specifically, similarly to other qualitative methodologies (Miles & Huberman, 1994), recurrent codes within the selected contributions are identified. Subsequently, these codes are further analysed to extract and derive themes as well as relationships among the various elements. The result of this work is presented in the next sections.

2.3 Unveiling the Framework: the first dimension, land ownership structures

Three key aspects of land capital emerge from the review, each significantly interacting with rural local development: the structures of landed property; the income flows generated through land capital, with a primary focus on land rent; and the local uses of this resource.

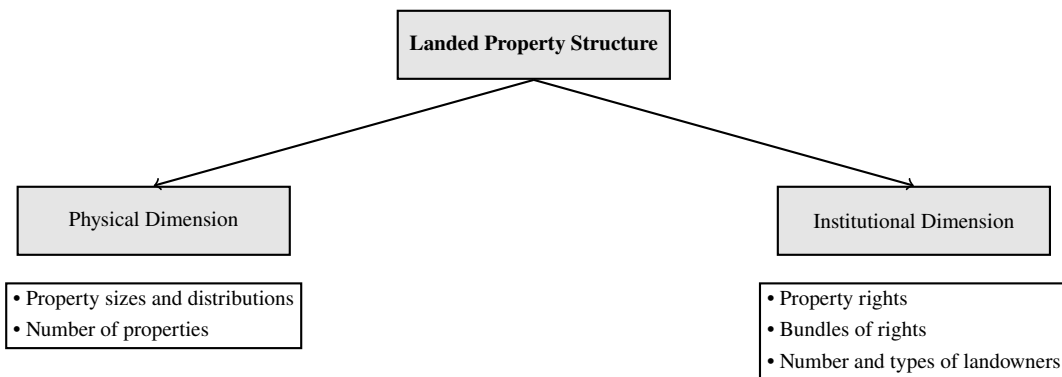
Let us begin by exploring the insights emerging from the sphere of landed property.

2.3.1 Dimensions of landed property structures

Structures of landed property represent the physical and legal architecture of land capital at the local level. Specifically, land capital is distributed and organised within different

societies and places through various *properties*¹⁰, which constitute the legal-economic units underpinning landed property structures (Zangheri, 1981). Within a given area, as depicted in Figure 2.1, land ownership structures consist of a varying number of properties of different sizes and spatial configurations, held by one landowner or more diverse co-owners, and governed by distinct property rights. These dimensions are deeply interconnected and are typically recorded in cadastral registers (Dale, 1997; Williamson, 2001).

Figure 2.1: **Dimensions of Land Ownership Structures**



Source: Author's elaboration

As detailed in Appendix A.2, property sizes may range from micro holdings (under 0.50 hectares), also referred to as *parcel properties*, to large estates (over 50 hectares). Their number must be considered with respect to different surface area classes within a given territory (see, for instance, Golzio, 1933; Cecchi, 1983). Moreover, the parcels that make up a property can be contiguous or exhibit a certain degree of spatial dispersion (Demetriou, 2014).

Property rights, by contrast, represent the key institutional mechanism mediating the interaction between land capital and socio-economic systems (Ryan-Collins et al., 2017). In modern contexts, they can be classified as private, public, common, or as absent altogether, as in the case of open access regimes (Bromley, 1989). Such titles effectively define the rights and duties of landowners over land capital, and function as the main channel through which land and its improvements, despite their immobile nature, are treated as *commodities* and exchanged within the socio-economic setting (Christophers, 2016; Harvey, 1982; Serpieri, 1940). Moreover, at the local level, formal property rights can be “*unbundled*” through contractual agreements with varying degrees of formalisation, such as leasehold arrangements (Schlager & Ostrom, 1992). In this sense, property rights can be understood

¹⁰Properties “comprise all parcels or plots attributed to or owned by the same entity, person, or group of persons/entities” (INEA, 1956).

as a *bundle of sticks* (Ellickson, 2011; Galik & Jagger, 2015) — that is, a set of distinct land rights that can be separated and allocated in different ways (Ostrom, 2003).

Furthermore, the ownership of land capital can be exercised individually or held in common with co-owners¹¹. Landholders can take various forms, ranging from individuals and private companies to public bodies and collective entities (Medici et al., 1962). Further details on these aspects, which define the makeup of landed property, are provided in Appendix A.2.

2.3.2 Landed property structures and rural development dynamics

At the local level, structures of landed property are heterogeneous, reflecting the various forms taken by the elements introduced so far. More precisely, landownership structures can vary across their different dimensions along a continuum between two extremes: land concentration and fragmentation. Concentrated landed property structures with a low degree of unbundling of property rights are characterised by a small number of landowners holding large and contiguous estates. On the other hand, instead, land fragmentation refers to a pulverisation¹² of the physical structure of landownership into parcels and micro-properties. Under such circumstances, properties are often spatially dispersed and held by a large number of landowners and co-owners (Golzio, 1933; Medici et al., 1962).

Diverse structures are the outcome of historical interactions between diverse local socio-economic and institutional conditions and the various features of land capital as organised through landed property (Cecchi, 1983; Golzio, 1933). They are therefore an expression of the relationship between given communities and the environment in which they have settled (Serpieri, 1969). Specifically, in the words of Rossi-Doria (2005, pp. 164–165, translation by the author), “*the landed property structure [in a certain place] is the result of a process of development in which the relationships among humans, humans and land, the forms of human settlement, and the characteristics of the rural social structure, crystallize.*”

From this perspective, therefore, different local structures of landed property are not only the outcome of various historical processes, but also both convey and reflect how diverse local socio-economic and institutional “*situations*” are organised in connection with land capital itself (Rossi-Doria, 2005). Thus, this reveals the diverse ways in which varying local features of land ownership structures are involved in, and can affect, different local

¹¹This circumstance may not be universal. For instance, in Scotland—unlike other systems, such as the Italian one—there can be only one possible owner of land (Beingessner, 2023). Another example is Switzerland, where co-ownership is now permitted but was prohibited until 1965 (Theurillat et al., 2015).

¹²Although the term pulverisation is more commonly used in English to describe natural processes—such as the breaking down of stone—it is adopted here to effectively convey the extreme subdivision of land properties observed under such conditions.

socio-economic dynamics (Triantafyllopoulos, 2008). Let us examine these considerations in more detail for each of the dimensions of landed property presented above (see Figure 2.1).

2.3.2.1 *Dimension and spatial distribution of properties*

Different property sizes, combined with varying spatial distribution, may reflect different patterns of land use, while also underpinning distinct productive organisations and local socio-economic dynamics.

- The rural context is intrinsically linked to agro-forestry activities, and land capital is a key productive factor within them (Serpieri, 1940). This direct link introduces specific rigidities and constraints into productive processes. The natural characteristics of land capital—while providing essential services throughout the entire biological cycle of agro-forestry production—limit the breakdown, reconversion, and adaptability of production processes and also shape the character of local output (Cecchi, 1988; Polidori & Rocchi, 2013). On the other side, the artificial characteristics of land capital—such as property size and contiguity—also influence the implementation of diverse local productive processes and models of agro-forestry enterprises¹³ which are tailored to these features. Particularly in the case of agro-forestry activities that are not specialised in highly intensive productive systems,¹⁴ the parcel-based organisation of land capital constitutes the basic productive unit (Cecchi, 1983). In this sense, the size and distribution of properties shape the density of productive units that agricultural enterprises can establish, influencing the economic viability of specific farming techniques (Dale, 1997) and determining the variety and scale of feasible production processes (Brusco, 1979). This, in turn, may support the emergence of broader and more diversified forms of local productive organisation and division of

¹³A detailed discussion of these models is beyond the scope of this study. For specific classifications, see Brusco (1979), Basile and Cecchi (2001), and Gaudio et al. (2008). Following the work of Brusco (1979), the stratification among different farm types is based on the proportion of wage labour and family labour in relation to total labour. Based on this, *part-time farms* are characterised by a majority of family labour, with no family member employed full-time. *Peasant farms* are those in which wage labour accounts for no more than 34% of total labour. *Peasant-capitalist farms* rely on wage labour ranging from 34% to 67%, while *capitalist farms* are those in which wage labour exceeds 67%. Each of these broad categories may be further disaggregated according to different criteria. For instance, capitalist farms can be distinguished into professional and non-professional farms, depending on the amount of labour provided by the farm holder and their family members, as well as by agricultural employees. Moreover, land size tends to increase progressively from part-time farms onwards (Brusco, 1979). Additional distinctions may also be made based on the internal and inter-farm organisation of productive processes (Basile & Cecchi, 1997), as further discussed throughout the paper.

¹⁴Highly specialised systems, such as floriculture or intensive indoor livestock farming, are usually less dependent on the size and distribution of arable land (Povellato, 2009).

labour, such as different agro-food clusters (Basile & Cecchi, 2001; Latruffe & Piet, 2014; Rocchi & Stefani, 2002).

From this perspective, scattered micro-properties can hinder local agricultural activities, with production costs exceeding the profitability of farming operations (Latruffe & Piet, 2014; Rossi-Doria, 2005). At the same time, small property sizes—depending on the type of agricultural production—may limit farms' potential to exploit internal economies of scale and reduce machinery field efficiency (Povellato, 2009; Rocchi & Stefani, 2002), while a high number of plots increases organisational and managerial complexity, and long distances between them raise transport costs (Latruffe & Piet, 2014). These conditions may, for instance, foster productive organisations whose competitive advantage rests on diversification strategies and on exploiting economies of scope—internal to farms or, when embedded in wider local labour systems, external to individual firms but internal to the local system (Basile & Cecchi, 2001; Rossi-Doria, 2005). Conversely, large contiguous estates can sustain intensive productive systems that exploit internal economies of scale and scope (Basile & Cecchi, 2001; Povellato & Vanni, 2017) or, in cases of under-efficient use of land resources, such systems may be characterised by extensive agricultural forms, as in historical latifundia (Bertolino, 1927) or in certain types of non-professional capitalist farms (Brusco, 1979).

- At the same time, land capital can also be linked to alternative uses and economic activities in rural contexts. In this regard, a high incidence of small and micro properties may also reflect a proliferation of housing, manufacturing workshops, commercial enterprises, and real estate developments, pointing to a potential spread of urban and industrial expansion within rural areas (Cecchi, 1983; Povellato, 2009). These dynamics, beyond signalling differentiated trajectories of rural socio-economic development, may also generate conflictual or complementary patterns between existing and emerging land uses, while at the same time reshaping land use itself, depending on how different activities compete for local resources and rents (Basile & Cecchi, 1997; Romagnoli, 1999).

2.3.2.2 *Number of properties*

The number of properties in relation to their surface size, along with the overall surface of the area under analysis, offers insight into how societies participate in and control land capital, thereby signalling diverse economic and socio-cultural phenomena.

- Given the finite nature of land capital within a given area, the number of properties is

closely related to its size. From this perspective, cases of concentrated landed property structures, predominantly composed of a few medium to large estates, may indicate a stronger control over land capital by a limited number of landowners, thus resulting in a restricted degree of societal participation. This, in turn, can narrow local socio-economic opportunities, such as entrepreneurial initiatives, and concentrate dynamics of wealth accumulation, savings, and political power in the hands of local land elites. Under this setting, local social structures tend to be polarised and weakly cohesive (Bertolino, 1927; Doepke & Zilibotti, 2005; Federico, 2009; Zangheri, 1981). As seen above, this circumstance can underpin both intensive and extensive agricultural systems, also calibrated to different degrees of local investment propensity, which are reflected in broader and differentiated long-term dynamics of local development (Banerjee & Iyer, 2005; Bertolino, 1961; Brusco, 1979).

- On the other hand, a loosening of the aforementioned conditions may allow for the emergence of a larger number of small to medium-sized properties, which can support a more equitable distribution of opportunities and income flowing through land capital across a broader segment of local households (BiGGAR Economics, 2024; Musotti, 2001). This, in turn, may also be accompanied by a greater local propensity for innovative productive investments within more cohesive social structures (Triantafyllopoulos, 2008). However, extreme cases of social participation may paradoxically reduce landowners' control over land capital which—given its finite nature—is likely to be divided into small or micro units, reflected in fragmented property structures. As noted, this condition can hinder land-based economic activities, with adverse effects on local socio-economic dynamics, particularly by fostering a fragmented social fabric and patterns of land abandonment—a phenomenon to be discussed shortly (Rossi-Doria, 2005).

2.3.2.3 *Number and type of holders*

The number of landholders represents one of the institutional dimensions of land capital that partially overlaps with, but does not perfectly coincide with, the number of properties. Land ownership is, in fact, often held either outright or jointly with other co-owners. Moreover, in certain systems, including the Italian one, there are situations where identifying the legitimate owner proves to be impossible. These so-called *silent properties* are typically the result of unregistered land transfers during inheritance succession (Medici et al., 1962). Different numbers of landowners remain associated with varying degrees of participation in and control over land capital at the local level, each carrying specific

socio-economic implications as previously outlined. Moreover, co-ownership may also reflect socio-economic relationships of affinity—such as family ties—and thus mirror specific forms of socio-cultural organisation (Triantafyllopoulos, 2008).

Different types of landowners, in turn, reflect distinct value creation initiatives translated into various land uses, as well as differing dynamics of value capture and distribution (Cecchi, 1983). For instance, rural contexts may exhibit virtuous productive practices by private landowners, such as entrepreneurial farmers, or by locally rooted companies that integrate land capital into embedded local economic activities. At the same time, public landowners may play a key role in enhancing the natural or historical value of this asset. Moreover, even considering the imperfect overlap between property ownership and land management (often resulting from the unbundling of land rights), landowners and related land actors reveal distinct layers of local social structures, organised around landed property (Bertolino, 1927; Brusco, 1979; Musotti, 2001).

2.3.2.4 *Property systems and bundles of rights*

The formal definition of property rights within a system capable of implementing and enforcing them is considered a mechanism to secure land ownership. This, in turn, provides conditions of stability conducive to land investment and economic growth (Aragón, 2015; Green & Moser, 2013; Meinzen-Dick & Di Gregorio, 2004; Musotti, 2000; Ryan-Collins et al., 2017). Moreover, depending on the property system and bundle of rights in place (see Appendix A.2 for further details), different local channels can be identified through which wealth, local economic opportunities, and power are distributed¹⁵.

That said, among the various property regimes, private ownership has become the dominant form worldwide and has, at times, assumed a pivotal role in scholarly debates as the mechanism deemed most suitable for ensuring the optimal allocation of capital to land (Hardin, 1968; Jacobs, 2010). Such a view remains open to debate. While recognising the fundamental role of private property in generating socio-economic benefits, both at the individual and collective level, in certain contexts and historical periods, its nature, as an exclusive right over land capital, activates mechanisms of wealth and power concentration in favour of specific landowners (Brown & Nabi, 2024; Christophers, 2020; Mazzucato et al., 2023; Ryan-Collins et al., 2017; Stiglitz, 2015; Wightman, 2024). Moreover, its management may become economically unsustainable in peripheral rural contexts, where the profitability of land capital is particularly low (Bromley, 1989, 1991).

Beyond this, the presumed superiority of private property is challenged by the diverse

¹⁵For alternative perspectives within the institutional literature, see, for example, North (1991), Bromley (1989), and Ostrom (1990).

forms that property systems assume at the local level. More precisely, property rights can be unpacked into a multitude of more or less formal entitlements that combine in various ways locally (Schlager & Ostrom, 1992). These processes unfold in different ways depending on their interaction with diverse local socio-economic, institutional, and land ownership conditions (Ostrom, 2003). This adds another layer to the analysis. Different local articulations of bundles of rights—which may combine various property systems, such as public and private (Ostrom, 1990)—further differentiate the formal organisation and distribution of land ownership. Such dynamics are exemplified by sharecropping or the Scottish Crofting systems, where, despite a broader distribution of land use rights, a more concentrated formal property structure can be commonly found (BiGGAR Economics, 2024; Brusco, 1982; Cecchi, 1992a; Crofting Commission, 2024; Musotti, 2001; Wightman, 2024). These arrangements, in turn, underpin distinct socio-cultural, economic, and institutional patterns, as illustrated, for instance, by the empirical cases presented in Ostrom (1990). These patterns may, in turn, favour diverse pathways of rural local development.

2.4 Unveiling the Framework: the second dimension, land rent

Let us now turn to the second block of our results. The combination of different ownership structures and land uses, explored in the next section, gives rise to diverse income streams generated through land capital. These remunerations may stem from productive activities, commonly referred to as “*earned income*”, or may take the form of land rent, that is, “*unearned income*” (Sayer, 2023). Given the role that this latter mechanism appears to play in local development dynamics, the following sections examine it in greater depth.

2.4.1 *The Full Rent*

In general, the rent of land results from the interaction between the inelastic supply curve, which reflects the fixed or rigid availability of this non-reproducible asset, and a demand willing to pay a market price that exceeds its production cost¹⁶. Specifically, given this interaction and all other things being equal, as demand increases, the greater the non-fungibility of land for the required use, especially in the short term, the higher the resulting rent will be. In the long run, this mechanism may be relaxed as a result of specific land-use transformations, which are usually carried out at increasing costs (Camagni, 1998).

Nowadays, the classical Ricardian rent of land, or *true rent* as referred to by Marshall

¹⁶Although, according to the classical approach, land should have no production cost, since it is not produced and contains no portion of social labour, in practice it does have it reflecting the cost of using the services provided by the land (Camagni, 1998; González, 2015; Marshall, 1920/2013).

(1920/2013), paid to the landowner exclusively for the use of the *original and indestructible powers* of the soil¹⁷ is scarcely ever met in its pure form, being altered by the very process of land capital formation itself (Marshall, 1920/2013). In line with this, Marx (1867)¹⁸, as cited by Harvey (1982), is indeed among the first to challenge an exclusively Ricardian perspective within Rent Theory (Bessaoud & Réquier-Desjardins, 2010; González, 2015; Harvey, 1982). More precisely, in analysing capital investment on land, he observes a long-term improvement in soil productivity which, once the investment is amortised, contributes to swelling the land rent (Harvey, 1982).

Moreover, in the short run, the application of capital to land creates an almost indistinguishable blend between interest on capital and land rent (Harvey, 1982). This transient form of remuneration can take the form of what Marshall (1920/2013) defined as *quasi-rent*¹⁹. In this case, *quasi-rent* refers to a temporary extra-remuneration resulting from capital investments on land which, under certain conditions, can give rise to a transitory monopolistic environment—namely, conditions of advantage that cannot be easily or quickly replicated by the rest of the system²⁰ (Marshall, 1920/2013). These conditions can thus enable the transitory capture of windfall extra profits as remuneration for the risk borne by the landowner-investor (Blaug, 1978).

That said, it is worth noting that not only does capital applied to land enrich *true rent*, but land itself also influences the rent of capital tied to it, making the two increasingly alike and subject to the same dynamics²¹. Indeed, although land improvements are generally

¹⁷According to Ricardo, land rent arises precisely from the innate productive power of land, combined with its scarcity, in relation to specific demand, and its durability over time (Parrinello & Cecchi, 1982; Ricardo, 1776c). It is therefore that “*portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible power of soil*” (Ricardo, 1776c). In this sense, it excludes any returns associated with land improvements undertaken by landholders (Whitaker, 2006). For further discussion on the original and inherited powers of land, see Definition 1, and for Ricardian rent, see Appendix A.3.

¹⁸Marx, K. (1867). *Das Kapital: Kritik der politischen Ökonomie. Erster Band. Der Produktionsprozeß des Kapitals*. Hamburg: Verlag von Otto Meissner.

¹⁹The concept of *quasi-rent*, which in general terms refers to income derived from man-made factors of production whose supply is temporarily fixed, was first introduced by Marshall (1920/2013) through the well-known parabola of the meteoritic stone (Dooley, 1991). This notion finds parallels in further theoretical elaborations within the scientific literature. Notable examples include the dynamic innovation-driven development environment formulated by Schumpeter (1934), as quoted by Mazzucato et al. (2023), and the Differential Rent of Type II elaborated by Marx (1867), as cited by González (2015).

²⁰In the words of Marshall (1920/2013): “*Thus there is likeness amid unlikeness between land and appliances made by man. There is unlikeness because land in an old country is approximately a permanent fixed stock: while appliances made by man, whether improvements in land [...] are a flow capable of being increased or diminished according to variations in the effective demand for the products which they help in rising. So far there is unlikeness. But on the other hand there is likeness, in that, since some of them cannot be produced quickly, they are a practically fixed stock for short period: and for those period the incomes derived from them stand in the same relation to the value of the products raised by them, as do true rents.*” (Marshall, 1920/2013, p. 358)

²¹In the words of Serpieri (1940), “*the saving assets, represented by the land investments, follow the*

reproducible in the long run, in line with variations in effective demand for the products they help to generate, and are therefore subject to depreciation (Ryan-Collins et al., 2017), recent contributions from residential real estate markets reveal a rather different reality (Christophers, 2020; Knoll et al., 2017; Mazzucato et al., 2023; OECD/Eurostat, 2015; Ryan-Collins & Murray, 2023). What emerges is that the value of land²² both constitutes and influences a substantial share of the total value of dwelling (OECD/Eurostat, 2015), and that both have increased over the past 140 years in most advanced economies, albeit with significant cross-country heterogeneity (Knoll et al., 2017). That is, in specific contexts and under particular conditions, capital tied to land not only fails to depreciate at the same rate as other man-made capital goods, but may even appreciate over time, as land typically does. Besides the general scarcity of land, the reason also lies in the fact that each property, in the combination of site and land improvements, may be regarded as ideally “*more or less unique*” (Marshall, 1920/2013). The replication of such unique conditions thus seems more constrained than that of other forms of capital.

Ultimately, the rent of land also incorporates an additional element shaped by the dynamics of the neighbouring atmosphere (Marshall, 1920/2013). The value of land is indeed further affected by its position in relation to both access to and the presence of surrounding socio-economic opportunities. More favoured sites can thus gain an extra income, in what Marshall (1920/2013) defines as “*situation value*” or “*special situation rent*”²³.

The rent of land is, therefore, a far more complex phenomenon today than traditionally conceived (Mazzucato, 2018; Mollard et al., 2001; Moulaert & Mehmood, 2025)²⁴. In light of the foregoing, contemporary land rent—or rent of land capital—can be understood as a “*composite product*”²⁵ and defined as “*full rent*” (Marshall, 1920/2013, p. 130). The

economic fate of the raw land, yielding—together with it—positive or negative rents, Ricardian differential or locational rents” (Serpieri, 1940).

²²In this work, the concept of value is primarily understood from a marginalist perspective, namely as the utility a good or service is able to generate, directly reflected in its market price (Mazzucato, 2018).

²³“*The situation value - that is, the value- which a site derives from the growth of a rich and active population close to it, or from the opening up of railways and other good means of communication with existing markets, is the most striking of all the influences which changes in the industrial environment exert on cost of production. [...] The extra income which can be earned on the more favoured site gives rise to what may be called a special situation rent*” (Marshall, 1920/2013, pp. 365–366).

²⁴According to Marshall (1920/2013), “*pure rent in the strict sense of the term is scarcely ever met with: nearly all income from land contains more or less important elements which are derived from efforts invested in building houses, in draining the land, and so on*” (Marshall, 1920/2013, p. 350).

²⁵In developing his rent theory, Marshall (1920/2013) defined both “*composite rent and quasi-rent*”. The latter refers to the rent obtained by organisations, arising from the fact that the total earnings of productive factors may exceed the sum of the earnings of individual productive factors. Unlike pure quasi-rent, composite quasi-rent is not a temporary phenomenon but can persist indefinitely (Kondo, 2006). Moreover, according to Kondo (2006), Marshall (1920/2013) used the term “*composite rent*” to describe a rent that is not clearly

full rent is therefore made up of (Marshall, 1920/2013)²⁶:

1. Income flows from the original and imperishable features of raw land (*True Rent*);
2. Income flows from land improvements made by humans (in the short run as *Quasi-Rent*);
3. Income flows from the influence of the surrounding socio-economic environment (*Special Situation Rent*).

2.4.2 Rural Land Rent

The rural context is particularly conducive to different types of land rent—understood here as *full rent*. On the one hand, in fact, the supply of specific types of rural land capital is difficult to expand, at least in the short term, due to distinct physical and environmental constraints (Camagni, 1998). On the other hand, there may be demand for the diverse *services* that rural land capital can offer (Arzeni, 2024; Mollard et al., 2001; Romagnoli, 1999).

Based on this and building on Camagni (1998), through a review of various strands of scientific literature²⁷, four diverse types of land rent can be identified in the rural context. Specifically, as illustrated in Table 2.1, these different types can be grouped based on the predominant supply- or demand-side mechanism and the corresponding territorial scale. Their underlying theoretical foundations are discussed in greater detail in Appendix A.3.

From a micro-territorial perspective (i.e., by looking at individual properties), more fertile plots in rural contexts—that is, those with higher quality in terms of suitability for specific rural uses (natural and artificial fertility), or those located closer to key central poles relevant to rural life (i.e., position)—can generate Differential Rent. Taking agricultural

attributable to a single individual. However, “*composite rent*” also applies to entities, such as land capital, which, given their composite nature, can yield a surplus from each of their constituent parts (Marshall, 1920/2013, p. 375).

²⁶As seen in Chapter 1, Marshallian rent theory has received some criticism within what McCaffrey (2025) describes as the Fetter–Marshall dispute. A detailed examination of this controversy lies beyond the scope of this study. What we wish to emphasise here, however, is that despite such criticism—some centred on the alleged lack of originality of Marshallian rent theory compared to the Ricardian one, as well as on the difficulty of clearly distinguishing between the concepts of land and capital—its value lies in the articulation it achieves and in the wide range of real-world situations it is able to account for (Whitaker, 2006). This is particularly true in light of the broader and more complex notion of land capital addressed in this paper.

²⁷From classical and neo-classical economists to Von Thünen-inspired mainstream localisation theory, within the broader framework of modern territorial and urban economic theory (Bessaoud & Réquier-Desjardins, 2010; Camagni, 2012, 2017, 2019; Capello, 2004; Capello et al., 2017; González, 2015; Harvey, 1982; Jager, 2020; Landreth & Colander, 1994; Marshall, 1920/2013; Marx, 1987; Mazzucato, 2018; Mazzucato et al., 2023; Mollard et al., 2001; Park, 2014; Parrinello & Cecchi, 1982; Ricardo, 1776a, 1776b; Ryan-Collins et al., 2017; Sayer, 2023).

Table 2.1: **Different types of land rent in the rural context**

		Territorial Level	
		<i>Micro-Territorial Level</i>	<i>Macro-Territorial Level</i>
Prevailing Effect	<i>Prevailing Supply Effect</i>	Differential Rent <i>different fertility/ position</i>	Absolute Rent Type 1 <i>“economic or class-based limitation”</i>
	<i>Prevailing Demand Effect</i>	Monopoly Rent <i>special fertility/position</i>	Absolute Rent Type 2 <i>rural localised economic advantages</i>

Source: Author’s elaboration based on Camagni (1998)

use as an example, greater fertility may refer to natural and biological qualities, but also to enhanced land improvements, such as hydraulic works, and to a more advantageous location, such as proximity to food processing and transformation centres. Within the traditional struggle between the limited supply of such properties and the growing demand for the products associated with them, landowners exploit the ability of more fertile plots to ensure lower production costs by appropriating the resulting differential in extra profits—among competing users—in the form of rent.

Remaining at the micro-territorial scale, land capital can also give rise to forms of Monopoly Rent. It arises when portions of land capital are capable of generating a specific advantage—such as a high-quality or unique products—that are subject to a “special” demand (Camagni, 1998). Landowners, taking advantage of the higher willingness to pay for these specific products—which remain in limited supply—can appropriate a form of extra-surplus by exploiting consumer competition, which drives up the market price of such goods. This effect is therefore primarily driven by demand, namely, by increasing competition and willingness to pay for these peculiar land-based goods or services. In rural areas, Monopoly Rent emerges in properties where land capital exhibits such special features ensuring landowners a monopolistic power within the market for those land products.

Moving to a macro-territorial level (i.e., when observed at the scale of a system), certain choices made by landowners may, relative to a given demand, give rise to situations of land scarcity within a certain area. Specifically, speculative strategies, such as concentrating land ownership or deliberately withholding part of the land capital off the market, may, under specific demand conditions, give rise to scarcity rent or Type I Absolute Rent, as defined by Camagni (1998). In rural contexts, such supply limitations may stem from *land grabbing*

phenomena or agricultural lobbying strategies (Gunnøe, 2014; Knuth, 2015; Povellato & Vanni, 2017).

Likewise, rural land capital may also be subject to specific demand due to particular local socio-economic advantages associated with it within a delimited area or system. Examples include the vocation for high-quality wine production in the Chianti area of Tuscany (Italy) (Polidoro & Romano, 1997), Parmigiano Reggiano cheese produced in the provinces of Parma and Reggio Emilia (Italy) (Brusco, 1979), and Baronnies PDO olive oil in France (Mollard et al., 2001). Indeed, the literature on rural local development recognises that certain rural areas display specific local advantages for particular economic activities, rooted in distinctive local socio-economic conditions of organised efficiency at the system level (Basile & Cecchi, 2001; Brusco, 1979; Mollard et al., 2001; Musotti, 2000). In these areas, the demand for land capital reflects the desire to access and benefit from such advantages, and depending on supply conditions, it may give rise to Type II Absolute Rents (Camagni, 1998).

Locally, these different types of rent can arise, overlap, and interact in various ways, depending on the evolving balance between supply and demand under diverse local socio-economic and land capital conditions (González, 2015; Marshall, 1920/2013). Building on previous insights, these conditions can be summarised as follows (González, 2015; Marshall, 1920/2013; Mollard et al., 2001; Povellato, 2012; Ryan-Collins et al., 2017; Theurillat et al., 2015):

- The fertility and productivity of land capital, stemming from both natural characteristics and human-made improvements;
- The location of land capital—especially in terms of accessibility to key centres or infrastructures, as well as to localised economies and specific advantages—and the level of surrounding local socio-economic development;
- Conditions of natural or economic scarcity, relative to a given demand, and linked both to the fixed nature of the resource and to landowners' choices.

In line with this, the structure of landed property also plays a significant role (see e.g. Ay and Latruffe, 2017; Povellato, 2012). Ownership arrangements influence the suitability of land capital for certain uses, potentially making some plots artificially “more or less fertile”. In cases of high fragmentation, for instance, demand for agricultural land may become latent or even disappear due to practical constraints on its effective use. From this perspective, even public policies—such as land-use regulations or agricultural measures—may establish a hierarchy of values among different land uses, effectively rendering certain properties

artificially “more fertile” for specific purposes than others, and thereby influencing the rent mechanisms associated with them (see, e.g. Sotte, 2017, Povellato and Vanni, 2017, Salhofer and Feichtinger, 2020, Cecchi, 1988, Graubner, 2018, Varacca et al., 2021, Christophers, 2020, Guastella et al., 2018).

Depending on the diverse local declination of these mechanisms, and the associated supply-demand dynamics, varying land prices—and consequently land values²⁸— can therefore be observed at the local level. In this sense, land prices contain a high degree of informational content regarding the characteristics of land capital and its surrounding environment in relation to specific uses (Ay & Latruffe, 2017).

2.4.3 *The Good and the Bad of Land Rent*

The manifestation of various forms of land rent entails both “*good and bad*” effects on local development dynamics, depending on whether their nature is transitory or permanent (see Table 2.2). Let us start by exploring its potential positive aspects, which can represent key factors in economic growth and innovation dynamics (Mazzucato et al., 2023).

Given its characteristics, positive land rent reflects localised competitive advantages associated with specific land uses at certain times and within specific rural contexts. For this reason, it cannot be temporarily eliminated, and its varying degrees of intensity express the diverse locational advantages embodied in land capital, as well as the different levels of attractiveness of rural areas (Camagni, 2019). Accordingly, diverse land prices reflect the varying profitability of land capital for different rural uses, based on current or expected socio-economic opportunities deriving from it (Povellato, 2012). In this sense, for instance, in rural contexts, higher land rent can be associated with land capital characterised by greater fertility for a specific use, such as agriculture, as previously discussed (Mollard et al., 2001). This circumstance may also signal a more dynamic rural context, linked to greater local socio-economic opportunities arising from this specific use. On the other hand, low or zero rent are associated with less fertile conditions—such as those characterised by a fragmented property structure for land-based uses, as discussed above— and signal more limited socio-economic opportunities embedded in land capital, potentially reflecting situations of lower investment and greater fragility in local development dynamics (Povellato & Vanni, 2017; Wojewodzic et al., 2021). As already Smith (1776/1973)²⁹, as quoted by Parrinello and

²⁸Within the economic literature, land value is also discussed in connection with its rental value (Camagni, 2019; Harvey, 1982; Marshall, 1920/2013). In general, it refers to land capital—whether it holds value or not—depending on the presence of positive, negative, or zero rent (Wojewodzic et al., 2021). However, drawing from the marginalist perspective, the concept of value here is an expression of its utility and is directly reflected in the market price (Mazzucato, 2018). In this sense, land value is always reflected in its price, which may or may not include portions of rent.

²⁹Smith, A. (1776). *Indagine sulla natura e le cause della ricchezza delle nazioni*, Isidei: Milano (1973).

Cecchi (1982) suggested, higher land rent guide stronger capital allocation flows—and thus land improvements and investments—towards more virtuous rural contexts (Parrinello & Cecchi, 1982).

Subsequently, under the assumption of a competitive environment, different levels of land rent can lead to an optimal spatial and inter/intra-sectoral allocation of land capital, favouring socio-economic activities able to pay higher rent—namely, those deriving greater benefits from land use. This, in turn, supports the maximisation of the overall social value generated in the system by minimising production costs (Camagni, 1998; Capello, 2004; Jager, 2020; Romagnoli, 1999).

Consistently with this framework, positive land rent can also foster local innovation paths. Indeed, the growing land demand for certain uses associated with positive rent can stimulate an innovative environment, pushing the socio-economic activities already involved to invest continuously in order to maintain their position and control over land capital and its localised advantages (Camagni, 2017; Chandra, 2023; Christophers, 2019; Romagnoli, 1999). This environment can foster the formation of *quasi-rents*, which, as noted, provide investors with transitory extra remuneration also within innovation dynamics. *Quasi-rent* is, by definition, a transitory phenomenon. In fact, in the long run, monopolistic conditions of advantage tend to fade, as other landowners undertake similar investments on their properties through mechanisms of imitation and competition (Blaug, 1978; González, 2015; Marshall, 1920/2013). In rural contexts, the phenomenon of *quasi-rent* can, for instance, emerge in relation to product innovation, such as the development of high-quality agricultural foodstuffs (Belletti, 2002).

After that, attention turns to the negative side of land rent formation in terms of local development. In particular, as previously discussed in Chapter 1, since the time of the Classical Economists, land rent is widely recognised as a mechanism that alters income distribution, which, in turn, may also hamper economic growth. More precisely, in their view, this extra-remuneration for landowners—or *rentiers*³⁰—occurs at the expense of the productive class, namely the capitalists, from whom it is subtracted (González, 2015). It thus represents a diversion of profit which, rather than being reinvested to support growth through capital accumulation, takes the form of rent allocated to actors who neither contributed to its generation nor play an active role in the system's dynamics (Mazzucato, 2018).

In this sense, land rent is seen as a mechanism of conservation, a semi-parasitic instrument that extracts surplus from productive activities, thereby limiting progress (Parrinello &

Trad. Bartoli, F., Camporesi, C., Caruso, S., con introduzione di Dobb, M., della versione originale *An Inquiry into the Nature and Causes of the Wealth of Nations*, a cura di Cannan, E., Methuen, London (1961).

³⁰Marx (1987) defines *rentiers* as “people who, satiated by the constant tension in business, aspire to nothing more than leisure and undemanding positions.”

Cecchi, 1982). More precisely, even in light of contemporary dynamics, the rise of positive and permanent land rent contributes to local economic stagnation by absorbing productive surplus (Mazzucato et al., 2023; Stiglitz, 2015). This occurs on behalf of landowners, who may also be involved in local productive organisations as entrepreneurs, yet increasingly prefer to take advantage of rent positions through rent-seeking behaviour (Bellandi & Storai, 2022; Bertolino, 1927). Such rent-seeking practices—aimed at preserving monopolistic conditions and securing privileges or protections to sustain rents—generate broader collective social costs (Bellanca, 2018; Stermerding, 2023; Theurillat et al., 2015; Tullock, 1967). In fact, they can lead to the diversion of locally generated value—including public value—towards other territories or speculative investments, while reshaping traditional local productive structures and potentially generating fractures in development trajectories. Specifically, behind the rise of rent positions, we can observe phenomena of restricted societal access to and participation in land capital—also in line with broader patterns of concentration—which in turn hampers local entrepreneurial initiatives (for example, those undertaken by young agricultural entrepreneurs (Stefani, 2025))—or rather, confines access to actors with substantial financial means (Florida, 2017; Gunnoe, 2014; Knuth, 2015). The entry of such actors, particularly when external and disconnected from the local cultural context, may inevitably lead to transformations in the local socio-productive organisation and paths of development (Bellandi & Storai, 2022; Camagni, 2017; Delladetsima, 2006; Rocchi & Stefani, 2002). These dynamics may also extend to the accessibility of local services and real estate for resident populations, particularly in highly attractive rural areas, where extractive dynamics can contribute to processes of rural gentrification (Crevoisier & Rime, 2021; Segessemann & Crevoisier, 2016).

Furthermore, the resulting process of wealth accumulation linked to rent mechanisms may be jeopardised, leading to rising inequalities in the distribution of wealth and income across and within territories and communities (Brown & Nabi, 2024; Camagni, 2017; Mazzucato et al., 2023). For example, as mentioned in Chapter 1, in OECD countries, the concentration of land ownership for residential use among wealthier and older households—combined with the real increases in its values observed over recent decades—has primarily benefited this specific social group, at the expense of younger and less affluent households. These latter are instead subject to the so-called “*rent trap*” (Ryan-Collins et al., 2017), in which rising private rents absorb a growing share of their wages—which, at the same time, do not exhibit comparable growth rates to local prices—limiting their ability to save and to access property ownership (Knoll et al., 2017; OECD, 2017; Ryan-Collins & Murray, 2023). Moreover, these dynamics also translate into spatially uneven outcomes, reinforcing territorial inequalities within OECD countries by differentiating development

trajectories between more and less attractive places (Buciuni, Corò, et al., 2023; Edwards, 2025; Florida, 2017).

In addition, the concentration of landed property and its associated rent flows in the hands of *rentiers* is likewise accompanied by a concentration of power. In particular, *rentiers* may form local power coalitions, or land elites, and act as conservative forces, opposing the implementation of innovative projects that could disrupt their existing balances (Barbera & De Rossi, 2021; Barca & Carrosio, 2020; Christophers, 2020). This power, which can take on monopolistic traits due to the control of a scarce and fundamental asset, can also hinder competition and stifle innovation dynamics (Christophers, 2016; Florida, 2017; Mazzucato, 2018).

Table 2.2: **Good and Bad sides of Land Rent**

<i>Good sides of Land Rent</i>	<i>Bad sides of Land Rent</i>
Positive land rent is an expression of localised advantage, both at the plot level and at the system level	Positive land rent as a mechanism of alteration in income distribution: jeopardising wealth accumulation and fostering income and spatial inequality
Positive land rent guides and attracts capital investment	It is a tool of conservation that limits progress and contributes to economic stagnation
It is a mechanism for the optimal allocation of land capital (spatial and inter-/intra-sectoral allocation) contributing to reduced production costs at the system level	Positive and permanent land rent favours <i>rent-seeking behaviour</i> , which in turn generates social costs and contributes to changes and fractures in local socio-economic dynamics
Positive land rent favours paths of innovation, particularly within the framework of <i>quasi-rent</i> phenomena	It can foster local power concentration, hinder competition and innovation, and enable the formation of power coalitions led by land elites or <i>rentiers</i>
<i>Transitory and re-invested</i>	<i>Permanent and rent-seeking behaviour</i>

Source: Author's elaboration based on Marshall (1920/2013), Tullock (1967), Parrinello and Cecchi (1982), Romagnoli (1999), Camagni (1998), Capello (2004), Camagni (2012), Stiglitz (2015), González (2015), Ryan-Collins et al. (2017), Camagni (2017), Camagni (2019), Christophers (2019), Barca and Carrosio (2020), Mazzucato et al. (2023), Sayer (2023), Ryan-Collins and Murray (2023)

Taken together, all the elements presented so far highlight a certain dualism in the dynamics of rural local development, rooted in the formation of local land rent. On the one hand, indeed, land rent serves as an instrument that signals more virtuous local socio-economic contexts, guiding investments and fostering innovation. On the other hand, it also acts as a mechanism that fuels inequalities and contributes to negative dynamics in development trajectories. At the core of this dualism lies the very nature of land rent—whether it is transitory or permanent. When transitory, land rent tends to be re-invested locally, supporting virtuous dynamics in productive processes, including innovation patterns. Conversely, when it becomes permanent and is accompanied by rent-seeking behaviours, it often leads to negative outcomes, such as social and spatial inequality,

economic stagnation, and the consolidation of unproductive power structures.

2.5 Unveiling the Framework: the third dimension, land uses

We now turn to the third and final element of the framework: distinct rural land uses. These uses extend to a broad array of productive spheres as well as civil and social functions (see Table A.3 in Appendix A.4 for a summary of uses and definitions). Locally heterogeneous, they contribute to shaping distinct development pathways (Abbozzo et al., 2002; Brusco, 1979; Cecchi, 2001; Merlo, 1984; Ostrom, 1990). On this basis, the following section presents various land uses, exploring—as far as possible—their implications for rural local development. Given the nature of the context, they are discussed with attention to possible complementarities or separations from agro-forestry activities, which—though not exclusive—remain a defining element of the rural environment (Iacoponi, 1998).

2.5.1 *Agro-forestry Uses of Land Capital*

As previously discussed, land capital—as a dominant productive asset in agro-forestry activities (see definition in Table A.3 in Appendix A.4)—shapes a variety of agricultural uses through both its natural and artificial features. These uses, in turn, concur to define different productive processes and forms of productive organisation at the local level. In other words, diverse agro-forestry productive processes and business organisational models adapt to different local socio-economic conditions and land capital characteristics in order to achieve profitability³¹ (Brusco, 1979; Latruffe & Piet, 2014; Musotti, 2000; Rocchi & Stefani, 2002; Rossi-Doria, 2005; Serpieri, 1969).

Focusing on land capital, greater fertility for agro-forestry purposes—which, as seen, is characterised by more favourable natural features³², and by valuable property structures organised in medium- to large-sized estates in good proximity to key agricultural centres (Povellato & Vanni, 2017)—can, in turn, favour what Basile and Cecchi (1997) define as *homologated agriculture*. Specifically, such conditions favour a productive model characterised by high capital investment and technological innovation, standardising processes and outputs, demanding specialised use of land capital, and relying on advanced technology. The advantages of this model lie in the achievement of internal economies of scale

³¹This intuition is not new in the literature and can be traced back to the theory of *economic place*, according to which there exists a specific economic location for different types of agricultural management, such as large capitalist enterprises, small peasant holdings and classical sharecropping. From this perspective, indeed, diverse agricultural management systems rationally adapt to different local economic and natural conditions. See, for an in-depth discussion, Cattaneo (1844); D'Antone (1981).

³²These include biological richness, suitable climatic conditions, and advantageous morphological aspects such as flat slopes.

and scope. This is the case of large capitalistic agricultural enterprises which, if further supported by specific land conditions—such as contiguity among different properties—may suggest the emergence of more complex local productive organisations across farms (e.g. agricultural business clusters) (Rocchi & Stefani, 2002). Such a model typically relies on wage rather than family labour, fostering a local socio-cultural structure polarised between entrepreneur-landowners and wage workers. Moreover, given the intensive agricultural use of land capital, negative environmental effects—such as increased pollution—can also be observed locally (Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003; Brusco, 1979; Gaudio et al., 2008; Povellato, 2009).

On the other hand, the condition of lower land capital fertility for agricultural purposes—due, for instance, to hilly or mountainous morphology and to smaller, more fragmented landholdings—imposes greater constraints on local productive processes. Specifically, as aforementioned in Section 2.3.2, these land characteristics may hinder the pursuit of internal economies of scale (Povellato, 2009), while instead supporting—under certain conditions—the development of a *non-homologated agriculture* model (Basile & Cecchi, 1997). The strength of this model lies in diversification strategies which, when organised also at the wider system level, enable the achievement of both internal and external economies of scope. In particular, non-homologation is expressed through the multiple use of productive resources—including land capital—across different productive processes that are spatially and economically integrated within and between productive units. This is the case for small to medium-sized multifunctional farms, where agricultural activity is integrated with tourism and small-scale manufacturing. These farms also rely on high labour input rates, largely provided by the farming household itself (Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003; Brusco, 1979; Gaudio et al., 2008). When the conditions of land capital are extremely unfavourable—as in cases of highly fragmented land structures—the economic viability of agricultural processes is hindered, leading to phenomena of land abandonment and, consequently, to the breakdown of the local economic and social fabric (Latruffe & Piet, 2014; Rossi-Doria, 2005; Schuh et al., 2020).

It thus appears that the connection between the diverse local characteristics of land capital—particularly its natural and artificial organisation through landed property structures—and the different forms of agro-forestry land use remains significant, even in spite of the recent technical and technological advancements (for some examples, see UNCEM, 2025). Technological innovations could, in fact, mediate and attenuate this relationship. From this perspective, however, an efficient ground-level implementation of innovative technologies is still constrained by local specificities; that is, by the capacity to adapt such technologies to local conditions through a process that is inherently expensive (ISTAT, 2020,

2021; OECD, 2019). This becomes evident in the case of *homologated agricultural models* which, although ideally aimed at abstracting from local structural rigidities, precisely due to the high rate of technological innovation adopted, still reveal that the characteristics of landed property structures remain, in practice, a relevant factor in both the implementation of such technologies and the achievement of specific competitive advantages (Brusco, 1979; Povellato, 2009; Sotte & Arzeni, 2013)³³.

2.5.2 *Industrial Uses of Land Capital*

Beyond the agro-forestry use, land capital is also engaged in industrial and manufacturing activities within the rural context. In particular, as defined in Table A.3 in Appendix A.4, a low degree of interaction with agro-forestry activities leads to a specialisation of land uses toward industrial and manufacturing activities. It is therefore reasonable to assume a corresponding orientation in local culture and in the rural socio-economic structure consistent with these vocations (Basile & Cecchi, 1997). Such conditions will display further heterogeneity depending on the specific models of manufacturing or industrial organisation that develop locally (see studies on various forms of local development models—such as manufacturing industrial districts or poles with large industrial enterprises located in rural contexts, for example, Becattini et al., 2000; Mäkitie & Steen, 2023; Russo, 1994).

Similar conclusions can be drawn for contexts characterised by a high degree of complementarity with agro-forestry activities (see Table A.3), such as industrialised agriculture or, in the case of non-homologated farming models, multifunctional holdings, mainly family-run, that flexibly combine agricultural and manufacturing activities (see, for example, Basile & Cecchi, 1997; Biscaro et al., 2004; Cecchi, 1988, 1992b).

2.5.3 *Residential and Touristic Uses of Land Capital*

Besides the value that residential use has acquired over time, scientific literature also highlights a growing awareness of the importance of what is referred to as the *residential economy* (Segessemann & Crevoisier, 2016). The residential approach considers how the living environment—namely, the places where people reside and spend most of their income—constitutes an important element of local development. More specifically, the diversity of residential locations and types becomes a factor shaping distinct development dynamics (Crevoisier et al., 2025; Segessemann & Crevoisier, 2016).

³³In fact, large capital-intensive agricultural enterprises tend to adopt standardised technological innovations, usually derived from the industrial sector, that are well-suited to specific structural conditions, including those related to their landed property structures discussed above (Basile & Cecchi, 2001).

Among the different forms of residentiality, we observe—particularly in rural areas of high attractiveness—a growing investment in second homes by both local and external actors, whether for personal use (e.g., second-home amenity migration) or for speculative purposes, as seen in many picturesque Italian villages or *borghi* (Barbera et al., 2022), in what Ryan-Collins and Murray (2023) terms *rentierization*—that is, the shift in the treatment of housing from shelter to a source of economic rent extraction. These practices may conflict with the use of land capital as primary residences by local socio-economic actors, while also putting pressure on the cost of life at the local level. In fact, in extreme cases, such dynamics resemble those of attractive city centres, including phenomena of rural gentrification (Segessemann & Crevoisier, 2016). Land capital is thus commodified through mass tourism activities, being used exclusively for consumption purposes aimed at extracting its cultural, historical, and natural value. The negative effects on local development—such as the desertification of the social and cultural fabric—are well documented in the literature (see, for instance, Barbera et al., 2022; Bell & Jayne, 2010; Bindi, 2022; Sacco, 2018).

Among other forms of residential use, land capital may serve merely as housing or as a dormitory function, up to overlapping with productive activities, as typically observed in multifunctional farms (Basile & Cecchi, 2001). Such combinations may, for instance, involve more sustainable synergies between agroforestry and tourism, culminating in agro-tourism activities and forms of slow tourism, such as the *albergo diffuso* model or community-based forms of management (Basile & Cecchi, 2001; Sacco, 2022; Teneggi, 2018; Varotto, 2020). When these land-use combinations become territorially widespread, they may also come to characterise the local economy and development pathways (Crevoisier et al., 2025; Segessemann & Crevoisier, 2016).

2.5.4 Environmental Uses of Land Capital

Growing awareness of the environmental crisis further links rural land capital to objectives such as biodiversity conservation, climate change mitigation, and landscape enhancement (Sella et al., 2024).

The two main and opposing perspectives concerning environmental use (see Table A.3 in Appendix A.4 for further details)—namely a non-use in line with the *wilderness philosophy* or a sustainable use aimed at producing Ecosystem Services³⁴—entail diverse consequences for rural socio-economic communities. In the former case, for instance, the

³⁴The Ecosystem services are positive environmental externalities that can result from specific and sustainable uses of land capital. They may include: the provision of essential food and raw materials for human survival and productive activities; air filtration and water regulation; climate change mitigation through low-emission practices and carbon sequestration; protection against extreme events such as hydrogeological risks and wildfires; and the provision of cultural and recreational values (Pettenella, 2025).

rural context is relegated to a mere hinterland or a passive backdrop for developments occurring elsewhere, whereas the latter assigns a proactive role to the rural context and its land capital in shaping sustainable local development dynamics (Pettenella, 2025; Varotto, 2020). In particular, it reinforces the overlap between agro-forestry and environmental land uses. Agro-forestry activities, in fact, represent a key pillar of environmental sustainability strategies, as highlighted by recent directions in public agricultural policies—foremost the orientation of the Common Agricultural Policy since 2014 (Brutti et al., 2023; Pe’er et al., 2014). Ultimately, the capacity to generate this environmental public value through the production of Ecosystem Services largely depends on the structure and distribution of land ownership, as emphasised by Atkinson and Ovando (2021).

2.5.5 Patrimonial and Speculative Uses of Land Capital

Land capital can also be viewed as a store of value that generally appreciates over time, making it attractive for patrimonial investment, especially among wealthier social groups (Dei Ottati, 1990; Povellato, 2012). Such investments, more likely where land values are high, may foster speculative strategies with negative effects on local dynamics linked to the rent positions discussed above (Povellato & Vanni, 2017). In this context, new and diverse actors—ranging from construction firms to large financial institutions and affluent social groups—may become involved in local dynamics, shaping the development of local land markets and the use of land capital. These patterns often give rise to tensions with the historically embedded local functions of land capital, with implications for rural communities, including rising prices and rents, the displacement of local populations, and environmental degradation (Delladetsima, 2006; Fairbairn, 2017; Gunnoe, 2014; Knuth, 2015).

2.5.6 The Non-Use of Land Capital: Land Abandonment

Despite its many and varied uses, land capital can also be abandoned (see Table A.3 in Appendix A.4 for a definition). This specific condition, affecting certain rural contexts, appears to stem from the inability to efficiently allocate land resources within processes of local value creation. The reasons behind this inability are manifold: it may result from broader economic and social changes to which local contexts are unable to respond effectively, or from dynamics internal to the territories themselves (Lasanta et al., 2017; Schuh et al., 2020; Weissteiner et al., 2011). Among the local factors, the make-up of landed property plays an important role (see, Rey Benayas et al., 2007; Turchetti, 2025; Wang et al., 2022). In fact, as shown throughout this paper, the structure of land ownership

contributes to shaping specific land uses, particularly in land-based rural activities, as well as their effective implementation and profitability, especially in the case of highly fragmented landownership structures (Cecchi, 1983; Corbelle-Rico et al., 2012; Latruffe & Piet, 2014; Serra et al., 2008).

Over time, when land abandonment becomes prolonged, a self-reinforcing vicious circle between unsuitable property structures and negative local development dynamics tends to intensify. Prolonged abandonment is indeed associated with a growing disinterest on the part of private landowners in maintaining their property—both in terms of plot size and the distribution of land titles—as land management becomes economically unsustainable (Bromley, 1989). In systems based on equal inheritance, this dynamic further exacerbates land fragmentation, including through the emergence of *silent* ownership, thereby reducing the availability of land suitable for local activities and related entrepreneurial initiatives (Cecchi, 1988).

The failure to efficiently allocate land capital within socio-economic activities, and its consequent abandonment, triggers a cascade of negative outcomes in rural contexts³⁵, including the (further) depreciation and deterioration of land capital, the (further) loss of potential for local socio-economic and environmental value creation, and an increase in environmental risks and damages (such as wildfires and biodiversity loss) (Lasanta et al., 2017; Schuh et al., 2020). In addition, land consolidation projects entail high costs that often exceed current land values, thus discouraging their implementation and perpetuating the vicious cycle of fragmentation.

2.6 A Driver of Rural Local Development

The work carried out so far supports not only the recognition of the fundamental role of land capital in local dynamics, but also provides a lens to interpret how this relationship unfolds within a proper and comprehensive analytical framework composed of three interconnected elements related to the land sphere, namely land structures, land uses, and land rents. The diverse local articulation of these elements supports the identification of differentiated land tenure patterns that, starting from heterogeneous landed property structures define different traits within the socio-economic and institutional structures that are organised in connection with them.

In particular, starting from different landed property structures, distinct patterns of land uses are observed locally. According to how these uses are articulated within each context,

³⁵See Curci and Zanfi, 2018, Povellato and Vanni, 2017, Varotto, 2020, Lanzani and Zanfi, 2018, Bevilacqua, 2018, Sella et al., 2024, UNCEM, 2025, Wojewodzic et al., 2021, Mottet et al., 2006, Van Doorn and Bakker, 2007.

heterogeneous processes of value creation³⁶ emerge, as previously discussed (e.g., processes linked to specialised and diversified agro-forestry uses), or fail to do so, as in the case of land abandonment. Such dynamics, beyond involving different types of firms/farms and economic actors, may also entail diverse and broader local divisions of labour, with wider and distinct repercussions for local contexts. Land capital therefore takes on an economic function within local development dynamics, supporting distinct processes of value creation both within and between different productive organisations.

These dynamics may also prove conflicting, given the growing number of interests surrounding land resources³⁷ (Daly & Torre, 2013; Merlo, 1984; Torre, 2023). According to economic theory, such tensions would be resolved as activities able to pay higher rents secure access to land capital; however, this does not necessarily guarantee the flourishing or sustainability of local development paths (Capello, 2004; d'Arcy & Keogh, 1997). A prominent example is that of negative environmental externalities (e.g., loss of biodiversity and increased pollution) associated with intensive forms of agriculture, which are usually considered capable of paying higher rents than more diversified and sustainable uses (Basile & Cecchi, 2001; Romagnoli, 1999).

Beyond this, variations in the combination of land uses and structures enable different forms of extraction and distribution of the value generated, with distinct repercussions for rural local development. Such value may take the form of both productive income and rental phenomena. In this sense, land capital intersects various local channels of wealth and savings accumulation and entrepreneurial opportunities, promoting distinct processes of local innovation and renewal—but also diverse phenomena of economic stagnation, rising inequalities—including those linked to housing markets—and the concentration of power, ultimately leading to diverse socio-economic dynamics in local development³⁸.

³⁶In this context, value creation refers to the processes through which value is generated, while value capture and distribution describe the mechanisms used to extract and allocate that value (Bailey et al., 2018).

³⁷Such conflicts, by definition, are more likely to occur in areas where land values are higher, due to the possibility of extracting both higher expected and actual rents (Povellato & Vanni, 2017; Romagnoli, 1999). However, even areas with lower land values may be affected. As seen, land abandonment and the resulting increase in land fragmentation reduce the availability of space and opportunities for those who would instead wish to return, invest, and settle in these areas (De Rossi & Barbera, 2018).

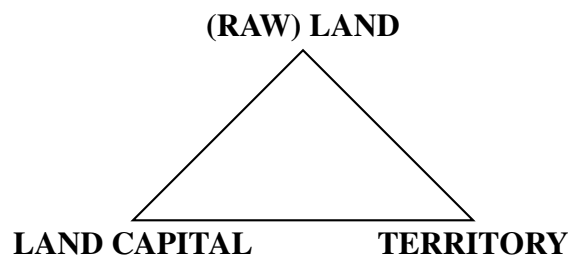
³⁸In this sense, besides the real-life cases illustrated by Ostrom (1990), a meaningful example can be drawn from the comparison between the latifundium regime and the sharecropping system (Bertolino, 1927; Musotti, 2001). The local configuration of properties and land rights under the métayage system—as seen, often rooted in a concentrated-ownership structure—allowed for a different degree of land participation, as well as wealth extraction and accumulation by sharecroppers, compared to peasants operating under the authority of latifundium landlords. In this light, sharecroppers experienced a certain degree of social and economic stabilisation within the system, accompanied by distinctive forms of local cultural organisation. In addition, this has also been suggested—within certain strands of the literature—as a foundational factor behind the emergence of subsequent and specific local manufacturing and industrial development trajectories (Brusco, 1982; Dei Ottati, 1990; Musotti, 2000; Pacelli, 2012; Sori, 1987).

From this perspective, land capital also reveals its social and cultural function. Different land tenure systems, by shaping distinct processes of value creation, capture, and distribution, underpin specific social classes and cultural organisations³⁹. Therefore, land elements act as defining drivers of local life, as *dominant forces* (Bertolino, 1927), shaping the characteristics of socio-cultural organisations within each place (Becattini, 1984; Brusco, 1982; Cecchi, 1991; Musotti, 2001; Serpieri, 1969; Triantafyllopoulos, 2008).

Finally, the political and governance functions of land capital also clearly emerge. Land dynamics involve different forms of local power coalitions. Such local elites tend to influence territorial governance and, in their most extreme form—defined by the rent-seeking behaviour of local rentiers—can hinder governance interventions and obstruct innovative local development projects, acting as forces of inertia and preservation (Barca & Carrosio, 2020; Bellandi, 2021; Florida, 2017; Ostrom, 2009).

Thus, through its various structures, uses, and income configurations, land capital emerges as a key factor shaping distinct rural local socio-economic dynamics, assuming diverse economic, social, and institutional functions at the local level. It is therefore repeatedly involved in these dynamics and, when meaningfully enhanced within local contexts, contributes to the direction and form of rural *place-based* development, effectively becoming territory—that is, part of the local heritage that influences the development dynamics of the place itself.

Figure 2.2: **From Raw Land to Territory: The Role of Land Capital**



Source: Author's elaboration.

Drawing on the very definition of land capital—as an extension of raw land (as discussed in Chapter 1)—a specific conceptual link illustrates its contribution to local development

³⁹By way of example, specialisation in agro-forestry uses—as opposed, for instance, to manufacturing—tends to shape local socio-cultural structures aligned with specific know-how nuclei rooted in agricultural traditions and sustained by farming family structures. However, various declinations within agro-forestry specialisations introduce further nuances in these dynamics. As seen, more *homologated agricultural* models—as opposed to *non-homologated* ones—tend to erode social structures based on family units, favouring instead the prevalence of wage labour and individual landholders (Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003; Musotti, 2001).

(see Figure 2.2). Starting from the top vertex, *raw land* today expands its meaning beyond its original and natural components, encompassing also land improvements resulting from the interconnection with human development. In this sense, we move towards the concept of *land capital* (bottom-left corner), which does not replace but rather enriches the natural and inherited components of raw land (top vertex), extending them through human-made investments structured and distributed via local landownership systems. These systems shape land uses and the mechanisms of rent and income formation, giving rise to diverse land tenure regimes which define distinct processes of value creation, capture, and distribution, thereby intersecting with and influencing the socio-economic, political, and institutional spheres of rural areas in multiple ways. In this sense, land capital is continuously involved in rural local development dynamics, becoming an integral component of the territorial heritage — or *territorial capital* (Camagni, 2008) — of places. That is, when meaningfully enhanced, it supports different local socio-economic and political trajectories of places within territorial reconstruction processes. In this sense, it may be regarded as *territory*—the opposite vertex of the triangle in Figure 2.2—representing a further expansion of the concept of land capital, which, starting from raw land, becomes an integral and foundational factor of local *place-based* development dynamics.

Within this framework, land capital is therefore conceived as a more structured and comprehensive resource than mere natural or infrastructural capital, as initially considered in Camagni (2008)'s conceptualisation of *territorial capital*. It encompasses the full set of interactions between raw land and capital across its various uses and functions within local socio-economic development. Finally, the axis of the triangle between raw land and territory may be illustrative of those rare and exceptional cases (as discussed in Chapter 1) in which only the original features of raw land, strictly speaking, can affect rural local development dynamics.

2.7 Some Concluding Observations

The paper unveiled the granular interactions between land capital and rural local development. This has been achieved through the reconstruction of a structured analytical framework that highlights how different land-related elements affect rural local dynamics in distinct ways. These elements—namely landholding structures, land uses, and land-based income configurations—are interconnected and summarised in the notion of land tenure systems. Evidence shows that such systems intertwine with the local socio-economic and governance spheres, shaping distinct processes of value creation, capture, and distribution. In line with this, land capital stands as a structural factor that plays a recurrent and deci-

sive role in shaping rural local development dynamics. When appropriately valorised, it becomes part of the territory — that is, part of the local heritage that contributes to shaping the trajectories of local development.

From a scientific perspective, the paper thus expands the existing literature by introducing an additional factor to be considered in local development dynamics. Moreover, it contributes to renewing the role of land in economic analysis as a fundamental factor of development (for a detailed discussion, see Chapter 1). Beyond its relevance for academic research, this upshot is also valuable for political reflection. Indeed, it provides a basis for further reasoning on the design of more appropriate interventions that also take into account the land-related elements of rural contexts. However, a full exploration of these implications goes beyond the scope of the current work and will therefore be addressed in the final part of this study.

That said, the work also presents certain limitations. First and foremost, it is confined to the rural context. Although *mutatis mutandis* the framework could be adapted to other settings, it may not fully capture all the land-related factors and dynamics that influence local development more broadly.

Secondly, certain physical and legal aspects of landholding structures are shaped by the specific features of the legal frameworks of Italy and the European Union. To enhance the framework's adaptability, this work also highlights differences from other land tenure systems, particularly those rooted in the Anglo-Saxon tradition. Nonetheless, considerable diversity continues to characterise the organisation and management of land structures across different places and nations.

Thirdly, many observed dynamics concern agro-forestry uses, reflecting their central role in defining the rural context and in the empirical cases reviewed. Although the framework appears adaptable to other uses, it nonetheless calls for further—particularly empirical—research to more thoroughly explore and analyse alternative rural vocations and related land dynamics.

Finally, while the framework provides a detailed account of the local articulations of land-related aspects and their implications for rural development in general, it falls short of explicitly addressing how these elements evolve and interact within specific contextual conditions — namely, distinct rural pathways and models of local development — also from a more dynamic perspective. That is, by considering evolutionary processes and potential feedback effects involving land-related components themselves. This will therefore be the focus of the following chapter.

Chapter 3

A Missing Dimension: The Land Tenure Organisation of Rural Development Models

Note. Some parts of Sections [3.4](#) and [3.8](#) have been published in:

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Abstract

Land capital represents a key factor in rural local development dynamics. When appropriately enhanced, it becomes part of the territory—that is, part of the local heritage—and thus contributes to shaping distinct local development trajectories. However, the diverse ways in which this process unfolds under different local conditions remain insufficiently explored in the scientific literature. Drawing on a set of representative rural development models and adopting a Structure–Conduct–Performance approach, this paper addresses this gap by uncovering a neglected dimension within the *place-based* framework of local development—namely, the *land tenure organisation*—and by clarifying its implications for different local development paths. A key theoretical implication emerges: local development should be understood as a process of territorial reconstruction that, beyond encompassing local productive structures alongside their societal, cultural, institutional, and political dimensions, also incorporates the organisation of land tenure systems.

Keywords: Rural development models; Place-based development; Land tenure organisation; Development trajectories; Territorial governance.

JEL codes: O18; P48; Q15; R14; R52.

3.1 Introduction

Land capital is a key factor in rural local development, as extensively discussed in Chapter 2. Indeed, through the various articulations of its main dimensions—namely land ownership structures, land uses, and rent—within distinct land tenure systems, it contributes to shaping a range of local processes of value creation, capture, and distribution, thereby influencing the socio-economic, political, and institutional spheres of rural settings¹ in multiple ways. In line with this, when meaningfully enhanced within local contexts, land capital therefore contributes to the direction and form of *place-based* development², effectively becoming territory³.

Thus, on a par with other factors recognised in the literature of regional science (for an in-depth discussion, see Section 1.2)—such as the organisation of local productive processes, cognitive dynamics, and settlement patterns (see Bellandi & Santini, 2020; Bellandi & Storai, 2022; Crevoisier et al., 2025; Segessemann & Crevoisier, 2016; Torre, 2018), technological and green innovation (see Bellandi & De Propriis, 2021; De Propriis & Bailey, 2020; Jeannerat & Theurillat, 2021), and approaches and structures of governance (see Barca et al., 2012; Torre, 2023)—land capital also acquires particular relevance in shaping diverse paths of local development.

In this regard, however, although rural development follows multiple pathways reflected in recognised local development models (see, for instance, Basile & Cecchi, 2001; Belletti et al., 2018; Biscaro et al., 2004; Cecchi, 2001; Mantino et al., 2023; Romano, 2001; Toccaceli, 2012), how these trajectories are shaped by land-related dynamics remains largely unexplored. That is, how the various local expressions of the main dimensions of land capital intertwine with specific components of well-defined rural models and influence distinct development pathways is still not well understood in the scientific literature.

These considerations therefore motivate the following research question:

¹Here, the rural context is understood as an area characterised by low population density and productive specialisations directly or indirectly linked to agro-forestry activities. More broadly, it describes a mixed economic setting in which agriculture coexists with other sectors—such as craftsmanship, tourism, and industry—that tend to integrate with and maintain a balanced relationship with the natural environment (Iacoponi, 1998).

²This perspective consistent with forms of endogenous development paths, whereby each place can find the basis for its competitiveness within its own territory, drawing on the stock of assets that constitute its territorial heritage. Nevertheless, it should be recalled that an endogenous approach to local development does not exclude—but rather integrates—the action of exogenous forces in the accumulation, valorisation, and mobilisation of such local resources, thus adopting a *place-based* perspective on local development (Becattini & Rullani, 1993; Morretta, 2021; Russo, 1994).

³The *territory* is understood as a geographical area that embodies and expresses a specific *territorial capital*—that is, a set of tangible and intangible assets accumulated over time—which provides those living in that place with the orientation and resources needed to pursue growth and continuous enrichment over time (Belliandi, 2024; Camagni, 2008; Garofoli, 2002).

RQ: How does land capital shape and interact with the diverse models of rural local development, thereby influencing distinct rural development pathways?

The novelty of the paper lies in offering new insights into rural development trajectories through an in-depth examination of land-capital dynamics across distinct and representative rural development models. The topic holds both academic and policy relevance, as it helps to inform more tailored and effective governance approaches aimed at underpinning or steering more virtuous and reproducible rural development pathways.

The paper is organised along two main lines of presentation:

- In the first part, we provide a concise overview of the key theoretical premises underlying the identified gap and research question and propose the methodological and conceptual framework, which sets the stage for its in-depth exploration;
- A multi-layered theoretical framework is then developed for a selected set of rural development models to shed light on the interactions between land capital and rural local development pathways.

3.2 Some Theoretical and Methodological Premises

3.2.1 Theoretical Underpinnings

3.2.1.1 Models and local development dynamics

Local development is a process of territorial reconstruction involving local productive structures alongside their societal, cultural, institutional and political dimensions (Becattini, 2015). More precisely, drawing on the tradition of studies on industrial districts (brought back to international attention by Giacomo Becattini in 1980s; see Becattini, 1979, 2004) structural dimensions of *place-based* development can be outlined as follows: local industrial organisations, such as business clusters with their markets and cognitive aspects; socio-cultural relationships and land tenure structures; institutional and governance support; and territorial networking organisations (for an in-depth discussion, see Bellandi, Cecchetti, & Santini, 2023; Bellandi & De Propriis, 2017; Bellandi et al., 2025). Different local expressions of these dimensions combine to define distinct development models, which may unfold through specific cycles and processes, thereby generating diverse local development pathways.

In particular, models of local development can be conceived as combinations of differentiated techno-organisational configurations, shaped by the local make-up of the aforementioned dimensions, and coherently balanced with specific articulations of internal and external conditions. This ensures the internal coherence of the models, which thus attain specific techno-organisational equilibria, allowing them to serve as analytical frameworks for viable socio-economic configurations (Pagano, 1991). This coherence also provides an analytical basis for the study of dynamic and, at times, evolutionary local development processes, as each equilibrium can be interpreted both as a consistent abstraction from empirical reality and as a temporary configuration. Starting from a given techno-organisational equilibrium, the framework thus enables the analysis of how internal and external elements evolve and recombine over time, potentially leading to the emergence of new equilibria and distinct life cycles in local development paths (Bellandi, 1996; Pagano, 1991, see also Box 7).

Definition 7. Techno-Organisational Equilibria

Pagano's concept of techno-organisational equilibrium, developed within a broader analysis of the organisation of technologies and property rights, provides an analytical framework for understanding different models of local development. In his words,

"The concept of multiple technological and property rights equilibria can help to explain the existence of alternative organisations of production which have characterised the histories of different Western industrialised countries" (Pagano, 1991, pp. 223).

More precisely,

"An economic system may have multiple equilibria in the sense that nodes A', A, E, E', C and C' may all be institutionally stable equilibria even if some of them are inefficient. The equilibrium which is actually achieved depends on the initial conditions of the system. These initial conditions can either be specified in terms of the starting technological conditions of the system or in terms of the starting system of rights (or safeguards)" (Pagano, 1991, p. 221).

In this regard, according to Bellandi (1996), dynamics of local development paths can be summarised into three broad patterns: (i) *slow and stationary change*, characterised by the absence of significant transformations in both internal and external conditions, such that the underlying techno-organisational equilibrium remains substantially unchanged; (ii) *quasi-steady development*, marked by sustained growth accompanied by gradual structural transformation (see also Becattini & Rullani, 1993); and (iii) *discontinuous development*, usually defined by interruptions and the need to depart from the previously prevailing techno-organisational equilibrium. More precisely, in this case development paths are disrupted

by specific triggering factors and may bifurcate into either lock-in trajectories or re-routing paths (Jeannerat & Theurillat, 2021). Lock-in refers to the persistence of obsolete techno-organisational configurations, actively preserved by local actors who seek not to relinquish the positions they have acquired, even though the old equilibrium is declining and requires change. Prolonged lock-in can therefore hamper socio-economic development, leading to patterns of crisis and decline, whereas re-routing, by contrast, can foster new virtuous dynamics in development paths by reconfiguring them around a new techno-organisational equilibrium (Hassink et al., 2019; Torre, 2023).

From a quasi-steady state perspective, models, instead, follow patterns of regular growth, remaining coherent with their initial techno-organisational equilibria. Such growth may manifest, among other things, through increases in scale, productivity, innovation intensity, and the quality of jobs and products. These incremental changes do not substantially alter, or do so only gradually, the overall features of the prevailing techno-organisational configurations, as they primarily reflect processes of incremental adjustment supported by specific local factors, such as entrepreneurial capabilities. In this sense, the long-term reproducibility of these processes defines the sustainability of development paths (Bellandi & Sforzi, 2003). However, a prolonged phase of success may eventually lead to a stage of maturity in which the dynamics of adaptation slow down, while the potential negative effects of internal or external challenges increase. In this context, a positive response may foster renewal or the creation of new development paths, ushering in a renewed phase of sustained growth; conversely, an inadequate response may result in decline under conditions of lock-in (Bellandi & Storai, 2022).

3.2.1.2 Land capital within local development dynamics

Against this background, land capital is introduced as a key analytical dimension of local development. Land capital is raw land—a natural agent with “*original and inherent features*” (Ricardo, 1776a)—which also encompasses permanent forms of capital in the shape of investments and lasting land improvements, such as soil tilling, plantations and buildings (for further details, see Chapter 1). It interacts with rural local development through three key aspects: diverse land-ownership structures (see Section 2.3), varying land uses (see Section 2.5), and land rent (see Section 2.4). In particular, diverse local articulation of these elements supports the definition of differentiated land tenure systems⁴, which entail diverse

⁴Land tenure system or regime, refers to the legal form under which land capital is owned, occupied, and used (Ryan-Collins et al., 2017), along with its economic and physical organisation. That is, the various conditions that determine its capacity to serve as a basis for life (Serpieri, 1940). Land tenure is therefore a nested concept that brings together the different characteristics of land capital, including its uses and organisation within landed property.

local processes of value creation, capture, and distribution ⁵. These processes, in turn, affect the local socio-economic, political, and institutional spheres of rural development, highlighting how land capital is involved in the dynamics of local development by closely interacting with their main dimensions.

In this sense, land capital can therefore be understood as the core component of the land tenure organisation of *place-based* development, as outlined in the previous subsection. Nonetheless, this dimension, although acknowledged in the literature, has not yet been systematically explored, particularly with regard to its contribution to different local development pathways. For instance, Bellandi, Cecchetti, and Santini (2023) introduce the concept without further elaborating its analytical implications, while studies such as Brusco (1982) and Bellandi and Storai (2022) only indirectly refer to possible land-related interactions within manufacturing-based local development models. Similarly, Triantafyllopoulos (2008), in analysing a specific rural development case study, focuses exclusively on land ownership structures, whereas Crevoisier et al. (2025) limits its scope to real estate dynamics and their primarily residential use in the development of cities and regions in Switzerland.

In line with this gap, the present paper explores the possibility of defining *land tenure organisation of place-based* development through the lens of locally specific configurations of land-related elements. In particular, it is hypothesised that, depending on the local organisation of these elements, distinct configurations of land-tenure arrangements may emerge across local development models, contributing to the formation of coherent techno-organisational configurations and shaping their underlying equilibria over time. The limited attention devoted to this issue in the existing literature thus points to the need for further investigation, in line with the research question outlined above.

3.2.2 *Methodological Underpinnings*

3.2.2.1 *A set of Rural Development Models*

In order to pursue this objective, this study draws on a set of rural development models identified within the scientific literature (see, Basile & Cecchi, 2001; Cecchi, 1988, 2001). These models are distinguished by the ways in which agricultural activities are locally articulated and integrated with other forms of socio-economic organisation (Iacoponi, 1998). Although not exhaustive, this set is representative of a plurality of development trajectories and enables the exploration of a broad range of socio-economic situations within the rural

⁵In this context, value creation refers to the processes through which value is generated, while value capture and distribution describe the mechanisms used to extract and allocate that value (Bailey et al., 2018).

context.

The work therefore seeks to build on the techno-organisational configurations of these models as proposed in the literature, enriching them with coherent features of their corresponding land tenure structures. In doing so, it becomes possible not only to understand how land patterns interact in supporting different rural development models, but also—by focusing on a quasi-steady stage—to observe how they influence distinct local development dynamics by sustaining different techno-organisational equilibria over time.

In line with this, let us briefly introduce these models by focusing on their main dimensions of *place-based* development, as identified through a review of the existing literature. These features are summarised in Table 3.1 and will serve as the starting point for further in-depth discussion and expansion in the second part of the paper.

1. *Rural Local System.* The Rural Local System (RLS) is a “*local system*⁶ (*LS*) whose social and economic environment is characterised by a set of productive and valorisation activities of renewable natural resources that have a common territorial basis and that constitute the core of the contextual knowledge of the system itself” (Romano, 2001). In the RLS the business cluster is mainly composed of small- and medium-sized (SMEs) family-run businesses that, starting from agricultural activities, diversify around them through a multiple and integrated uses of local resources. The social structure is cohesive, and cultural capital is shaped around rural local vocations. The institutional environment is characterised by a mix of informal institutions—comprising norms, beliefs, and cultural habits—as well as formal agencies and their interventions, including local, national, and supranational administrations. Following Becattini (2015) and Bellandi et al. (2021), these can be referred to as chorality rules. Moreover, the strong rural identity usually associated with this type of model tends to foster more balanced relationships, based on mutually beneficial exchanges (e.g. raw materials and labour), with other territorial contexts, including nearby central areas (Barbera & De Rossi, 2021; Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003).
2. *Agricultural Local Systems.* Agricultural Local Systems (ALS) are characterised by clusters of small-medium firms mainly specialised in agricultural and/or complementary activities (Cecchi, 1992b). ALS can be distinguished into: (i) *Agricultural Districts*, where a pool of SMEs is specialised in agricultural production; and (ii)

⁶The Local System can be defined as “a human settlement with a high degree of interaction between its component elements; i.e., residential and productive locations” (Bellandi, 1994). It usually identifies stable spheres of everyday experience-sharing among resident human groups (Bellandi & Sforzi, 2003).

Agro-Industrial Districts, where, by contrast, food-processing activities assume a leading role in shaping the specialisation of the business cluster (Basile & Cecchi, 2001). The productive organisation tends to follow a more capital-intensive and industrial orientation, with a greater reliance on hired labour. This, in turn, is reflected in a local social organisation that is more polarised between landowners–entrepreneurs and employees (Brusco, 1979). By contrast, no substantial differences emerge with respect to the RLS in terms of the institutional structure and territorial networking arrangements outlined above.

3. *Local System characterised by Capitalistic Agricultural Enterprises.* The rural context can also host large professional capitalistic agricultural enterprises (Brusco, 1979). Such realities are usually characterised by high rates of capital investment and wage labour within standardised and specialised productive processes (Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003). At the system level, the business cluster may consist of one or more capitalist entities characterised by high vertical integration and specialised in specific agricultural or agro-industrial production. Such entities may also be surrounded by small satellite enterprises that orbit around them. The productive structure, associated with monopolistic tendencies, reinforces capitalist polarisation within the social structure. At the same time, the institutional environment relies primarily on formal and codified coordination mechanisms, reflecting a limited development of a shared substratum of informal norms and practices that characterises the contexts discussed above. Finally, territorial dynamics, when intersecting with high rates of technological innovation, may enable engagement with wider networks, including international ones, through which access to global markets, knowledge, and advanced technologies can be obtained (Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003).
4. *The Rural Context as a Periphery of Other Local Systems.* This refers to rural areas that are not extremely remote but rather occupy an intermediate position, in close proximity to highly urbanised or industrialised zones. These contexts are characterised by the extension and rooting of urban–metropolitan or manufacturing lifestyles, which shape local socio-economic activities. Farms typically occupy an interstitial position, and their productive organisation is generally less structured, giving rise to micro-enterprises, part-time farming, and hobby farming (Brusco, 1979; Cecchi, 1988). The local socio-economic culture is often shaped by the contamination of urban–metropolitan lifestyles, displaying weak or absent distinctive local identities and limited forms of social cohesion (Dematteis, 2018). Governance interventions

are often either absent or primarily oriented towards supporting the dominant LS, resulting in territorial dynamics that place the rural context in a condition of some degree of dependence or subordination.

5. *The Rural Context as Periphery tout court.* Some rural areas, usually more remote and marginal, can be characterised by fragile socio-economic conditions in which no intrinsic drivers of local development can be identified (Cecchi, 2001). This situation involves economic activities with limited or absent entrepreneurial opportunities, resulting in fragmented and weak socio-cultural capital. Institutional support may be absent or unable to promote consistent and structured alternatives to the prevailing local socio-economic decline, while territorial relations, when present, may take the form of dependency and resource exploitation by other centres (Bertolino, 1961; Curci & Zanfi, 2018; Rossi-Doria, 2005).

Table 3.1: **Place-based dimensions in rural development models**

<i>Dimensions of place-based development</i>	Rural Local System	Agricultural Local Systems	LS of Capitalistic Agricultural Enterprises	Rural Context as a periphery of others LSs	Rural Context as a periphery tout court
<i>Local industrial organisation</i>	Cluster of family-run SMEs that diversify around agricultural activities	Cluster of SMEs specialised in agricultural or food-processing production	Cluster of large capitalistic agro- and agri-food farms	Loosely structured (e.g. part-time farming)	Absent or fragmented
<i>Sociocultural structure</i>	Highly cohesive social capital	Slight social capital polarisation	Capitalist-dominated social relations	Low social cohesion	Fragmented and weak
<i>Institutional and governance support</i>	Rules of chorality	Rules of chorality	Formal and codified rules	Absent or dominated by the central LS	Absent or inadequate
<i>Multi-territorial networks</i>	Balanced multi-polar relations	Balanced multi-polar relations	Engagement with global networks	Some degree of dependence on the main LS	Relations of dependence and exploitation

Source: Author's elaboration based on Brusco, 1979, Basile and Cecchi, 2001, Bellandi et al., 2025.

3.2.2.2 The Structure–Conduct–Performance Approach

The analysis builds on the Structure–Conduct–Performance (hereinafter, SCP) methodology, traditionally used in studies of industrial organisation (Baroncelli & Serio, 2013; Lelissa

& Kuhl, 2018). Indeed, the SCP approach provides a coherent analytical framework for investigating cause–effect relationships within different forms of economic organisation, including local development models (Bellandi, 2002).

More precisely, the SCP framework allows for the explicit identification and articulation of both internal and external features characterising local contexts, ensuring analytical coherence and internal consistency. Specifically, it enables the reconstruction of local development models as logically grounded techno-organisational configurations, in which identified structural conditions (*S*) give rise to feasible and context-dependent forms of conduct by socio-economic and institutional actors (*C*). The interaction between specific structure and conduct, in turn, generates distinct performance outcomes in economic, social, and institutional terms (*P*). This makes it possible to identify specific techno-organisational equilibria that are coherent with given initial configurations, as well as to trace their evolution over time as a result of changes in selected elements and the feedback mechanisms operating within and across these dimensions.

Following Bellandi (2002), which takes the ideal typical model of the Marshallian Industrial District (MID)⁷ as a reference, the main elements of local development models within the SCP paradigm can be drawn as those outlined in Table 3.2 (for a further discussion, see Appendix A.5). Specifically, each model represents a local economy embedded in a global context that encompasses the general structure of markets, technologies, institutions, and environmental dynamics (e.g. climate change)—namely, the Basic Global Structure (S_{bg}) in our framework. Local development models, in turn, can be defined as a set of intermediate structural features of industrial and public goods—respectively S_{io} and S_{pg} in Table 3.2. S_{io} captures the main features of the local productive organisation, as reflected in the structural elements of the local business cluster, whereas S_{pg} denotes, in certain contexts, the presence of specific institutional support structures that sustain the functioning of the local cluster itself (e.g. rules on prices and contracts within local markets, or technical and trade standards and rules) (Bellandi, 2021). In addition, more virtuous contexts can be characterised by specific *local factors*—namely, shared socio-cultural, institutional and environmental ties, identified in our framework as the Basic Local Structure (S_{bl})—which act as key mechanisms through which the path is quasi-automatically reproduced under steady-state conditions (Becattini, 2009).

Specific structures then determine particular patterns of behaviour—namely, Market Conduct (C_m), understood as the set of market (non-strategic) behaviours of local players. Besides market behaviour, local contexts are also characterised by the actions of strategic

⁷The Marshallian Industrial District (MID) is a model of local development brought to international attention by Giacomo Becattini in the 1980s (see Becattini, 1979, 2004).

Table 3.2: **Key Elements of the SCP Framework of Local Development Models**

Symbol	Meaning
S_{bg}	Structure, basic global
S_{io}	Structure, industrial organisation
S_{pg}	Structure, public goods
S_{bl}	Structure, basic local
C_m	Conduct, market
C_{st}	Conduct, strategic
P_v	Performance, value
P_e	Performance, external (economies)

Source: Bellandi (2002)

agencies specialised in providing support to sustain the system's virtuous functioning. From a dynamic perspective, the intervention of specific agencies is required to facilitate the re-adjustment of structural features of the models when addressing local and global changes and challenges. Aside from mechanisms of incremental adaptation of intermediate structures (S_{io} and S_{pg}) and processes of quasi-automatic regulation supported through S_{bl} , specific public and territorial governance⁸ initiatives are required and are included among those defined as Strategic Conduct (C_{st}) (Hassink et al., 2019; Torre, 2023).

The combination of specific structures and conduct results in different performance achieved at the firm level—Value of Performance (P_v) in our framework—and at the system level—External Performance (P_e)—that is, at the level of the bounded area exhibiting such specific socio-economic features (Bellandi, 2002). Diverse local development pathways then stem from the interactions among different intermediate and basic structures, as well as from the competitive and strategic actions undertaken by various actors and agencies.

Within this perspective, the SCP methodology therefore provides a consistent analytical tool for incorporating land tenure organisation as an additional and integral dimension of local development models. This makes it possible, first, to coherently associate each local development model with its specific form of land tenure structure, in line with its defining characteristics, and, second, to assess how such configurations, in interaction with other structural, behavioural, and performance-related elements, systematically shape local development dynamics and trajectories. Accordingly, the following section takes a first step towards this objective by introducing the *land-tenure loop* within the rural development framework, which captures how the various elements of land capital interact with one

⁸The *territorial governance* is here defined as “a process of coordination between different types of actors with axisymmetric resources, who meet around issues concerning their territory and contribute with tools and structures to the elaboration of a common joint project for the development of the territory itself” (Torre, 2023).

another and with the broader rural development context.

3.3 Conceptualising the land tenure loop

Building on the work developed in the previous chapter, this section proposes a conceptual framework through which land capital, with its features—namely, land structures, land uses, and land rents—is explicitly positioned within the SCP framework of rural local development.

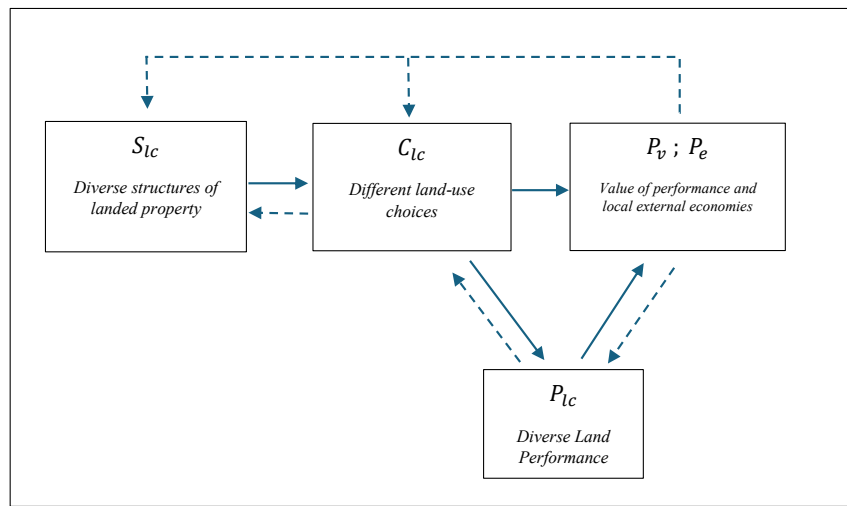
Within a given area, land capital, which is a natural agent with artificial features, is organised and distributed through various properties (Serpieri, 1969). The organisation of these properties—characterised by diverse physical dimensions and spatial distributions, as well as by property rights and types of landowners—defines different local structures of landed property (Zangheri, 1981). Locally, heterogeneous property structures vary along a continuum between two extremes: concentration and fragmentation. Land concentration is characterised by large estates held by a few landowners, whereas land fragmentation refers to situations where numerous small and micro properties are owned by many. Between these extremes, additional intermediate cases—for instance, small- to medium-sized properties held by a large but not excessive number of landowners—can also be considered (Golzio, 1933; Medici et al., 1962). The diverse structures of landed property thus constitute S_{lc} , that is, the first box in our SCP framework (see Figure 3.1).

Starting from these different land-ownership structures, and in line with specific local socio-economic and institutional conditions, markedly distinct patterns of land use emerge (direct arrow from S_{lc} to C_{lc}). C_{lc} encompasses all strategies concerning the use of land capital by local and non-local actors. These uses range from diverse agro-forestry specialisations to environmental, industrial, touristic, residential, and speculative purposes (see Section 2.5). Specifically, diverse land-ownership structures underpin the development of distinct productive processes within economic activities, while also fostering broader patterns of integration or disaggregation among these entities at the business-cluster level (Cecchi, 1983; Rocchi & Stefani, 2002; Rossi-Doria, 2005).

In particular, considering the rural nature of the context under analysis, one can envisage diverse land uses branching out around agro-forestry specialisations (C_{lc}). Building on the two aforementioned extreme cases, large estates—especially when combined with a high degree of natural fertility—may, for instance, underpin a standardised and intensive use of land capital within professional capitalistic farms⁹ (Brusco, 1979). This can sustain

⁹Following the work of Brusco (1979), *capitalist farms* are those in which wage labour accounts for more than 67% of the farm's total labour. Furthermore, capitalist farms can be distinguished into professional and non-professional categories, depending on the amount of labour provided by the farm holder and their family

Figure 3.1: The land tenure loop



Source: Author's elaboration. *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects.

systems characterised by models of *homologate agriculture*, in which farms primarily replicate capitalist forms of production based on a high degree of capital investment, technological innovation, and waged labour (Basile & Cecchi, 1997). At the same time, such concentration in land ownership, under varying local socio-economic and environmental conditions, may also be associated with extensive yet inefficient uses of land capital, as historically exemplified by latifundia systems (Bertolino, 1927) or by non-professional capitalistic farms¹⁰ (Brusco, 1979). On the other hand, fragmented and scattered property structures can foster fragmentation in the local organisation of productive processes, both within and between farms. In extreme cases, such a structure can increase production costs to the point of making the use of land capital in land-based economic activities economically unsustainable, even leading to non-use—that is, farmland abandonment (Latruffe & Piet, 2014; Rossi-Doria, 2005).

The combination of different ownership structures S_{lc} and land uses C_{lc} , in turn, gives rise to diverse income streams generated through land capital (direct arrow from S_{lc} and members, as well as by agricultural employees.

¹⁰Non-professional capitalist farms are characterised by the fact that landowners do not directly manage the farm. They typically represent forms of land investment attributable to the urban bourgeoisie, who allocate part of their income to land assets either as a safe investment or for reasons linked to rural cultural values, such as a symbolic attachment to their rural origins. Agricultural operations are delegated and, unlike professional capitalist farms, are marked by low levels of investment and an under-efficient use of resources (Brusco, 1979; Dei Ottati, 1990).

C_{lc} to P_{lc} in Figure 3.1). These remunerations may stem from productive activities or take the form of land rent and can be regarded as the land performance (P_{lc}) as reflected in land prices. Land prices indeed contain a high degree of informational content regarding the characteristics and profitability of land capital, as well as the opportunities offered by the surrounding environment in relation to specific uses (reverse arrow from P_v and P_e to P_{lc}) (Ay & Latruffe, 2017; Marshall, 1920/2013). Land performance (P_{lc}) therefore differs from firm performance (P_v), as land capital represents an autonomous element that may be detached from productive activities, a distinction evidenced by the fact that landowners are not necessarily the managers of productive enterprises.

Continuing the previous examples, the rise of advantageous productive conditions associated with capitalistic agricultural production, supported by an adequate combination of ownership structures and land uses, can result in the emergence of positive land rents, which are reflected in higher land values¹¹. Conversely, less competitive circumstances for land-based activities—as in the case of fragmented land-ownership structures—result in zero or negative land rents and typically low land values (Curci & Zanfi, 2018; Longhitano & Povellato, 2017; Wojewodzic et al., 2021). At the same time, high rents in concentrated land-ownership structures can be consistent with a framework of concentration in local processes of wealth and income accumulation. If reinvested, they can foster innovation dynamics and higher profits; otherwise, speculative strategies aimed at securing such rents may contribute to stagnation and to the rise of local socioeconomic inequalities (Camagni, 2017; Mazzucato et al., 2023; Ryan-Collins et al., 2017; Stiglitz, 2015). On the other hand, land prices reflecting zero rent highlight the lack of socioeconomic opportunities (Curci & Zanfi, 2018). All this is represented by the arrow from P_{lc} to P_v and P_e , or by the loop from P_{lc} to C_{lc} to P_v and P_e .

Further effects on rural local development may also involve diverse socio-economic and entrepreneurial opportunities—narrowed in the case of land concentration and largely absent under land fragmentation—as well as specific local socio-cultural configurations, environmental consequences, and policy implications. Moreover, feedback effects may emerge through the formation of a land elite that, under certain conditions, leverages its control over land capital to influence local governance and preserve specific structural conditions (see for instance Moulaert & Mehmood, 2025; Wightman, 2024), pointing to a potential reverse effect from performance outcomes to S_{lc} as further discussed below.

¹¹In this work, the concept of value is primarily understood from a marginalist perspective, namely as the utility a good or service is able to generate, directly reflected in its market price (Mazzucato, 2018).

3.3.1 The Land Tenure Loop in the Multi-layered SCP Framework of Rural Development Models

Consistent with the discussion above, it is therefore reasonable to enrich the SCP framework of rural local development with elements concerning land capital and its tenure arrangements¹². In other words, to expand Table 3.2 by also considering:

- **Structure, landed property (S_{lc}).** This represents an intermediate structure within rural local development models, reflecting the physical and legal organisation of land capital at the local level within distinct ownership structures. Taking into account the natural dimension of the resource, it also encompasses its inherent characteristics as raw land.
- **Conduct, land uses (C_{lc}).** This encompasses the full range of strategies regarding land use adopted by both local and non-local actors.
- **Performance, land capital (P_{lc}).** This covers the performance of land capital—in terms of profit and rent—as reflected in land prices.

These elements therefore represent a source of novelty with respect to previous studies and contribute to enriching our understanding of local development dynamics. More precisely, as discussed in the following sections, they take on different forms, coherently intertwining with the specific local and extra-local configurations that define the reference development model.

To capture these different configurations, each model is presented as a multi-layered theoretical SCP framework, namely an architecture of nested layers structured around diverse interconnections among the key *place-based* dimensions. Accordingly, the literature has so far identified and discussed three main layers (Bellandi, 2002): (i) the *competition loop*, which generates specific local economic performances through the interplay between local and global structures and non-strategic conduct; (ii) the *strategic loop*, which describes the cause–effect relationships underpinning the actions of governance and strategic agencies; and (iii) the *evolutionary loop*, which highlights how local contextual factors influence the functioning of the evolutionary cycle.

This work expands this perspective by explicitly introducing the *land tenure loop* into the analysis of rural development models, thereby addressing for land-related elements and

¹²This analytical choice is justified by the fact that land-related elements connected to the main *place-based* dimensions of local development constitute a specific domain in their own right. Rooted in the original and inherited features of land, land-related investments, and their spatial articulation, these elements cannot be fully subsumed under the other analytical dimensions, yet they ultimately shape and constrain long-term paths of local development.

their feedback dynamics, as illustrated in Figure 3.1. Beyond accounting for their internal feedback mechanisms, this approach makes it possible to examine how land-related elements interact with and affect—and are in turn also affected by—the other key components characterising different rural techno-organisational configurations. In doing so, it allows for a clearer understanding of the feedback relationships between land tenure arrangements and the broader system components, as well as of their implications for differentiated local development trajectories.

The added value of this contribution thus lies in its ability to capture the role of the *land tenure organisation and loop* in shaping distinct rural local development models and long-term development pathways. In addition, the analysis extends beyond the strictly local scale to consider land-capital dynamics and their effects on local development at a broader territorial level, in line with the growing attention devoted to territorial networking in explaining contemporary local development dynamics (Bellandi et al., 2025).

3.4 The Rural Local System

3.4.1 Model Overview

The RLS is usually characterised by a cluster of small- and medium-sized, family-run businesses that, starting from agricultural activities, diversify around them through the multiple use of local resources. Agriculture, while remaining fundamental in shaping and defining local contextual knowledge, is integrated with other activities such as craftsmanship and tourism. As a result, no single production or economic sector emerges as dominant, reflecting models of farm multiactivity and territorial multi-sectorality (Belletti et al., 2018; Pacciani, 2003; Toccaceli, 2012).

The combined effect of this differentiation and integration, together with the enhancement of local natural resources and the valorisation of local traditions and identity, results in the production of integrated specialities—that is, high-quality “*baskets of goods*”—(Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003).

3.4.2 Multi-Layered Framework

3.4.2.1 The Competitive Loop

On this basis, the RLS makes explicit some features of the intermediate structures that guide specific local socio-economic performance. In this sense, let us analyse this first level of the RLS multi-layered framework, referred to as the *competition loop*, whose graphical representation is depicted in Figure 3.2.

In the RLS the S_{io} represents a business cluster mainly composed by a pool of independent small and medium enterprises (Pacciani, 2003). Such a structure, in combination with specific global and local features, gives rise to peculiar strategies of productive diversification and integration (C_m) among the actors involved.

Specifically, the global structure (S_{bg}), by comprising certain levels of knowledge in specific productive techniques and technological advances, as well as a specific demand for high-quality rural products¹³, supports the definition of diversified productive strategies and identifies suitable final markets for the goods produced. This refers to new technologies which, for instance, within a broader perspective of environmental sustainability and circular economy, can reduce agricultural waste by supporting parallel production processes of reuse (such as the production of fibres or innovative packaging from agricultural foodstuffs; see, for example, UNCEM (2025)), as well as to the growing demand for higher-quality products that embody a distinct local identity and reflect an increasing preference for experiential consumption practices (Becattini & Omodei Zorini, 2003; Biscaro et al., 2004).

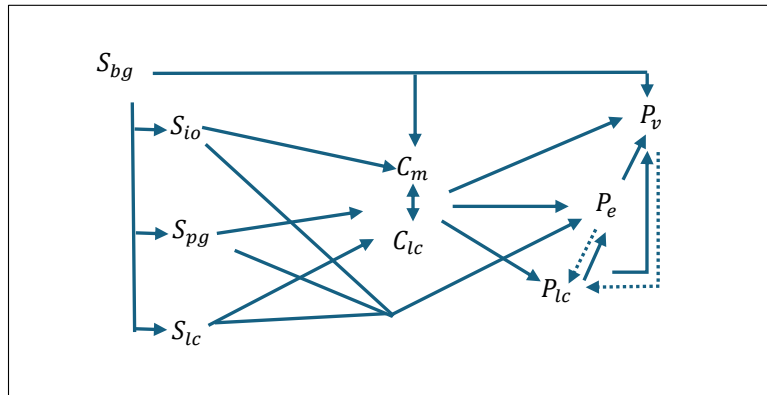
Contemporaneously, the structure of landed property (S_{lc}) also concurs in this process. The local productive organisation is indeed supported by a decentralised land-ownership structure, expressing a certain degree of fragmentation yet confined to small- to medium-sized properties. This S_{lc} makes certain agricultural techniques—those centred on standardised production and the pursuit of economies of scale—economically unsustainable. However, owing also to its natural fertility for certain productions, land capital lends itself to diversification strategies based on multiple and integrated uses, consistent with its high-quality vocations (C_{lc}) (Latruffe & Piet, 2014; Povellato, 2009). These integrations may occur both sectorally, within the same productive unit, and territorially, among several farms that share a local common pool of resources (C_m) (Basile & Cecchi, 1997). The spatial distribution of these properties is therefore also relevant in ensuring a certain degree of socio-economic proximity consistent with the requirements of the model, as well as in fostering the integration among the different productive processes carried out at the system level (Rocchi & Stefani, 2002). This is also supported by a more flexible and context-specific management of land-use rights, tailored to local socio-economic conditions (C_{lc}).

In this sense, models based on small- to medium-sized multifunctional farms —mainly family-run, given the size and natural and artificial characteristics of the properties—emerge (see Basile & Cecchi, 2001; Belletti et al., 2018; Brusco, 1979), developing business models that build around agricultural activity while integrating complementary functions such as

¹³Thus not only agricultural goods but also those combined with the enhancement of local natural and historical resources within touristic, manufacturing and environmental activities (Becattini & Omodei Zorini, 2003)

tourism (e.g., agritourism initiatives), manufacturing (for instance, the processing of agricultural products), and environmental purposes. These latter may include projects related to the circular economy as well as the production of positive environmental externalities, such as landscape and land stewardship and the provision of Ecosystem Services¹⁴ (see IRPET, 2023a; Pettenella, 2025; UNCEM, 2025).

Figure 3.2: **The competitive loop of RLS**



Source: Author's elaboration, based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects.

The efficient combination between S_{io} and S_{lc} therefore supports a complex local division of labour within the business cluster, in line with what Basile and Cecchi (2001) define as a model of *non-homologated agriculture*. The realisation of such dynamics, however, is conditional upon the presence of specific public or quasi-public goods (S_{pg}) capable of supporting these decentralised systems and conduct (from S_{pg} to C_m) (Bellandi, 2021). In this sense, several examples can be identified. These include behavioural rules among local actors and contractual arrangements within local markets (Toccaceli, 2012), such as network agreements between farms that enable the sharing of labour (see UNCEM, 2025), as well as quality schemes for agricultural products—such as the Designation of Origin or Protected Geographical Indication—which serve as coordination mechanisms for territorially dispersed production processes (Belletti, 2002). Further instances concern training

¹⁴The Ecosystem services are positive environmental externalities that can result from specific uses of land capital. They may include: the provision of essential food and raw materials for human survival and productive activities; air filtration and water regulation; climate change mitigation through low-emission practices and carbon sequestration; protection against extreme events such as hydrogeological risks and wildfires; and the provision of cultural and recreational values (Pettenella, 2025).

initiatives promoted by universities and research centres, designed to provide knowledge and skills tailored to local territorial needs (for example, the European project AgriSmart Consortium (2025) or the UNIMONT - Università della Montagna (1996) experience in Lombardy, Italy), together with land-related arrangements such as specific rental or usage contracts and informal shared management agreements for agricultural land (arrow from S_{pg} to C_{lc}) (Schlager & Ostrom, 1992).

The interplay between these structural and conduct elements affects the individual performance of farms (P_v), which are able to gain economic advantages in terms of internal economies of scope. This process involves both market conduct and land-use choices, which, by adapting to structural conditions, aim at an efficient use of land resources through diversified and integrated productive processes within the same units (see Figure 3.2).

Furthermore, in line with the Marshallian conceptualisation of external economies (MEE) (see Marshall, 1920/2013), it is possible to argue that the RLS can also generate specific competitive advantages at the system level based on external economies of scope and flexibility (P_e in Figure 3.2) (Basile & Cecchi, 2001). The local division of labour (S_{io}), rooted in a specific socio-cultural context and in a distinctive land-ownership structure with natural and historical peculiarities (S_{lc}), and enhanced by specific local public goods (S_{pg}), allows for the efficient creation of integrated specialities in the form of a *high-quality basket of goods* (Becattini & Omodei Zorini, 2003). Local production and marketing chains branch out from the vocations and traditions of land capital, enhancing local food and beverages, environmental and cultural goods, and other local resources, and benefiting from economic advantages both at the system level (P_e) and at the firm level (P_v)—thus giving rise to a specific techno-organisational equilibrium of the model.

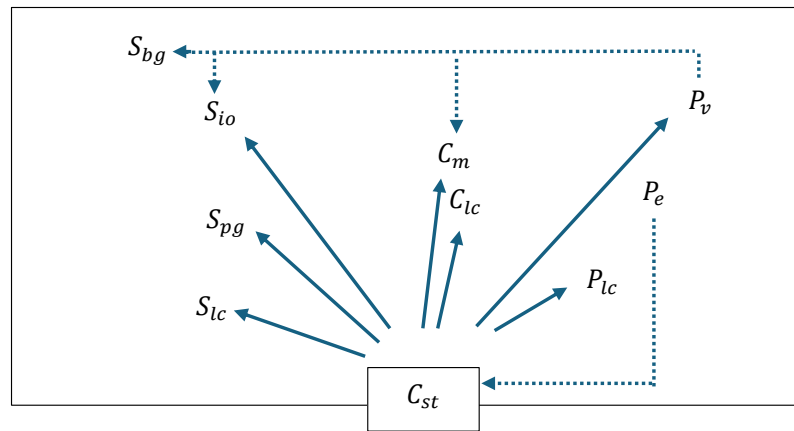
In these mechanisms, S_{lc} impinges on P_e by supporting territorial proximity in socio-economic relationships and shaping the local productive organisation and vocations. Indeed, this configuration creates room for specific entrepreneurial initiatives, while also enabling family-based units to pursue locally integrated life and work projects within multifunctional business forms (Becattini & Omodei Zorini, 2003; Brusco, 1982).

Finally, structural and behavioural conditions related to land elements give rise to specific local performances of land capital in terms of land prices (direct arrows towards P_{lc}), which reflect income generated by productive activities as well as land rents and localised competitive advantages associated with the RLS (dotted arrows from P_e and P_v to P_{lc}). At the same time, this land-capital performance supports both internal and external firm-level performance outcomes (direct arrows from P_{lc} to P_e and P_v).

3.4.2.2 The Strategic Loop

In a dynamic perspective, mechanisms of incremental adaptation of intermediate structures within quasi-steady development paths may not be sufficient to cope with the internal and external challenges affecting the local system. The intervention of specific agencies (C_{st} in Figure 3.3) is therefore required to prevent possible lock-in or exhaustion dynamics in the local development path (Bellandi & Storai, 2022). These specific agencies can be interpreted through the lens of territorial governance (Torre, 2023), which also encompasses a further core network of various actors defined as place leadership (PL) (Beer et al., 2019; Sotarauta & Beer, 2017). Territorial governance and PL can take different forms and styles, ranging, for instance, from weaker and more conservative to stronger and more open approaches (Bellandi et al., 2021). Moreover, multilevel governance structures are increasingly emphasised in the literature, as they include both local and extra-local actors and elements within a *place-based approach* (Barca, 2011; Barca & Carrosio, 2020; Ferrara et al., 2026; McCann, 2023; Vaño et al., 2026). Depending on the different styles and governance interventions within diverse local development paths, various local articulations of the *strategic loop* can thus be observed.

Figure 3.3: **The strategic loop of RLS**



Source: Author's elaboration, based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Larger rectangle: a simplified version of Figure 3.2.

In this regard, Figure 3.3 illustrates these dynamics within the RLS, in which strategic and multilevel agencies (C_{st} in Figure 3.3, placed at the system boundary to capture their potentially multi-level character) provide fine-systemic conditions in terms of specific public

goods (direct arrow from C_{st} to S_{pg}), such as the recognition of specific high-quality agricultural production areas or the establishment of rules supporting collaborative entities and producer associations (Polidoro & Romano, 1997; Toccaceli, 2012). Furthermore, they intervene in other structural elements, as well as in market and land-related choices, according to the overall performance of the system (P_e). An example in this sense is represented by the Common Agricultural Policy (CAP), which, in addition to influencing dynamics and processes within local productive organisations (from C_{st} to S_{io} and C_m)—for example, by supporting the development of specific specialisations or agrarian systems (Belletti et al., 2018; Carbone, 1992)—can also affect local land uses by favouring certain land-use practices over others (from C_{st} to C_{lc}) (European Commission, 2013).

Although less frequently, territorial governance may also intervene directly on performance elements, including those linked to land capital, for instance through mechanisms aimed at redistributing land rents. This may occur, for example, through the application of specific tax rates on income derived directly from land ownership, such as rental income¹⁵ (direct arrow from C_{st} to P_{lc}) (see, for instance, Delladetsima, 1999).

3.4.2.3 The Land Tenure Loop

Let us now focus on the role of land dynamics within these processes of quasi-steady development. The elements of land tenure organisation identified so far—primarily involving the direct relationships depicted in the general *land tenure* framework in Figure 3.1—generate cumulative feedback effects that progressively shape the techno-organisational equilibrium underlying the local development path (see the *land tenure loop* in Figure 3.4).

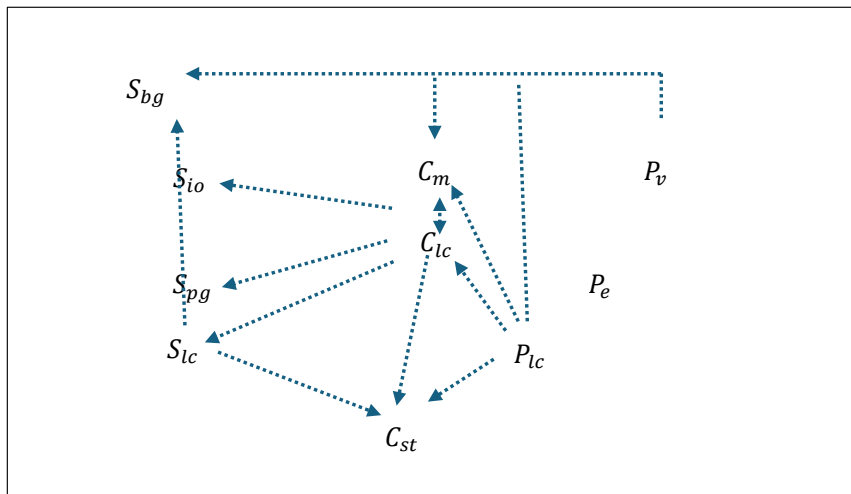
In particular, land capital—recurrently involved in various local dynamics—gives rise to specific performances reflected in its prices. Given the structural conditions of the RLS, it is possible to imagine that, after an initial phase of fluctuation in land values during the first period of local system expansion, a stabilisation may occur towards higher land prices in the medium to long term. This is due to the system entering the maturation phase, in which stable and structural local economic advantages translate into positive land rents (dotted arrows from P_e and P_v to P_{lc} in Figure 3.2) (Camagni, 2019).

The emergence of rent phenomena, in turn, generates feedback effects on market and land behaviours within the RLS (dotted arrows from P_{lc} to C_m and C_{lc} in Figure 3.4). Local actors may decide to reinvest such rents in the local productive organisation, generating innovation and potentially producing changes in structural aspects as well (with possible

¹⁵An illustrative example is provided by the Italian case, where an increase in the tax rate applied to short-term residential land leases has been introduced in recent years. See, for example, *Il Sole 24 Ore*, “Affitti brevi, la nuova stretta parte dal terzo immobile locato,” last accessed on August 31, 2026, available at <https://www.ilsole24ore.com/art/affitti-brevi-nuova-stretta-parte-terzo-immobile-locato-AI1Aqei>.

spillovers also to the renewal path). Here we refer to product and/or process innovations, which are further discussed in the following section and may expand the local productive organisation, generating additional positive outcomes in terms of overall performance. The latter represents a crucial factor in ensuring the long-term reproducibility of the local development path. That is, such a mechanism ensures the incremental reproduction of the specific techno-organisational configurations and equilibria that characterise the current development model. Specifically, part of the income extracted from property should be devoted to specific local productive investments. When accompanied by broad social involvement in land ownership and interconnected economic activities, this favours the use of local savings in new entrepreneurial initiatives, which are conducive both to mobility and generational renewal within the productive organisation and to introducing innovations into production while preserving its local specificities (Basile & Cecchi, 2001; Triantafyllopoulos, 2008).

Figure 3.4: **The land tenure loop of RLS**



Source: Author's elaboration. *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Larger rectangle: a simplified version of Figure 3.3.

On the other hand, the reduction or distortion of such investments by some landowners seeking to take advantage of rent positions (C_{lc}) that have emerged at the local level puts at risk the reproducibility of this development path (Bellandi & Storai, 2022). Indeed, this could lead to the entry of new actors (C_m) endowed with substantial financial resources but distant from local dynamics and culture, bringing about changes in the local productive organisation and its core know-how (dotted arrows towards S_{io}) (Delladetsima, 2006; Rocchi & Stefani, 2002), as well as in local institutional support (dotted arrows towards S_{pg}). For

instance, this may limit social reproduction and mobility, with family-based realities no longer able to find space to pursue their life and work projects (Brusco, 1982; Crevoisier et al., 2025; Gunnoe, 2014). These dynamics are also consistent with possible changes in the local land structure (dotted arrows towards S_{lc}), showing tendencies towards concentration, and in land uses (C_{lc}) moving away from diversified patterns towards a monopolisation of uses oriented to activities that enable greater rent extraction—for instance, touristic or patrimonial uses—with limited spillover effects and benefits at the local level (P_e and P_v).

Such mechanisms are noted in economic theory, which associates the emergence of parasitic and *rent-seeking* behaviours with processes of land concentration, as well as with a reorientation of local economic activities towards those capable of sustaining higher land rents (see for instance, Basile & Cecchi, 1997; Camagni, 2017; Rocchi & Stefani, 2002; Romagnoli, 1999; Ryan-Collins et al., 2017). These patterns have been analysed in urban contexts—where they are more prominently observed (see, for instance, Edwards, 2025, which examines these trends in the development dynamics of London)—but they can also be identified in specific rural contexts (Fairbairn, 2017; Gunnoe, 2014; Knuth, 2015; Longhitano & Povellato, 2017). In this regard, it is worth recalling that Bertolino (1927), in his in-depth analysis of the Sicilian latifundium (a system that had already reached a significant degree of land concentration), observes how the local land elite, or landed aristocracy, tends to expand its control over land capital. Tendencies towards land concentration appear indeed to be self-reinforcing, insofar as land capital simultaneously constitutes a source of social prestige and a key generator of rent and income (Bertolino, 1927; Buciuni, Corò, et al., 2023). Similar mechanisms are observed by Wightman (2024) in Scotland, where land concentration reaches particularly extreme levels through successive processes of *land grabbing*, generating a cumulative and self-reinforcing dynamic that progressively consolidates landownership in the hands of a small group of landowners or *rentiers*.

From this perspective, an RLS that has reached a certain level of maturity and in which rent-seeking dynamics prevail may become stuck in extractive dynamics operating through land capital. In doing so, the system deviates from previously virtuous development trajectories and stabilise around a new techno-organisational equilibrium characterised by structural rigidities and entrenched inequalities, typically associated with persistent and parasitic rent-seeking behaviour. Such an equilibrium may temporarily endure, yet it can also become fragile as a result of the progressive exploitation of local resources and mounting systemic imbalances, thereby requiring structural reorientation¹⁶. However, rentiers

¹⁶Following Buciuni, Corò, et al. (2023), persistently high land rents associated with rent-seeking behaviour—when exceeding the general level of local incomes—may, in the long run, lead to a misallocation of

seeking to preserve established rent positions, may resist such adjustments, reinforcing lock-in dynamics and increasing local territorial fragilities, inequalities and conflicts (see, for instance, Bellandi & Storai, 2022; Buciuni, Corò, et al., 2023).

In these circumstances, the intervention of territorial governance is essential to realign individual and collective interests around land capital within local development projects (direct arrows starting from C_{st} as shown in the *strategic loop* in Figure 3.3). However, even governance characterised by an open and constructive PL may clash with local power dynamics, as coalitions of major landowners tend to preserve the existing balance of power (Barca & Carrosio, 2020; Florida, 2017). Such conflict dynamics may therefore hinder or delay governance interventions (dotted arrows from land-elements to C_{st}), ultimately maintaining the state of lock-in. In this respect, Bertolino (1927) emphasises how a narrow group of Sicilian landowners is able not only to influence and resist necessary land reforms promoted by the Italian state, but also to benefit from earlier reform attempts that ultimately failed. Rather than reducing inequalities, these initiatives reinforce existing disparities in land distribution, as the close interconnections between landed elites and political power enable established landowners to further expand their holdings. In doing so, such dynamics effectively constrain the emergence of alternative or renewed development trajectories for this Italian island (Bertolino, 1927). Along comparable lines, Wightman (2024) shows how, in Scotland, the close intertwining of landed elites and political power has generated enduring privileges in favour of the former—most notably, the successful abolition of virtually all taxes on rural land. Such institutional arrangements continue to shape public life to this day. In Wightman (2024)’s words, the persistent adherence to the existing conservative equilibrium of the landed aristocracy and its status quo is evocatively described as being trapped in “*the sleep of those who own Scotland*” (p. 115, Wightman, 2024).

Beyond what has been discussed so far, analysing the *land tenure loop* also makes explicit a set of cause–effect relationships involving land capital that shape broader territorial networks linking the RLS with other territorial contexts synthesised in the element of S_{bg} . In particular, the possibility of envisaging a high degree of integration of the RLS, in a dynamic and virtuous development setting, with neighbouring central areas—whether manufacturing or urban—opens up prospects for mutually beneficial relationships branching out from local vocations of land capital.

In particular, it is possible to envisage the RLS as supplying the central area with food products, tourist–cultural, social, and energy goods and services (e.g., the provision

resources and the displacement of skilled labour. This may occur, for instance, through processes of spatial segregation and rising living costs, ultimately weakening the local innovative and productive capacity (Veltz, 2025).

of wood and biomass), together with environmental public goods (e.g., bio-regulation, carbon sequestration) (Becattini & Omodei Zorini, 2003; Dematteis, 2018; Pettenella, 2020; UNCEM, 2025). Conversely, the RLS strengthens the channels of contact with the central area, stimulated by the latter's demand for goods and services, in order to improve access to citizenship services, high-knowledge-intensity services, employment opportunities, and channels of connection with international value chains (Barbera & De Rossi, 2021; Crevoisier & Rime, 2021). These territorial networking dynamics may also entail hierarchical relationships, with rural contexts acting as satellites orbiting central areas (as will be discussed later). However, rural areas with strong local identities and their own development models can establish more balanced relations with dominant central areas (Becattini, 2015), especially when supported by open and constructive governance (direct arrows of multilevel governance C_{st} as seen previously). Such initiatives, for instance, can involve enhancing land tenure regimes to strengthen rural production and foster local value chains and markets, as well as supporting the provision of local and extra-local services (e.g. those linked to residential demand and to cultural values and amenities) at a broader territorial scale. Consider, for instance, the possibility of agreements between urban systems and RLS aimed at the provision of Ecosystem Services (Dematteis & Magnaghi, 2018; IRPET, 2023a). Supporting systemic, sustainable, and complementary practices among different agro-forestry landowners allows not only for the preservation of natural capital but also for the production of environmental services, such as carbon credits, and local raw materials, such as timber. When accompanied by specific local development projects, these can lead to short wood supply chains and exchanges of environmental credits between rural farms and local manufacturing or urban actors (in this respect, see, for example, the experience of sustainability credits promoted by the Parco Nazionale dell'Appennino Tosco-Emiliano, Italy)¹⁷. The establishment of such synergies can support the creation of multipolar and solidarity-based models centred on local awareness, as in the *metromontagna* (Barbera & De Rossi, 2021) or in the *bio-region* (Becattini, 2015) perspective.

In this light, it becomes therefore crucial to monitor and govern specific land-related dynamics, particularly in more mature phases of development, in order to prevent rent-seeking trajectories and to sustain balanced and mutually beneficial relationships between the RLS and neighbouring central areas.

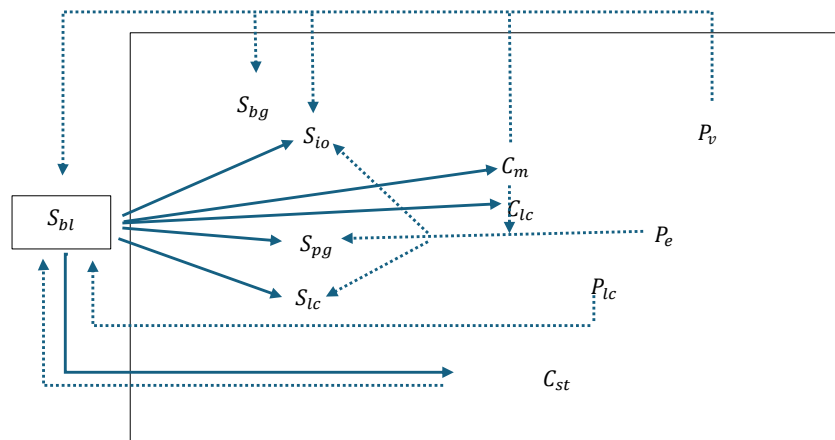
3.4.2.4 The Evolutionary Loop

The reproducibility of the development path within virtuous contexts can also be supported by specific local factors that function as quasi-automatic regulation mechanisms of long-

¹⁷See <https://creditisostenibilita.it/> (last accessed on 16 January 2026).

term dynamics (Becattini, 2009). Defined as the basic local structure (S_{bl}), these factors impinge on intermediate structures and conduct, ensuring their continuity and allowing for incremental changes in line with the *evolutionary loop* of the place (see Figure 3.5). More precisely, they constitute the set of socio-cultural and trust-based norms that define the *rules of the game* within the place (Brusco, 1999), representing a form of social capital that tends to reproduce itself when intertwined with local development, thanks to the shared reference to the natural environment and the community's narrative traditions (Becattini, 2015). They support the diffusion of contextual knowledge and specialised services for local productions through more or less formalised channels (Becattini, 2009), such as mechanisms of community mobilisation, while also promoting social and economic mobility and forms of innovation dynamics (Brusco, 1982).

Figure 3.5: **The evolutionary loop of RLS**



Source: Author's elaboration, based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Larger rectangle: a simplified version of Figure 3.4.

Innovation within the RLS can occur by following local rhythms, resources, and norms, whereas disruptive entrepreneurial actions tend to be generally discouraged (Barbera & De Rossi, 2021). Cumulative innovation, although not disruptive, is a key requirement for the gradual increase in productivity within this model of development. It allows for the extension of differentiation and diversification both in terms of new varieties and improved quality within the prevailing agro-forestry specialisations, and in terms of connected sectoral branches. An example in this sense could be the further valorisation of local resources

through more sustainable and organic perspective, for instance in line with the framework of the *Organic District* (Belletti et al., 2018). Innovation can also concern vertical divisions of labour involving firms specialised in commercial phases and in the provision of instrumental goods, brands of origin and quality, hospitality, cultural initiatives, environmental services, and production oriented towards a more international context (see Basile & Cecchi, 2001; Carbone, 1992; Pettenella, 2025; Polidoro & Romano, 1997; UNCEM, 2025).

In all this, S_{bl} also helps to preserve the rural character of the system by maintaining a certain balance and harmony between the territory and the various local activities, including agricultural ones, which remain central but not dominant. Finally, according to a process of co-evolution, firms and system performance generate feedback on structural and conduct elements (see Figure 3.5).

3.5 The Agricultural Local System

3.5.1 Model Overview

The Agricultural Local System (ALS) can be generally defined as “*a set of productive units belonging to the agri-food sector, linked to each other through economic relationships and coexisting within the same geographically defined area*” (translation by the author, p. 137, Carbone, 1992). It is a local system in which agricultural specialisation once again becomes a dominant feature of the area. More precisely, the ALS can be distinguished between Agricultural Districts (AD) and Agro-Industrial Districts (AID), depending on whether the prevailing activity within the local industrial organisation is farming or the industrial one of processing and distribution (Cecchi, 1992b). As already mentioned, these are illustrative models which, in reality, may give rise to further variations and additional nuances (Toccaceli, 2012).

In the AD, the business cluster is mainly composed of SMEs specialised in agricultural production. Farming activity is also supported by processing, distribution, and marketing activities. These phases, sometimes more artisanal than industrial in nature, remain closely linked to local agriculture, supporting the core cluster in an auxiliary way (Carbone, 1992; Cecchi, 1992b). Productive processes are rooted in local natural and cultural heritage and are characterised by a certain level of standardisation, underpinned by explicit and commonly accepted rules, such as technical and qualification schemes (e.g. Protected Designations of Origin – PDO) and/or implicit codes of behaviour. In particular, the AD “*corresponds to a situation in which the goods produced have a strong local characterisation that is highly dependent on agricultural local production*” (translation by the author, p.192, Basile & Cecchi, 2001).

On the other hand, the AID represents a cluster of firms in which industrial processing and distribution activities play a leading role in the productive organisation, while purely agricultural farms assume an ancillary role in the local division of labour (Cecchi, 1992b). Nevertheless, agricultural culture continues to characterise the local social fabric and shapes the specificity of production itself. In particular, the AID can be defined as “*a circumscribed territory with a business cluster oriented towards the production of processed food, characterised by numerous SMEs, among which there are also agricultural enterprises that supply raw materials to the local industry*” (translation by the author, p. 191, Basile & Cecchi, 2001).

3.5.2 Multi-Layered Framework

3.5.2.1 The Competitive and Strategic Loop

Let us start by examining the *competitive loop* in ALS (see panel (a) in Figure A.2, reported in Appendix A.6, given the similarities with Figure 3.2 discussed above). Here, an S_{io} composed of independent SMEs is identified, whose core, given diverse local structural and global conditions, becomes specialised in specific phases of agricultural activities in the case of AD, or in processing activities in the case of AID (C_m) (Cecchi, 1992b).

As observed in the RLS, this entails specific configurations within the global structure (S_{bg}), concerning the levels of knowledge and agricultural technologies available, as well as the presence of markets for high-quality agricultural products. In addition to this, the industrial structure merges with the land structure (S_{lc}), which—being characterised by a more concentrated structure with a prevalence of medium-sized properties—allows for the efficient implementation of more standardised agricultural uses of land capital (C_{lc}), and the specialisation in specific phases of productive processes (C_m), thereby ensuring certain levels of profitability at the firm level (P_v) (Dale, 1997; Latruffe & Piet, 2014). The land structure is also suitable for hosting dominant and competitive industrial processing activities, as in the case of AID, while ensuring adequate proximity and efficient transport networks between agricultural, processing, and marketing firms.

In this sense, the nature of the business cluster is characterised by agricultural and processing firms with a more capitalistic and industrial orientation, that is, with a higher reliance on hired labour compared to the family component discussed above (see Brusco, 1979). This does not exclude the presence of important family-based enterprises, as well as a greater articulation of the business cluster among agricultural, processing, distribution, marketing, and service firms (Carbone, 1992). Moreover, local agro-ecological conditions and the vocation of land capital (S_{lc}) characterise the specific high-quality food productions

and techniques (C_{lc} and C_m) (Becattini & Omodei Zorini, 2003).

Structural and conduct elements result in specific competitive advantages at the firm level (P_v), as enterprises reduce production costs through standardised procedures and specialisation in a specific phase of the production processes carried out within the cluster. Consequently, a broader and flexible division of labour embedded in a specific socio-cultural and environmental context can be observed, allowing firms to benefit from external economies of scale and scope (P_e)-thereby giving rise to the techno-organisational equilibrium of the model. We are here dealing with realities that recall the experience of industrial districts, though with their own specific features and peculiarities, such as a lower territorial density (Biscaro et al., 2004; Carbone, 1992; Toccaceli, 2012). Also in this case, the presence of a specific structure of public goods (S_{pg}) contributes to efficiently supporting and coordinating this territorial widespread division of labour. This refers, for instance, to formal and informal regulations on the production of quality products, as well as to rules on prices and contracts within local markets, to technical and trade standards, and also to shared facilities for the processing phase of agricultural products.

In the ALS, the *strategic loop* mirrors the dynamics observed in the RLS (see panel (b) in Figure A.2 in Appendix A.6). Among the strategic agencies that may characterise agricultural and agro-industrial district realities, it is worth recalling trade associations and agricultural consortia (e.g., the Chianti Classico Consortium in Tuscany, Italy; Polidoro and Romano (1997)), which help regulate, coordinate, and support the behaviour of the local productive community.

3.5.2.2 The Land Tenure and Evolutionary Loop

The *land tenure loop* in ALS (panel (a) in Figure A.3 in Appendix A.6) displays relational dynamics that mirror those observed previously. However, a few further considerations are warranted. As in the RLS, from a medium- to long-term perspective—given the profitability of local productions and the competitive advantages that emerge and consolidate—one can expect rising land prices that also include the formation of land rent (P_{lc}). As aforementioned, if reinvested, such rents can promote innovation and potentially reorient the local development trajectory around the local vocations expressed by land capital. Territorial governance interventions may be decisive in this regard.

An illustrative example is the Chianti wine-producing area (Tuscany, Italy), where the establishment of the Chianti Classico Consortium helped reallocate a substantial share of land rent within the local community, thereby strengthening the local socio-economic organisation and distributing benefits territorially. These benefits also encompass process and product innovation in an area that displays stronger tendencies towards multi-activity

and cross-sectorality (S_{io}) (see Polidoro & Romano, 1997).

Conversely, the emergence of rent-seeking behaviour, as discussed, can lead to changes in structural elements and in the techno-organisational equilibrium of the model, positioning itself alongside adverse local socio-economic effects driven by trends towards land-ownership concentration and, hence, wealth concentration, as well as environmental impacts associated with shifts towards more profitable, yet sometimes more polluting, agricultural practices. Similarly, *mutatis mutandis*, the considerations regarding territorial networks also apply to agricultural and agro-industrial districts, where—unlike in the RLS—the linkages among wider areas are rooted in the more specific agricultural vocations expressed by rural land capital in these settings.

The *evolutionary loop* (see panel (b) in Figure A.3 in Appendix A.6) does not depart from that described for the RLS, although the interpretation of its constituent elements takes on a different meaning. In this case, S_{bg} is characterised primarily by contextual knowledge—grounded in agriculture in AD and in agro-industrial practices in AID—diffused within a cohesive community of producers.

Social and economic mobility tends to be more restricted compared to the RLS, owing to a local social organisation that is somewhat more polarised between landowners/entrepreneurs and employees (e.g., contractors and salaried workers) (Basile & Cecchi, 2001). The socio-economic and entrepreneurial opportunities, consistent with a more concentrated land structure, are therefore more limited. Neither cumulative innovation nor disruptive innovation is precluded; both may introduce process and product innovations. Illustrative examples include precision agriculture, the use of drones and the Internet of Things—extending also to processing stages—as well as business models aligned with Industry 4.0 (UNCHEM, 2025). Quality upgrading of agricultural products—building on local vocations—can also intersect with environmental objectives through the adoption of organic and sustainable techniques, thus moving towards a reality closer to an *Organic District* (Belletti et al., 2018), or supporting diversification processes, thereby resembling more closely the case of the RLS.

3.6 Local System characterised by Capitalistic Agricultural Enterprises

3.6.1 Model Overview

The rural context can also host large professional capitalist agricultural enterprises (Basile & Cecchi, 1997; Brusco, 1979). These entities are usually characterised by high levels of cap-

ital investment and hired labour within standardised and specialised productive processes. These conditions allow them to benefit from internal economies of scale and scope and to overcome sectoral specificities and rigidities common in agricultural production, effectively decoupling local production from its potential vocations. As a result, they tend not to be embedded in the local socio-cultural structure and to produce standardised goods aimed at mass markets (Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003). In particular, they mirror the model of *homologated agriculture* proposed by Basile and Cecchi (1997). At the system level, one possible configuration may entail the presence of a few medium- to large-sized agricultural farms specialising in high-intensity, standardised agricultural and agro-industrial production.

3.6.2 Multi-Layered Framework

Considering therefore the peculiarities of the LS with capitalistic agricultural enterprises, starting with the *competitive loop* (see panel (a) in Figure A.4 in Appendix A.6), the business cluster (S_{io}) emerges as comprising a group of few medium- to large-sized agricultural enterprises (Basile & Cecchi, 1997). This industrial organisation intersects with a concentrated land structure (S_{lc}), consisting of medium- to large-sized properties held by a small number of landowners/entrepreneurs. In combination with specific global conditions (S_{bg})—in particular, advanced technical and technological innovations of industrial origin, but also specific competitive advantages at supra-local levels (Bellandi, 2011)—this land and industrial configuration leads to a specialised agricultural use of land capital (C_{lc}), implemented through intensive, standardised production processes (C_m) aimed at mass markets (S_{bg}). Indeed, these processes are supported not only by the large size of landholdings but also by their spatial proximity—which, for example, enables a high density of production units, facilitates intensive mechanisation, and reduces production and transport costs (Latruffe & Piet, 2014; Rocchi & Stefani, 2002)—as well as by the natural fertility of the areas, both morphological (often associated with flat terrain) and pedoclimatic/edaphic (soil and microclimatic qualities), which favours agricultural production operating under economies of scale (Basile & Cecchi, 2001; Longhitano & Povellato, 2017; Povellato, 2009).

Although supported by a local public-goods structure (S_{pg}), the technical and technological innovation component emerges as a key driver of growth in this model of development (Becattini & Omodei Zorini, 2003). In this sense, one can envisage both in-house R&D centres within firms and joint laboratories conceived as club goods, alongside extra-local and sectoral innovations, also accessed through international pipelines. The capacity to sustain certain farming systems is closely linked to the ability to deploy highly mechanised production techniques, which require larger scales of operation and are therefore accessible

primarily to larger agricultural enterprises (Brusco, 1979), reflecting capitalistic industrial models from which most of these innovations have been imported (Basile & Cecchi, 1997). On this basis, the upshot of the competitive loop is that large agricultural enterprises secure firm-level competitive advantages (P_v) by attaining internal techno-economic equilibria—namely internal economies of scale and scope (Basile & Cecchi, 2001).

By contrast with the previous cases, the conditions required for the emergence of external economies can be assumed to be largely absent. Although collaborations among local firms may occur—usually governed by contractual and market arrangements and stemming from specialisations along the productive process (e.g., between farming and processing)—in this specific case there is no evidence of either a complex local division of labour (as in the RLS and the ALS) or of embeddedness within a specific socio-cultural substratum that would sustain such dynamics (Becattini & Omodei Zorini, 2003). Consequently, system-level benefits (P_e) remain limited, with advantages predominantly internalised at the firm level rather than diffused territorially. For this reason, the *evolutionary loop* is omitted here, as none of the specific local factors identified above are present. Instead, one can envisage an evolution sustained by strategic agency—the *strategic loop* (panel (b) in Figure A.4 in Appendix A.6)—such as agricultural policy interventions at the national, and supranational levels, thus following a markedly top-down approach (Toccaceli, 2012).

The *land tenure loop* (panel (c) in Figure A.4 in Appendix A.6) originates from long-term high land rent (P_{lc}), which—when not reinvested locally—can exacerbate already concentrated land-ownership structures and, under rent-seeking behaviour, drive specialised agricultural uses of land capital towards increasingly intensive and profit-oriented monocultural production (dotted arrow towards C_{lc}). Decoupling production from the local vocations of land capital results in a loss of historical and cultural value, as production becomes detached from locally rooted crops, while the intensification of production also generates negative environmental consequences, including biodiversity loss and higher concentrations of pollutants (e.g., pesticides and plant protection products) in local ecosystems.

Within this new rent-seeking equilibrium, socio-economic spillovers to rural areas may turn negative. The intensification of landownership concentration—driven by the self-reinforcing dynamics of *land grabbing* discussed above (Bertolino, 1927; Wightman, 2024)—translates into a further concentration of local socio-economic opportunities and of the mechanisms through which local value is extracted and distributed, thereby exacerbating existing inequalities and social tensions. Rent, understood as a social relation, therefore gives rise to both inter- and intra-class conflicts (Moulaert & Mehmood, 2025). Indeed, beyond the divide between those who can and those who cannot access land capital, these conflicts may be further intensified by speculative uses of land capital, which may generate

additional artificial increases in land prices (P_{lc}) (Povellato & Vanni, 2017) and foster the rise of non-professional capitalist enterprises—which, according to Brusco (1979), represent speculative investments in land capital—namely, safe-haven assets held by the urban or manufacturing bourgeoisie (Dei Ottati, 1990). In many respects, these entities resemble a latifundist model of under-efficient utilisation of land capital, based on extensive cropping and low technological intensity investments¹⁸—what Brusco (1979) describes as *terra malcoltivata*—thereby limiting positive socio-economic and environmental impacts at the local level, including the development of extensive and complex productive and territorial networks, even in relation to nearby central areas. At the same time, these dynamics may also be associated with the emergence of financial actors, such as large intermediaries, for whom land capital becomes an object of speculative investment, with potentially significant local consequences documented in the literature, including the displacement of resident populations and forms of environmental degradation (Fairbairn, 2017; Gunnoe, 2014; Knuth, 2015). The emergence of these realities and of speculative behaviours therefore further worsens local socio-economic conditions, even for those entrepreneurs who continue to invest in their own activities. Conflicts and limited access to land capital—due to high prices—can act as a barrier to potential productive expansions and innovation dynamics for those who continue to invest, while also discouraging the entry of new ancillary activities along the productive chain. This, in turn, constrains the development of the local productive cluster (S_{io}), and may signal emerging crisis dynamics within the development trajectory (Bellandi & Storai, 2022; Longhitano & Povellato, 2017).

Constructive and open territorial governance interventions are therefore essential; yet, as observed for the RLS, the presence of certain elites can be decisive in hindering such efforts. The concentration of landownership, coupled with high land rents, can confer political and economic power on a small set of *landed elites*, enabling them to obstruct innovative local-development projects and preserve the existing equilibrium (*status quo*), as discussed above (Barca & Carrosio, 2020).

3.7 The Rural Context as a Periphery of other Local Systems

3.7.1 Model Overview

Some rural areas can function as the periphery of other Local Systems (LSs), such as urban or manufacturing-oriented places (Cecchi, 2001). The relationships between rural and other

¹⁸Latifundia owners tended to prioritise the acquisition of additional land—thereby expanding their source of social prestige—rather than reinvesting agricultural income and land rents into improvements of the estates already under their control (Bertolino, 1927).

central areas may take various forms — ranging from a dialectical and complementary nature, as exemplified by the case of the RLS, to conflictual or dependent configurations, in which rural areas may end up as satellites within the orbit of other local systems, exploited as reservoirs of natural and human resources, as will be shown in the following and final model analysed. With the aim of capturing, at least in part, the remarkable differentiation that characterises rural contexts (Annunziata et al., 2024; Basile & Cecchi, 2001; Becattini & Omodei Zorini, 2003; Mantino et al., 2023) — and thus avoiding overly polarised interpretations of territories (Nisticò, 2019) — the following case, though closer to a conflictual dynamic, does not represent an extreme instance of it. It refers, in fact, to rural areas that are not extremely remote but rather situated in an intermediate position, in proximity to highly urbanised or industrialised zones, and therefore classifiable as a *peri-urban rural context of the lower valleys* (Dematteis, 2018).

In these contexts, within a centre–periphery dialectic, urban–metropolitan or manufacturing lifestyles extend and take root, shaping rural socio-economic activities. Farms typically occupy an interstitial position, and their productive organisation is generally less structured, giving rise to micro-enterprises, part-time farmers, or hobby farmers (Brusco, 1979; Cecchi, 1988).

3.7.2 *A single-layer framework*

Based on this, the *competitive loop* (see Figure A.5 in Appendix A.6) highlights an S_{bg} that plays a predominant role in shaping the local dynamics of the rural context, reflecting the characteristics of nearby manufacturing or urban areas. The arrow linking S_{bg} to the other intermediate local structures is highlighted in bold in order to represent the strong dependence of the rural context on these features. These centre-periphery influences can take multiple forms, depending on the characteristics of the prevailing LS. In line with this, such dynamics intersect land structures S_{lc} and uses C_{lc} , as well as the interwoven productive structure S_{io} and market conduct C_m . It is indeed possible to observe an industrial structure S_{io} composed of small and micro independent agricultural enterprises, interrelated with a land structure S_{lc} mainly consisting of small and micro scattered properties. The presence of public goods is not excluded. However, where present, they tend to be weakly structured and poorly organised, and are most often supported by the nearby LS. For this reason, they are not explicitly included within the *competitive loop*, as they are implicitly embedded in the S_{bg} . These structural conditions support a use of land capital C_{lc} linked to models of micro-enterprises and part-time farmers, for which it is not possible to identify local labour division dynamics between farms, or, when present, they appear very weak. Agricultural production therefore takes on a residual and interstitial role, detached from the area's

prevailing productive vocation, characterised by extensive and limited production with low investment and mechanisation (C_m), giving rise to low profitability and precarious working conditions¹⁹ (P_v) (Brusco, 1979; Cecchi, 1988).

Moreover, the peripheral rural context of a LS can also be characterised as a place of residence, both due to more advantageous economic conditions — with generally lower living costs compared to central areas — and to a certain attachment to rural values and culture (Brusco, 1979; Cecchi, 1988; Dematteis, 2018; Moulaert & Mehmood, 2025). The *residential economy*²⁰ of this area, may take different forms and expressions (Segesseman & Crevoisier, 2016). In this sense, it is possible to imagine the presence of many hobby farmers, often workers from nearby urban or manufacturing realities, who nonetheless choose the rural context as a place to live and cultivate small plots of land for self-sustenance and income integration (Dei Ottati, 1990; Golzio, 1933). At the same time, when such residential patterns prevail over productive functions, the area can take on the features of mere *dormitory zones*, with low levels of both residential and productive activities (S_{io}) and a high presence of commuters. Alternatively, in more attractive areas, residential functions may manifest as second homes owned by urban and manufacturing bourgeoisies — that is, forms of *annuitants' residential areas* (Segesseman & Crevoisier, 2016) — which can also be associated with a certain seasonality, both in residence and in the local economy (Crevoisier et al., 2025). This latter case may also give rise to non-professional capitalist agricultural enterprises which, as previously noted, entail under-efficient use of land capital and generate weak or negligible spillovers in the local economy (Brusco, 1979; Dei Ottati, 1990).

The land structure reflects and supports these dynamics through greater fragmentation (S_{lc}), in light of the spread and proliferation of land uses (C_{lc}) such as housing and real estate development, and possibly small commercial activities and farms. At the same time, it may also include large properties resulting from the rise of non-professional landholdings (Cecchi, 1983).

In this case, no clear elements can be identified that would allow one to define a structure of local factors (S_{bl}). The local socio-economic culture may result from the contamination of urban–metropolitan lifestyles, showing no signs of distinct local identities (Dematteis, 2018). Governance interventions (C_{st}) may likewise be absent or oriented

¹⁹At the same time, more dynamic and structured farming realities may still be present; however, they tend to remain marginal in shaping the overall local economic configuration.

²⁰The residential approach considers how the living environment—namely, the places where people reside and spend most of their income—constitutes an important element of local development. More specifically, the diversity of residential locations and types becomes a factor shaping distinct development dynamics (Crevoisier et al., 2025; Segesseman & Crevoisier, 2016)

towards benefiting the main LSs. It is worth noting, in fact, the frequent orientation of local development initiatives exclusively towards areas of high dynamism—and, though more rarely, in a polarising perspective, towards areas of very low dynamism (e.g. the Italian National Strategy for Inner Areas (NSIA), see Agenzia per la Coesione Territoriale / Dipartimento per le Politiche di Coesione (2025)) (Barca, 2011; Nisticò, 2019).

Given the elements presented so far, the framework therefore lacks the other loops previously identified, including the *land tenure* one. It is indeed possible to imagine that the dynamics and prices of land capital therefore depend on the trends of the reference local system. However, land capital still represents a reservoir of resources that could be mobilised to promote multi-sectoral specialisations rooted in locally unexpressed vocations (Bertolino, 1961; De Rossi & Mascino, 2018), or to support potential local manufacturing pathways based on models of *diffuse industrialisation*, which may, for instance, involve rural contexts—as was the case with the spread of Italian district systems (Becattini, 1979). This recalls, in fact, the role of such rural peripheries in district development trajectories — such as labour reservoirs — and how, in certain phases, manufacturing activities have branched out into these areas (Cecchi, 1988, 2001; Dei Ottati, 1990).

3.8 The Rural Context as a Periphery Tout Court

3.8.1 Model Overview

Some rural areas, usually more remote and marginal, can be characterised by fragile socio-economic conditions in which no intrinsic drivers of local development can be identified (Basile & Cecchi, 2001). In this sense, they can be regarded as peripheries *tout court* (Cecchi, 2001). In these circumstances, agricultural activities may mainly take two forms: those usually characterised by limited physical and economic size, with loosely structured productive organisations; or those of extensive agricultural production, marked by weak entrepreneurship and low investment rates, as has historically been the case in *latifundia* (Bertolino, 1927; Martinelli, 2014; Storti, 2022). The persistence of such weak conditions around agro-forestry and artisanal economies fosters dynamics of out-migration and land abandonment (Bevilacqua, 2018; Curci & Zanfi, 2018; Sella et al., 2024).

3.8.2 The framework

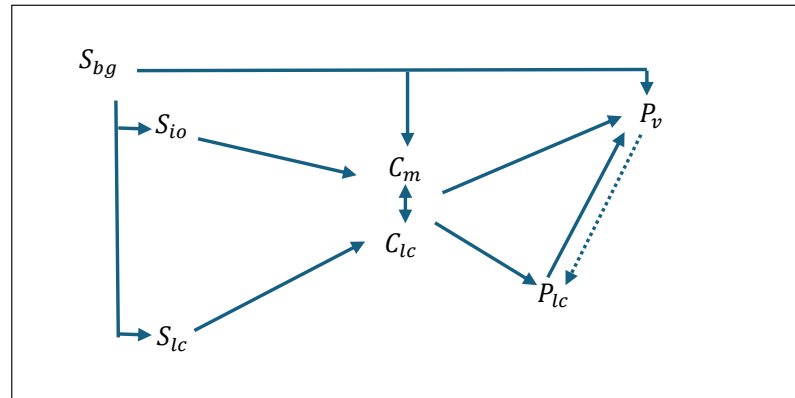
3.8.2.1 The Competitive Loop

Let us focus here on the former case, namely a productive organisation (S_{io}) composed of small and micro agro-forestry enterprises—realities reflected in a land structure (S_{lc}) pre-

dominantly characterised by small and micro properties scattered across the area. However, the possible presence of large properties cannot be excluded—for instance, those linked to public management aimed at the conservation and enhancement of rural areas with high environmental value, which are usually configured as natural parks or protected areas (Bimonte et al., 2023).

The predominantly fragmented land structure—also interconnected with certain natural rigidities of land capital typical of more marginal areas, such as mountainous morphology and harsher climatic conditions—thus drives small and micro agricultural activities towards a dispersed use of land capital (C_{lc}). Land fragmentation and small property size are reflected in productive organisation, making it difficult to achieve division of labour, agricultural specialisation, and complementary service activities (C_m), as well as to pursue specific competitive advantages in terms of internal economies of scale and scope (P_v). This therefore results in low local productivity and profitability at the farm level, as exemplified by P_v at the end of the *competitive loop* in Figure 3.6 (Brusco, 1979; Latruffe & Piet, 2014; Rossi-Doria, 2005). Also in this case, as in the previous one, the presence of public goods is not excluded. However, where present, they tend to be weakly structured and poorly organised, and are most often provided by S_{bg} .

Figure 3.6: **The competitive loop of the rural context as a periphery tout court**



Source: Author's elaboration, based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects.

These are therefore areas of economic and socio-cultural depression—nuclei of populations that contain within themselves the seeds of development, including economic development, yet for some reason are unable to germinate (Bertolino, 1961). Depression is an *area-based phenomenon* (Bertolino, 1961), which not only manifests itself in the local

social culture—thus strongly limiting the emergence of local factors S_{bl} such as heritages that preserve shared experiences and are preparatory to defining an autonomous path of local socio-economic development—but also involves territorial governance institutions C_{st} (Becattini, 1990; Bertolino, 1961). The only limited exceptions typically lie beyond local governance and are instead associated with supra-local policy interventions (such as the NSIA Agenzia per la Coesione Territoriale / Dipartimento per le Politiche di Coesione, 2025 or the “*Valorizzazione della Toscana diffusa*” regional law Regione Toscana, 2025). In this sense, it is therefore possible to imagine the absence of further layers within the local framework. However, it is necessary to focus on land tenure dynamics, as land capital directly impinges on this area-based depression and generates feedback effects on the other elements of the system.

3.8.2.2 *The Land Tenure Loop*

The combination of fragmented productive and land structures, resulting in less structured agro-forestry activities and, in turn, low levels of productivity and profitability, is reflected in low and limited land values (P_c within the *competitive loop* in Figure 3.6). In particular, it is possible to imagine how the persistence of such fragile conditions in the medium to long term may lead to a further reduction in these values (P_c within the *land tenure loop* in Figure 3.7). Indeed, looking at the *land tenure loop* in Figure 3.7, the persistence of a lack of profitability in local activities and socio-economic opportunities leads, over time, to their abandonment (reverse arrow to C_m) and the abandonment of land capital (reverse arrow to C_{lc}), ultimately resulting in phenomena of out-migration of the local population and in zero or even negative rent (P_{lc}) (Curci & Zanfi, 2018; Rossi-Doria, 2005; UNCEM, 2025). This new techno-organisational configuration, shaped by abandonment, in turn causes, in the long run, economic, social, environmental, political–governance, and land-capital damage in contexts that are already precarious and marginal (Schuh et al., 2020).

Let us examine this in more detail as follows:

- [*socio-economic damage*] a (further) loss of opportunities for local socio-economic and environmental value creation, as in the case of ecosystem services or agri-food value chains (dotted arrows towards S_{io}), along with the disappearance of local socio-cultural heritage (dotted arrows pointing towards S_{bl} , located outside the rectangle and shown in a shadowed format, reflecting the weakness or near absence of this structure’s features within the model) (Bevilacqua, 2018; Lasanta et al., 2017; Rossi-Doria, 2005);
- [*environmental damage*] (further) environmental risks and damages, such as a higher

likelihood of hydrogeological hazards, wildfires, the uncontrolled return of forest cover, and biodiversity loss (dotted arrows towards S_{lc}) (Lasanta et al., 2017; Sella et al., 2024; UNCEM, 2025);

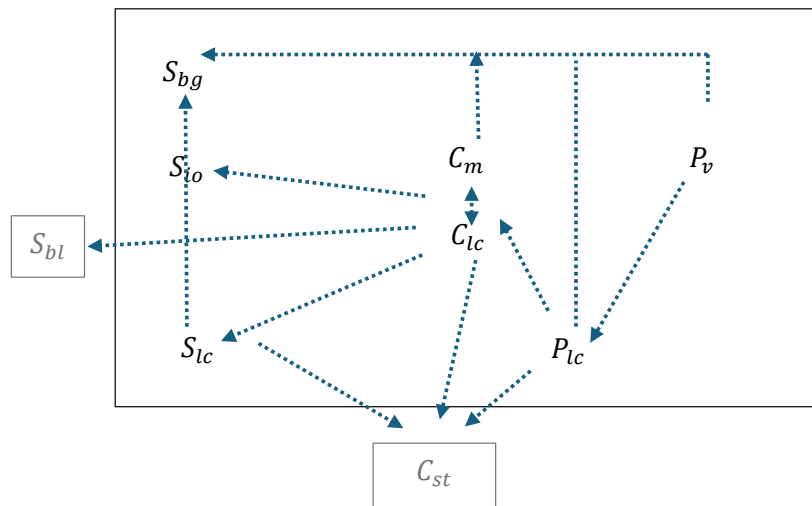
- *[damage to land assets]* (further) deterioration of residential and productive land capital, creating barriers to the return of residents and new entrepreneurs, as well as to the development of potential activities connected to it. Moreover, prolonged abandonment is also linked to a growing disinterest on the part of private landowners in maintaining their property—both in terms of its size and the distribution of land titles—as land management becomes economically unsustainable (Bromley, 1989). In the long run, in systems based on equal inheritance, associated with general trends of population growth, this dynamic can exacerbate land fragmentation—representing a further self-reinforcing dynamic, albeit of opposite sign to that observed in processes of land concentration—with the emergence of *silent ownership*²¹, thereby reducing the availability of land suitable for local activities and related entrepreneurial initiatives (Cecchi, 1988) (dotted arrows towards S_{lc}). This, in turn, underpins a further loss of value—or depreciation—of land capital, reflecting an increasingly fragmented structure and the worsening lack of socio-economic opportunities (P_{lc}) (Curci & Zanfi, 2018; Povellato, 2012);
- *[territorial networking damage]* a (further) form of damage concerns broader territorial dynamics (arrows also involving S_{bg}). In this framework, depressed rural areas tend to express purely dependent relationships with nearby central areas. In other words, they merely constitute a reservoir of resources—human and material—that are exploited by the neighbouring areas. An example is the intensification of seasonal and secondary residential use by urban inhabitants (as seen in the previous model), which also affects local land dynamics (Barbera & De Rossi, 2021; Crevoisier et al., 2025; Segessemann & Crevoisier, 2016). All this erodes local socio-cultural and natural capital, limiting the emergence of possible bottom-up mechanisms for recognising local socio-economic potential, and thus often fostering stagnation in local development paths (Barbera et al., 2022; Becattini, 2015; Bertolino, 1961). Moreover, the lack of development in such rural areas also entails disadvantages for the neighbouring central areas. Among these are the direct costs of potential environmental damage resulting from poor land management (for instance, flooding in valley areas due to inadequate maintenance of slopes and upland territories), as well as missed opportunities to benefit from stronger local value chains (such as those observed in the

²¹These are situations in which identifying the legitimate owners is impossible (Medici et al., 1962)

case of RLS) and the costs associated with the redistribution of financial resources through public interventions supporting fragile contexts, which, in the absence of structural visions, risk constituting merely temporary buffers and a dissipation of local resources.

- *[political-governance damage]* consistently with the weakness of the socio-economic dimension, these areas struggle to express a form of territorial governance (Bertolino, 1961). This is further aggravated by the depression reflected in the land tenure regime: land fragmentation entails a large number of landowners to be involved and negotiated with in order to define joint local development projects; the presence of silent owners exacerbates these difficulties; and low land values discourage not only private initiatives but also public ones, as no economic convenience is perceived even in implementing land reconsolidation projects (dotted arrows from land tenure elements to C_{st} , located outside the rectangle and shown in a shadowed format, reflecting the weakness or near absence of this element's features within the model) (UNCHEM, 2025; Wojewodzic et al., 2021).

Figure 3.7: **The land tenure loop of the rural context as a periphery *tout court***



Source: Author's elaboration. *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Larger rectangle: a simplified version of Figure 3.6.

3.9 Discussion of Findings

The work developed so far has made it possible to gain a clearer understanding of the role of land capital across distinct local development pathways.

In line with the initial research question, the analysis has first clarified how land capital interacts with different local development models. Specifically, for each model, we have identified a corresponding *land-tenure organisation*, that coherently supports the model-specific techno-organisational equilibrium originally described in the scientific literature. Subsequently, by developing a specific framework centred on the links among land-related elements, it became possible to analyse the feedback effects generated by these elements—both among themselves and in their interactions with the other components of the system—over time and across distinct techno-organisational configurations. In doing so, the analysis has identified the role of the *land-tenure loop* in shaping differentiated rural local development paths in a quasi-steady state. From this perspective, the key findings are briefly outlined below and summarised in Table 3.3, which expands initial Table 3.1.

Starting from the RLS, given its structural techno-organisational configuration, a decentralised land tenure regime—characterised by a limited degree of fragmentation, confined to small- and medium-sized properties and maintained in close spatial proximity—emerges as the *land-tenure organisation* underpinning this model (see, Table 3.3). This configuration, also in connection with local natural features, is positively associated with differentiated uses of land capital, from which agro-forestry multifunctionality unfolds into a range of diversified sectoral specialisations and advantageous broader territorial connections. This, in turn, reinforces the distinctly rural character and identity of the RLS itself.

Within a quasi-steady development perspective, the dynamics affecting land-related elements influence the local development trajectory of the RLS through specific mechanisms operating within the *land-tenure loop* (see, Table 3.3). In this respect, the reinvestment of a share of land-related incomes and rents into the local productive organisation—and thus into the local vocations of land capital itself—emerges as a key condition for supporting the expansion and sustainability of local development paths, as well as for generating spillovers conducive to trajectory re-routing. Moreover, when appropriately leveraged these dynamics can extend into advantageous territorial networks with nearby central areas, thereby supporting the consolidation of virtuous multipolar development models.

On the other hand, high land rents, if left ungoverned or improperly channelled, may sustain the consolidation of an extractive equilibrium centred on rent-seeking behaviour, whereby incomes and rents accruing through land capital are not reinvested within the local socio-economic organisation. Over time, such dynamics may lead to exploitative

Table 3.3: **Land Tenure Organisation and Loops in Rural Development Pathways**

<i>Dimensions of place-based development</i>	Rural System	Local	Agricultural Local Systems	LS of Capitalistic Agricultural Enterprises	Rural Context as a periphery of others LSs	Rural Context as a periphery tout court
<i>Local industrial organisation</i>	Cluster of family-run SMEs that diversify around agricultural activities	of	Cluster of SMEs specialised in agricultural or food-processing production	of large capitalistic agro-and agri-food farms	Loosely structured (e.g. part-time farming)	Absent or fragmented
<i>Sociocultural structure</i>	Highly cohesive social capital		Slight social capital polarisation	Capitalist-dominated social relations	Low social cohesion	Fragmented and weak
<i>Institutional and governance support</i>	Rules of chorality	of	Rules of chorality	Formal and codified rules	Absent or dominated by the central LS	Absent or inadequate
<i>Multi-territorial networks</i>	Balanced relations		Balanced relations	Engagement with global networks	Some degree of dependence on the main LS	Relations of dependence and exploitation
<i>Land Tenure Organisation</i>	Decentralised and differentiated land regime		Decentralised and specialised land regime	Concentrated and specialised land regime	Partially fragmented land regime	Fragmented and Pulverised land regime
<i>Land Tenure Loop within Local Development paths</i>	<i>Reinvested land rents:</i> innovation and expansion; multipolar development <i>Rent-seeking equilibrium:</i> extractive and concentration dynamics; rising inequalities and conflicts; potential lock-in and decline		<i>Reinvested land rents:</i> innovation and expansion; multipolar development <i>Rent-seeking equilibrium:</i> extractive and concentration dynamics; rising inequalities and conflicts; potential lock-in and decline	<i>Reinvested land rents:</i> innovation and expansion; linear growth <i>Rent-seeking equilibrium:</i> concentration and speculative dynamics; rising inequalities and conflicts; potential lock-in and decline	Absence of autonomous land-tenure loop	<i>Land abandonment and land fragmentation;</i> crisis, structural decline and depression

Source: Author's elaboration.

and suboptimal uses of local resources, increased land concentration, and the monopolisation of land uses. They may also erode local land and socio-cultural capital, thereby reinforcing rising inequalities. Such an extractive configuration may persist as a relatively stable equilibrium, despite its structural inefficiencies and distributive distortions. However, in contexts of external shocks or mounting internal imbalances that require structural adaptation, the capacity of the system to reorient may be constrained. In particular, local elites—including rentier elites—may resist reforms that threaten established rent positions, thereby reinforcing institutional and economic lock-in effects. In the long run, this resistance may exacerbate systemic rigidities, deepening crises and increasing the risk of decline in the development trajectory of the RLS. Moreover, such patterns undermine the possibility of establishing balanced relations with nearby central areas, instead creating conditions for hierarchical and exploitative dependencies driven by these central territories.

Mutatis mutandis, analogous conclusions can be drawn for ALS, where similar land-tenure configurations and land-rent dynamics shape local development trajectories through comparable mechanisms.

The case of LS of capitalistic agricultural enterprises is instead emblematic of a highly concentrated land-tenure structure, characterised by specialised and standardised uses of land capital (see Table 3.3). From a dynamic perspective, when land rents are not only reinvested but also appropriately governed, the system can follow a relatively stable and functional development path. However, given the specific techno-organisational configuration of this model, such dynamics tend to sustain a polarised socio-economic structure, in which entrepreneurial opportunities—and the channels of value creation and appropriation—remain relatively narrow. On the other hand, the emergence of ungoverned rent-seeking dynamics and equilibria may further exacerbate these tendencies, leading the productive structure to lose its virtuous character and become increasingly shaped by speculative and financial investments. The further intensification of these dynamics may amplify conflicts and inequalities, potentially triggering crises that, if not properly reoriented, may ultimately lead to structural decline and environmental degradation.

The case of rural contexts functioning as peripheries of other LSs is instead emblematic of the absence of an autonomous *land-tenure loop*, which does not develop independently but remains largely shaped by centre-periphery dynamics originating from the main LS. Nevertheless, as previously noted, it remains analytically relevant to consider land capital in these contexts as a reservoir of resources that can be properly and systemically valorised through coordinated linkages with neighbouring and connected central areas.

In rural peripheries *tout court*, the analysis highlights the prevalence of fragmented and pulverised land-tenure regimes, combined with weak or non-existent productive and

social organisational structures. As observed, in these contexts of structural depression, land-related elements, if left ungoverned, may reinforce processes of socio-economic and environmental deterioration over time, pushing local development trajectories into a spiral of decline that results in self-reinforcing patterns of land abandonment and land fragmentation. When taken to their extreme, such equilibrium may also discourage governance actions and collective initiatives aimed at reversing these trajectories (see Table 3.3).

3.10 Concluding Remarks

This paper advances the understanding of the interconnections between land capital and local development dynamics. Having acknowledged its fundamental role and main mechanisms through which it affects rural development at large, this work delves more deeply into its implications once specific local and extra-local structural elements are taken into account. In doing so, it examines how land capital interacts and intertwines with distinct models of development, thereby shaping different rural development pathways. Drawing on the tradition of *place-based* development studies, the *land-tenure organisation* of such models has indeed been largely overlooked in explaining both the techno-organisational configuration of these models and their differentiated implications across distinct local development trajectories. In this respect, the paper contributes by further defining this structure and by exploring its role in shaping distinct local development paths.

Specifically, drawing on the SCP methodology, the related *land-tenure organisation* was reconstructed for a set of rural development models identified in the scientific literature. These models are representative of a broader range of socio-economic realities within rural contexts. The *land-tenure organisation* thus takes the form of coherent configurations of different land-ownership structures, land uses, and land rents, logically aligned with the core structural features—both internal and external—characterising each model. Taken together, this constitutes a first significant contribution of the paper, as it embeds the *land-tenure organisation* within the conceptual framework of local development models, introducing it as a key additional analytical dimension of *place-based* development.

A second key contribution of the paper lies in the analysis of the feedback effects generated by land-tenure organisation over time and across the other components of distinct systems. By explicitly tracing how land-related elements interact with other structural, behavioural, and performance dimensions of distinct models, the analysis shows how such feedback mechanisms can either steer or constrain specific rural development trajectories, supporting the emergence of distinct techno-organisational equilibria. These dynamics are synthesised within distinct *land-tenure loops*, which capture the role of land-tenure

organisation in shaping differentiated rural development pathways.

In doing so, the analysis has made it possible to closely examine the role of land capital across different rural local development pathways and to derive a set of general conclusions that also provide grounds for reflection and guidance for territorial governance interventions.

First, the analysis clearly shows that the soundness of rural local development pathways is closely linked to the capacity to define and sustain a synergic overlap between the elements of land-tenure organisation and the other key dimensions of *place-based* development over time. In particular, virtuous local development pathways appear to depend on how this overlap is continuously enhanced and re-adapted over the medium to long term, in ways that are grounded in local vocations and specific territorial features articulated through land capital. In this sense, the extent to which land tenure organisations are able to adapt to and support the productive, social, and governance dimensions of local development—according to locally embedded land-related specificities—emerges as a crucial factor. As exemplified by the RLS, a coherent overlap between land and industrial structures—beyond ensuring specific competitive advantages in local production—also guarantees the development of local factors and identities, such as contextual knowledge, as well as mechanisms of economic and social mobility that sustain the participation of the local community in land capital and, consequently, in processes of value creation and appropriation. By doing so, they ensure the reproducibility of virtuous local development trajectories over time.

Secondly, the analysis shows how the loss of such structural coherence contributes to divergent local development trajectories. In this respect, the case of rural areas functioning as peripheries *tout court* is emblematic, as *land-tenure organisation* in these contexts is unable to support the formation of viable and efficient local social and economic structures in line with local vocations. Moreover, over time, inherited dynamics embedded in *land-tenure organisation* and in the *land-tenure loop* itself may drive this situation towards increasingly extreme stages, thereby obstructing the activation of innovative local development projects and locking them into persistent conditions of structural depression. Within this broader analytical framework, albeit under different structural conditions, the emergence of ungoverned and persistent land rents also plays a critical role. Across rural local development trajectories, the analysis highlights how the inability to govern rising land rents and associated rent-seeking behaviours may undermine the virtuous functioning of local development paths, leading to new equilibria typically characterised by growing inequalities and social conflicts. This occurs through a growing misalignment between land-tenure organisation and local socio-economic structures, which become increasingly detached from the productive vocations and specificities of land capital itself.

Thirdly, beyond local outcomes, the ability—or inability—to activate synergies between

land-tenure organisation and the other structural dimensions of *place-based* rural development, in line with rural local vocations and supported by land-capital-oriented strategies, carries significant consequences for multi-scalar territorial development trajectories. In rural contexts characterised by virtuous local development paths, such structural coherence constitutes a crucial precondition which, when effectively enhanced, enables the establishment of balanced and mutually beneficial relations with historically stronger neighbouring areas. These relations not only underpin the potential development of rural territories but also provide the foundations for stronger and more resilient competitive advantages at wider territorial scales, including area-based systems encompassing nearby central areas. Conversely, the lack of proper valorisation of land-tenure structures tends to foster dependent or exploitative relationships to the detriment of rural territories. More generally, the analysis therefore suggests that *land-tenure organisation* and its related strategies play a key role in promoting and supporting rural development on a footing comparable to that of manufacturing and urban development.

Fourthly, the analysis highlights how specific land-tenure configurations and related dynamics may actively obstruct the functioning and effectiveness of local governance. On the one hand, highly concentrated land-tenure structures—often intertwined with elevated land rents—may foster the emergence of land elites and *rentiers* that, through their control over land capital, are able to influence or constrain local decision-making processes in ways that preserve existing techno-organisational equilibria. In such cases, governance mechanisms risk being captured or selectively oriented towards the protection of rent-extractive positions, limiting the scope for adaptive change and the re-routing of development initiatives. On the other hand, extreme land fragmentation may likewise hinder governance capacity, albeit through different mechanisms. In these contexts, the dispersion of land ownership, low rental values, and the absence of coordinated land management make it difficult to mobilise collective initiatives, align individual interests, or implement coherent territorial strategies. In both cases, extreme land-tenure configurations contribute to constraining governance effects, limiting the scope of policy interventions and hindering initiatives aimed at reversing declining trajectories or reorienting development paths towards more sustainable and inclusive ones.

In conclusion, the foregoing discussion supports the view that local development should be understood as a process of territorial reconstruction which, beyond encompassing local productive structures together with their social, cultural, institutional, and political dimensions, also incorporates the organisation of land-tenure systems. Further research extending this perspective to non-rural contexts is therefore recommended, in order to deepen the analysis of a dimension that has so far remained largely neglected in the scientific literature.

Moreover, an additional and particularly promising avenue for future research would consist in the empirical investigation of the relationships emerging within the *land-tenure loop*, so as to provide robust evidence on the underlying mechanisms of these linkages through the systematic observation of real-world dynamics. This line of inquiry will therefore constitute the focus of the subsequent chapters.

Part III

Empirical Analysis

Chapter 4

Beyond Policy Intentions: What Has Crop Diversification Actually Achieved?

Towards a Broader Environmental, Economic and Land-Use Assessment

Note.

Part of the research presented in this chapter was subsequently developed into the following Working Paper, which expands the original analysis through the contribution of additional co-authors: Brutti, Z., Cecchetti, M. C., Freo, M., Landi, G., and Stefani, G. (2026). *Beyond Policy Intentions: What Has Crop Diversification Actually Achieved? Towards a Broader Environmental and Land-Use Assessment. Working Paper Economics*, 17/2026. Department of Economics, University of Florence.

Abstract

The greening of the Common Agricultural Policy has faced criticism in both ex-ante and ex-post evaluation analyses. Positioning itself within this latter strand of literature, our study provides further evidence on the impact of the crop diversification requirement under the greening on the local economic and environmental performance, as well as on land-use practices. Exploiting the discontinuity in eligibility criteria at 10 and 30 hectares, we apply a fuzzy regression discontinuity design to a detailed georeferenced dataset for Tuscany (Italy). The data also allow to assess innovative crop-rotation indicators as an indirect measure of environmental performance. The results show that the crop diversification measure supports the intended changes in land-use patterns, generating local environmental benefits particularly among small and medium-sized farms. However, no significant effects emerge for local economic outcomes or for larger farms. Additionally, the findings indicate a positive relationship between diversification and rotation practices, suggesting potential policy implications in which diversification can be leveraged to promote crop rotation. Overall, this constitutes a clear example of how the governance of different uses of land capital can shape distinct performance dynamics within rural areas, thereby providing empirical support for the conceptual linkages developed in Part II of this study.

Keywords: Green Direct Payments, Crop Diversification, Crop Rotation, Counterfactual Impact Evaluation, Regression Discontinuity Design.

JEL codes: O18; Q12; Q18; Q58; R52.

4.1 From Conceptual Framework to Empirical Analysis: Evaluating Land-Use Policy Impacts

Part II has expanded the theoretical understanding of the role of land capital and the dynamics through which it shapes distinct trajectories in rural development pathways¹. One of the main outcomes of this work is the development of a conceptual framework—the *land tenure loop*—that systematises the relationships (direct and reverse) between land-related elements and rural local development (a more articulated version of the framework proposed in Figure 3.1 in Chapter 3 is depicted in Figure 4.1, which also incorporates elements of territorial governance²).

According to this framework, land capital is legally and physically organised through diverse landed property structures³ across different areas (S_{lc} in Figure 4.1). Starting from these different land-ownership structures, and in line with specific local socio-economic and institutional conditions, markedly distinct patterns of land use emerge⁴ (direct arrow from S_{lc} to C_{lc} in Figure 4.1). The combination of different land structures and uses, in turn, gives rise to diverse income streams generated through land capital, as well as to local-level performance and effects (direct arrows from S_{lc} and C_{lc} to P_{lc} , and then, to P_v and P_e , or from S_{lc} and C_{lc} to P_v and P_e in Figure 4.1). The performance of rural areas is expressed at three levels: at the firm level, through individual profitability and operational performance (P_v);

¹This statement builds on two key concepts emerging from the previous analysis. First, land capital is understood as raw land—a natural agent with “*original and inherent features*” (Ricardo, 1776a)—which also encompasses permanent forms of capital embodied in lasting land improvements, such as soil tilling, plantations, and buildings (for further details, see Chapter 1). Second, the rural context is defined as an area characterised by low population density and productive specialisations directly or indirectly linked to agro-forestry activities. More broadly, it refers to a mixed economic setting in which agriculture coexists with other sectors—such as craftsmanship, tourism, and industry—that tend to integrate with, and maintain a balanced relationship with, the natural environment (Iacoponi, 1998). Moreover, as well documented in the literature, rural contexts follow multiple development pathways, reflected in a variety of recognised local development models (see, for instance, Basile & Cecchi, 2001; Belletti et al., 2018; Biscaro et al., 2004; Cecchi, 2001; Mantino et al., 2023; Romano, 2001; Toccaceli, 2012).

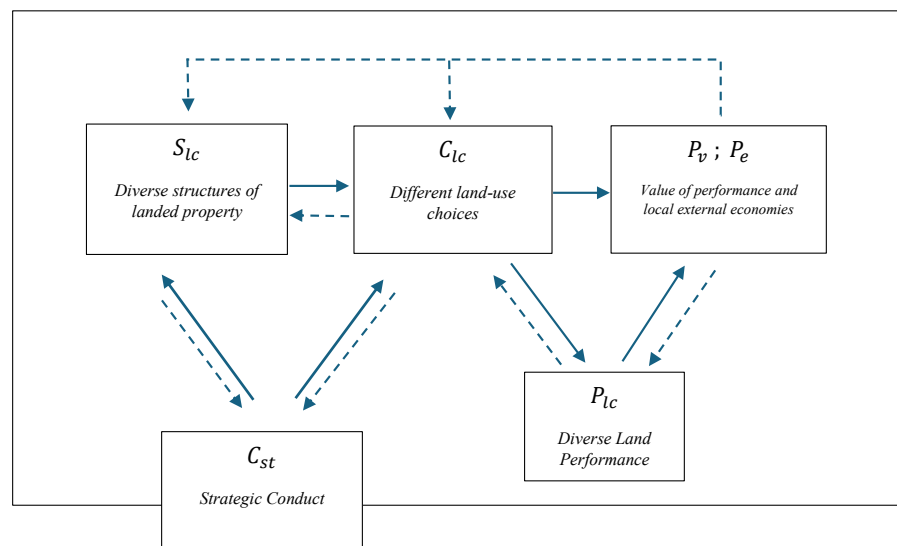
²Territorial governance is here defined as “*a process of coordination between different types of actors with asymmetric resources, who engage around issues concerning their territory and contribute, through tools and structures, to the elaboration of a shared project for territorial development*” (Torre, 2023).

³Landed property structures are characterised by properties of varying physical size and spatial distribution, as well as by different property rights and types of landowners (Zangheri, 1981). At the local level, heterogeneous property structures vary along a continuum between two extremes: concentration and fragmentation. Land concentration is characterised by large estates held by a few landowners, whereas land fragmentation refers to situations in which numerous small and micro properties are owned by many. Between these extremes, intermediate configurations can also be identified—for instance, small- to medium-sized properties held by a relatively large, though not excessive, number of landowners (for further details, see Section 2.3).

⁴Land uses encompass all strategies concerning the use of land capital by local and non-local actors. These uses range from diverse agro-forestry specialisations to environmental, industrial, touristic, residential, and speculative purposes (see Section 2.5).

at the system level (P_e in Figure 4.1), through the emergence of potential localised economic advantages in terms of external economies within territorially bounded areas (see Marshall, 1920/2013); but also at the land-capital level, where P_{lc} captures the performance of land capital—in terms of profit and rent⁵—as reflected in land prices⁶. Land prices contain a high degree of informational content regarding the characteristics and profitability of land capital, as well as the opportunities offered by the surrounding environment in relation to specific uses (reverse arrow from P_v and P_e to P_{lc}).

Figure 4.1: **The land tenure loop with elements of governance**



Source: Author's elaboration. *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Direct and reverse arrows linking strategic conduct to performance elements are conceptually embedded in the framework but have been omitted from the figure for clarity, as they are not required for the analytical purposes of the present analysis.

Diverse local articulations of these land-related elements, organised within distinct *land-tenure organisations* as a key *place-based* dimension, therefore support the definition of differentiated *land tenure loops*. These loops capture distinct interactions within land-related elements and between land-related elements and other key *place-based* socio-economic, political, and institutional dimensions, which, in turn, support differentiated performance in rural local development pathways.

In this regard, the framework depicted in Figure 4.1 also incorporates the territorial

⁵These remunerations may stem from productive activities or take the form of land rent and can be regarded as the land performance. For further details see also Section 2.4

⁶ P_{lc} is analytically distinct from P_v , as land capital represents an autonomous element that may be detached from productive activities, a distinction evidenced by the fact that landowners are not necessarily the managers of productive enterprises.

governance dimension (C_{st} , namely the conduct of strategic agencies) consistently with the analysis developed in Part II. These agencies are specialised in providing support to sustain the system's virtuous functioning over time, by facilitating the re-adjustment of structural and conduct features of the local context when facing local and global challenges and changes (such as the direct arrows from C_{st} to S_{lc} and C_{lc})⁷. Moreover, multilevel governance is increasingly emphasised in the literature, as they encompass both local and extra-local actors and institutional elements within a *place-based* approach (Barca et al., 2012; McCann, 2023). Accordingly, C_{st} is positioned at the system boundary in Figure 4.1, so as to capture its potentially multi-level character with respect to the elements of the *land tenure organisation*, as well as the feedback effects that these elements may generate towards it in the medium to long run (reverse arrows from land-related elements; see Chapter 3 for further details).

In line with the discussion, the elements included in Figure 4.1 may therefore assume different local configurations, consistent with other local and extra-local conditions discussed in Part II (such as the local socio-economic organisation, the institutional support for specific public goods, as well as broader global structures and markets), which, for the sake of simplicity, are not reported here given the purposes of the present analysis. These heterogeneous configurations support differentiated interactions among these various key *place-based* dimensions, thereby giving rise to distinct outcomes in terms of rural development pathways. In this regard, what is particularly relevant for the present study is the capacity of this framework to capture a subset of these relationships, especially those concerning the *land-tenure organisation*.

Against this theoretical background, the time has now come to complement the conceptual framework with an empirical analysis. While the *land tenure loop* provides a coherent theoretical representation of the interactions between land-related elements and other dimensions of local development, an empirical investigation is required to substantiate some of these linkages and assess their relevance in observed rural local development dynamics. In particular, the work in the current Part III focuses on analysing two key interactions within the proposed framework. The first examines the direct relationship linking heterogeneous forms of strategic conduct to differentiated land-use patterns ($C_{st} \rightarrow C_{lc}$), as deepened in this Chapter (Chapter 4). The second, by contrast, still focuses on the interaction between land-related elements and governance mechanisms, but from a reversed perspective, examining the indirect dynamic relationship between landed property structures and strategic conduct

⁷Such interventions may also involve performance-related elements, with associated feedback effects; however, these are not displayed in Figure 4.1 for clarity, as they are not required for the analytical purposes of the present analysis.

($S_{lc} \rightarrow C_{st}$), as explored in Chapter 5. Taken together, the analyses provide empirical evidence of how these different interactions, involving land-related elements and governance mechanisms, may translate into distinct rural local development outcomes. The decision to focus on these relationships is motivated not only by the aim of enriching empirical knowledge to the proposed theoretical framework, but also by the presence of specific gaps in the existing literature with regard to the dynamics underpinning these interactions, as will be discussed in the following chapters.

4.2 Setting the Ground for the First Empirical Analysis

Building on the foregoing discussion, this chapter empirically analyses the relationship between certain governance initiatives and the resulting land-use patterns, which in turn support distinct rural development outcomes, as conceptualised by the direct relationships $C_{st} \rightarrow C_{lc} \rightarrow P_{(v,e,lc)}$ in Figure 4.1.

In this regard, the scientific literature widely acknowledges the role of specific agencies in shaping local development pathways (see Beer et al., 2020; Bellandi, 2021). These agencies can be interpreted through the lens of territorial governance (Torre, 2023), encompassing a variety of approaches—ranging from *place-blind* to *place-based* interventions (see Barca et al., 2012; Ferrara et al., 2026)—which, by involving different spheres of local development, carry distinct implications for development trajectories (see, for a fuller discussion, Bailey et al., 2018; Bellandi & Storai, 2022; McCann, 2023; Torre, 2023).

Accordingly, initiatives on land-use management constitute a potential policy area for advancing economic, environmental, and social objectives of local development (OECD, 2017; Vaño et al., 2026). As discussed throughout this work, different ways of allocating and using land capital across productive and non-productive activities generate heterogeneous effects on local development dynamics. In this respect, the possibility of politically addressing rural land uses⁸—both in terms of type and intensity—shapes differentiated local impacts. For instance, supporting less intensive uses of land capital within agro-forestry activities may produce significant environmental sustainability benefits. At the same time, initiatives of land-use planning can establish a hierarchy of values among alternative uses, thereby influencing the associated rent mechanisms and development dynamics (see, Chapter 2 and Chapter 3; Cecchi, 1988; Darly & Torre, 2013; Delladetsimas & Katsigianni, 2023; Moulaert & Mehmood, 2025; Ryan-Collins et al., 2017; Van Lier, 1998).

Among these interventions at the European level, the Common Agricultural Policy

⁸In the rural context, land-use management is commonly understood as referring to initiatives aimed at governing the use of land capital across agricultural, forest, and nature-related purposes (Van Lier, 1998).

(hereafter, CAP) has played a crucial role over the past decades, by progressively evolving from a form of farmers' income support into a policy framework underpinning broader socioeconomic and environmental objectives, directly involving farmers' decisions over the use of land capital within agro-forestry activities (Sotte, 2023).

From this perspective, the 2013 reform marks a decisive step in strengthening the environmental orientation of the CAP, by making 30% of Direct Payments (DPs) in Pillar I conditional on compliance with a set of sustainable practices related to the agro-forestry use of land capital (the so-called Green Payments, or *greening*). Among these measures, the policy includes crop diversification (CD) rule, which requires farmers to cultivate a minimum number of crops, depending on the size of their arable land, with the explicit aim of countering mono-cultural production systems, typically associated with higher environmental pressures (European Commission, 2013). Through these mechanisms, the policy aims to influence farmers' land-use decisions towards more sustainable practices, fostering the local provision of environmental public and quasi-public goods—such as improvements in soil and water quality and biodiversity—while simultaneously supporting farm competitiveness and the socio-economic performance of rural contexts by aligning production strategies with sustainability-oriented development models. To this end, the policy relies on Green Payments (GPs) as a form of compensation for part of the additional costs associated with the adoption of these sustainable land-uses (Brutti et al., 2023, 2026).

Beyond policy intentions, however, the effects of the GPs regulation remain heavily debated, both in political circles (European Court of Auditors, 2017) and in academic work (Vanni, 2014). Empirically, several ex-ante impact assessment studies provide predictions of potential impacts under alternative scenarios, and a number of ex-post evaluations, utilizing counterfactual methodologies (Sauquet, 2023; Diop and Védrine, 2025; Brutti et al., 2025), quantitatively assess the regulation's impact on changes in agricultural land-use practices and a range of environmental and economic outcome drivers. Overall, the results remain somewhat mixed.

Against this background, the study therefore provides an ex-post evaluation of the CD measure, as a specific component of the *greening* framework under the 2014–2020/22 CAP, with the aim of offering new empirical insights into the effectiveness of such a land-use policy measure in shaping local land-use practices and their economic and environmental implications. In doing so, the analysis provides empirical evidence on selected linkages articulated within the *land-tenure loop* framework—particularly those involving strategic agencies and land-use practices—and their implications for rural local development, an area that remains insufficiently explored in the literature (Van Lier, 1998).

In particular, the paper contributes to the ongoing debate on the effectiveness of the CD

measure (Sauquet, 2023; Diop and Védrine, 2025; Brutti et al., 2025) by providing, for the first time, an ex-post causal assessment based on a highly granular, georeferenced, parcel-level administrative dataset that also allows tracking changes in land allocation over time. Its extensive coverage therefore ensures representativeness and enables more robust causal insights, addressing key limitations highlighted in previous studies relying on aggregated data sources (Brutti et al., 2026).

Furthermore, the analysis employs a fuzzy Regression Discontinuity Design (RDD) to estimate the causal impact of the CD regulation. Within this framework, we enrich the empirical evidence by distinguishing between three different effects: the intention-to-treat (ITT)—that is, the effect of policy implementation regardless of actual treatment take-up; the treatment take-up—namely, the effect of policy implementation on participation; and the local average treatment effect (LATE) on compliant units—that is, the policy's actual impact on those who participate. This approach proves particularly relevant, as it enables the investigation of a non-negligible gap between eligibility and actual participation, with implications for policy design, at least in the Italian context in which the analysis is conducted.

Beyond this, direct evaluation of environmental effects remains constrained by data limitations—most notably the lack of micro-level environmental information (Brutti et al., 2023) and biases arising from aggregation approaches (Baldoni et al., 2023). In response, this study proposes and assesses an innovative measure of indirect environmental outcomes based on a set of crop-sequence (CS) indicators capturing changes in crop rotation (CR) practices over time (Stein & Steinmann, 2018). CR is indeed an agronomic practice widely recognised for its inherently high capacity to deliver substantial environmental benefits (Karlen et al., 1994). As such, these indicators provide a more informative and valuable proxy for the environmental implications of CD than those commonly employed in previous studies (see, Brutti et al., 2025; Diop & Védrine, 2025).

Consistent with this framework, the 2014–2022 CAP was indeed initially designed around a more ambitious CR requirement, which, however, was subsequently diluted during the negotiation process into a simplified version, namely CD. Against this backdrop, beyond assessing the environmental effects of the CD measure, it also becomes particularly relevant to further investigate the local-level relationship between CR and CD—an issue that remains largely unexplored in the existing literature, yet one with potentially substantial policy implications. Indeed, the debate surrounding CR and CD does not end with the 2014–2020/22 CAP programming period but extends to the subsequent reform cycle (2023–2027). During this latter phase, CR is initially introduced as a requirement under enhanced environmental conditionality, but is subsequently weakened following farmers'

protests, with CD once again allowed at the discretion of Member States (MS) (European Commission, 2024; Marandola & Vanni, 2019; Sotte, 2023).

In addressing these issues, the paper is organised as follows. Section 4.3 provides a discussion on the CD requirement and an overview of the relevant literature. Sections 4.4 and 4.5 illustrate the data description and the methodology, respectively. Results of our analysis are presented in Section 4.6 and discussed in Section 4.7. Section 4.8 concludes.

4.3 Evaluating Green Payments: A Literature Overview

4.3.1 Policy design: crop diversification and implementations features

The 2014–2020/22 *greening* conditions, for the first time, a substantial share of direct payments (30%) within Pillar I on compliance with specific, more environmentally friendly land-use practices. Specifically, the GPs requirements are defined according to the size of farms' arable land (AL), and farmers exceeding certain thresholds—namely, from 10 hectares onwards, as discussed below—are required to adapt their production practices to the *greening* provisions; non-compliance entails a reduction in financial aid of up to 1.25 times the greening component, along with additional penalties introduced from 2017 (Brutti et al., 2026; European Commission, 2013; Gocht et al., 2017). In doing so, the primary objective of this initiative is to enhance the environmental and socio-economic performance of the agricultural sector and rural areas by incentivising farmers to adopt sustainable land-use practices without compromising their economic competitiveness (Brutti et al., 2023).

Among these measures, the CD requirement applies to farms with more than 10 hectares of AL, which are required to cultivate at least two crops, with the main crop covering no more than 75% of total area. Farms exceeding 30 hectares are subject to an additional requirement to cultivate a third crop, with the two main crops together not exceeding 95% of total AL⁹ (European Commission, 2013). Accordingly, farms below 10 hectares of AL are not subject to *greening* requirements and remain eligible for the full share of direct payments, without additional obligations (Brutti et al., 2023).

Despite uniform application at the EU level, MS retain discretion over payment modalities and the extent of land subject to *greening* obligations (Sotte, 2023). With explicit reference to the Italian case, GPs are applied only to the share of agricultural area eligible under the Basic Payment Scheme (BPS), which replaces the former Single Payment Scheme.

⁹Exemption criteria include farms already applying environmentally beneficial practices, such as organic farming, as well as farms where grassland, forage area, rice cultivation, or leguminous crops cover more than 75% of the agricultural area, or where crops grown under water account for 100% of the AL (European Commission, 2013).

Moreover, these payments are not uniform, as per-hectare aid varies according to the value of entitlements granted to farmers on a historical basis—stemming from the decoupling introduced in 2005 and anchored to production patterns observed between 2000 and 2002. As a result, the area that farmers can allocate to *greening* is determined on a historical basis, and, in terms of payments, they receive an individualised amount of GPs, determined by the historical value of the entitlements attached to the BPS-eligible area¹⁰ (see, Guastella et al., 2018; Pierangeli, 2014; Pupo D’Andrea, 2014; Vanni, 2014).

4.3.2 *Ex-ante and ex-post evaluation analysis*

Against this institutional framework, a growing body of literature employs both ex-ante impact assessments and ex-post evaluation studies to assess the effectiveness of GPs. Among ex-ante analyses, Louhichi et al. (2018), using a farm-level IFM-CAP simulation model applied to FADN data at the European level, find highly limited impacts of GPs. Despite approximately 55% of farms and 86% of utilised agricultural area (UAA) being subject to greening requirements, their simulations suggest that only about 4.5% of UAA would be effectively affected by the policy, alongside projected reductions in farm income and total production. Similar conclusions are reached by Was et al. (2014), who apply the CAPRI model to the Baltic countries and identify only marginal effects of *greening*, and by Hristov et al. (2020), who simulate the environmental impacts of the Ecological Focus Area (EFA) measure—another component of GPs—and find a limited potential to enhance biodiversity and ecosystem services in two Swedish regions.

As far as geographical heterogeneity is considered, Solazzo et al. (2016) conduct an ex-ante analysis on four regions in northern Italy. Their findings, instead, indicate the possibility of modest reductions in GHG emissions and changes in land-use practices, including a sharp decline in maize and other cereal crops, along with an increased spread of nitrogen-fixing crops, which are typically associated with positive environmental benefits. Similarly, Gocht et al. (2017), using FADN data combined with a farm-level CAPRI model, simulate the economic and environmental impacts of *greening* at the EU level. Their findings indicate small positive effects on sustainable land-use practices, productivity, and farm income, as well as reductions in GHG and ammonia emissions. At the same time, the authors observe slight increases in biodiversity but also in soil erosion.

¹⁰In this regard, Italy programmed the implementation of the 2014–2020/22 CAP by introducing an internal convergence process based on the so-called ‘Irish model’, aimed at increasing low-value payment entitlements and reducing high-value ones, while deferring full equalisation to subsequent reforms in order to limit potential losses for holders of high-value entitlements. At the same time, the initial programming envisaged the possibility of extending Basic Payment Scheme eligibility to the entire national UAA under a ‘Single Region’ approach. However, this process effectively stalled, with full implementation deferred to the subsequent programming cycle (Bartolini, 2021; Frascarelli, 2021; Pierangeli, 2014; Pupo D’Andrea, 2014).

A second strand of scientific contributions on GPs and CD evaluations focuses on ex-post assessment studies. Bertoni et al. (2021) use Markov chain approaches to assess the impact of *greening* on land use changes, distinguishing between already compliant farms, non-eligible farms, and new compliers in a flat area of Lombardy, Italy. The authors find evidence of a shift in farmland use among those with a lower degree of CD, suggesting adjustments in land allocation aimed at complying with the policy requirements. In contrast, Díaz-Poblete et al. (2021) find limited economic and environmental impacts of *greening* based on a difference-in-differences analysis applied to regionally aggregated data from Spain, covering a set of economic and land-use indicators. Subsequently, Sauquet (2023) observes, in a representative sample of French farms, that only farms exceeding 30 hectares show increased compliance with CD measures and cultivate a larger number of crops. Within the same national context, Diop and Védérine (2025) conduct an analysis using a Difference-in-Discontinuity approach on a sample of farms, comparing those just above and below the 10-hectare and 30-hectare thresholds in terms of economic outcomes, land-use practices, and environmental measurements. The results show that farms around the 10-hectare threshold increase CD with significant land reallocation, unlike those around the 30-hectare threshold. However, the effects are largely driven by farms already compliant with crop diversity requirements, suggesting limited additional impact from *greening*.

Further empirical evidence is then provided by Brutti et al. (2025), who conduct a counterfactual evaluation analysis of CD's effectiveness across 28 EU member states using FADN data. They find significant impacts on regulatory outcomes for farms not already compliant with regulation's requirement. The policy contribution is found higher for crops farms, and for farms with smaller AL. Along the same lines, the insights provided by Brutti et al. (2026), analysing the behaviour of Spanish farms in 2022, identify a stronger contribution of the CD measure at the 10-hectare compared with the 30-hectare threshold.

Although not strictly comparable due to differences in methodology, territorial scale, and the outcomes evaluated, the existing studies nonetheless depict a complex and at times contradictory picture, with indications that impacts tend to be limited overall.

This evidence has primarily been traced back to political and design-related factors. Indeed, the *place-blind* and *one-size-fits-all* design of the *greening* measures has been criticised since its introduction for its restricted ability to adapt to heterogeneous local socio-economic and environmental conditions, resulting in limited and potentially jeopardised impacts (Matthews, 2012). In particular, the wide diversity of agricultural systems across Europe—in terms of productive models, specialisations, and economic advantage mechanisms, which are also shaped by distinct local structural and territorial conditions—may lead to heterogeneous responses to these measures. This implies that a uniform threshold

applied indiscriminately across diverse contexts may be appropriate in some settings but less so in others (Cortignani & Dono, 2020; Matthews, 2012).

Moreover, the environmental effectiveness of GPs may also be constrained by the lack of context-specific design, as different territorial settings would require more tailored interventions to address their specific ecological needs (Hristov et al., 2020). Consistently, Galán-Martín et al. (2015) suggest that *greening* should be redefined at the regional scale in order to secure meaningful environmental benefits, while Hristov et al. (2020) argue that improving the environmental performance of the GPs requires granting MS greater flexibility to design spatially targeted measures under Pillar I, as typically envisaged under Pillar II.

In addition, when focusing specifically on CD, the aforementioned replacement of CR, together with a subsequent tightening of CD participation thresholds—from 3 to 10 hectares—further reinforces the idea of a structural weakness in policy design (Pe’er et al., 2014). This configuration is, in fact, the outcome of an intense negotiation process that took place prior to its introduction, among competing interests—particularly agricultural lobbies and environmental stakeholders—resulting in a political compromise that may have limited the overall effectiveness of the measure (Sotte, 2023).

However, beyond policy design, a methodological dimension of the existing evidence also warrants attention. The ability to access and exploit highly detailed administrative data at the holding level appears crucial for producing consistent and reliable results (Brutti et al., 2023). In this respect, the recent contribution by Brutti et al. (2026), using administrative data from the Geospatial Aid Application (GSAA) for Spain, highlights the reliability limits of earlier ex-post evaluations relying on farm survey data. These highly detailed administrative data enable the identification of more robust and less biased patterns. Accordingly, in their case it allows for a qualitative improvement in empirical assessment, making it possible to detect bunching at both CD thresholds and thereby prompting the authors to apply a calibrated decision-making model to better understand farms’ incentives for policy participation (Brutti et al., 2026). Prior to this contribution, only Bertoni et al. (2021) employed a detailed administrative dataset in an ex-post evaluation of the 2014–2022 CAP, albeit relying on methodologies that do not allow for causal inference (see Sauquet, 2023).

In line with this, the present study therefore revisits the environmental, economic, and land-use effects of CD by exploiting a highly granular, parcel-level administrative dataset drawn from the Italian GSAA and covering the entire region of Tuscany (Italy). While based on the same parcel-level unit of observation as Brutti et al. (2026), the dataset is characterised by a substantially richer and more detailed set of parcel-specific variables. For the first time, these data are employed within a counterfactual impact evaluation (CIE)

framework to provide causally grounded evidence on the effects of the measure. In doing so, the empirical analysis is therefore guided by the following research question:

RQ1: *What have been the local environmental, economic, and land-use effects of the CD measure?*

By jointly leveraging highly disaggregated georeferenced administrative data and a causal identification strategy, this study advances the existing literature by providing a more robust assessment of CD effects at the local level, thereby contributing new evidence to the ongoing debate on the effectiveness of this measure in the broader context of rural local development.

4.3.3 Crop Rotation Indicators for Environmental Outcome Assessment

Within this perspective, particular attention is devoted to the assessment of environmental outcomes, which remain among the most challenging dimensions to evaluate empirically. As already noted, despite the policy's explicitly "green" intention, the evaluation of the environmental impacts of the 2014-2022 CD measure remains limited by the scarce availability of micro-level environmental data that can be directly linked to individual farms, whether participating in the measure or not (Baldoni et al., 2023; Brutti et al., 2023). To overcome these limitations, much of the existing literature focuses on policy participation criteria, inferring environmental performance from compliance with the land-use requirements of the measure. Beyond this compliance-based perspective, other proxies are also suggested, including indicators of CD (e.g. the Shannon index), input-use indicators (e.g. fertiliser and pesticide use), and environmental efficiency metrics (Brutti et al., 2025; Diop & Védrine, 2025; Sauquet, 2023).

From this perspective, the study proposes a set of innovative and more informative indicators of environmental performance by measuring and assessing Crop Rotation (CR) practices. CR is indeed a land-use agronomic practice based on specific rotation cycles and is widely acknowledged for its substantial environmental benefits¹¹(Cortignani & Dono, 2020; Karlen et al., 1994). More precisely, as further detailed below, the study proposes an alternative approach in measuring CR practices that combines two complementary frameworks: the crop-sequence (CS) typification framework suggested by Stein and Steinmann (2018) and raster-based analytical techniques developed in Upcott et al. (2023). Building

¹¹Among others, it enhances soil quality and productivity, promotes more efficient use of water resources, reduces the leaching of nitrogen, phosphorus, and other agricultural pollutants into surface and groundwater, and represents a key mechanism for pest and disease management (Cortignani & Dono, 2020; Karlen et al., 1994).

on this integration the work develops an innovative set of crop-sequence¹² (CS) indicators as measures of CR practices.

Assessing CR, through CS indicators, thus provides a valuable indirect indicator of the environmental outcomes of the policy. Observed increases in crop-rotation dynamics can indeed be interpreted as evidence of positive environmental effects associated with the implementation of the CD measure. The rationale behind this assumption also lies in the partial and asymmetric complementarity between these two land-use practices. CR entails a temporally articulated land-use management strategy, requiring planned crop succession across consecutive growing seasons and typically involving higher compliance and adjustment costs. By contrast, CD operates within a single growing season, focusing on the coexistence of multiple crops in the same year, and can therefore be interpreted as a simplified and lower-cost approximation of rotation dynamics, generally associated with more limited environmental benefits. Thus, to the extent that CD supports or facilitates the adoption of CR practices, it is associated with greater environmental benefits at the local level.

In this respect, the introduction and measurement of CR practices not only represent significant value added for the assessment of the environmental effects of CD but also provide a valuable analytical lens through which to investigate the interaction between these two land-use practices. To the best of our knowledge, existing empirical evaluations of the CD measure have largely left the interrelationship with CR under-explored. By explicitly focusing on this interaction, the present study offers a novel contribution to the literature and addresses an issue of direct policy relevance, particularly in light of the evolving design of GPs, which has repeatedly alternated between CR and CD as key environmental instruments. In doing so, this approach allows the analysis to further expand and deepen the following research question:

RQ2: *Would crop diversification have supported or hindered crop rotation practices?*

4.4 Data

4.4.1 Data description, sample size and outcome variables

Our analysis exploits the dataset provided by the Regional Agency of Tuscany for Agricultural Payments (ARTEA), which contains primary administrative data feeding into the

¹²Crop sequence is here defined as the sequence of crops occupying a field parcel over consecutive annual growing seasons. It refers to the order, spacing, and frequency of crops within a given time period (Lelissa & Kuhil, 2018; Stein & Steinmann, 2018).

national GeoSpatial Aid Application system¹³ (GSAA)—namely, the Graphic Crop Plans (GCPs) submitted annually by farm holdings to access various agricultural funds (e.g. CAP incentives and gas-oil subsidies). Specifically, the dataset includes georeferenced agricultural land parcels across the Tuscany region (Italy) over the period 2016–2022 (e.g. approximately 691,400 polygons in 2022). Each parcel is characterised by a high level of detail in land use, including information on the type of crop cultivated in a given year, as well as its location and size. Parcels are linked to the farm’s official holding file (*fascicolo aziendale*), which contains information on the farm holder and provides detailed structural and economic information on the farms managing these parcels, such as the number of employees and farm typology. In addition, the dataset includes detailed information on CAP aid applications, enabling the reconstruction of each farm’s eligibility, treatment status, and the amount of Direct Payments received.

The dataset ensures extensive coverage, as confirmed by comparing the data on Utilized Agricultural Area (UAA) and Arable Land (AL) with those reported by the Italian National Statistical Office (ISTAT, 2022) in the latest National Agricultural Census (see Table A.4 in the Appendix A.7). In terms of AL, compared with the 440,829 hectares recorded in 2020 (ISTAT, 2022), the dataset contains roughly 416,000 hectares in 2022. Of these, about 246,938 hectares fall under GPs. In particular, although more than 70% of farms in 2022 operate on less than 10 hectares of AL (see Figure A.6 in the Appendix A.7)—reflecting the predominantly family-based agricultural model typical of the Tuscan context (IRPET, 2023b)—only about 20% of AL under GPs falls within these small and medium-sized holdings, whereas approximately more than 50% of AL under GPs is managed by farms with an AL size exceeding 50 hectares.

As a preparatory step for the empirical analysis, parcel-level information is used to reconstruct a farm-level dataset. The sample is restricted to GPs beneficiaries. Farms below the 10-hectare applicability threshold are retained, whereas those covered by other statutory exemptions or failing the data-validity criteria are excluded (see Appendix A.7.3 for further details on the cleaning procedure). A final sample of 14,512 farms for the year 2022 is obtained. Although the empirical focus is on the year 2022, the same analysis can be replicated across multiple years.

Subsequently, a set of outcomes related to land-use practices, as well as economic and environmental drivers, is then constructed at the farm level. Specifically, the economic performance is measured using the Standard Output (SO). The SO is the average monetary

¹³The GSAA is a componente of the Integrated Administration and Control System (IACS) a set of computerized databases serving the management and distribution of Common Agricultural Policy subsidies and whose structure is common to all EU countries (Brutti et al., 2026).

value of agricultural output at farm-gate prices, in euros per hectare or per head of livestock (Eurostat, 2024). It is an indicator estimated on the basis of agricultural output per farm, taking into account the areas of the various crops multiplied by a series of remuneration coefficients laid down by legislation (see, for example Regione Toscana, 2024a). The SO is analysed both in absolute terms and relative to the farm's UAA. In line with the policy rationale underpinning GPs—namely, that financial support for the adoption of environmentally sustainable practices should enhance farms' long-term competitiveness—a positive effect on SO is therefore expected.

In terms of land-use practices, the policy criteria for the CD measure are applied. The implementation of CD requirements is based on the amount of AL, according to which farms are required to cultivate a minimum number of crops in order to obtain GPs (two for farms above 10 ha and three for those above 30 ha). The number of AL crops cultivated by each farm is therefore measured (for further details on crop categories see Appendix A.7.4) and, in line with the *greening* initiative, is expected to increase at the relevant policy thresholds. At the same time, the regulation also sets limits on the share of the main crop and of the two main crops, which are expected to decrease for farms involved in the policy initiative. Relative to each farm's total AL, the percentage of area dedicated to each crop is therefore measured and assessed. Preliminary statistics indicate that Tuscan farms cultivated, on average, 1.99 different crops in 2022, allocating about 81% of their arable land to the main crop and approximately 96% when considering the two main crops (see Table A.6 in the Appendix). In general, while an increase in AL is expected to be associated with a higher number of cultivated crops, farm expansion is typically accompanied by a less-than-proportional increase in crop diversity (Brutti et al., 2026).

On the other hand, indirect environmental outcomes are captured by crop-rotation indicators—discussed in the following section—and by the Shannon Index. An increase in either of these indicators for farms located just above the CD policy thresholds is interpreted as evidence of improved environmental performance induced by the crop diversification measure. In particular, the Shannon Index is computed as the number of crops cultivated by each farm, weighted by their respective acreage shares, as follows:

$$S_{it} = - \sum_c \frac{AL_{it,c}}{AL_{it}} \log \left(\frac{AL_{it,c}}{AL_{it}} \right), \quad \forall c \in C \quad (4.1)$$

where $AL_{it,c}$ indicates the arable land allocated to species c by farm i at time t , AL_{it} defines the total arable land cultivated by farm i at time t , and C indicates the cardinality of the crop set observed across all farms. This formulation captures biological diversity

by reflecting both the evenness and richness of crop diversification at the farm level. It equals zero under monoculture and increases steadily with crop diversity (see, Varacca et al., 2023).

4.4.2 Estimating Crop Rotation through Crop Sequences

Crop rotation, widely acknowledged for its environmental benefits, provides a valuable indirect indicator of the environmental effects of the CD measure. Given their close relationship, increases in rotation dynamics can be interpreted as evidence of positive environmental effects associated with the launch of the CD measure. On this basis, the analysis contributes to ex-post evaluations of the CAP CD measure by leveraging rotation-based indicators to assess environmental performance at the farm level.

However, in measuring and monitoring CR practices, some important challenges emerge, particularly in relation to: (i) the wide variety and flexibility of crop combinations that farmers can implement over time, often with relatively low occurrence of each combination type; (ii) the need for a detailed, long-term dataset, typically spanning five to seven years; (iii) the fact that available crop data frequently represent only segments of full rotations, as the cycle may begin before or continue beyond the observed time window; and (iv) the difficulty of tracing rotations when parcel boundaries within a field block change from year to year (Pahmeyer et al., 2025; Stein & Steinmann, 2018; Upcott et al., 2023). Most existing approaches measure crop-rotation management using diverse models and methods (see, for example Bachinger & Zander, 2007; Castellazzi et al., 2008; Dogliotti et al., 2004; Dury et al., 2012; Levavasseur et al., 2016). Nonetheless, these approaches remain only partially suitable for capturing complete crop-rotation sequences (Stein & Steinmann, 2018) and for constructing meaningful indicators at the farm level, which is a critical dimension for the environmental evaluation of the CD rule¹⁴ (Brutti et al., 2023).

To address these limitations, the paper combines two frameworks: the crop-sequence typification framework proposed by Stein and Steinmann (2018) and raster-based analytical techniques as suggested by Upcott et al. (2023). Specifically, by exploiting the seven-year dataset and shifting from the concept of CR to that of CS, the analysis captures the ordered succession of crops cultivated on a given field parcel across consecutive annual growing seasons, without requiring predetermined rotation cycles, thereby allowing the reconstruction of rotation dynamics beyond partial observation windows (Stein & Steinmann, 2018). Operationally, crop sequences are derived through a typification procedure that classifies

¹⁴For further discussion on the evaluation of environmental effects of diverse CAP measures, including the integration of data sources and evaluation scales, see Brutti et al. (2023), Baldoni et al. (2023), Michalek (2022).

individual agricultural fields at the parcel (polygonal) level according to a set of rotation categories. The set of rotation categories is adapted to the characteristics of the dataset and therefore slightly differs from those originally proposed by Stein and Steinmann (2018). In particular, six rotation categories—namely cereals, legumes, renewable crops, aromatic crops, industrial crops, and horticultural crops—are identified and used to classify each arable-land field on an annual basis (see Table A.7 in Appendix A.7).

Once the classification is completed, we measure the *sum of transitions*, defined as the total number of crop changes in a sequence, with a maximum equal to the sequence length minus one (Stein & Steinmann, 2018). In doing so, we adopt a raster-based technique to account for possible changes in field boundaries over time (see also Pahmeyer et al., 2025, Upcott et al., 2023). Specifically, for each year a 10×10 m raster is created, using the six-category crop classification as bands for the entire region under analysis. Each pixel for each year indicates which of the six categories it belongs to. If a pixel does not fall into any of these categories (e.g., non-agricultural areas or permanent crops), it is assigned a “Not Available” NA classification. After that, using a multi-band raster tool—that is, by overlaying all the yearly layers—an appropriate algorithm is applied to measure the sum of transitions for each pixel. Pixels that are taken out of cultivation—that is, classified as NA even for a single year—are excluded according to Stein and Steinmann (2018) (Figure A.7 in the Appendix A.7 illustrates the spatial distribution of crop transitions across Tuscany over the period 2016–2022).

To derive farm-level rotation indicators for the year of analysis, the 2022 agricultural field polygons associated with each farm are overlaid onto the resulting pixel-level *sum of transitions*. For each field polygon, the *sum of transitions* is computed as the average of the pixel-level values contained within that polygon. These field-level measures are then aggregated at the farm level by constructing three rotation indicators, defined as follows:

1. CS_{max} : the maximum value of the sum of transitions observed among different polygons within a farm;
2. CS_{avg} : the average value of the sum of transitions observed among different polygons within a farm;
3. CS_{index} : a farm-level indicator of crop-sequence intensity. This measure represents an area-weighted average of crop transitions on the plots under rotation, scaled by the share of the farm’s total area that actually undergoes rotation.

For each farm i , CS_{index} is defined as:

$$CS_{index,i} = \frac{\sum_{j \in i} (N_transitions_j \times AL_j)}{AL_i^{tot}}, \quad (4.2)$$

where $N_transitions_j$ denotes the number of crop-sequence transitions observed in plot j of farm i , AL_j the corresponding arable-land area (ha), and AL_i^{tot} the total arable-land area (ha) of farm i .

The proposed CS indicators capture different dimensions of farms' responses to the CD requirements. Although all are computed at the farm level, they summarise crop-sequence dynamics in different ways. In particular, CS_{max} reflects the highest crop-sequence transition observed across the parcels of a farm and is therefore more sensitive to localised adjustments in crop allocation induced by the diversification requirement. By contrast, CS_{avg} and CS_{index} summarise CS dynamics at the farm level and are intended to capture broader changes in farming practices. It is important to emphasise that these indicators are not intended to measure the agronomic benefits of crop rotation directly. Rather, they provide a measure of changes in CS dynamics that may arise following compliance with the CD requirements. Consequently, positive discontinuities in these indicators at the policy thresholds are interpreted as evidence that the policy measure has induced changes extending beyond annual CD towards more dynamic cropping patterns. Given the well-established evidence that crop rotation generally delivers greater environmental benefits than crop diversification alone, such changes provide indirect evidence that the CD measure may have generated broader improvements in the environmental performance.

At the same time, the absence of changes in the CS indicators should not be interpreted as evidence that the policy generated no environmental benefits. Farms may comply with the diversification requirements without altering their crop sequences, in which case these changes would not be captured by the CS indicators. For this reason, the crop-sequence indicators are interpreted jointly with the Shannon Index, which captures the environmental effects of changes in crop diversification independently of crop-sequence dynamics. Taken together, these indicators provide a more comprehensive indirect assessment of the environmental performance associated with the CD measure.

4.5 Methodology

4.5.1 Identification Strategy: RDD within a Multi-cutoff and Fuzzy Design

The implementation of CD requirements is based on specific thresholds tied to farm size metrics, which serve as criteria for compliance with administrative regulations. These thresholds can be utilized to estimate local treatment effects within a Regression Discontinuity Design (RDD) in a continuity-based framework. The RDD is increasingly being employed in agricultural and environmental economics to identify the causal effects of policy initiatives (Brutti et al., 2023; Wuepper & Finger, 2023), and has been recognised as an appropriate technique for analysing different sub-fields of intervention within a single broad policy framework (Ferrara et al., 2017). Specifically, the RDD proves to be a valid methodology for estimating policy causal effects, as it relies on three fundamental components: a continuously distributed score variable that determines treatment assignment—here, the AL of each farm; a cutoff reference value, set in our case at the 10- and 30-hectare, where farms exceeding these levels are expected to be assigned to the treatment group; and perfect or imperfect compliance with treatment assignment and take-up, an aspect we discuss shortly. On the basis of these elements, the RDD relies on the assumption that units located immediately above and below the threshold are sufficiently comparable to approximate a randomized controlled trial; consequently, any observed discontinuity in the outcome at the cutoff can be directly attributed to the policy implementation, which thus represents the sole source of variation between units (Cattaneo et al., 2019, 2024).

Given the multi-cutoff policy design, a midpoint between the two thresholds (20 hectares, the median) is used to assign each unit uniquely to one cutoff, thus preventing correlated cutoff-specific estimates¹⁵. The dataset is then partitioned into two sub-samples for separate cutoff-specific analyses.

In addition, preliminary data analysis reveals imperfect compliance between treatment assignment and treatment receipt at both cutoffs, consistent with a RD with a Fuzzy design (Cattaneo et al., 2024). In this context, treatment assignment is determined by total cultivated AL, with farms exceeding the 10-hectare threshold being eligible for CD requirements. By contrast, treatment receipt depends on the share of AL actually subject to CD obligations, which is linked to the area associated with activated payment entitlements under the Basic Payment Scheme (BPS). As illustrated in Table A.8 (Appendix A.7), a two-sided non-compliance pattern emerges: some farms located above the cutoff, although eligible, do not comply with the crop diversification (CD) requirements, while others, albeit

¹⁵This issue may arise if the same observation is alternately classified as treated and control according to diverse cutoffs (Cattaneo et al., 2024).

few, below the cutoff do implement it. This discrepancy reflects the institutional legacy of how GPs have been implemented in Italy since their inception (see Section 4.3). In particular, effective participation does not depend solely on total AL, but on the share of AL associated with historical payment entitlements that determine access to *greening*. The value and activation of these entitlements vary across parcels, resulting in an imperfect alignment between AL farm size (eligibility) and the share of AL actually subject to greening obligations and payments (participation). This institutional configuration underlies the observed Fuzzy design, which becomes empirically identifiable thanks to the high level of detail provided by the dataset. The georeferenced dataset, indeed, includes a flag indicating whether a farm is subject to CD, based on the area of AL eligible for the Basic Payment Scheme (BPS), which can then be compared with the farm's total cultivated AL. While in a classical intention-to-treat setting the gap between intended and actual treatment reflects willingness to participate, here it is instead captured by the difference between the area covered by BPS and the total cultivated area. This interpretation is further supported by the design of the GPs themselves. Given the penalties associated with non-compliance (see, Brutti et al., 2026), it is unlikely that farms eligible for and applying for Direct Payments would systematically forgo the greening payment.

The presence of imperfect compliance allows for a more comprehensive assessment of the effects of the CD measure compared to a canonical Sharp RD design. In particular, beyond the effect of treatment assignment (eligibility), it is possible to further investigate how this effect changes when focusing on those farms that actually comply with the CD requirements (participation) (Cattaneo et al., 2024).

In practice, the analysis focuses on the effect of being eligible for the CD requirement on the outcomes of interest, capturing the effect of treatment *assignment*. This is known as the Intention-to-Treat (ITT) effect. The key idea is that the policy assigns farms to treatment or control based on a threshold: farms above the cutoff are eligible for CD, while those below are not. The ITT effect therefore captures the impact of this assignment rule—that is, the effect of being eligible for the policy—without distinguishing between farms that actually comply and those that do not. In addition, the analysis examines whether being eligible increases the likelihood of actually receiving the treatment—namely, being subject to CD requirements (participation). This is referred to as the *first-stage effect* and captures the discontinuity in treatment take-up at the cutoff, providing a direct measure of policy participation in CD measures at both cutoffs, conditional on the structural characteristics discussed above (Cattaneo et al., 2019, 2024).

After this step, the analysis concerns the assessment of the effect of actually *receiving* treatment—i.e. participating in the CD measure—on the outcomes of interest, obtained

by estimating the *Fuzzy RD* parameter. Under the monotonicity assumption, this parameter can be interpreted as the effect of the treatment received for the subpopulation of *compliers*—that is, those units whose treatment status (participation) coincides with their treatment assignment (eligibility). This effect corresponds to the Local Average Treatment Effect (LATE) and is defined as the ratio between the difference in average outcomes (ITT) and the difference in the probability of receiving the treatment (the *first-stage effect*) between units above and below the cutoff. The estimation of the *Fuzzy RD* parameter therefore requires a non-zero *first-stage* assumption to avoid taking an undefined value. However, taking the simple ratio between the two ITT effects could, when using different bandwidths, involve a different number of observations in the estimation of the denominator and the numerator. Although this approach is theoretically valid, following Cattaneo et al. (2024), the preferred strategy is to estimate the *Fuzzy RD* parameter as a ratio by re-estimating both the ITT and the *first-stage effect* using the same bandwidth (Cattaneo et al., 2024).

The analysis relies on a data-driven procedure that employs local linear polynomial RD estimators with symmetric, mean-squared-error optimal bandwidths (MSERD) on either side of the cutoff. Once the effects are estimated, inference is conducted using the same bandwidth applied in the estimation, while confidence intervals are adjusted through a robust bias-correction procedure. Finally, it should be noted that RD estimates are local by construction and therefore identify causal effects only for farms located in the vicinity of the policy thresholds. Consequently, the estimated effects should not be interpreted as representative of the entire population of farms (see, Cattaneo et al., 2019, 2024).

4.5.2 Design Validation

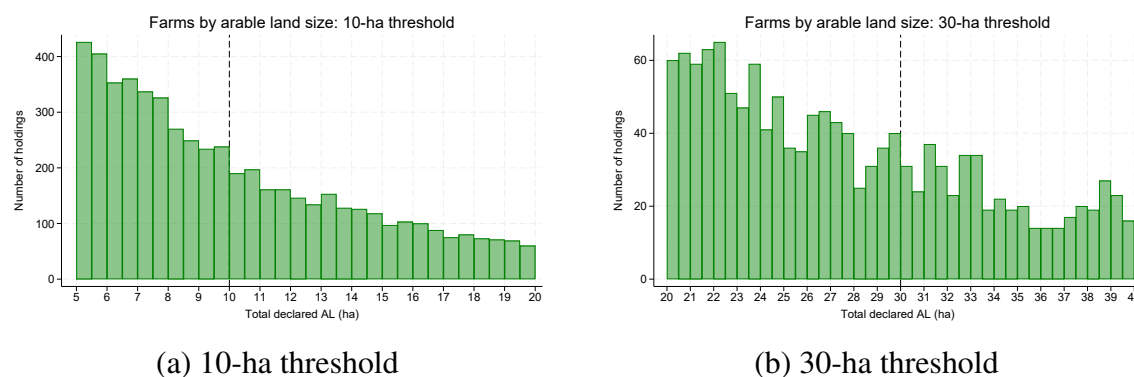
RDD is a valid empirical design if it successfully replicates the conditions of local randomization, which must therefore be tested. Specifically, knowing the rule that assigns treatment and the cutoff is not sufficient, by itself, to ensure that the assumptions required to identify the RD effect are satisfied. Indeed, units could actively manipulate their score values when they are around the cutoff in order to either avoid or participate in the treatment.

In this case, the validity of the design is ensured by administrative cross-checks, including remote controls, the use of GIS databases, and satellite monitoring carried out directly by ARTEA, which therefore oversees compliance with conditionality requirements and the accuracy of farmers' declarations (ARTEA, 2025; Rete Rurale Nazionale, 2014). Moreover, an explicit RD manipulation test based on the density of observations around the cutoff is performed to validate the design (Cattaneo et al., 2019).

For this test only, the dataset is deliberately expanded to include farms exempt under Article 44(3) of Regulation (EU) No 1307/2013, namely those where grassland, forage

area, rice cultivation, or leguminous crops cover more than 75% of the agricultural area, or where crops grown under water account for 100% of AL (European Commission, 2013) (see Appendix A.7.3, point (v)). Indeed, these farms (2,226 observations), by policy design, do not follow the smooth distribution observed for other exempted farms (e.g. organic farms). Rather, as expected, they appear mainly beyond the 10-hectare threshold—the first eligibility cutoff (see Appendix A.7.9.1)—thereby constituting a sizeable and consistent share of farms located to the right of the cutoff. As a result, failing to account for these farms may generate a discontinuity in the density curve at the threshold that reflects regulatory design rather than potential manipulation by farmers, thereby biasing the results of the test. For further discussion of the rationale behind this choice, as well as the potential for farmers’ bunching behaviour around the threshold, see Appendix A.7.9.1.

Figure 4.2: Distribution of AL around the cut-off



Source: Author’ elaboration based on dataset ARTEA (2022).

The null hypothesis of continuity in the density of AL at both cutoffs—namely, the assumption of no “manipulation”—is then tested. The underlying idea is that, in the absence of manipulation, the number of observations just above the cutoff should be approximately equal to the number just below it. The density of observations around each cutoff is thus estimated separately using a local polynomial density estimator, which avoids data pre-binning and improves size and power relative to alternative methods (Cattaneo et al., 2019). Using this dataset (16,738 observations), the test statistic at the 10-hectare cutoff equals -1.384 ($p = 0.166$), whereas at the 30-hectare cutoff it equals -0.502 ($p = 0.615$) (see Table A.9 in Appendix A.7.9). Under the continuity-based approach, we therefore fail to reject the null hypothesis. This indicates the absence of statistical evidence of manipulation at either cutoff, thereby supporting the validity of the RDD design. Consistently, Figure 4.2 provides graphical evidence supporting the absence of sorting dynamics at both cutoffs. A broader distribution over the 0–50 hectare range is finally reported in Figure A.12 in

Appendix A.7.

Although we do not find evidence of sorting that could imply avoidance (or bunching) behaviour in our sample, the existing literature documents a tendency in this direction (see Brutti et al. (2026) but also Cocco (2026), seminar presentation at the JRC-Ispira, 01/13/2026). While we do not observe such patterns in the data, their presence cannot be entirely ruled out. If avoidance behaviour were indeed occurring but remained undetected, our estimates could be upward biased. However, the absence of visible discontinuities in the density of the running variable suggests that any potential bias is likely to be more limited in magnitude compared to previous studies that document phenomena of manipulation around the policy cutoffs.

4.6 Results

4.6.1 Effects of the Crop Diversification Policy

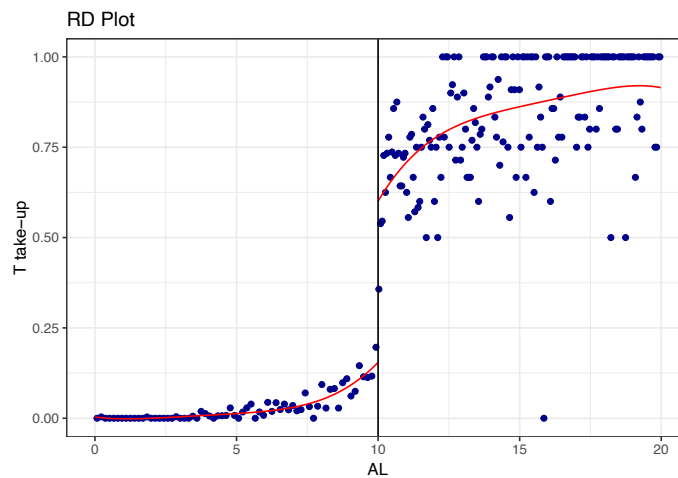
Starting with the estimation at the 10-hectare threshold (subsample of 12,777 farms), Figure 4.3 confirms the presence of two-sided non-compliance. The graph depicts the effect of CD assignment on treatment uptake —the *first-stage effect*—showing that some farms below the cutoff, on the ineligible side, have a positive probability of receiving the treatment, while some farms above the cutoff, on the eligible side, exhibit a probability lower than one. This pattern is thus in line with a Fuzzy RD design.

The formal analysis, reported in Table 4.1, shows that the *first-stage effect* is 0.476, consistent with the observed discontinuity in Figure 4.3. This effect is statistically significant at the 1% level, with a 95% robust confidence interval ranging from 0.362 to 0.556, which does not include zero. This implies that crossing the 10-hectare total AL threshold increases the probability of taking up CD measure in 2022 by approximately 47 percentage points. This therefore provides a measure of how the introduction of the *greening* reform impacts, at the 10-ha cutoff, participation in the policy itself, namely compliance with CD requirements.

Table 4.1: First-stage effect

	cutoff=10	cutoff=30
<i>First Stage</i>	0.476***	0.171
Robust 95% CI	[0.362, 0.556]	[-0.122, 0.277]
<i>h</i>	3.085	8.318
Eff. Observation	2147	689
Kernel	Triangular	Triangular

Source: Author' elaboration. Note: ***, **, * denote 1%, 5%, and 10% significance levels, respectively; *h*: MSERD bandwidth.

Figure 4.3: RD plot of First Stage Effect at 10-ha

Source: Author' elaboration based on ARTEA dataset (2022); Note: Evenly-spaced bins.

At the 30-hectare threshold, the analysis should be interpreted with more caution given the substantially smaller subsample (1,735 farms) available at this cutoff, which may reduce the statistical power of the estimates. Consequently, the evidence at this threshold should be regarded as exploratory. In this respect, no statistically significant effect of treatment assignment on actual participation is detected (see Table 4.1). As a consequence, the fuzzy RD parameter for the corresponding outcomes cannot be precisely identified, since the hypothesis of indeterminacy discussed in Section 4.5 cannot be rejected. Moreover, the ITT analysis identifies only two marginally statistically significant effects: farms just above the 30-hectare cutoff, and thus barely eligible for the CD requirement, allocate, on average, 5.020 and 3.943 percentage points less arable land to the main crop and the two main crops, respectively, consistent with the policy requirements (Table A.10 in the Appendix). Nevertheless, the evidence at this threshold remains limited and largely inconclusive.

Extending the analysis at the 10-hectare threshold, the effects of treatment assignment on the different outcomes of interest are reported in the Intention-to-Treat (ITT) Table 4.2. As can be observed, there is no significant evidence that CD assignment at the 10-hectare threshold affects economic outcomes. Instead, positive and statistically significant evidence emerges in relation to land-use practices. Specifically, the results show that assignment to the CD requirement increases the number of crops cultivated by farms with AL just above the 10-hectare threshold by 0.49 on average, while reducing the share of AL allocated to the main crop and the two main crops by 10.78 and 2.62 percentage points, respectively. These changes are consistent with the policy requirements. Assignment to the CD requirement also increases the Shannon index by approximately 0.22 points on average, indicating an improvement in environmental performance. This effect is statistically significant at the 1%

level, and the corresponding robust 95% confidence interval, ranging from 0.133 to 0.315, excludes zero. By contrast, the analysis identifies no statistically significant effects on the CS indicators (Table 4.2).

Table 4.2: **ITT: policy assignment on CD outcomes (cutoff=10 ha)**

	<i>RD Estimator</i>	<i>Robust 95% CI</i>	<i>h</i>	<i>Eff. Observations</i>
Economic Outcomes				
<i>Standard Output</i>	6804	[-12688, 22586]	1.424	912
<i>Standard Output_UAA</i>	370.35	[-737.9, 1444]	2.836	1950
Land-use practices				
<i>Number of Crops</i>	0.491***	[0.252, 0.785]	2.948	2041
<i>Share of main crop</i>	-10.778***	[-15.963, -6.266]	3.277	2294
<i>Share of two main crops</i>	-2.621**	[-5.051, -0.598]	3.657	2574
(Ind.) Environmental Outcomes				
<i>Shannon Index</i>	0.216***	[0.133, 0.315]	3.316	2328
<i>CS_{max}</i>	0.157	[-0.526, 0.669]	2.245	1094
<i>CS_{avg}</i>	-0.067	[-0.722, 0.392]	2.146	1049
<i>CS_{index}</i>	-0.065	[-0.741, 0.408]	2.056	994

Source: Author' elaboration. *Notes:* ***, **, * denote 1%, 5%, and 10% significance levels; *h* = MSERD bandwidth; Kernel: triangular.

The estimation of the Fuzzy RD (FRD) parameter provides further evidence of changes in land use and environmental performance among those who are compliers (see Table 4.3). Specifically, farms just above the 10-hectare threshold that comply with the policy requirements exhibit a 0.47-point increase in the Shannon index and a 1.05-point increase in the number of crops, together with reductions of approximately 23 and 6 percentage points in the share of the main crop and of the two main crops, respectively. The CS coefficients remain statistically insignificant also for the subgroup of compliers.

4.6.2 The Relationship between Crop Diversification and Crop Rotation

In line with the aim of the study, this section further explores the relationship between crop diversification (CD) and crop rotation (CR) practices and presents the results of the empirical analysis. In particular, a correlation analysis is conducted to assess whether variations in CD indicators between 2016 and 2022 are systematically associated with changes in crop-rotation dynamics observed in 2022 (subsample of 5,962 farms identified as practising crop rotation as of 2022 and already present in the dataset since 2016). While this approach does not allow for causal interpretation, it provides complementary evidence

Table 4.3: **FRD: policy take-up on CD outcomes (cutoff=10 ha)**

	<i>RD Estimator</i>	<i>Robust 95% CI</i>	<i>h</i>	<i>Eff. Observations</i>
Economic Outcomes				
<i>Standard Output</i>	12772	[-23310, 56186]	1.535	990
<i>Standard Output_UAA</i>	783.3	[-1169, 2761.08]	3.535	2546
Land-use practices				
<i>Number of Crops</i>	1.045***	[0.506, 1.742]	2.601	1772
<i>Share of main crop</i>	-23.31***	[-36.53, -12.63]	2.743	1881
<i>Share of two main crops</i>	-5.885**	[-11.89, -1.071]	2.749	1884
(Ind.) Environmental Outcomes				
<i>Shannon Index</i>	0.471***	[0.266, 0.727]	2.588	1762
<i>CS_{max}</i>	0.649	[-0.249, 1.401]	3.959	2036
<i>CS_{avg}</i>	0.201	[-0.923, 0.864]	3.357	1694
<i>CS_{index}</i>	0.303	[-0.747, 0.945]	3.661	1871

Source: Author' elaboration. *Notes:* ***, **, * denote 1%, 5%, and 10% significance levels; *h* = MSERD bandwidth; Kernel: triangular.

on the extent to which diversification practices are aligned with, or potentially substitute for, crop-rotation strategies. The results are reported in Table 4.4.

Table 4.4: **Correlation matrix between diversification and rotation indicators**

	Δ Number Crops	Δ Share Main Crop	Δ Share Two Crops	Δ Shannon Index	CS _{index}	CS _{max}	CS _{avg}
Δ Number Crops	1.000						
Δ Share Main Crop	-0.610***	1.000					
Δ Share Two Crops	-0.629***	0.536***	1.000				
Δ Shannon Index	0.788***	-0.931***	-0.687***	1.000			
CS _{index}	0.045***	-0.069***	-0.050***	0.063***	1.000		
CS _{max}	0.066***	-0.090***	-0.076***	0.086***	0.898***	1.000	
CS _{avg}	0.052***	-0.070***	-0.054***	0.067***	0.981***	0.895***	1.000

Source: Author' elaboration. *Notes:* *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Δ : variation between 2016 and 2022.

Although the magnitude of these relationships remains relatively modest, the correlation analysis suggests that variations in land-use practices consistent with diversification behaviour between 2016 and 2022 are positively associated with crop-rotation practices observed in 2022, and these relationships are statistically significant. In particular, increases in the number of crops cultivated are positively correlated with the rotation indicators considered. At the same time, reductions in the share of the main and the two main crops—corresponding to negative variations in crop concentration between 2016 and 2022—are associated with higher values of the rotation indicators in 2022.

This pattern is further supported by the results related to the Shannon index, whose positive variation between 2016 and 2022 is also positively correlated with the crop-rotation

metrics in 2022. Overall, these findings therefore suggest a coherent and positive association between diversification dynamics—as supported by the policy initiative between 2016 and 2022—and crop-rotation practices observed in Tuscany in 2022.

Furthermore, for these farms, one CD indicator and one CR indicator for 2022—namely the Shannon index and the crop-sequence index (CS_{index})—are further classified into three distinct levels—low, medium, and high—allowing for a more granular differentiation of holdings according to their diversification and rotation profiles. This categorisation enables a cross-tabulation analysis of the joint distribution of diversification and crop-rotation intensity in Tuscany in 2022.

Table 4.5: Farms by Different Levels of the Shannon Index and the Crop Transition Index

Shannon Index	CS _{index}			Total
	Low	Medium	High	
Low	1,048	470	470	1,988
Medium	599	691	697	1,987
High	341	826	820	1,987
Total	1,988	1,987	1,987	5,962

Source: Authors' elaboration.

Table 4.5 reports this distribution. The results, although not revealing a systematic alignment along the main diagonal, show that approximately 43% of farms display corresponding levels of crop diversification and crop rotation. This suggests that, for a substantial share of holdings, the two practices tend to move together, confirming the patterns observed previously. At the same time, the remaining farms are distributed almost symmetrically across the two off-diagonal patterns: farms exhibiting relatively higher diversification than rotation, and farms displaying the opposite configuration.

4.6.3 Robustness Checks

The robustness of the main RD findings is evaluated using distinct methodological approaches.

First of all, we assess predetermined covariates. The main idea behind this type of robustness exercise is that, since predetermined covariates should not have been influenced by the treatment, the null hypothesis of no treatment effect should hold if the RD design is properly specified (Cattaneo et al., 2019). Given the results, the analysis is conducted only

at the 10-hectare threshold. Moreover, considering the purpose of this exercise—testing the null hypothesis of no effect—the focus is placed more on inference than on point estimation. Therefore, in line with Cattaneo et al. (2019), a coverage error (CER) optimal bandwidth is used instead of the MSE-optimal one. The graphical analysis presented in Figure A.13 in the Appendix A.7 does not reveal any discontinuities, nor does the formal estimation reported in Table A.11.

Secondly, we investigate treatment effects at placebo cutoffs. A core assumption in RD design is the continuity of the regression functions for both treatment and control groups at the threshold in the absence of the intervention. While this assumption cannot be directly tested at the actual cutoff, it is possible to examine whether the estimated regression functions for both groups are continuous at points other than the cutoff itself. Although evidence of continuity away from the cutoff is neither necessary nor sufficient to guarantee continuity at the cutoff itself, systematic discontinuities at placebo thresholds may raise concerns regarding the credibility of the RD design (Cattaneo et al., 2019).

Tables A.12, A.13 and A.14 in Appendix A.7 report the analysis for artificial cutoffs of the main variables examined at the 10-hectare threshold. The first-stage estimates display statistical significance at the 9- and 11-hectare cutoffs, but with coefficients of opposite sign relative to the policy cutoff. However, this significance does not extend to the outcome variables of interest at the 11-hectare threshold. At the 9-hectare cutoff, statistical significance emerges in the ITT estimates for both the Shannon index and the share of the main crop, again with coefficients of opposite sign compared with those observed at the 10-hectare policy threshold. Nevertheless, these effects lose statistical significance once the analysis is restricted to compliers through the estimation of the fuzzy parameter (see Table A.14). Overall, these results provide further support for the absence of systematic discontinuities at alternative cutoffs.

Thirdly, the same analysis at the 10-hectare threshold—excluding crop-rotation indicators, as these are defined only for 2022, as discussed above—is also repeated for 2021. The results, presented in Table A.15 in Appendix A.7, are similar to the main findings reported for 2022, further reinforcing the stability of the empirical evidence.

Finally, the robustness of our findings is assessed by employing alternative bandwidth selectors and kernel functions.

Given the central role of bandwidth selection in determining the estimation window around the cutoff, assessing the sensitivity of the results to alternative bandwidth choices is a crucial robustness check. Overall, the estimates remain largely robust across the different bandwidth selectors considered (see Section A.7.11.4 in Appendix A.7), confirming the strength of the results obtained.

Similarly, the main findings are broadly confirmed when using the Epanechnikov and Uniform kernels instead of the baseline Triangular kernel, which assigns diverse weight to observations located closer to the cutoff (see, Section A.7.11.5 in Appendix A.7).

Taken together, these results confirm the robustness of the estimated treatment effects and suggest that the findings are not driven by a particular bandwidth or kernel specification.

4.7 Discussion

The primary objective of this analysis is to assess the impacts of the CD measure within the 2014–2020/22 Green Payments framework in terms of changes in land-use practices, as well as economic and environmental performance at the local level. The results indicate that, in Tuscany in 2022, the CD rule contributed to the intended adjustments in land-use patterns and to improvements in environmental performance, particularly among medium-small farms located just above the 10-hectare threshold. By contrast, no statistically significant effects emerge for economic outcomes, nor when the analysis is conducted at the 30-hectare threshold, where evidence remains largely inconclusive.

With regard to economic outcomes, previous ex-ante analyses forecasted a potential decline in farmers' economic performance due to the additional costs associated with the adoption of sustainable agricultural practices (Louhichi et al., 2018). By contrast, ex-post evaluations, such as Diop and Védrine (2025) and Díaz-Poblete et al. (2021), report no statistically significant effects of the CD requirement on farm income. In line with this latter strand of evidence, our findings also suggest the absence of measurable economic impacts. Although direct comparisons with previous studies remain limited due to differences in methodology, data sources, and geographical scope, several factors may account for this result, including partial or pre-existing compliance with diversification requirements (Diop & Védrine, 2025), as well as the relatively limited economic commitment required by the CD measure compared with more demanding crop-rotation schemes (European Court of Auditors, 2017; Matthews, 2012).

The analysis conducted at the 10-hectare threshold, instead, provides clear and statistically robust evidence that, among small- and medium-sized farms located around this cut-off, the implementation of CD requirement has operated as intended. In fact, beyond highlighting positive evidence in terms of farm participation in the measure, the results also indicate that among compliers, there are signs of increased involvement in sustainable agricultural practices. Specifically, in addition to an increase in the number of crops cultivated and a reduction in the share of arable land allocated to the main and second crop, these farms also exhibit an increase in the Shannon index, suggesting potential improve-

ments in local environmental performance. From this perspective, the findings suggest that the environmental effects of the CD measure, at least among farms around the 10-hectare cutoff, appear to be mainly driven by crop diversification behaviour rather than by inducing changes in crop-sequence dynamics. Therefore, while the evidence points to positive environmental outcomes, no additional evidence emerges that the rule generated the broader environmental benefits typically associated with more dynamic crop-rotation practices, at least among farms around this cutoff.

By contrast, the exploratory findings at the 30-hectare threshold show that only a higher probability of reducing the share of land allocated to the main crop and to the two main crops, among farms eligible for the measure, emerges as marginally statistically significant following the implementation of the policy. These results are not supported by other consistent evidence. Overall, there is no clear indication that the measure has effectively increased participation or fostered a shift toward more sustainable agricultural practices among these relatively larger farms—holdings that, given their scale, are also likely to generate more substantial environmental impacts. These findings are consistent with the most recent contributions in the literature (Brutti et al., 2025; Diop & Védérine, 2025), particularly those based on similarly detailed administrative data (Brutti et al., 2026).

Several factors may help explain the limited evidence observed around the 30-hectare threshold. First, although the RDD provides a highly credible identification strategy, it relies on a sufficient number of observations in the vicinity of the cutoff to estimate treatment effects precisely. In the present case, the substantially smaller subsample of farms around the 30-hectare threshold may have reduced the statistical power of the analysis.

Nevertheless, while this represents a plausible methodological explanation, the consistency of these findings with recent contributions in the literature suggests that the limited evidence may not be attributable solely to reduced statistical power, but may also reflect characteristics of the policy design itself. In particular, as documented in the literature, farm expansion is generally associated with an increase in the number of cultivated crops (Brutti et al., 2026). Under these circumstances, the additional requirements introduced at the 30-hectare threshold may not constitute a sufficiently binding constraint to induce further behavioural adjustments among farms that already tend to diversify as their size increases. In this respect, it should be recalled that the policy thresholds and criteria were determined not only by technical considerations but also through political negotiations, which may have influenced their stringency and practical effectiveness (Pe'er et al., 2014).

In this regard, additional descriptive analyses conducted on farms immediately below the 30-hectare threshold (specifically between 27–30 ha; see Appendix A.7) provide descriptive evidence consistent with this interpretation. In particular, focusing, for instance, on the

number of crops, farms immediately below the threshold already cultivated, on average, 3.30 crops (see Table A.22 in Appendix A.7). Notably, approximately 74% of these farms already met the additional crop requirement introduced at the 30-hectare threshold by cultivating at least three crops. While purely descriptive, these findings may indicate that, for a large share of farms immediately below the cutoff, the additional crop requirement may have left relatively limited scope for further behavioural adjustments. By contrast, only around 61% of these farms already satisfied the requirement that the two main crops jointly account for no more than 95% of the eligible agricultural area (see Table A.22 in Appendix A.7). Although still representing a majority of farms, this lower proportion suggests that compliance with this dimension of the measure may have left relatively greater scope for behavioural adjustments, consistent with the weaker evidence observed for outcomes related to crop concentration at the 30-hectare threshold (see Table A.10). That said, the evidence discussed above should be interpreted as characterising the response of farms located around the 30-hectare threshold, rather than that of larger farms as a whole.

Moreover, the identification of a fuzzy RD design, together with the estimation of a broader set of distinct effects, allows for a more structured discussion of policy design and implementation, not only in the Italian context but also in other European countries that adopt similar implementation approaches. In particular, comparing the effect of being eligible for the policy with the effect among those who actually respond to it helps to better understand how the policy works in practice. It shows that the strongest changes occur among farms that are able to adjust their behaviour in response to the incentive, at least at the 10-hectare threshold. This suggests that national implementation should aim to better align eligibility status with actual participation, as determined by the area covered by the Basic Payment Scheme (BPS), thereby strengthening the overall local effectiveness of the policy. At the same time, it underscores the crucial importance of highly granular administrative data, without which such discrepancies between formal eligibility and actual uptake would remain unobserved. The ability to identify and quantify these mechanisms is therefore not merely a methodological refinement, but a necessary condition for a more transparent and equitable evaluation of policy effectiveness.

Finally, an additional noteworthy aspect emerging from the analysis concerns the relationship between CD and CR. While the policy approach—by prioritising diversification over rotation—might have suggested a potential trade-off between the two practices, despite their underlying conceptual affinity, the empirical evidence does not support this interpretation. The correlation analysis reveals an overall positive association between changes in land-use practices related to crop diversification and crop-rotation indicators, suggesting that greater crop diversification may encourage the adoption of rotational strategies. More-

over, as shown in Table 4.5, around 40% of farms lie along the diagonal, indicating a certain degree of alignment between different levels of diversification and rotation practices within the same units. Therefore, these findings suggest that strengthening crop diversification may promote a greater adoption of crop rotation practices. From a policy perspective, this opens up the possibility of leveraging diversification requirements as a stepping stone toward the promotion of more environmentally valuable rotation schemes.

4.8 Conclusions: Policy Implications, Limitations, and Future Research

CAP is one of the most influential policies at the European level, shaping land-use practices across rural areas. Within this framework, the GPs—particularly the CD measure—are designed to encourage the adoption of more sustainable agricultural practices, while enhancing farms' environmental performance, resilience, and long-term competitiveness. The heterogeneity of findings regarding the economic, environmental, and land-use effects of CD requirement in previous ex-post analyses motivated a deeper investigation using a highly comprehensive and georeferenced administrative dataset. In this respect, this study contributes to the body of ex-post evaluation research by exploiting a detailed parcel-level dataset and by adopting a causal identification strategy. By doing so, we addressed the need for greater data quality and accuracy in this type of analysis, thereby providing more robust insights, as highlighted in the literature.

The results show that the implementation of the crop diversification requirement led to positive changes in land-use practices and environmental performance, particularly for medium-small farms in Tuscany in 2022. However, similar conclusions do not hold when shifting the focus to larger farms around 30-hectares. Indeed, for larger farms, although the evidence should be interpreted as more exploratory, there is no evidence of consistent changes, suggesting a missed opportunity to promote greener practices among these entities.

The sources of this discrepancy, as seen, may be manifold. Among them, although the paper addresses potential methodological concerns by relying on a detailed dataset with broad coverage of the local population, some limitations may still persist around the 30-hectare threshold due to the relatively small number of observations. As discussed above, this may reduce the statistical power of the analysis and partly explain the lack of statistically significant effects. However, the fact that these findings are consistent with existing evidence in the literature, including studies based on similarly detailed datasets, together with the descriptive evidence showing that many farms already satisfied the crop diversification requirements immediately below the 30-hectare threshold, suggests that the

issue may also lie in potential weaknesses in the policy design, thereby raising broader policy considerations that extend beyond the Tuscan context. Specifically, the results raise questions about whether the design of the CD requirement itself—both in terms of the 30-ha threshold and the permitted concentration levels—is sufficiently stringent or appropriately calibrated to induce behavioural change among larger farms around the 30-hectares threshold. These farms may not perceive the measure as a binding constraint, as their production models already incorporate a certain degree of diversification.

Alternatively, the limited effects observed at the 30-hectare threshold may also reflect structural characteristics of local agricultural production, such as the organisation of production and the degree of farm specialisation around this threshold (e.g. cereal-based systems or specialised horticultural production). These aspects warrant further investigation and highlight the need for policy measures that are better tailored to the structural characteristics of local agricultural systems. Such an approach could help identify more appropriate and effective policy criteria capable of inducing behavioural change among these larger farms, which, given their scale, also have the potential to generate greater environmental benefits.

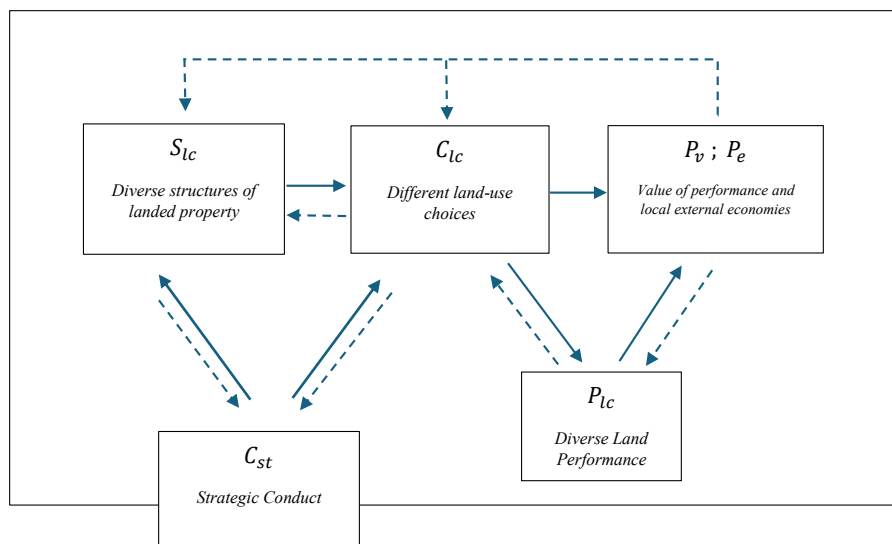
Furthermore, the results of the exploratory analysis on the relationship between crop diversification and crop-rotation practices further enrich this multifaceted picture. While diversification appears to support the adoption of rotation practices, a closer look at the evidence also reveals some degree of heterogeneity across farms. This suggests that policy measures should not only leverage diversification as a driver of rotation, but also be more finely targeted to account for differences in land-use practices and their intensity, thereby further strengthening their contribution to improved environmental performance at the local level. In this respect, the present study represents an important step forward, as it contributes to improving the measurement and empirical assessment of crop-rotation practices, thereby enhancing policy capacity to monitor and evaluate these dynamics in a more systematic way.

A broader policy implication emerging from this study further concerns the strategic importance of investing in high-quality, granular administrative data infrastructures. As illustrated by the Italian case, the availability of detailed, georeferenced parcel-level information proved crucial for identifying heterogeneous treatment effects and disentangling behavioural responses across farms. This, in turn, enabled the identification of policy design issues that would have been difficult to detect using more aggregated data, while also providing more targeted and evidence-based policy recommendations. More generally, these findings suggest that strengthening data collection systems—particularly by integrating environmental indicators that can be spatially linked to farm-level information—is not merely a technical improvement, but a necessary condition for more effective policy design,

monitoring, and evaluation of green agricultural policies.

Finally, the results provide relevant insights with respect to the conceptual framework developed in the previous part of the thesis, particularly by supporting and further qualifying the relationships illustrated in Figure 4.4 and introduced at the beginning of this chapter, concerning the role of governance actions (C_{st} in Figure 4.4) in shaping land-use practices (C_{lc} in Figure 4.4) and, more broadly, rural development dynamics ($P_{(v,e,lc)}$ in Figure 4.4).

Figure 4.4: The land tenure loop with elements of governance



Source: Author's elaboration. **Note:** Continuous arrows represent linear effects; dotted arrows represent feedback effects. Direct and reverse arrows linking strategic conduct to performance elements are conceptually embedded in the framework but have been omitted from the figure for clarity, as they are not required for the analytical purposes of the present analysis.

The empirical evidence contributes to assessing this theoretical relationship and its implications for local development trajectories. In this respect, the findings confirm the proposed relationship by showing that governance actions targeting land use can effectively influence farming practices. More generally, they further suggest that changes in land-use practices may, in turn, affect different dimensions of local development with varying intensity, thereby contributing to diverse local development trajectories. In the present case, these changes primarily translate into improvements in the environmental dimension of local development, as the policy intervention successfully promotes more sustainable land-use practices among small- and medium-sized farms, thereby supporting broader transformation processes, including the green transition of the rural areas in which they operate. In doing so, although the empirical application focuses on agriculture, the underlying mechanisms identified in the conceptual framework are likely to have broader validity, potentially

extending to other sectors and influencing distinct land-use practices and behaviours across a wider range of local actors and contexts.

At the same time, the analysis further qualifies the conceptual relationship by showing that the effects of governance actions on diverse land-use practices, and ultimately on local development outcomes, are contingent upon both the design of the policy intervention and the structural characteristics of the local context in which it operates. In the case of a uniform, top-down and largely *place-blind* measure such as crop diversification, the empirical findings reveal heterogeneous effects across the two policy thresholds. More specifically, more pronounced environmental and land-use improvements are observed among small- and medium-sized farms around the 10-hectare threshold, whereas more limited or negligible effects emerge around the 30-hectare threshold. Although these findings should be interpreted in light of the methodological limitations discussed above, they nevertheless suggest that governance interventions are unlikely to generate comparable outcomes across territories unless their design is aligned with local structural and territorial conditions, as anticipated by the conceptual framework.

From this perspective, these findings lend support to the argument for more tailored *place-based* governance interventions targeting land-use practices, which may act as important levers within the *land tenure loop* and contribute to shaping local development trajectories. Although such approaches may entail greater design complexity, they are more likely to induce effective behavioural change when aligned with local structural conditions, thereby reducing inefficiencies and the potential misallocation of public resources. More broadly, these findings suggest that a promising way forward—even within common European policy frameworks targeting land-use practices—would be to combine shared policy objectives at the European level with greater flexibility in implementation at both the national and sub-national levels.

This study is subject to several limitations that should be acknowledged. First, the results identify a Local Average Treatment Effect (LATE), as derived from the RDD framework, which restricts the external validity of the findings beyond the immediate vicinity of the cutoff. Second, the available data do not allow us to identify or distinguish between farms that were already compliant with crop diversification requirements prior to the reform and those that adjusted their behaviour in response to it. Third, although we employ a set of indicators that are arguably more informative from an environmental perspective, environmental performance is still assessed indirectly. This limits our ability to fully capture the actual environmental impact of the introduction of sustainable agricultural practices. Moreover, although the data allow for an accurate methodological design compared with previous studies, they do not allow us to fully rule out potential avoidance or strategic

compliance behaviours, which may attenuate the observed effects. Fourth, the empirical analysis is confined to a single regional case study, namely Tuscany, which may limit the external validity of the findings. Nevertheless, Tuscany encompasses a broad diversity of rural contexts and agricultural systems, making it a particularly informative setting for examining heterogeneous policy responses. While further evidence from other regions and institutional contexts is needed to assess the generalisability of these findings, the diversity characterising the Tuscan case provides a valuable empirical basis for the analysis conducted in this study. Finally, the approach adopted to assess the relationship between CD and CR practices should be regarded as an initial and exploratory attempt. The correlation analysis provides preliminary insights into their potential complementarity, yet it does not allow for causal interpretation. Future research should therefore aim to further substantiate and refine these findings through more robust empirical strategies capable of strengthening their validity. In this respect, ongoing work is already directed toward deepening this line of inquiry.

Chapter 5

Landownership Structures and Participation in CAP Pillar I Direct Payments

Evidence from the Tuscany Region (Italy)

Abstract

The scientific literature has largely overlooked the role of land capital, as organised through diverse landownership structures, in shaping participation in green agricultural policy measures, particularly with respect to Pillar I Direct Payments of the Common Agricultural Policy. This gap is particularly relevant, as land capital represents a key productive factor in agriculture, and its organisation within distinct landownership structures affects the effectiveness and profitability of production techniques and, consequently, the feasibility and costs of adopting and engaging in sustainable practices required under Pillar I, with direct implications for farms' ability to comply with and access these measures. Differences in land structural conditions may translate into heterogeneous variation in policy uptake at the local level, with potentially differentiated implications for local development trajectories, both in socio-economic and environmental terms. To empirically investigate these relationships, the analysis relies on an original municipal-level dataset for Tuscany (Italy) and is conducted using Spatial Error Models integrated with Causal Discovery techniques. Overall, the results indicate that the physical organisation of landholdings represents a key structural condition shaping both participation in Pillar I Direct Payments and its intensity, while also providing a more structured—albeit exploratory—interpretation of the underlying mechanisms behind these patterns.

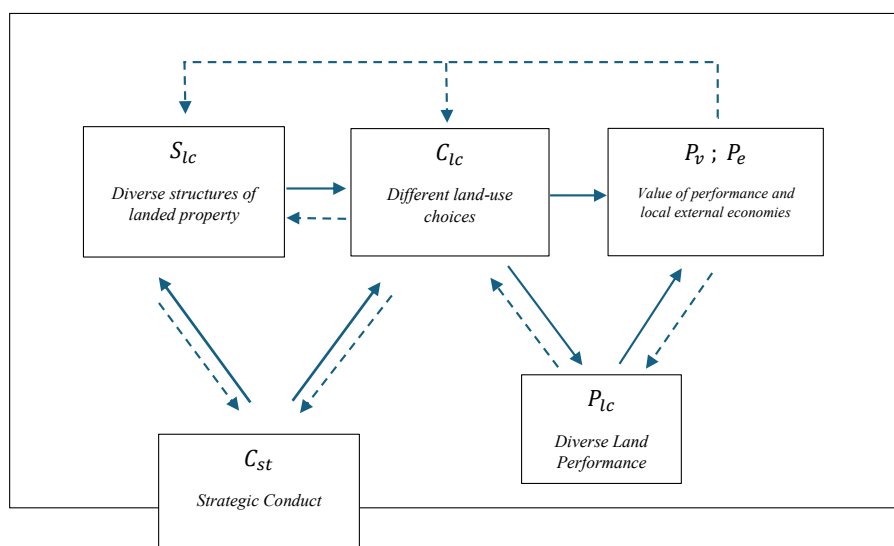
Keywords: Landed Property Structures; Common Agricultural Policy Pillar I; Direct Payments; Policy participation; Spatial Error Models.

JEL codes: C31; O18; Q18; Q15; R11.

5.1 From Conceptual Framework to Empirical Analysis: Landownership and Governance Impacts

As introduced in Chapter 4, the present paper further develops the empirical investigation of one of the relationships identified within the conceptual *land-tenure loop*, as depicted in Figure 5.1. Specifically, it examines the linkage between different landownership structures¹ (S_{lc} in Figure 5.1) and elements of territorial governance² (C_{st} in Figure 5.1) within rural³ development dynamics.

Figure 5.1: **The land tenure loop with elements of governance**



Source: Author's elaboration. *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Direct and reverse arrows linking strategic conduct to performance elements are conceptually embedded in the framework but have been omitted from the figure for clarity, as they are not required for the analytical purposes of the present analysis.

The *land tenure loop*, extensively developed in Chapter 3 and briefly recalled in Section 4.1 indeed constitutes a theoretical framework designed to capture the interconnections (direct and reverse) among the various components characterising land capital⁴, as well as

¹Structures of landed property represent the physical and legal architecture of land capital at the local level.

²Territorial governance is here defined as “a process of coordination between different types of actors with asymmetric resources, who engage around issues concerning their territory and contribute, through tools and structures, to the elaboration of a shared project for territorial development” (Torre, 2023).

³The rural context is defined as an area characterised by low population density and productive specialisations directly or indirectly linked to agro-forestry activities. More broadly, it refers to a mixed economic setting in which agriculture coexists with other sectors—such as craftsmanship, tourism, and industry—that tend to integrate with, and maintain a balanced relationship with, the natural environment (Iacoponi, 1998).

⁴Land capital is understood as raw land—a natural agent with “original and inherent features” (Ricardo,

their interactions with other structural dimensions of *place-based* development⁵. In doing so, it offers an analytical lens through which to interpret the dynamics of land capital that shape rural development trajectories. In this respect, after having theoretically examined these elements, this part of the work advances the investigation of these relationships by grounding them in empirical evidence. The choice, as already discussed in Section 4.1, is therefore to empirically investigate selected relationships within this loop. This selection is motivated not only by their explanatory relevance within the loop itself, but also by the presence of specific knowledge gaps surrounding these linkages.

In this sense, this chapter delves into the dynamics associated with distinct landed property structures—such as more fragmented or more concentrated configurations, as further discussed below—and their influence on elements of territorial governance (Torre, 2023). These elements include coordination mechanisms implemented by specific agencies operating at different territorial levels and specialised in fostering the virtuous development of systems at the local level (e.g. policy initiatives and locally embedded development projects). As illustrated in Figure 5.1, this relationship operates as a feedback mechanism within the loop, whereby the structural configuration of landed property conditions the form and effectiveness of specific governance mechanisms put in place at the local level. By way of illustration, private ownership of land capital may confer exclusive control over a strategic resource that not only generates economic returns but also constitutes a source of political power (Zangheri, 1981). Where property structures are highly concentrated, such control may become vested in a limited landholding elite, potentially enabling the exercise of pressure and the consolidation of collusive relationships capable of shaping and directing local governance arrangements put in place. This example represents only one of the possible local mechanisms through which this relationship may operate; a broader discussion of alternative configurations has already been provided in Chapter 3.

In contrast to Chapter 4, which focuses on the direct effects of territorial governance actions on land-use practices and local development outcomes, this chapter therefore adopts a reverse perspective by examining how the effectiveness of these interventions is shaped by structural characteristics of local contexts, notably landownership structures. Recognising

1776a)—which also encompasses permanent forms of capital embodied in lasting land improvements, such as soil tilling, plantations, and buildings (for further details, see Chapter 1). It is characterised by three main dimensions (see Chapter 2)—namely diverse land ownership structures, land uses, and rent—that define distinct land tenure systems.

⁵This perspective is consistent with forms of endogenous development paths, whereby each place can find the basis for its competitiveness within its own territory, drawing on the stock of assets that constitute its territorial heritage. Nevertheless, it should be recalled that an endogenous approach to local development does not exclude—but rather integrates—the action of exogenous forces in the accumulation, valorisation, and mobilisation of such local resources, thus adopting a *place-based* perspective on local development (Becattini & Rullani, 1993; Morretta, 2021; Russo, 1994).

these structural conditions—and their influence on the implementation of governance actions—allows for a more context-sensitive and *place-based* refinement of policy initiatives, thereby enhancing their performance, as already suggested in the previous chapter. In line with this perspective, the following analysis focuses on how landownership structures in rural areas interact with land-use governance interventions, by examining participation in the policy framework of the Common Agricultural Policy (hereinafter, CAP), and in particular in the Direct Payment schemes under Pillar I introduced in the 2014–2022 programming period.

Compared to Chapter 4, which focuses on assessing the land-use effects, including participation dynamics, of specific Direct Payments measures (2014–2022)—most notably Crop Diversification measure—around policy thresholds, thereby capturing primarily local behavioural responses, this chapter adopts a broader approach by considering participation in the overall Direct Payments scheme and extending the analysis to the full population of farms of all sizes, including both participants and non-participants in CAP Direct Payments. In doing so, it also encompasses a wider range of productive activities—for instance, including farms specialised in permanent crops, and not only those engaged in arable cropping. This approach thus allows for a more comprehensive assessment of the determinants underlying participation patterns across heterogeneous agricultural systems.

Importantly, although participation in Direct Payments is partly determined by institutional conditions—most notably the availability of eligible land associated with payment entitlements under the Basic Payment Scheme⁶ (BPS) (see Chapter 4)—it can be reasonably hypothesised that these factors do not fully account for observed participation patterns across the full population of farms. First, while the BPS account for a substantial share of Direct Payments, it does not encompass the entire policy framework (Sotte, 2023). Second, as shown in the previous chapter, the magnitude of this effect, although present, appears to concern only a subset of farms (see Table A.8). Finally, the fact that entitlements are historically determined does not preclude the influence of other structural factors that may shape participation dynamics.

Adopting this broader analytical perspective therefore allows for a more general assessment of how structural characteristics—and, in particular, landownership structures—shape participation in a key policy framework designed to support rural local development. Thus, building on the general conceptual background, the analysis proceeds by empirically exam-

⁶As discussed in Chapter 4, eligibility for the Basic Payment Scheme (BPS) is conditional upon the availability of payment entitlements and the corresponding eligible agricultural area. These institutional features are historically determined, stemming from the decoupling introduced in 2005 and anchored to production patterns observed between 2000 and 2002 (see, Guastella et al., 2018; Pierangeli, 2014; Pupo D'Andrea, 2014; Vanni, 2014).

ining this relationship, with the aim of refining our understanding of how land capital shapes rural development processes through its interaction with governance actions and outcomes.

5.2 Chapter Introduction

Structures of landed property represent the physical and legal architecture of land capital at the local level (Zangheri, 1981). Through their diverse local configurations, they are differently embedded in, and can shape, distinct rural socio-economic dynamics (see also Chapter 2 for further discussion; Banerjee & Iyer, 2005; Triantafyllopoulos, 2008). Land capital is indeed a source of material wealth and power (Christophers, 2020), and its organisation across varied ownership structures determines access to and control over a scarce yet fundamental resource. In this respect, structures of landed property exert influence across several local dimensions, affecting the distribution of income and wealth, savings capacity, and the forms of rent extraction. Simultaneously, they shape distinct patterns of land use and productive organisation, while conditioning entrepreneurial origins and the degree of interconnectedness with political power (see Cecchi, 1983; Dale, 1997; Zangheri, 1981).

Focusing on the interconnections and effects between distinct landed property structures and mechanisms of territorial governance (Torre, 2023)—while acknowledging that this relationship may take multiple forms, ranging from processes of political influence and capture to forms of institutional weakening (see, Chapter 3)—this study concentrates on a specific and analytically tractable dimension of such interactions. In particular, it examines how different configurations of landed property structures in rural areas respond to locally implemented governance actions aimed at influencing land-use practices, by analysing participation in one of the most significant policy frameworks shaping rural socio-economic development, namely the Common Agricultural Policy (hereinafter, CAP).

In this respect, the CAP represents a central pillar of European Union policy and expenditure. Originally designed to support the agricultural sector, it progressively expands to address broader rural environmental and socio-economic development objectives. This evolution culminates in the establishment of a two-pillar architecture in 2003. Specifically, under Pillar I, the CAP retains its traditional economic focus, addressing market interventions and providing income support to farmers. Meanwhile, Pillar II broadens the policy's scope to include rural and sustainable development through payments for voluntary environmental measures—such as agri-environment schemes—and investment subsidies for small-scale rural development projects (Hristov et al., 2020).

Within this framework, the 2013 CAP reform marks a further turning point, represent-

ing a decisive step towards stronger environmental commitment and effectively introducing a greener architecture for the 2014–2020/22 programming period (Matthews, 2012). In particular, 30% of Direct Payments (DPs) under Pillar I are made conditional on compliance with a set of sustainable agricultural practices. Specifically, these so-called Green Payments (GPs) or *greening* required: (1) crop diversification practices, asking farmers to grow a minimum number of crops according to their arable land size; (2) the dedication of a certain share of arable land to an ecological focus area (EFA); and (3) the maintenance of a certain share of permanent grassland, measured at the national level (European Commission, 2013). In line with the more environmentally oriented trajectory initiated in 1992 with the MacSharry reform, the 2013 CAP therefore made, for the first time, part of Pillar I income support conditional upon compliance with specific environmental practices (Sotte, 2023). Indeed, once farms have applied for Direct Payments, non-compliance with *greening* requirements entails a reduction in financial support of up to 1.25 times the GPs, together with additional penalties introduced from 2017 (Brutti et al., 2026; European Commission, 2013; Gocht et al., 2017). In addition, a substantial share of the remaining Direct Payments—particularly those related to the Basic Payment Scheme (BPS)—is subject to other cross-compliance obligations aimed at promoting environmental sustainability, the violation of which may result in payment reductions or even exclusion from the scheme (Sotte, 2023).

Thus, compared to the past, participation in Pillar I is now characterised by greater selectivity, driven by the need to comply with these specific policy requirements. This shift increases the degree to which farmers' decisions are constrained by regulatory conditions governing adherence to the measure. Participation indeed depends on the extent to which a combination of factors, both internal and external to the farms, are compatible with the renewed policy architecture (Stefani & Giudicissi, 2011; Vanslebrouck et al., 2002).

In this context, structures of landed property emerge as a potentially decisive element. Land capital is indeed a key productive factor within agricultural activities and its parcel-based organisation within landed property structures constitutes the basic unit of agricultural production (Cecchi, 1983; Serpieri, 1940). The size and spatial distribution of these parcels thereby condition the density of production units, the variety and scale of feasible productive processes, as well as diverse arrangements of local productive organisations (Povellato, 2009; Rocchi & Stefani, 2002; Rossi-Doria, 2005; Serpieri, 1940). Different physical configurations of landownership structure can therefore determine whether, and to what extent, the use of specific farming techniques is economically viable (Dale, 1997; Latruffe & Piet, 2014). This, in turn, may condition the feasibility of complying with the specific land-use requirements of DPs—both in terms of adopting practices that are economically

viable and of covering the associated production and transaction costs—thereby shaping the intensity of farms’ participation in these measures, with potential implications for the development trajectories of local contexts. Indeed, participation in income support schemes aimed at promoting sustainability may contribute to sustaining farms’ competitiveness, while also fostering the emergence of local development patterns increasingly oriented towards green practices and models (Brutti et al., 2023; European Commission, 2013).

Despite the theoretical relevance of these mechanisms, empirical research has so far paid limited attention to the role of landed property structures in influencing participation in green policy initiatives. This is particularly true with reference to CAP Pillar I, whose design—at least until the 2013 reform—imposed relatively limited conditionality requirements and participation constraints, thereby attracting little attention from studies concerned with the structural determinants of policy take-up. More broadly, although the literature on farm participation in agri-environmental measures—such as agri-environmental schemes under Pillar II or conservation programmes—acknowledges the relevance of land tenure systems, empirical contributions addressing this issue remain limited (see, for instance, Adinolfi et al., 2011; Wynn et al., 2001). Moreover, given the substantial differences in policy design between these schemes and the compensatory logic under CAP Pillar I, the existing evidence cannot be directly transferred to the context of the present analysis.

Building on this, this paper aims to address this knowledge gap by providing an in-depth empirical analysis of selected structural and physical features of landed property, in order to understand their role in shaping participation in CAP Pillar I DPs (2014–2022). By doing so, it contributes to enhancing our understanding of the land-related mechanisms that may influence participation in Pillar I and, more broadly, in sustainability-oriented governance initiatives. Given the limited available evidence, this analysis should be therefore interpreted as a first empirical step towards uncovering these relationships.

In doing so, the study also contributes by constructing an original dataset that combines detailed information on participation in CAP Pillar I Direct Payments with measures of landownership structures derived from multiple data sources. In particular, it integrates data on landed property with a set of indicators specifically selected following a review of the literature, aimed at capturing both the physical organisation and structural characteristics of landholdings, thereby providing a novel empirical basis for a systematic analysis of landownership structures and their interactions with other dimensions of local development.

The issue addressed in this paper is also particularly relevant from a policy perspective, especially in light of the growing orientation of European policies towards sustainability-oriented interventions, such as those introduced in subsequent CAP programming cycles (2023–2027) as well as initiatives developed under the European Green Deal, such as the

Farm-to-Fork Strategy (European Commission, 2019a, 2020). At the same time, the analysis clarifies how landed property structures interact with distinct rural development trajectories through their influence on governance-related mechanisms. In particular, it highlights how differences in landownership structures shape variation in participation in CAP Pillar I (2014–2022). Such participation, as noted, is widely regarded as relevant for promoting the diffusion of sustainable agricultural practices, sustaining the competitiveness of the European farming sector, and addressing related socio-economic challenges. Differences in participation may therefore translate into uneven opportunities to support virtuous and sustainable development trajectories across rural contexts.

The remainder of the paper is organised as follows. Section 5.3 reviews the relevant literature. Section 5.4 presents the innovative dataset, while Section 5.5 describes the empirical strategy used to address the research question. Section 5.6 presents the main results, Section 5.7 discusses their implications, and Section 5.8 concludes.

5.3 Background Literature

Land capital is a valuable and scarce resource distributed across societies and places through *properties*, which constitute the legal-economic units underpinning landownership structures. Within a given area, these properties may display significant variation along both their physical and legal dimensions, as reflected in their number, size, and spatial distribution, as well as in the number and type of landowners holding them and in the property rights attached to them (see Chapter 2 and Appendix A.2 for a detailed discussion of these dimensions). According to the different configurations of these elements, distinct and heterogeneous landed property structures can be observed at the local level. More precisely, landownership structures can vary across a continuum between two extremes: land concentration and fragmentation. Concentrated landed property structures are usually characterised by a small number of landowners holding large and contiguous estates. On the other hand, instead, land fragmentation refers to a pulverisation of the physical structure of landownership into parcels and micro-properties. Under such circumstances, properties are often spatially dispersed and held by a large number of landowners and co-owners (Golzio, 1933; Medici et al., 1962; Zangheri, 1981).

Such different landownership arrangements may shape local agricultural productive organisation in distinct ways. Land capital is indeed an essential productive factor in agricultural activities (Serpieri, 1969), and its parcel-based organisation within landownership systems constitutes their basic productive unit (Cecchi, 1983; Povellato, 2009). It provides essential services throughout the entire production cycle, while simultaneously constrain-

ing the breakdown, reconversion, and adaptability of productive processes and shaping the character of local output (Cecchi, 1988; Polidori & Rocchi, 2013). In this sense, the size and distribution of properties shape density and type of productive units that agricultural enterprises can establish, influencing the economic viability of specific farming techniques (Dale, 1997) and determining the variety and scale of feasible productive processes (Brusco, 1979; Latruffe & Piet, 2014; Rocchi & Stefani, 2002).

In line with this, small-micro properties (under 2 hectares), according to diverse types of agricultural production, may limit farms' potential to exploit internal economies of scale and reduce machinery field efficiency, while a high number of plots increases organisational and managerial complexity, and long distances between them raise transport costs. While not excluding the presence of some dynamic farms, such contexts are typically associated with micro-sized productive units, often characterised by less structured organisational settings (for example, part-time farmers) (Brusco, 1979; Cecchi, 1983). When these land conditions become more pronounced, they give rise to fragmented landownership, characterised by scattered micro-properties that hinder local agricultural activities, with production costs often exceeding the profitability of farming operations (Latruffe & Piet, 2014; Povellato, 2009). Such conditions are consistent with broader patterns of local economic and social fragility in rural contexts, in which productive activities face structural constraints that limit their capacity to emerge and consolidate, thus influencing local development trajectories (Rossi-Doria, 2005).

On the other hand, larger contiguous estates—ranging from medium-sized to large holdings—characterised by a certain degree of soil fertility, may support diverse agricultural productive activities. Depending on the degree of land concentration, these may range from entities centred on a diversified use of land capital—based on diversification strategies and the exploitation of internal economies of scope, by combining agricultural activities with other economic activities (e.g. tourism and manufacturing) (Basile & Cecchi, 1997; Gaudio et al., 2008; Sotte & Arzeni, 2013)—to more specialised and intensive land use systems—often oriented towards monocultural or highly specialised cropping patterns—with activities benefiting from the attainment of internal economies of scale and scope (Brusco, 1979; Longhitano & Povellato, 2017). Such conditions are often associated with rural areas characterised by higher levels of economic dynamism and more favourable local development trajectories (Basile & Cecchi, 2001). In these contexts, different farms benefit from diverse structural conditions—among which distinct land organisations conducive to the implementation of profitable productive processes—that facilitate the development and consolidation of a variety of agricultural activities, as well as the emergence of related economic linkages and opportunities within the local economy (for a more detailed discus-

sion of the relationships between landownership structures, agricultural activities, and local development trajectories, see Chapter 3).

Different landed property structures, particularly depending on the physical organisation of landholdings, therefore contribute to shaping distinct and viable agricultural production processes. In this sense, they influence the economic viability and overall profitability of farming practices and, consequently, the ability of the farms to cover the associated production and transaction costs, including those related to participation in specific policy schemes. As such, they inevitably affect policy outcomes, while these policies aim to redirect and reorient those same processes. In this light, it becomes possible to interpret the relationship between specific land-tenure organisations and the measures introduced under the 2014–2022 Direct Payments in Pillar I, which are explicitly designed to influence and support the adoption of agricultural practices oriented towards a more sustainable use of land capital by farmers (European Commission, 2013). This is particularly relevant given that 2014–2022 DPs incorporate environmental conditionalities, linking income support more closely to the adoption of sustainability-oriented farming practices. Within this framework, the GPs represent the most demanding components of this shift, as they directly affect farms' production choices and organisational strategies, encouraging crop diversification and the allocation of part of the land to ecological set-aside areas (Sotte, 2023). In this sense, the effectiveness of DPs operates through the structural characteristics of landholdings, which may either support or hinder the adoption of such practices and, consequently, influence the level of participation in these measures⁷.

In this regard, conditional on other relevant factors, it is plausible to expect higher levels of participation and engagement among farms located in rural areas characterised by relatively more concentrated land structures—ranging from small- and medium-sized to larger holdings—thus supporting more structured productive organisations capable of implementing economically viable and sustainable agricultural practices, with varying levels of engagement intensity. By contrast, fragmentation may hinder the implementation of profitable production processes and organisational efficiency, also in relation to the adoption of sustainable land-use practices, thereby discouraging participation among farmers operating under such conditions.

Despite the plausibility of this mechanism, its empirical relevance remains largely unexplored. To the best of our knowledge, no empirical evidence currently exists on the role

⁷Against this background, it is also important to recall that participation in DPs is partly shaped by institutional conditions—most notably the availability of eligible land associated with BPS entitlements. However, these factors alone do not fully account for observed participation patterns, as they do not necessarily ensure that engaging in such measures is economically viable for farms operating under different structural conditions.

of land ownership structures in shaping participation in CAP Pillar I measures. To further complicate the picture, from an empirical perspective, the general mechanisms driving participation in Pillar I remain largely unexplored, and a coherent framework of the factors shaping participation is still lacking. This gap is particularly relevant because participation in Pillar I DPs is widely recognised as a key mechanism for promoting sustainable agricultural practices and supporting the socio-economic development of rural areas. Consequently, territorial differences in participation may translate into uneven opportunities for pursuing sustainable local development pathways.

Against this background, insights from the literature on participation in environmental policy measures—primarily developed in the context of CAP Pillar II and related schemes—provide a useful reference point to identify a broad set of potential drivers of participation⁸ (see, Defrancesco et al., 2008; Lastra-Bravo et al., 2015; Stefani & Giudicissi, 2011; Wossink & van Wenum, 2003). However, given the substantial differences in policy design, objectives, and implementation mechanisms, these findings cannot be directly transferred to the context of CAP Pillar I. Rather, they serve as an initial conceptual guide to inform the identification of relevant factors, without imposing a predefined structure on their relationships.

Taken together, these considerations highlight both the absence of direct empirical

⁸From this perspective, participation in green measures is generally found to be positively associated with larger farm size and a stronger orientation towards innovation and investment, while a stronger market orientation tends to reduce involvement (Cullen et al., 2021; Defrancesco et al., 2008; Hynes & Garvey, 2009; Vanslebrouck et al., 2002; Wossink & van Wenum, 2003; Zimmermann & Britz, 2016). Farming systems also matter, with less intensive systems typically displaying higher participation rates, whereas labour-intensive crops and the presence of permanent crops are often associated with lower adoption (Cullen et al., 2021; Defrancesco et al., 2008; Hynes & Garvey, 2009; Was et al., 2021; Zimmermann & Britz, 2016). Structural and household characteristics further influence participation: the presence of tangible assets tends to facilitate adoption, while the absence of a successor and a strong dependence of household income on farming tend to discourage it (Lastra-Bravo et al., 2015; Stefani & Giudicissi, 2011; Was et al., 2021). Farmers' socio-demographic characteristics also play a role, with younger, better educated, more risk-oriented, and environmentally aware farmers generally displaying higher participation rates, particularly when they have previous experience with green policy schemes (Giovanopoulou et al., 2011; Vanslebrouck et al., 2002; Was et al., 2021; Wossink & van Wenum, 2003). In addition, external factors related to policy design and context may affect participation, as schemes characterised by clearer requirements, adequate compensation, and easier access to information tend to encourage uptake (Giovanopoulou et al., 2011; Vanslebrouck et al., 2002; Wossink & van Wenum, 2003; Wynn et al., 2001; Zimmermann & Britz, 2016). Contextual conditions also matter, as farms located in less favourable socioeconomic environments and those influenced by neighbouring farmers' behaviour may display higher participation rates (Vanslebrouck et al., 2002; Wossink & van Wenum, 2003; Wynn et al., 2001; Zimmermann & Britz, 2016). Evidence explicitly accounting for land-related dimensions remains comparatively limited. Van der Meulen et al. (1995), for instance, considers the physical configuration of landholdings, showing that in areas where parcels are less concentrated, farms tend to allocate larger areas to conservation programmes. A limited number of studies have also explored property-rights arrangements—particularly the distinction between owned and rented land—although the available empirical evidence does not provide clear support for a systematic relationship with participation in sustainability-oriented measures (Adinolfi et al., 2011; Was et al., 2021).

evidence on the role of land ownership structures in shaping participation in CAP Pillar I DPs and the limited understanding of the broader mechanisms underlying such participation. While existing studies on other policy measures provide useful insights into potential drivers, their applicability to this specific institutional setting remains uncertain.

Against this background, this paper specifically addresses the first gap by examining how the organisation of land ownership structures at the local level shapes participation in CAP Pillar I Direct Payments. Specifically, it investigates the following research question:

RQ1. *How do different local configurations of land ownership structures—particularly in terms of the physical organisation of landholdings—shape variation in both participation in and the intensity of participation in CAP Pillar I Direct Payments, within the 2014–2022 programming period?*

In doing so, this study contributes to expanding our understanding of how land ownership structures shape participation in Pillar I measures, addressing a dimension that has so far received little attention in the literature. At the same time, while the primary focus remains on land ownership structures, the analysis is embedded within a broader set of contextual and structural factors which, as will be discussed below, are plausibly relevant in shaping participation dynamics. By situating this primary relationship within such a broader framework, the paper thus contributes indirectly to a wider debate on the drivers of participation in CAP Pillar I.

5.4 Data and Variables

5.4.1 Data sources and dataset construction

The study relies on an innovative georeferenced dataset built for the year 2022 at the municipal level, covering the entire Tuscany region (Italy). The region represents a relevant case study, as 269 of its 273 municipalities are classified as rural areas, with different degrees of rurality reflecting the varying role and intensity of agricultural activities across territories (as defined by the zoning under the CAP 2014–2022 Rural Development Programme (CSR FEASR)) (Regione Toscana, 2024b). Agriculture represents a structurally relevant component of land use in the region. In 2020, the utilised agricultural area (UAA) amounted to approximately 640,111 hectares—corresponding to about 28% of the regional territory—distributed across 52,146 farms, with an average farm size of about 12.3 hectares (see, IRPET, 2023a; ISTAT, 2022).

To address the research question, this study constructs an original and innovative dataset

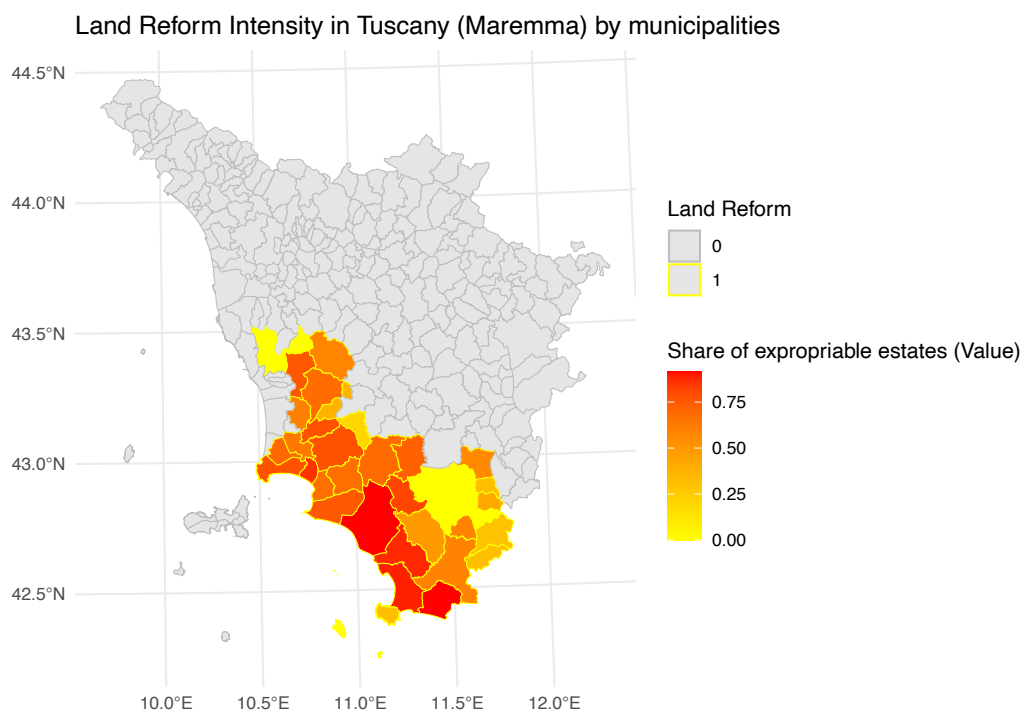
by integrating information from multiple data sources. In particular, the dependent variables capturing participation in policy measures are constructed using administrative data for 2022 provided by the Regional Agency of Tuscany for Agricultural Payments (ARTEA). These data contain primary administrative information on farms at the parcel level. Specifically, the dataset includes georeferenced agricultural land parcels across the Tuscany region (approximately 691,400 polygons in 2022), each containing detailed information on crop types, structural and economic characteristics of the farms managing these parcels, and agricultural aid applications. This information enables the reconstruction of each farm's treatment status under Direct Payments CAP Pillar I (for further details, see Chapter 4).

Data on landed property are instead derived from the most recent—and so far the only—national census on landownership conducted in Italy in 1948 (INEA, 1956). These data are used as a proxy for landownership structures in 2022. The rationale behind this choice lies in the fact that landownership structures typically evolve slowly over time, as changes in property arrangements tend to occur gradually and are often constrained by institutional, legal, and inheritance mechanisms. This assumption is supported by empirical evidence obtained by analysing the correlation between several indicators describing the configuration of landownership structures, constructed for both 1948 and 2022 in a sample of 14 municipalities in Tuscany (see Appendix A.8.1 for further details on the methodological approach used to measure landed property structures). The high positive and statistically significant correlation observed across these indicators suggests a substantial persistence in the spatial configuration of landownership structures over time, thereby supporting the use of historical data as a proxy for contemporary patterns (see Table A.24 in Appendix A.8.2).

Nevertheless, the use of historical landownership data inevitably raises questions regarding the extent to which these variables accurately proxy contemporary landownership structures. In this regard, the principal source of concern is represented by the land reform implemented in Italy in the early 1950s, which constituted the main institutional intervention capable of substantially altering pre-existing ownership structures. The reform redistributed large landed estates to individual peasant families, thereby reshaping the local distribution of landed property (Albertus, 2023; Medici et al., 1962). In Tuscany, the reform primarily affected the Maremma area, located in the southern part of the region (see Figure A.20 in Appendix A.8.3). In these municipalities (44 in total), the landownership patterns observed in 1948 cannot be therefore considered a reliable proxy for contemporary structures. Nevertheless, the intensity with which the reform was implemented varied locally, as the share of expropriable land depended on the fiscal value of landed property (taxable income expressed in Italian Lire £), as established by the reform legislation. Following Caprettini et al. (2021), an indicator of land reform intensity is constructed as the share of expropriable estates (in

terms of value) within each municipality (see Figure 5.2). The analysis is therefore further refined by considering as effectively affected by the reform those municipalities where the land initiative can be considered to have had a substantial impact, namely where the share of expropriable estates (value) exceeds 75% of the total taxable value of landed property at the municipal level (resulting in a total of 11 municipalities). In the empirical specification, this is accounted for by including an interaction between the explanatory variable capturing landownership structure and a dummy variable indicating the municipality's eligibility for the reform, defined on the basis of the constructed land reform intensity index. Further details on the construction of this variable and on the municipalities identified as treated by the land reform are provided in Appendix A.8.4.

Figure 5.2: Intensity of Land Reform in Maremma area (Tuscany)



Source: Author's elaboration based on INEA (1956) and Caprettini et al. (2021).

Beyond this exceptional institutional intervention, landownership structures are generally characterised by a high degree of persistence over time. Although ownership arrangements naturally evolve, these changes tend to occur gradually and rarely alter the broader spatial configuration of landed property. This persistence primarily reflects the mechanisms through which ownership is transferred. On the one hand, land markets are characterised by limited mobility. According to the European Access to Land Network, annual farmland sales in Italy account for only around 2% of the total agricultural land area, suggesting that

market exchanges play a relatively limited role in reshaping ownership patterns over time (European Access to Land Network, 2018). On the other hand, the majority of ownership transfers occur through intergenerational inheritance. By their very nature, inheritance processes unfold gradually over time, and therefore tend to preserve existing territorial patterns instead of generating abrupt reallocations of landed property. Consequently, while landownership structures naturally evolve over time, these changes tend to reinforce existing territorial configurations rather than fundamentally reshaping them, leaving the broader spatial organisation of landownership largely unchanged.

In the case of Tuscany, this long-term persistence is also supported by both historical scholarship and subsequent empirical evidence. In particular, according to Giorgetti (1977), by the end of the nineteenth century Tuscany could be broadly interpreted as comprising three distinct areas, each characterised by specific land-tenure arrangements, settlement patterns, and agricultural practices. In the northern and eastern mountain areas, agricultural activities were largely organised around small-scale peasant ownership, characterised by highly fragmented properties and family-based farming systems. In the southern part of the region, particularly within the Maremma, extensive cereal-livestock systems were historically associated with large landed estates (*latifundia*) and a socio-economic organisation centred on wage labour and pastoral activities. Between these two extremes, much of central Tuscany was characterised by the sharecropping (*mezzadria*) system, based on relatively stable, diversified small- and medium-sized family farms. This tripartite territorial organisation is subsequently confirmed by the 1961 Agricultural Census (see Table A.25 in Appendix A.8), which documents a remarkably similar distribution of agricultural land across the three aforementioned land-tenure systems almost a century later, thus providing further evidence of the persistence of these territorial patterns over time. Nevertheless, it should be acknowledged that some municipalities may have experienced exceptional changes in landownership structures that are not captured by the historical proxy. While such cases are expected to be limited, they would primarily introduce measurement error, potentially leading to more conservative estimates of the relationship under analysis.

The long-term persistence documented above also mitigates broader concerns that landownership structures and CAP participation may have jointly evolved over the analysis period through reciprocal interactions or in response to common underlying demographic, economic, or institutional factors. Unlike CAP participation, which reflects a relatively recent policy outcome, landownership structures represent long-standing territorial characteristics shaped by historical processes unfolding over decades. Although some demographic, economic, or institutional changes may influence both phenomena, the historical and empirical evidence presented above supports the view that such processes have

not fundamentally altered the underlying spatial configuration of landownership structures exploited in this study. Accordingly, given the evidence supporting the validity of the historical proxy, the empirical analysis is conducted as a cross-sectional exercise for the year 2022, relating contemporary CAP participation to current landownership structures, proxied by the historical indicators, while controlling for other contextual covariates relevant to explaining the phenomenon under analysis.

To account for these additional controls, a set of variables capturing the structural features of the Tuscan agricultural system, as well as the morphological and institutional characteristics of the territorial context, is included using information drawn from the Italian National Institute of Statistics (ISTAT). In particular, data from the most recent Agricultural Census conducted in 2020 are used to enrich the dataset with additional structural and socio-economic characteristics of farms (ISTAT, 2022). These data are complemented with municipal-level information describing the morphological and territorial features of municipalities (ISTAT, 2024). In addition, data from the 2000 Agricultural Census (ISTAT, 2000) are used to construct a municipal-level indicator capturing the share of eligible land in 2003 for the Single Payment Scheme—now replaced by the Basic Payment Scheme (BPS)—thus providing a proxy for historical entitlement allocation at the local level. Consistent with the theoretical discussion, these variables are selected to capture a set of contextual and structural factors that may contribute to influencing participation, drawing on insights from the existing literature, including that on green policy measures. While this literature does not provide a fully comparable empirical framework—given the differences in policy design—it offers useful indications for identifying relevant factors. Accordingly, these variables are included with due caution, acknowledging the limitations of their direct applicability to the CAP Pillar I context.

5.4.2 Key variables and Summary Statistics

The final sample consists of 271 municipalities out of a total of 273. Specifically, two municipalities corresponding to small islands (the islands of Giglio and Capraia) are excluded in order to avoid issues in the construction of spatial contiguity relationships, as discussed below.

Key variables are then constructed (for a detailed discussion of some variable construction see Appendix A.8.6). More precisely, two dependent variables are built to capture variation in farm participation in CAP Pillar I at the municipal level. The first indicator measures the share of farms receiving CAP DPs relative to the total number of farms within each municipality (*Farm share under Pillar I* in Table 5.1). As illustrated in Summary Statistics in Table 5.1, on average, almost half of the farms located within Tuscany's

municipalities participate in and apply for CAP DPs. The second indicator can be interpreted as capturing the intensity of participation dynamics and focuses on farms displaying a higher degree of participation in CAP Pillar I. More specifically, it measures the share of farms whose ratio of UAA under Pillar I DPs to total UAA at the farm level exceeds a specific threshold, thereby identifying farms with a relatively high intensity of participation. The municipal-level indicator is then computed as the share of such farms over the total number of farms in the municipality (*High-intensity CAP farms share*). On average, high-intensity farms account for about 13% of the total number of farms at the municipal level.

Table 5.1: Summary Statistics

Category	Variable	Obs	Mean	s.d.	Min	Max
<i>Participation Outcomes</i>	Farm share under Pillar I	271	0.473	0.223	0.000	0.949
	High-intensity CAP farms share	271	0.130	0.089	0.000	0.456
<i>Landownership Structure</i>	Share of properties < 2 ha	271	0.090	0.101	0.002	0.517
	Gini index	271	0.401	0.131	0.101	0.710
<i>Histo-Insti. Factors</i>	Share of eligible UAA (2003)	271	0.722	0.209	0.185	0.998
	Land reform	271	0.041	0.198	0.000	1.000
	Inner-area municipality	271	0.598	0.491	0.000	1.000
<i>Morphological Context</i>	Mean elevation	271	353.028	270.053	2.930	1267.045
	Mean slope	271	10.408	5.751	0.710	27.588
<i>Agricultural Structure</i>	Average farm size	271	12.275	10.135	1.160	58.254
	Share of rented UAA	271	0.379	0.139	0.000	0.914
	Farms with investment share	271	0.146	0.061	0.000	0.382
	Multifunctional farms share	271	0.161	0.079	0.000	0.500
	Young farmers share	271	0.003	0.005	0.000	0.050

Source: Author's elaboration.

When examining the spatial distribution of these variables (see Figure A.23 in Appendix A.8.7), a clear and consistent pattern emerges that closely reflects the threefold division of Tuscany described above and originally proposed by Giorgetti (1977). In particular, consistently with the territorial pattern discussed above, the northern area, which largely overlaps with the Apennine mountain chain, is characterised by lower participation rates. The central belt of the region, predominantly characterised by hilly landscapes, displays comparatively higher values. The highest participation rates are observed in the southern part of the region, an area traditionally characterised by flatter terrain and more intensive agricultural activity.

The explanatory variables used to characterise landownership structures at the municipal level include the share of small properties (*share of properties < 2 ha*) and the Gini

index. The former provides a size-based measure of land fragmentation, thus signalling more fragmented landownership structures when assuming higher values. By contrast, the Gini index captures the degree of concentration in the distribution of land capital across landowners, thus incorporating not only the size of holdings but also their distribution across ownership units, ranging from 0 (perfectly equal distribution) to 1 (complete concentration in the hands of a single landowner). Taken together, these indicators allow for a more nuanced characterisation of landownership structures, capturing different aspects of their physical configuration through distinct measurement approaches. Descriptive statistics indicate that, on average, micro properties account for about 9% of total properties, while the Gini index displays a mean value of 0.40, pointing to a moderate degree of land concentration (see Table 5.1). Figures A.24 in Appendix A.8.7 show the spatial distribution of these indicators. Higher levels of fragmentation are observed in the northern Apennine area, reflected in higher shares of small properties and lower Gini values. Land concentration increases moving southwards, a pattern broadly consistent—though not identical—with the spatial distribution previously observed for measures of participation in CAP Pillar I.

Finally, a set of variables capturing the structural and territorial characteristics potentially affecting participation in environmental policy measures is constructed at the municipal level. In particular, the institutional variable—capturing the share of UAA historically eligible for BPS under DPs at the municipal level (*share of eligible UAA (2003)*)⁹—is included to account for pre-existing differences in eligibility conditions across territories. On average, about 72% of municipal UAA corresponds to land historically eligible for BPS under Pillar I. In addition, given the spatial co-occurrence of participation patterns with geographical and morphological features of municipalities, further controls are included to account for these contextual dimensions, which are likely to shape agricultural dynamics and participation behaviour. In this respect, municipalities display considerable variation in their morphological features: average elevation is approximately 353 metres above sea level (s.d. $\approx$ 270), while mean slope is around 10 degrees (s.d. $\approx$ 5.8). Moreover, around 60% of municipalities are classified as *Inner Areas*¹⁰, a category that may proxy more marginal rural contexts, where less favourable socio-economic and environmental conditions may constrain agricultural and economic activities, while potentially increasing the reliance of

⁹Eligibility refers to the agricultural area entitled to receive decoupled payments under Regulation (EC) No. 1782/2003, based on historical production patterns observed between 2000 and 2002. These entitlements were subsequently incorporated into the Direct Payment Scheme under the 2014–2020 CAP reform (see, Pierangeli, 2014; Pupo D’Andrea, 2014; Vanni, 2014).

¹⁰Following the terminology of the Italian National Strategy for Inner Areas (SNAI) (Agenzia per la Coesione Territoriale / Dipartimento per le Politiche di Coesione, 2025), Inner Areas are municipalities characterised by reduced accessibility to essential services such as education, healthcare and mobility, often associated with geographically and infra-structurally marginal territories.

local farms on policy support. Furthermore, we include a set of indicators describing the structure of the local agricultural sector. These variables are selected in line with the existing literature on participation in environmental policy measures, which suggests that structural characteristics of farms, such as larger size, higher investment rates and multifunctional activities, may influence the likelihood of participation. In this respect, the average farm size is about 12 hectares, while rented land accounts for roughly 38% of municipal UAA. In addition, the share of farms undertaking investments averages about 15%, the share of multifunctional farms about 16%, and farms managed by young farmers represent a much smaller fraction of the total.

5.4.3 *Correlation Patterns*

The exploratory nature of the analysis calls for a careful investigation of the relationships among the main variables. To provide a more comprehensive overview, Table A.26 in Appendix A.8.7 reports the correlation matrix. Overall, the results indicate a strong positive and statistically significant association between land concentration, measured by the Gini Index, and the measures of participation in CAP DPs Pillar I, suggesting that municipalities characterised by more concentrated landownership structures tend to display higher participation rates in CAP Pillar I. Conversely, the indicator capturing land fragmentation shows a negative correlation with these participation measures, pointing to lower participation rates as land fragmentation increases.

A similar pattern emerges when considering the morphological characteristics of municipalities. Both elevation and slope display negative correlations with the indicators of participation.

Comparable dynamics can also be observed for several structural features of the local agricultural sector, including the share of farms undertaking investments, the presence of multifunctional farms, and the share of young farmers, as well as for historical institutional characteristics. In particular, for investment and multifunctionality variables, the sign of the relationship varies depending on the dependent variable, showing positive or negative associations across participation measures.

5.5 **Empirical Strategy**

5.5.1 *Compositional framework and ALR transformation*

To investigate the research question the empirical analysis relies on dependent variables expressed as shares. The bounded nature of these variables (varying between 0 and 1)

precludes the use of standard linear models¹¹ (Gallani et al., 2015). For this reason, following Morais et al. (2016), the empirical strategy is based on the broader framework of compositional data analysis, modelling the dependent variables through a transformation approach (Aitchison, 1982).

Compositional data (CoDA) are, by definition, expressed as proportions or percentages¹² and provide a useful framework for analysing data composed of multiple parts or components, where the total itself is not informative or of primary interest, and the focus instead lies on the components of the composition (Aitchison, 1982; Filzmoser et al., 2018; Morais et al., 2016). This methodology is, for instance, useful for studying changes in land use over time, when land capital is considered as a composition of different land-use categories (Leininger et al., 2013; Thomas-Agnan et al., 2021).

Three fundamental principles characterise compositional data (CoDA): (1) scale invariance, (2) permutation invariance, and (3) sub-compositional coherence (Filzmoser et al., 2018). These principles are relevant for our dependent variables, which represent one component of an underlying two-part composition¹³. More specifically, the observed dependent variable corresponds, alternatively, to the share of farms applying for CAP direct payments, or the share of farms displaying a higher degree of participation in CAP Pillar I. In both cases, the variable can be interpreted in relation to its complementary component, defined as the residual share of farms not included in the respective category. Taken together, each observed share and its complement define a two-part composition describing the relative distribution of farms across different degrees of participation in CAP Pillar I Direct Payments at the municipal level¹⁴.

¹¹The presence of bounded dependent variables limits the use of linear regression models. The main issues with linear models, such as the linear probability model, include predictions that may fall outside the admissible range, floor or ceiling effects with heteroskedasticity in the error terms, and the fact that the response to changes in predictors is not constant across the entire range of the dependent variable (Stock & Watson, 2020; Wooldridge, 2013).

¹²The framework was first introduced in the 1980s by Aitchison (1982), with its mathematical foundations further developed during the 1990s. Early applications were mainly in the field of geology, where this approach was used to analyse the composition of geological samples (e.g. rocks) in terms of the relative presence of different chemical elements (Morais et al., 2016).

¹³Formally, let S_i denote the observed share of interest, which alternatively represents: (i) the share of farms applying for CAP direct payments, or (ii) the share of farms displaying a higher degree of participation in CAP Pillar I. Although S_i is the variable observed and modelled in the empirical analysis, it can be interpreted as one component of a two-part composition, whose complementary part is given by $1 - S_i$. The underlying composition can therefore be expressed as $(S_i; 1 - S_i)$, where the two parts jointly describe the relative distribution between the group of interest and its complement. In particular, this interpretation is most straightforward when considering participation versus non-participation, or when the higher-intensity group is defined relative to the remaining farms (i.e. lower-intensity and non-participating units).

¹⁴The two dependent variables considered in the analysis correspond to different two-part compositions capturing distinct dimensions of participation. In the first case, the composition is defined by participating and non-participating farms. In the second case, it is defined by farms displaying a high degree of participation

Within this framework, given the nature of CoDA, standard statistical tools cannot be directly applied¹⁵ (see, Aitchison, 1982; Filzmoser et al., 2018; Morais et al., 2016). To address this issue, the literature proposes several transformation approaches, commonly referred to as log-ratio transformations (Filzmoser et al., 2018). In this sense, the *Additive Log-Ratio (ALR) transformation* is adopted (Aitchison, 1982). Intuitively, this approach expresses the component of interest relative to another component of the composition chosen as a reference by taking the logarithm of their ratio¹⁶. In other words, it compares the weight of the observed share with respect to a reference component of the composition. Formally, the transformation is defined as follows (Morais et al., 2016; Thomas-Agnan et al., 2021):

$$\text{alr}(\mathbf{S}) = \left(\log \frac{S_1}{S_D}, \dots, \log \frac{S_{D-1}}{S_D} \right) = \mathbf{y} = \left(y^{(1)}, \dots, y^{(D-1)} \right) \quad (5.1)$$

where $\mathbf{S} = (S_1, \dots, S_D)$ is a D -part composition, that is, a vector composed of D components S_i ($i = 1, \dots, D$) representing the parts of the composition. The component S_D is chosen as the reference component used as the denominator in the ALR transformation. The resulting transformed vector is $\mathbf{y} = (y^{(1)}, \dots, y^{(D-1)})$, which contains $D - 1$ log-ratio coordinates (Morais et al., 2016).

Although the ALR transformation is widely used, it may be sensitive to the choice of the reference component, since the resulting coordinates depend on which variable is selected as the denominator (Filzmoser et al., 2018; Thomas-Agnan et al., 2021). However, this issue does not arise in the present study due to the simplified structure of the data. In fact, the underlying composition consists of only two parts, namely the share of interest and its complementary component. As a result, the reference component is uniquely determined and no arbitrary choice of the denominator is required. Moreover, the ALR transformation yields a single coordinate¹⁷, corresponding to the logarithm of the ratio between the observed

versus all remaining farms. Although participation intensity could in principle be represented through multiple participation classes, the objective of the present study is not to model the complete distribution of participation intensity, but rather to explain the relative prevalence of highly participating farms. Accordingly, medium-intensity and non-participating farms are treated as the complementary component of the composition. This specification directly reflects the empirical question of interest.

¹⁵In fact, compositional data do not conform to the Euclidean vector space but rather to what is commonly defined as a simplex, where the components represent parts of a whole constrained to sum to a constant (Aitchison, 1982).

¹⁶In the Additive Log-Ratio (ALR) transformation, one component of the composition is selected as the reference and used as the denominator in the log-ratio. Alternative transformations exist within the log-ratio family. For instance, the centred log-ratio (CLR) transformation expresses each component relative to the geometric mean of all components of the composition (Filzmoser et al., 2018).

¹⁷For some dependent variables, zero values may occur. Since log-ratio transformations require strictly positive components, following Aitchison (1982) and Thomas-Agnan et al. (2021) zeros are replaced with the minimum positive value observed in the dataset before applying the ALR transformation.

share S_i and its complement $1 - S_i$ ¹⁸:

$$y = \log \left(\frac{S_i}{1 - S_i} \right) \quad (5.2)$$

Thus, in the case of a two-part composition, this transformation is equivalent to the logit transformation.

After accounting for the compositional nature of the dependent variable, the empirical analysis can be conducted within standard statistical tools. However, due to the transformation, the interpretation of the estimated coefficients is not immediate. For this reason, the results will be interpreted in terms of elasticities¹⁹, according to Morais et al. (2016).

5.5.2 Spatial dependence and econometric specification

Although the ALR transformation allows the dependent variable to be modelled within a conventional regression framework, the empirical analysis must also account for potential spatial dependence across municipalities. Agricultural systems and landownership structures often exhibit strong spatial patterns, as neighbouring territories tend to share similar environmental, institutional, and socio-economic characteristics, as also illustrated by the maps reported in Appendix A.8.7. Ignoring such spatial interactions may therefore lead to biased estimates.

To investigate this issue, we begin by estimating a baseline specification using ordinary least squares (OLS), which serves as a preliminary step to test for the presence of spatial autocorrelation in the residuals. For the sake of clarity, we present the results of a representative specification, where the dependent variable corresponds to the share of farms under Pillar I direct payments and the main explanatory variable is the share of small properties. The OLS estimation results are reported in Model (1) Table A.27 in Appendix A.8.8. At this stage, the coefficients are not interpreted, as the primary purpose of this estimation is to test for the presence of spatial dependence in the residuals. Spatial dependence is assessed through Moran's I statistic and the inspection of the spatial correlogram of the

¹⁸More generally, for a composition with D components the ALR transformation produces $D - 1$ coordinates. Since the composition considered in this study contains only two parts ($D = 2$), the transformation reduces to a single coordinate, which corresponds to the logarithm of the ratio between the observed share and its complement. In this specific case, the ALR transformation is equivalent to the logit transformation, capturing the relative relationship between participating farms and the remaining component.

¹⁹In the case of a two-part composition, the elasticity of the share component S_i with respect to a covariate X_k can be expressed as:

$$e_{S_i}^{X_k} = \beta_k (1 - S_i) X_k \quad (5.3)$$

where β_k denotes the estimated coefficient associated with the covariate X_k , and S_i represents the fitted value of the share component obtained through the inverse ALR transformation.

OLS residuals. The results of Moran's I test reported in Table 5.2 indicate significant positive spatial autocorrelation ($I = 0.228$, $p < 0.000$). This evidence is further supported by the correlogram displayed in Figure 5.3, which shows positive spatial correlation at short distances that gradually declines as the spatial lag increases. The same diagnostic tests are performed for all alternative specifications, and the results consistently indicate the presence of spatial autocorrelation in the residuals (see Appendix A.8.8).

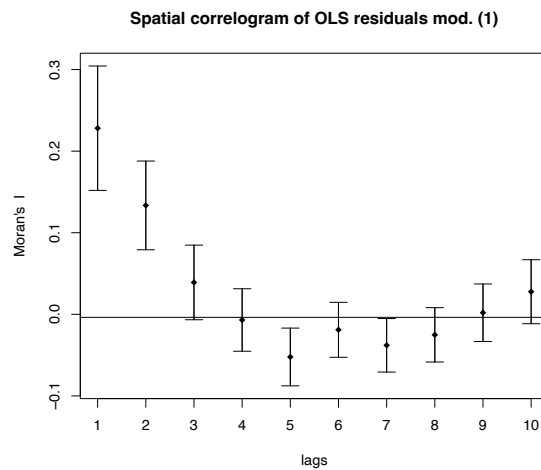
Table 5.2: **Moran's I test for spatial autocorrelation of OLS residuals**

	(1)
Moran's I statistic	0.228
Expected value	-0.0037
Variance	0.00145
Std. deviate (z)	6.083
p-value	0.000
Observations	271

Moran's I test computed on residuals from OLS model (1) in Table A.27.
Spatial weights matrix based on queen contiguity.

Source: Author's elaboration.

Figure 5.3: **Spatial correlogram of OLS residuals**



Source: Author's elaboration.

Given this systematic spatial dependence, the empirical analysis proceeds by estimating a Spatial Error Model (SEM) (Anselin, 2022), which allows spatial autocorrelation to be captured in the error term while preserving the structural specification of the model. The empirical model therefore takes the following form:

$$Y = \alpha + \beta X + \delta \text{reform} + \theta (X \times \text{reform}) + \Gamma Z + \varepsilon, \quad \varepsilon = \lambda W \varepsilon + u \quad (5.4)$$

where Y denotes the ALR-transformed dependent variable capturing participation in, or the intensity of participation in, CAP DPs Pillar I; X represents an indicator of landownership structure; reform is a dummy identifying municipalities subject to the 1950 land reform, readjusted according to the intensity index presented above; Z is a vector of control variables; W denotes the spatial weights matrix capturing the spatial structure of interactions among municipalities; λ is the spatial autoregressive parameter measuring the degree of spatial dependence in the error term; and u is an independently and identically distributed error term.

Given the lack of a well-established empirical framework on the determinants of participation in CAP Pillar I, the specification of the empirical models is guided by a *causal discovery approach*²⁰ (Zanga et al., 2022), rather than by conventional forward and backward variable selection methods, thereby reducing concerns related to data mining and ad hoc specification search. This procedure allows, through the use of specific algorithms, the identification of the underlying structure of relationships among the broad set of potential drivers, without imposing a fully specified a priori structure. Within this framework, the final model specification is the result of a more coherent and data-consistent refinement process, in which variables are selected based on their relevance within the emerging dependency structure. As a result, not all variables initially considered are included in the following baseline specifications, as some are found to play a more marginal role within the identified causal structure. However, these variables are not discarded entirely: they are reintroduced in a set of robustness checks to assess the stability of the main results. The consistency of the findings across these alternative specifications further supports the reliability of the baseline models, as defined through this approach. Further details on this procedure are provided in Appendix A.8.9.

5.6 Results

5.6.1 Participation in CAP Pillar I

Table 5.3 reports the Spatial Error Models estimate using the two alternative measures of landownership structure: the share of small properties and the Gini index. Both specifications estimate the relationship between different configurations of landownership structures and variation in participation in CAP Pillar I, measured as the municipal share of firms

²⁰<https://www.ccd.pitt.edu/>

receiving direct payments, while controlling for a set of relevant territorial and institutional characteristics.

Across both models, the coefficients associated with the indicators measuring landownership structure are highly statistically significant and display signs consistent with theoretical expectations. In particular, higher levels of land fragmentation are associated with lower participation in Pillar I, whereas greater land concentration is associated with higher participation. It is interesting to note that, although these two indicators are constructed using different approaches—capturing fragmentation in terms of the share of small properties and concentration in terms of the distribution of land capital across ownership units—they yield a consistent and complementary empirical pattern. In particular, the estimated effects point in opposite directions, appearing both consistent and mutually reinforcing, thereby suggesting that the two measures capture closely related underlying structural dynamics.

Table 5.3: **SEM estimates: farms participating under Pillar I**

Variables	(1)	(2)
Share of properties < 2 ha	-4.316*** (0.631)	
Gini index		1.733*** (0.473)
Land reform	0.600 (0.376)	5.579* (3.181)
Slope	-0.0455*** (0.0113)	-0.0364*** (0.0123)
Share of eligible UAA (2003)	0.099 (0.249)	-0.018 (0.261)
Share of rented UAA	0.886*** (0.264)	0.960*** (0.265)
Average farm size	0.0286*** (0.0053)	0.0291*** (0.0056)
Fragmentation × Reform	-0.454 (49.413)	
Gini × Reform		-7.925 (4.904)
Constant	-0.113 (0.286)	-1.240*** (0.331)
<i>Spatial error coefficient (λ)</i>	0.669*** (0.054)	0.762*** (0.044)
Observations	271	271
Log Likelihood	-251.302	-262.119
AIC	522.60	544.24
AIC (OLS)	613.35	671.34

Source: Author's elaboration.

Notes: Dependent variable: ALR-transformed municipal share of farms receiving Pillar I direct payments. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Given the ALR form of the dependent variable, the coefficients are interpreted using the elasticity discussed in Section 4.5. As the elasticity is computed for each municipality, the reported values correspond to the average elasticity estimated across the sample. The results therefore indicate that, holding other factors constant, a 1% increase in the share of small properties is associated with a reduction of about 0.27% in the number of farms participating in Pillar I DPs (Model (1) in Table 5.3). Conversely, a 1% increase in the Gini index is associated with an increase of approximately 0.34% in the same indicator (Model (2) in Table 5.3). Taken together, these results provide consistent evidence that more concentrated (or less fragmented) landownership structures are associated with higher (or lower) levels of participation in Pillar I direct payments.

The morphological context also appears to play a relevant role. In this specification, average slope at the municipal level is used, as it emerges as a relevant variable within the causal discovery framework. In particular, the coefficient associated with the average slope is negative and highly statistically significant in both specifications, indicating that municipalities characterised by steeper terrain tend to exhibit lower levels of participation in Pillar I Direct Payments. By contrast, institutional factors such as the share of eligible UAA defined in 2003 and the land reform display limited and not consistently statistically significant effects across specifications.

The share of rented UAA, as well as average farm size at the municipal level, are included in these specifications, as both emerge as directly linked to the share of farms participating in Pillar I direct payments in the discovery analysis (see Figure A.27 in Appendix A.8.9). This relationship, however, does not hold when considering the variable capturing the intensity of participation, as will be discussed below. In this regard, considering the share of rented UAA, the estimated coefficients are positive and highly statistically significant, indicating that municipalities characterised by a higher incidence of rented land tend to exhibit higher participation in terms of the number of farms. Similar conclusions apply to the coefficients associated with average farm size at the municipal level. In this case as well, the relationship is positive, suggesting that as average farm size increases, the number of farms participating in Pillar I direct payments also rises across municipalities.

Furthermore, the results reveal strong spatial dependence in the error term, as indicated by the large and highly statistically significant values of the spatial error coefficient λ . This provides clear support for the use of a SEM, suggesting that ignoring spatial dependence would lead to model misspecification. Consistently, the SEM provides a better fit to the data than the corresponding linear model, as indicated by the lower values of the Akaike Information Criterion (AIC) reported in Table 5.3.

5.6.2 *Intensity of Participation in CAP Pillar I*

In line with the previous findings, the organisation of landownership structures continues to emerge as a key factor in shaping not only participation, but also the intensity of participation in CAP Pillar I DPs, measured by the share of high-intensity CAP farms (see Table 5.4). The coefficients associated with the share of small properties and the Gini index remain highly statistically significant and display the expected signs. In particular, higher levels of land fragmentation (and, conversely, greater land concentration) are associated with lower (higher) intensity of participation, holding other factors constant. Even in this case, these results therefore confirm that the two indicators provide consistent and mutually reinforcing evidence on the role of landownership structures in shaping farms' participation intensity in CAP Pillar I Direct Payments.

In this case, the magnitude of the estimated effects is slightly larger compared to the previous specification. In particular, holding other factors constant, a 1% increase in land fragmentation is associated with a reduction of approximately 0.41% in the share of farms with high participation intensity. Conversely, a 1% increase in land concentration, as measured by the Gini index, is associated with an increase of about 1.04% in the same indicator. The larger magnitude of the estimated effects suggests that landownership structures play a more decisive role in shaping participation at higher levels of intensity. While the previous specifications in Models (1) and (2) capture an average effect across municipalities, reflecting overall participation patterns among farms, this specification focuses on high-intensity engagement, thereby capturing how landownership structures influence more intensive forms of participation. This pattern likely reflects the more selective nature of the dependent variable, where structural land constraints appear to be more binding and translate into larger proportional effects.

Also in these specifications, morphological characteristics—captured by average slope—remain negatively and significantly associated with participation intensity. Holding other factors constant, municipalities characterised by steeper terrain tend to exhibit lower levels of high-intensity participation. By contrast, historical and institutional variables—such as the share of UAA under the Basic Payment Scheme (BPS) and variables related to the land reform—do not display statistically significant effects.

Unlike in the previous models, when analysing the intensity of participation, variables related to the agricultural structure—namely average farm size and the share of rented UAA—do not appear to play a relevant role, at least according to the evidence emerging from the discovery analysis (see, for instance, Figure A.28 in Appendix A.8.9). For this reason, they are not included in the main specification but are instead used in subsequent robustness checks, as will be discussed below.

Table 5.4: **Spatial Error Model estimates: high-intensity CAP farms**

Variables	(5)	(6)
Share of properties < 2 ha	-4.905*** (0.691)	
Gini index		2.974*** (0.547)
Land reform	0.243 (0.486)	3.283 (4.253)
Slope	-0.0788*** (0.0125)	-0.0682*** (0.0137)
Share of eligible UAA (2003)	0.065 (0.287)	-0.061 (0.305)
Fragmentation $\times$ Reform	7.556 (65.193)	
Gini $\times$ Reform		-5.161 (6.546)
Constant	-1.109*** (0.298)	-2.758*** (0.354)
<i>Spatial error coefficient (λ)</i>	0.493*** (0.069)	0.589*** (0.062)
Observations	271	271
Log Likelihood	-316.280	-322.306
AIC	648.56	660.61
AIC (OLS)	680.45	707.62

Source: Author's elaboration.

Notes: Dependent variable: ALR-transformed municipal share of high-intensity CAP farms. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Across all the specifications, the use of the Spatial Error Model is consistently supported by the results. In particular, the estimates continue to reveal strong spatial dependence in the error term, as indicated by the large and highly statistically significant values of the spatial error coefficient λ . Consistently, the SEM continues to provide a better fit to the data than the corresponding linear model.

5.6.3 Robustness Checks

5.6.3.1 Spatial robustness

Given the strong spatial dependence detected in the data, additional spatial robustness checks are performed to further assess the validity of the results. In this respect, Moran's I

tests conducted on the residuals of the SEM specifications presented so far, as reported in Table 5.5, indicate that residual spatial autocorrelation is no longer statistically significant. This suggests that the spatial error specification adequately captures the spatial dependence structure in the data, thereby supporting the validity and reliability of the estimated coefficients.

Table 5.5: **Moran's I test for spatial autocorrelation of SEM residuals**

	(1)	(2)	(3)	(4)
Moran's I statistic	-0.0313	-0.0372	-0.036	-0.055
Expected value	-0.0037	-0.0037	-0.0037	-0.0037
Variance	0.00144	0.00143	0.00145	0.00145
Std. deviate (z)	-0.726	-0.885	-0.845	-1.341
p-value	0.766	0.812	0.801	0.910
Observations	271	271	271	271

Moran's I test computed on residuals from the SEM specifications.

Spatial weights matrix based on queen contiguity.

Source: Author's elaboration.

5.6.3.2 Causal robustness

In addition to the robustness checks on spatial dependence, further analyses are conducted to assess the robustness of the model specifications proposed in Tables 5.3 and 5.4 from a causal perspective. In particular, the causal discovery approach is used to guide the selection of covariates, identifying variables that are likely to exert a direct effect on the outcomes of interest, as well as suitable controls that are less likely to introduce bias through conditioning on colliders²¹. Within this framework, landownership structure emerges, as a key component, positioned relatively close to the outcome in the underlying causal structure. The model specifications presented are therefore grounded in this identification strategy, reflecting the assumption that landownership structure exerts a direct and central role in shaping the outcomes of interest.

To further support this identification strategy, additional model specifications are estimated by including variables that, according to the causal discovery analysis, may lie along alternative pathways or be more distant in the causal chain. The results, reported in Table A.29 and A.30 in Appendix A.8.10, show that the main coefficients of interest remain stable across these alternative specifications. This provides further support for the validity of the previous baseline specification and suggests that the estimated relationships are not driven

²¹A collider is a variable that is causally influenced by two (or more) other variables; conditioning on a collider can induce a spurious association between those variables, even if they are otherwise independent (Pearl, 2009).

by omitted mediating channels or unaccounted confounding factors, insofar as the set of explanatory variables captures the relevant determinants of the outcome.

In particular, with regard to participation dynamics measured as the share of farms under Pillar I Direct Payments, Table A.29 in Appendix A.8.10 shows that the inclusion of additional controls capturing structural characteristics of the agricultural sector—typically regarded as factors influencing participation in the broader literature on green policy participation—namely, the presence of multifunctional farms and farms undertaking investments, as well as alternative morphological specifications such as average elevation, does not materially alter the main results. In particular, across all specifications, the estimated effects of both land fragmentation (share of small properties) and land concentration (Gini index) remain stable in sign and statistical significance, thereby reinforcing the conclusions drawn from the baseline models.

A similar degree of stability is observed across the full set of coefficients in Models (1) and (2) in Table 5.3 (see model (1) and (5) in Table A.29), including those associated with morphological and agricultural structural characteristics. In particular, the negative and statistically significant effect of average slope remains consistent, as does the positive and statistically significant effect of average farm size and the share of rented UAA, further supporting the role of both morphological conditions and selected structural features of the agricultural sector in shaping participation patterns.

A comparable pattern emerges when considering robustness checks for models involving participation intensity. The main results, also in this case, remain stable across alternative specifications (see Table A.30 in Appendix A.8.10). In particular, the inclusion of additional controls capturing structural characteristics of the agricultural sector—such as average farm size and the share of rented UAA—as well as territorial characteristics, such as mean elevation, does not materially alter the estimated effects of the main variables of interest.

5.7 Discussion of the Empirical Results

The empirical findings provide consistent support for the central hypotheses formulated in this paper: landownership structures are not a neutral background condition in shaping local dynamics of participation in CAP Pillar I DPs, but instead represent a relevant structural dimension. Specifically, in line with the main research question guiding this study, the results show that municipalities characterised by more fragmented landed property structures tend to display systematically lower levels of participation in CAP Pillar I Direct Payments, while more concentrated structures are associated with higher participation and greater participation intensity.

In this respect, the negative relationship between land fragmentation and participation is consistent with the hypothesis that fragmented ownership structures are more frequently associated with micro, spatially dispersed, and organisationally less efficient agricultural production units. In such contexts, this may condition the feasibility of complying with the specific land-use requirements embedded in CAP Pillar I Direct Payments—both in terms of adopting economically viable practices and of covering the associated production and transaction costs. Fragmented and spatially dispersed land structures may constrain the adoption of coordinated cropping strategies, limit the effective implementation of diversification requirements, and reduce overall production efficiency, while increasing organisational complexity and costs, and ultimately limiting access to CAP Pillar I schemes. Conversely, municipalities characterised by more concentrated or less fragmented landownership structures may be more likely to host farms operating on more coherent land bases, which in turn may support more economically viable production organisations. In such contexts, farms may be better positioned to implement profitable production processes and to adopt the agricultural practices embedded in CAP Pillar I Direct Payments, thereby facilitating both access to Direct Payments and the management of the associated administrative requirements and costs.

At the same time, when looking at the intensity of participation, the stronger effects estimated for farms with higher levels of engagement are particularly informative. They suggest that the role of landownership structures may differ across farms and may be more relevant among those more intensively involved in CAP Pillar I. This is consistent with the idea that, as the degree of reliance on the policy increases, a more coherent organisation of landholdings may become a more important factor shaping farms' ability to comply with its requirements. This may reflect the fact that farms more intensively involved in CAP Pillar I are already more structured and organised around policy requirements, which, as seen, require coordinated and spatially coherent production practices across land plots and entail higher organisational costs. In such contexts, the physical organisation of land capital, thus their productive plots, may thus become a more binding constraint, so that variations in landownership structures translate into larger differences in participation intensity outcomes.

These findings therefore suggest that, alongside the emphasis placed in much of the existing literature on farm-level structural characteristics in shaping participation in agri-environmental or “green” measures, landownership structures may capture an additional and relevant dimension of variation in such dynamics.

Furthermore, from this perspective, it is interesting to observe that while agricultural structural characteristics—namely average farm size and the share of rented UAA—are positively and significantly associated with participation when measured as the share of

farms under Pillar I DPs (see Table 5.3), their effects lose statistical significance when the analysis focuses on participation intensity, as shown in Table A.29 in Appendix A.8.10. This pattern indicates that these variables primarily operate along the extensive margin, facilitating farms' entry into the policy framework. In particular, larger average farm size—and, similarly, a higher share of rented UAA—are associated with a greater number of participating farms at the municipal level. By contrast, when focusing on participation intensity—i.e. on farms committing a large share of their utilised agricultural area to Pillar I schemes—the role of farm-level structural variables becomes less relevant. In this case, the analysis captures differences in the degree of engagement among participating farms, independently of their size. In this respect, the results indicate that, unlike broader agricultural structural characteristics, landownership structures retain their explanatory relevance. What seems to matter, therefore, is not the scale of land operated per se, but how this land capital is physically organised. Underlying this pattern, although the adopted land capital indicators do not directly capture the physical dispersion of land, both the fragmentation index and the distribution of landownership among owners (as measured by the Gini index) may nonetheless proxy some aspects of this spatial configuration at the municipal level. In particular, areas characterised by higher levels of fragmentation are more likely to be associated with a greater spatial dispersion of plots, compared to contexts where land is more concentrated among a limited number of landowners. From this perspective, participation intensity may be more strongly influenced by the physical organisation of land capital. Higher fragmentation—and thus more dispersed landholdings—may reduce the level of engagement, limiting the extent to which farms allocate their entire utilised agricultural area to CAP schemes, regardless of their size. This interpretation is also consistent with the previous findings, which show that the effect of landownership structures is more pronounced when considering participation intensity rather than participation itself (i.e. the number of participating farms).

Moreover, morphological characteristics—most notably slope—also emerge as relevant factors. This variable displays a consistent and significant relationship with participation outcomes across different model specifications, thus confirming the intuitions from the initial discovery analysis. Moreover, its role appears to be at least partly independent from the dynamics of landownership structures. This is particularly noteworthy given that descriptive evidence suggests a degree of overlap between morphological conditions (e.g. mountainous municipalities in the Tuscan Apennines), more fragmented landownership patterns, and lower levels of participation in CAP Pillar I. However, although these features tend to co-occur within the same spatial contexts, the empirical results suggest that they represent distinct explanatory channels with respect to participation in CAP Pillar I. In other words,

once both dimensions are jointly considered, morphological constraints and landownership structures each retain an independent association with participation outcomes.

Overall, the results not only indicate that the physical organisation of landholdings represents one of the key structural conditions shaping both the feasibility and the intensity of participation in CAP Pillar I Direct Payments, but also allow for a more structured—albeit exploratory—interpretation of the mechanisms underlying these participation patterns. The main findings emerge consistently across all dependent variables considered and remain stable across alternative model specifications. This suggests that the observed patterns are not driven by a specific measurement choice, but rather reflect a more general and robust relationship between the variables considered and farms' engagement with CAP Pillar I Direct Payments.

Taken together, these results point to the organisation of land capital at the local level as a key structural mechanism underlying both the likelihood and the intensity of participation in Pillar I schemes. In this sense, landownership structures appear to represent a major determinant of participation patterns. At the same time, morphological characteristics and broader features of the agricultural sector play also a relevant role, depending on the specific dimension of participation considered.

5.8 Conclusions

This paper set out to address a largely unexplored question within the scientific literature: whether and how different local configurations of landownership structures shape participation in CAP Pillar I Direct Payments. More specifically, previous studies have paid limited attention to the role of the physical organisation of landed property in influencing participation in more general green agricultural policy mechanisms. This gap is even more pronounced in the case of CAP Pillar I, where empirical research has so far devoted only limited attention to participation mechanisms themselves, and a coherent framework of the factors shaping participation is still lacking. Against this background, this paper provides a first and necessarily exploratory contribution by examining whether the organisation of distinct landownership structures is associated with different levels and intensities of participation in CAP Pillar I across Tuscan municipalities.

The empirical results offer consistent support for the main hypothesis advanced in the paper. Municipalities characterised by more fragmented landownership structures tend to display lower levels of participation in CAP Pillar I Direct Payments, whereas more concentrated structures are associated with higher participation and greater participation intensity. This pattern emerges consistently and remains stable across alternative model

specifications. Notably, this consistency is further reinforced by the fact that the two main indicators of landownership structure—capturing fragmentation and concentration through distinct measurement approaches—yield coherent and complementary results. Although not directly interchangeable, their estimated effects point in opposite directions and appear mutually reinforcing, suggesting that they capture closely related underlying structural dynamics.

The findings also suggest that the role of landownership structures becomes even more relevant when participation is observed among farms at higher levels of intensity Pillar I participation, pointing to the possibility that the organisation of landholdings becomes increasingly binding when these farms are more deeply engaged in policy-related production requirements. At the same time, the analysis highlights the relevance of other structural and contextual factors. In particular, morphological characteristics—most notably slope—consistently emerge as significant and negatively associated with participation outcomes. By contrast, average farm size and the share of rented utilised agricultural area are positively associated with participation at the extensive margin, i.e. in terms of the number of participating farms. Taken together, the results indicate that the physical organisation of land capital is not a neutral background condition, but a key structural factor that helps explain why participation in sustainability-oriented policy schemes under CAP Pillar I differs across rural contexts, in interaction with broader territorial conditions. In this sense, the paper contributes both by filling a specific empirical gap and by offering a first, exploratory reconstruction of some of the mechanisms through which landownership structures—and related contextual factors—may shape governance outcomes, in terms of CAP Pillar I.

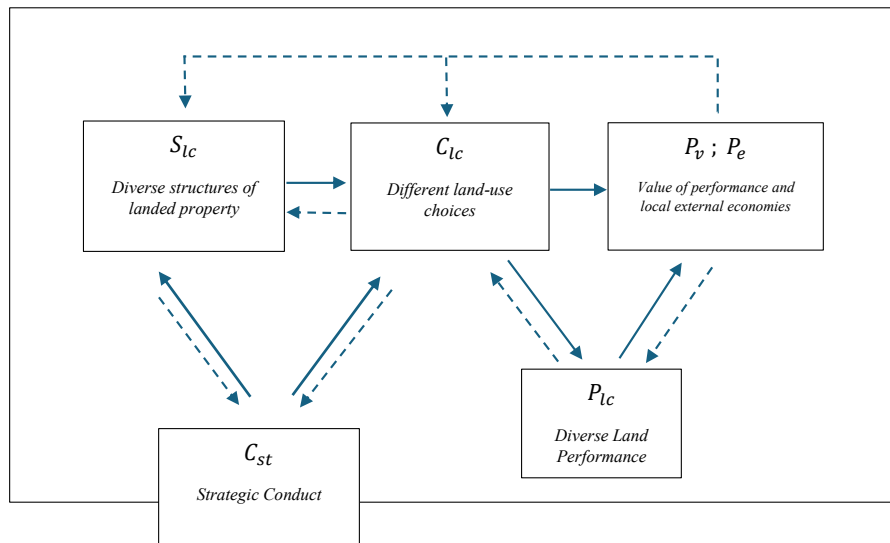
These findings carry relevant policy implications. If participation in CAP Pillar I is partly conditioned by distinct local organisations of landed property, then formally uniform sustainability-oriented measures, that do not account for that, may produce territorially differentiated outcomes. In particular, policy effectiveness may be weaker precisely in those rural contexts where fragmented land structures and morphological constraints are already associated with conditions of economic and social fragility. Under these circumstances, a uniform policy design risks reproducing—or even reinforcing—pre-existing territorial asymmetries, as support is more readily absorbed by contexts characterised by more favourable structural conditions (i.e. dynamic areas characterised by more concentrated landownership structures), while remaining more difficult to access and operationalise in structurally constrained areas—dynamics already highlighted in the literature, both with respect to agricultural policy interventions (see, e.g., Sotte, 2017) and, more broadly, to other European policy interventions (see, e.g., Carrieri et al., 2024; Ferrara et al., 2026).

From this perspective, the results point to the importance of complementing broad CAP instruments with more place-sensitive measures capable of accounting for the structural heterogeneity of land tenure systems. This could imply, for example, greater attention to territorial differences in the design of local coordination tools aimed at reducing the structural disadvantages faced by farms operating in more fragmented, constrained and fragile contexts. In this respect, policy or complementary initiatives should support the development of mechanisms facilitating the temporary or stable aggregation of dispersed plots, reducing the administrative and contractual burdens associated with highly fragmented ownership structures, and strengthening intermediary arrangements capable of easing access to land for active farmers. This may call for complementary initiatives to CAP agricultural measures that, in such fragile contexts, go beyond standard market-based instruments and instead rely on collective and community-based arrangements better suited to these structural conditions (see Stefani, Bellandi, et al., 2025). In particular, greater support could be devoted to initiatives aimed at coordinating multiple landowners and promoting forms of joint land management, thereby facilitating a more coherent and less costly operational reorganisation of landholdings over time. A relevant example in this respect is represented by landowners' associations (e.g. *associazioni fondiarie*, Regional Law of Piedmont l.r. 31/2018 and Pastorelli (2016)), which can help overcome coordination and access barriers in highly fragmented contexts. However, many of the more flexible and *place-based* instruments potentially suited to addressing these structural constraints have traditionally fallen within CAP Pillar II, to which substantially fewer resources are allocated than to Pillar I. Therefore, if such interventions are primarily pursued within this framework, their effectiveness would depend not only on greater flexibility in their design, but also on ensuring adequate and sustained financial support. From this perspective, European-level intervention could therefore play an important enabling role if it succeeded in providing both a flexible general policy framework for land mobilisation, plot aggregation, and coordinated land management—including through collective and community-based mechanisms—which is still largely lacking, and adequate financial support. This could stimulate the development of such mechanisms while leaving room for their adaptation to regional and local contexts.

These findings also have implications for the broader conceptual framework developed in Part II of the thesis, introduced in the first part of this work and reproduced in simplified form in Figure 5.4. In particular, the analysis provides empirical support for the relationship between the structural organisation of land capital (S_{lc} in Figure 5.4) and territorial governance actions (C_{st} in Figure 5.4). More specifically, the findings suggest that, in the case of governance interventions targeting farmland use, different configurations of landownership

structures condition their effectiveness, resulting in heterogeneous patterns of participation in such measures across territories. In turn, these differentiated governance outcomes may contribute to shaping distinct local development performance outcomes ($P_{v,e,lc}$ in Figure 5.4) and, consequently, different rural development trajectories over time.

Figure 5.4: **The land tenure loop with elements of governance**



Source: Author's elaboration. *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. Direct and reverse arrows linking strategic conduct to performance elements are conceptually embedded in the framework but have been omitted from the figure for clarity, as they are not required for the analytical purposes of the present analysis.

Beyond supporting this relationship, the empirical evidence also helps qualify it by providing insights into how it operates in practice. Rather than acting upon a homogeneous territorial substrate, governance interventions targeting farmland use interact with heterogeneous *place-based* structural conditions. In the Tuscan case, the findings suggest that different landownership configurations are associated with systematically different participation outcomes under common CAP Pillar I measures, thereby influencing the extent to which these interventions translate into changes in land-use practices. In particular, more fragmented landownership structures appear to represent more binding constraints to the implementation of sustainability-oriented land-use policies than less fragmented ones.

These findings confirm the role attributed in the conceptual framework to landownership structures in shaping the effectiveness of territorial governance in addressing local development dynamics. Such effectiveness depends on the structural coherence of governance interventions with locally embedded land-capital configurations and other *place-based* conditions. Policy instruments should therefore be tailored to the specific constraints

and opportunities characterising each territory rather than uniformly applied across heterogeneous contexts. Governance approaches combining common policy objectives with complementary measures adapted to different landownership structures may facilitate not only higher participation but also the broader diffusion of sustainable farming practices. In turn, this may strengthen their contribution to sustainable local development performance and, ultimately, support the emergence of more virtuous rural development trajectories over time. As anticipated by the conceptual framework, this consideration may be especially relevant in structurally disadvantaged and peripheral rural contexts—referred to as the *periphery tout court* in Chapter 3—where fragmented landownership patterns may be more prevalent.

At the same time, the analysis presents some important limitations. First, while the causal discovery approach has helped to refine the empirical specification and to organise a broader set of potential mechanisms beyond policy participation, the interpretation proposed here remains necessarily exploratory in nature. Second, although the use of historical data on landownership structures is both theoretically and empirically justified by their persistence over time, the lack of contemporary and comprehensive data on landed property covering the entire Tuscany region remains a constraint. Third, the analysis focuses mainly on the physical organisation of landholdings, while other dimensions of landed property structures may also matter. Fourth, the analysis is conducted at the municipality level, which may mask within-municipality heterogeneity in both landownership structures and farms' participation behaviours. As a result, the estimated relationships should be interpreted as capturing average local patterns rather than farm-level dynamics.

In this direction, future research projects could extend the present contribution along at least three directions. First, it could further refine the broader framework of mechanisms underlying participation in CAP Pillar I, building on the exploratory evidence provided here. Second, it could consider additional indicators of landownership structure beyond fragmentation and concentration, in order to assess whether other dimensions—such as the number of landowners, co-ownership patterns, spatial dispersion of plots, or other property rights features—also shape participation dynamics. Combining these two lines of research, and drawing on richer and more detailed data, would make it possible to investigate more thoroughly the multiple dimensions underlying different participation dynamics. For instance, it would allow for a more fine-grained, micro-level analysis of the interplay between farm-level characteristics and landownership structures, thereby improving our understanding of how these elements jointly shape diverse participation outcomes. Third, the analysis could be extended towards more integrated econometric frameworks capable of jointly accounting for governance outcomes, including land-use practices, since both

participation in the CAP and the organisation of land capital ultimately interact with the way land capital is used and managed at the local level. Advancing along these lines would not only improve our understanding of the determinants of participation in CAP Pillar I DPs, but also help clarify more broadly how land tenure systems condition the effectiveness of sustainability-oriented rural development policies through their influence on land-use practices.

Part IV

Implications and Concluding Remarks

Chapter 6

Conclusions

6.1 Main Findings and Contributions

The dissertation developed from the recognition that land—more precisely conceptualised and extended through the broader notion of *land capital*—represents a potentially crucial yet still insufficiently explored factor in shaping local development dynamics. In this sense, the thesis seeks to contribute to a more structured understanding of the role of land capital within local development processes, with a particular focus on rural contexts. To address this issue, the thesis articulates its contribution through a sequence of interconnected analytical steps, each developed in a specific chapter.

The first step of the analysis, developed in Chapter 1, builds on the observation that while land occupied a prominent place in classical economic thought, its role in contemporary economic analysis has received far more limited attention. This relative neglect has also contributed to a limited understanding of what land represents in the current economic debate, namely a factor whose contemporary form has been progressively shaped through continuous interactions with broader socio-economic development processes.

In response to this limitation, the thesis contributes to reflecting on the following question: *What is the most appropriate concept of land for the current economic debate?*

In doing so, it advances a clearer conceptualisation of land within the current economic literature. The analysis suggests that the traditional notion of land as a purely natural agent may no longer be sufficient to capture its contemporary characteristics and functions within socioeconomic dynamics. Rather, land emerges as a more complex and dynamic factor, whose properties are shaped not only by its original and inherent attributes, but also by the accumulation of more permanent forms of capital embodied in lasting improvements and investments. On this basis, the dissertation—also engaging with the analytical framework of agricultural economics—articulates the concept of *land capital* (Serpieri, 1940), which extends the classical notion of land by explicitly incorporating these dimensions (Chapter 1). This conceptualisation offers a more suitable analytical framework for understanding how land operates within contemporary development processes. In doing so, it contributes to synthesising the current configuration of the elements under analysis, while also supporting the broader effort to strengthen economic theory, whose explanatory power ultimately rests on its ability to account for the diversity of real-world situations.

Building on this conceptualisation, the second step of the thesis focuses on demonstrating the role of land capital within local development dynamics, with a specific focus on the rural context (Chapter 2). This constitutes the first main scientific contribution of the dissertation.

While existing evidence—mainly at the macroeconomic level—suggests that land capital may play a relevant role in shaping socio-economic and institutional dynamics at the local

level as well, the local development literature provides only limited and indirect insights into these relationships. Against this background, Chapter 2 contributes by incorporating land capital into the analytical framework of rural local development. This step makes it possible to disentangle the key components of land capital and to understand how their interaction shapes local development dynamics.

The results highlight that three main land-related elements actively interact with rural development dynamics: landownership structures, land uses, and land rents. These elements are not independent, but interconnected, jointly defining distinct land tenure organisations. Such systems, in turn, intertwine with local socio-economic and governance spheres, shaping differentiated processes of value creation, capture, and distribution. More precisely, starting from different landownership structures—ranging from more fragmented to more concentrated configurations—diverse patterns of land use emerge, spanning, in the case of agro-forestry vocations, from specialised to more diversified uses, as well as to land abandonment. These patterns give rise to differentiated processes of value creation, supporting distinct economic activities and productive processes, through which land capital assumes a clear economic function.

Beyond this, variations in the combination of land uses and structures enable different forms of value extraction and distribution, with distinct repercussions for rural local development. Such value may take the form of both productive income and rental phenomena. In this sense, land capital intersects various local channels of wealth and savings accumulation and entrepreneurial opportunities, promoting processes of local innovation and renewal—particularly where rental gains are temporary and reinvested—but also generating dynamics of economic stagnation, rising inequalities, and the concentration of power, especially where rents assume more permanent and rent-seeking forms. From this perspective, land capital also reveals its social and cultural function. Different land tenure systems, by shaping distinct processes of value creation, capture, and distribution, contribute to underpinning specific social classes and cultural organisations. Different local declinations in land elements thus act as defining drivers of distinct local life, as *dominant forces* (Bertolino, 1927), shaping the socio-cultural characteristics of each place in a different way.

Overall, these findings demonstrate that land capital plays a key role in rural local dynamics and, when meaningfully enhanced within local contexts, contributes to the direction and form of rural *place-based* development, effectively becoming territory—that is, an integral component of the local territorial heritage — or *territorial capital* (Camagni, 2008) — shaping the development trajectories of places.

Building on the insights of Chapter 2, Chapter 3 takes a further step in advancing the understanding of the role of land capital in rural local development dynamics. In this

regard, the analysis shows how the various local expressions of *land-tenure organisations*, intertwine with the different components of well-defined rural models and shape distinct development pathways—an issue that has so far received very limited attention in the scientific literature.

The findings show that local development pathways also critically depend on the degree of coherence between land-tenure organisation and other local structural *place-based* elements. Virtuous and sustainable development trajectories emerge where landownership structures and land uses are aligned with local productive, social, and institutional configurations and vocations of rural places, and where land-related incomes and rents are reinvested within the local system over time. In particular, these trajectories are more likely to arise in contexts characterised by balanced landownership structures—neither excessively concentrated nor highly fragmented—which enable a more equitable distribution of and access to land capital across local actors. Conversely, structural imbalance, tend to reinforce inequalities on the one hand and limit entrepreneurial opportunities on the other, while also producing lock-in effects that hinder the capacity of local systems to adapt and reorient their development paths. In this respect, the analysis also highlights how specific land-tenure configurations may constrain the effectiveness of territorial governance. Both highly concentrated and excessively fragmented land structures indeed limit the scope for coordinated actions, either through the influence of rent-based power coalitions or through the inability to mobilise collective initiatives among local actors, including a large number of landowners.

In doing so, Chapter 3 extends the analytical framework of local development by defining and incorporating *land-tenure organisation* among the structural elements of *place-based* development, and by developing a conceptual framework—the *land-tenure loop*—to interpret how the land-related elements interact with one another and with other dimensions of local development, thereby shaping differentiated development trajectories across distinct rural contexts over time. The loop thus provides an analytical lens through which to understand how land capital, organised through different ownership structures, shapes distinct land uses at the local level and, in turn, generates diverse income streams, including both earned returns and unearned income in the form of land rents. At the same time, it also enables the interpretation of how these elements interact with other key *place-based* socio-economic, political, and institutional dimensions, which, in turn, underpin differentiated performance across distinct rural local development pathways. Importantly, these relationships are not unidirectional; the loop also enables the identification and interpretation of feedback mechanisms involving land-related elements, and of their further implications for local development dynamics. Within this perspective, land capital can no longer be

conceived as a passive container of local development. Rather, the analysis developed thus far lays the conceptual foundations for a systematic and in-depth understanding of the active role played by land-related dynamics in shaping—and being continuously reshaped by—local development processes—an issue that has so far been largely overlooked in the scientific literature. This marks the conclusion of the first theoretical part of the work.

The conceptual framework then provides the basis for an in-depth empirical investigation of some of the relationships identified at the theoretical level. In this respect, the second part of the thesis assesses and tests these theoretical insights. More specifically, the empirical analyses focus on the interaction between specific land-related elements and governance mechanisms, and on how this interaction may affect rural local development dynamics. Both analyses are conducted across the Tuscany region (Italy), providing a comprehensive and territorially consistent empirical setting. The region indeed represents a relevant case study, as most of its territory is classified as rural, with nearly all municipalities characterised by different degrees of rurality (Regione Toscana, [2024b](#)).

In particular, Chapter 4 examines the local economic, environmental, and land-use effects associated with the implementation of policy measures targeting the use of land capital, with a specific focus on the Crop Diversification (CD) requirement introduced under the Direct Payment Pillar I of Common Agricultural Policy in 2013.

From this perspective, the contribution of the analysis is manifold. Firstly, the study advances the existing literature by improving both the data and the methodological framework. It exploits an innovative highly granular, georeferenced, parcel-level administrative dataset and, by combining it with a causal identification strategy, provides the first ex-post causal assessment based on data of this level of detail. Its extensive coverage ensures representativeness and enables more robust causal insights, thereby addressing key limitations of previous studies relying on aggregated data sources. Building on this data infrastructure, the study also implements a causal identification strategy based on a fuzzy Regression Discontinuity Design (RDD), which proves particularly relevant, at least in the Italian context under analysis, as it enables, for the first time, an in-depth analysis of the gap between eligibility and actual participation in the policy measure. The findings show that the CD requirement improved sustainable land-use practices and environmental performance, particularly among medium-small farms in Tuscany (2022), while effects remain weaker or negligible for larger holdings.

Beyond this, the study also contributes by overcoming persistent data constraints in the evaluation of the environmental effects of the CD measure through the development of an innovative set of indicators capturing changes in crop rotation practices over time. This approach reflects a novel and creative use of highly detailed data, combining two

existing analytical frameworks (Stein & Steinmann, 2018; Upcott et al., 2023), to fully exploit their informational potential. This allows for a more comprehensive assessment of the environmental impact of the policy measure, while also enabling a more in-depth investigation of the relationship between crop diversification and crop rotation practices at the local level—an issue that remains largely under-explored in the literature. In this respect, further heterogeneity emerges: while the diversification measure appears to encourage the adoption of crop-rotation patterns, the evidence reveals substantial variability across farms.

Beyond these empirical contributions, the analysis also provides relevant insights with respect to the conceptual framework developed in the first part of the thesis, particularly concerning the role of governance mechanisms in shaping land-use practices and, more broadly, rural local development dynamics. In this respect, the findings confirm the proposed relationship by showing that governance actions targeting land use can effectively influence farming practices. More generally, they suggest that changes in land-use practices may, in turn, affect different dimensions of local development with varying intensity, thereby contributing to diverse rural development trajectories. In the present case, these changes primarily translate into improvements in the environmental dimension of local development, as the policy intervention successfully promotes more sustainable land-use practices among small- and medium-sized farms, thereby supporting broader transformation processes, including the green transition of the rural areas in which they operate. At the same time, the analysis further qualifies the conceptual relationship by showing that the effectiveness of governance interventions depends not only on their design but also on their alignment with the structural characteristics of the contexts in which they operate. In the case of the largely uniform and *place-blind* crop diversification measure, the empirical findings reveal heterogeneous effects across the two policy thresholds: more pronounced environmental and land-use improvements emerge among small- and medium-sized farms around the 10-hectare threshold, whereas more limited or negligible effects are observed around the 30-hectare threshold. Although these findings should be interpreted in light of the methodological limitations discussed above, they nevertheless support the argument developed in the conceptual framework that governance interventions are unlikely to generate comparable outcomes across territories unless they are complemented by *place-based* mechanisms capable of accounting for local structural conditions. While the empirical application focuses on agriculture, the underlying mechanisms identified in the conceptual framework are likely to have broader validity, potentially extending to other sectors and influencing distinct land-use practices, behaviours, and ultimately local development trajectories across a wider range of actors and territorial contexts.

After that, Chapter 5 shifts the analytical focus from the effects of governance mech-

anisms to the structural factors shaping their implementation. In particular, the analysis examines how structural characteristics of local contexts—namely landownership structures—influence the implementation of specific policy schemes by affecting patterns of policy uptake. In doing so, the chapter moves beyond the analysis of the effects of a specific land-use measure to examine the broader patterns of participation in CAP Pillar I Direct Payments.

In this respect, the analysis of farms' participation in CAP Pillar I Direct Payments (2022) is conducted through an original municipal-level dataset constructed for this study for the Tuscany region (Italy). The originality of the research—both in examining the mechanisms underlying participation in Pillar I and, more importantly, in investigating the role of landownership structures in shaping these dynamics—requires a substantial effort in the design and construction of the dataset. The construction of this dataset involves extensive data processing and integration efforts, combining multiple administrative and historical sources and ensuring their harmonisation at the municipal level. In doing so, various techniques are employed, including GIS-based analyses and the digitalisation of historical statistics. These data are then used within an appropriate econometric framework, complemented by causal discovery approaches. Importantly, this process is also supported by a dedicated research effort aimed at conceptualising and operationalising landownership structures for empirical analysis. This involves identifying relevant dimensions and features—particularly those related to their physical organisation—and identifying appropriate indicators, alongside the collection and integration of original data. In this respect, the study provides a significant methodological contribution, offering a systematic approach to the empirical analysis of land-related elements, and in particular landownership structures, within the investigation of local development dynamics (see also [Appendix A.8](#)).

Taken together, this approach allows the analysis to uncover clear and systematic patterns at the local level in relation to the main research question guiding [Chapter 5](#). Municipalities characterised by more fragmented landownership structures tend to display lower levels of participation, whereas more concentrated structures are associated with higher participation rates and greater participation intensity. The analysis also highlights the role of other contextual factors, particularly morphological characteristics such as slope, which are consistently negatively associated with participation outcomes. By contrast, structural characteristics of the agricultural sector—such as average farm size and the share of rented utilised agricultural area (UAA)—are positively associated with participation, although their influence appears to be primarily limited to participation levels rather than participation intensity.

These findings contribute to filling an important empirical gap in the literature and provide an initial reconstruction of the mechanisms through which landownership structures

and related contextual conditions shape both the patterns and the intensity of participation in CAP Pillar I Direct Payments, thereby influencing the functioning and effectiveness of governance actions at the local level. More broadly, the results also have important implications for the conceptual framework developed in the thesis. In particular, the findings are consistent with the idea that the structural organisation of land capital shapes the effectiveness of territorial governance actions, also through indirect mechanisms, by influencing patterns of participation in the implementation of policy measures. This, in turn, affects broader local development dynamics, as differential levels of participation condition access to policy-related benefits and support mechanisms, which potentially contribute to improving local socio-economic and environmental performance. In this respect, uneven patterns of participation may reinforce differentiated development trajectories across territories, where policy effectiveness tends to be weaker in structurally constrained contexts—such as those characterised by fragmented land structures and adverse morphological conditions, including the peripheral rural areas discussed in Chapter 3—thereby contributing to the persistence or reinforcement of existing territorial inequalities.

Against this background, the dissertation broadly contributes to strengthening the understanding that rural local contexts are characterised by heterogeneous local land tenure conditions, which play a crucial role in shaping local development dynamics. In this respect, the thesis expands the set of *place-based* dimensions to be considered, by explicitly introducing and systematically defining the *land-tenure organisation* of rural local contexts. At the same time, it provides a comprehensive conceptual framework—the *land tenure loop*—that clarifies and systematises the interactions between the different dimensions of land capital and their interplay with rural local development dynamics. In support of this framework, the empirical analysis further reinforces these insights by confirming and providing additional evidence on the role of land-related structural conditions in shaping governance mechanisms and local development outcomes within rural contexts.

6.2 Limitations and emerging avenues for further research

The work presented is nonetheless subject to a number of limitations that should be taken into consideration. In particular, each contribution has highlighted specific constraints, which are briefly summarised below.

Chapter 2, which introduces the concept of land capital within rural development dynamics, draws primarily on evidence from rural contexts. This may limit its direct applicability to other local settings—such as manufacturing or urban contexts—where different socio-economic and environmental mechanisms are likely to be at play. In addition, the

conceptualisation of landholding structures is partly shaped by the specific institutional and legal frameworks of Italy and the European Union. Although the analysis acknowledges differences with other land tenure systems, a significant degree of heterogeneity across countries remains, potentially affecting the broader generalisability of the framework.

Furthermore, while the framework developed in Chapter 2 provides a detailed representation of land-related components and their local articulation, its static nature does not fully capture their dynamic interactions over time and in relation to other context-specific local elements. This limitation is addressed in Chapter 3, which extends the analysis by incorporating the role of land-tenure organisation within diverse rural development pathways and by introducing a more dynamic perspective. However, Chapter 3, while aiming to encompass a wide range of socio-economic, environmental, and land-related configurations, may not fully capture all rural local specificities and, as a primarily theoretical contribution, requires empirical validation. This latter is addressed in the second part of the thesis, where Chapters 4 and 5 provide two empirical analyses based on quantitative methodologies, both conducted within the regional context of Tuscany (Italy).

These, in turn, present additional and more specific limitations, related to the particular relationships investigated, as well as to the data and methods employed. In particular, with reference to Chapter 4, the empirical analysis is subject to a set of constraints mainly associated with the local nature of the RDD estimates, which are identified around the policy thresholds and therefore cannot be directly generalised to observations far from these cut-offs, as well as with the inability to directly assess environmental performance and the challenges inherent in the empirical strategy adopted to disentangle the relationship between land-use practices—namely crop diversification and crop rotation—in a causal framework.

On the other hand, Chapter 5 is subject to further limitations, particularly related to the availability of more detailed data and a broader set of land-related variables, which could allow for a more comprehensive analysis. These limitations could be addressed through the adoption of more complex econometric frameworks capable of jointly accounting for a wider range of elements within the conceptual framework, including, for instance, land-use dynamics.

Taken together, these considerations allow for the identification of a further set of more general limitations underlying the overall research design. A first key aspect concerns issues of external validity, that is, the extent to which the findings can be generalised beyond the specific contexts analysed, affecting both the conceptual and empirical components of the thesis. From a conceptual perspective, although the framework is grounded in the broader literature on local development, the insights derived are more appropriately confined to rural contexts. Given the relevance of the findings, this calls for further research to investigate

whether and to what extent similar mechanisms may operate in other settings, such as urban or industrial contexts, where different socio-economic and environmental dynamics are likely to prevail.

From an empirical perspective, the analyses presented in Chapters 4 and 5 focus on the regional case of Tuscany (Italy). Although Tuscany has distinctive institutional and historical characteristics, it also encompasses a high degree of internal heterogeneity in both agricultural systems and landownership structures, as extensively discussed in Chapter 5, particularly with reference to the regional patterns identified by Giorgetti (1977). In particular, the coexistence of markedly different land-tenure configurations across the region provides a rich empirical setting for analysing how supranational governance mechanisms interact with diverse territorial conditions. Nevertheless, caution is required when extending these findings beyond the specific regional context considered. The results are more likely to be transferable to rural regions sharing similar institutional and structural characteristics, whereas their applicability to substantially different territorial settings should be assessed through further comparative research. Future studies could therefore extend the analysis to other regional, national, and European contexts while explicitly accounting for territorial heterogeneity, thereby assessing the extent to which the relationships identified in this thesis hold under different institutional, governance, and land-tenure configurations.

In addition, a set of further empirical considerations emerges, particularly with respect to the methodologies employed and the specific relationships investigated. In this respect, it should be noted that only a limited number of the conceptual relationships embedded in the conceptual framework have been empirically explored, and that these have been analysed primarily through quantitative approaches.

This opens up several avenues for further research. From a quantitative perspective, future work could aim to investigate additional relationships, as well as a broader set of components within the conceptual framework, potentially through the adoption of more advanced econometric models capable of capturing more complex interactions. Moreover, such analyses could also explore different facets of land-related components beyond those examined in this dissertation, thereby providing a more comprehensive understanding of their role within local development dynamics. At the same time, there is scope to complement these approaches with qualitative methodologies, which could provide deeper insights into the underlying mechanisms and support the interpretation of the empirical evidence. More broadly, expanding the range of relationships analysed—or revisiting those already examined from alternative perspectives and with different empirical strategies—would contribute to enriching the overall understanding of the processes underpinning the conceptual framework.

In line with these considerations, the present work is currently being further developed along two complementary research lines, both at an early stage, the details of which are reported in Appendix A.9.

In particular, in response to the need to enrich the empirical evidence through qualitative approaches, a first line of inquiry explores the potential use of the Living Labs approach as both an informational qualitative research tool and a research-action methodology. From this perspective, Living Labs can contribute to deepening the understanding of land-related dynamics and rural local development processes, while also enabling direct engagement with local actors and policy initiatives. This dual role not only supports the collection of context-specific knowledge, but also enables the direct implementation of innovative *place-based* interventions aimed at fostering rural local development dynamics through the management of different land-related dynamics and components (see Appendix A.9.1).

A second line of research extends the empirical analysis by examining the direct relationship between different landownership structures and land-use dynamics, with particular attention to farmland abandonment (that is, the direct relationship from S_{lc} to C_{lc} , and in turn to $P_{lc,e,v}$, in Figure 4.1 in Chapter 4). In this respect, the analysis aims to provide empirical validation of an additional relationship embedded in the conceptual framework, while at the same time contributing to a more comprehensive understanding of the multiple dimensions of landownership structures in shaping land-use patterns. In particular, beyond the physical dimension explored in Chapter 5, this line of inquiry also incorporates the institutional dimension of landownership structures, with the aim of assessing the role of additional factors—such as the number of landowners and co-ownership arrangements—in shaping land-use outcomes and rural development dynamics (see Appendix A.9.2).

Overall, these limitations do not undermine the relevance of the findings, but rather help to contextualise them and to delineate a coherent future research agenda. In this sense, they reinforce the need for more integrated, context-sensitive, and methodologically diverse approaches to further advance the understanding of how land capital shapes local development dynamics.

6.3 Policy implications and future research directions

The work developed in this thesis demonstrates, as a fundamental contribution, the central role of land capital in shaping local development dynamics in rural contexts. In contrast to earlier perspectives, in which land capital was often overlooked or treated as a secondary element—primarily associated with distributive aspects—it emerges here as a key structural *place-based* factor that must be explicitly incorporated both into scientific analyses and into

policy interventions at the local level. More precisely, from a governance perspective, the findings clearly and systematically highlight the importance of directing and managing land capital—organised through different land-tenure organisations—in order to support virtuous local development trajectories in rural areas, while also contributing to the reduction of inequalities both between rural and non-rural contexts and within rural territories. The lack of a coherent and explicit orientation in addressing such issues, or in accounting for these structural factors, may generate negative repercussions, including unintended or distorted effects on local development dynamics and policy actions, as suggested by the empirical evidence presented in this dissertation.

Despite this, and presumably reflecting the still limited awareness of the actual role of land-tenure organisations in local development dynamics, policy interventions directly addressing land capital and land-tenure systems remain relatively limited and fragmented, and are rarely embedded within broader local development strategies. This holds both when adopting a broader European perspective—where different countries implement heterogeneous and uneven policy approaches, and where recent policy attention has largely focused on specific, often separately addressed, dimensions of land dynamics, including farmland concentration (see European Parliament, 2017), land take¹ trajectories within the broader framework of the European Green Deal and the EU Biodiversity Strategy for 2030 (see Desjardins et al., 2024), and sustainable land use in the agricultural sector, as seen, within the Common Agricultural Policy framework (European Commission, 2013)—and at the national level. More fundamentally, within countries, land capital is rarely addressed as a coherent domain of local policy intervention. Rather, it tends to be treated in a fragmented manner across different policy fields, such as spatial planning frameworks, building regulations, fiscal and taxation systems (Hartmann et al., 2025).

It is therefore rare to encounter land interventions, even within broader local development projects, that comprehensively address the multiple dimensions of land-related dynamics highlighted in this work across different rural contexts. In this respect, it is useful to first recall a general definition of land policy, as proposed by Albrechts (2025), namely as a “*set of legal measures, processes and systematic actions implemented by public authorities to make the most suitable land available at the most appropriate time, under fair conditions, to those who wish to use it for purposes consistent with the common good*” (Albrechts, 2025). Building on this definition, and in light of the findings of this dissertation, it is also important to consider how the role of land policies has evolved over time. In the

¹Land take refers to the process by which natural and semi-natural land—such as agricultural or forest areas—is converted into artificial surfaces (e.g. built-up areas and infrastructure), typically associated with land-use change towards urban or industrial uses (Desjardins et al., 2024).

past—particularly in the aftermath of the Second World War—land policies largely assumed a redistributive function and were instrumental in supporting specific emerging models of agriculture and settlement at the local level (Hartmann et al., 2025). Today, by contrast, they should increasingly engage with a broader and more complex set of issues related to local development dynamics, as extensively demonstrated in this dissertation. These include, among others, persistent social and territorial inequalities, arising, for instance, from uneven access to land capital and to the value generated through it. They also encompass disparities in entrepreneurial opportunities, housing conditions, in the development of diverse local economic activities, and in local socio-cultural structures. At the same time, land policies are closely linked to land rental dynamics and the associated distributional and power relations. Furthermore, these implications extend to environmental dimensions, including land use, landscape management, and the sustainability of territorial systems.

Against this background, it is therefore appropriate to consider supporting local contexts through targeted land policies that should also be embedded within broader and more structured local development strategies. In this respect, the thesis concludes by offering a set of reflections and policy recommendations in this direction. More specifically, these implications, grounded in the reflections and findings developed in this dissertation, unfold along two interrelated dimensions: on the one hand, the territorial governance arrangements through which land policies should be designed and implemented; on the other, the most appropriate policy instruments and initiatives to be adopted.

First, with regard to governance arrangements, the findings of this thesis clearly point to the need to strengthen *place-based* models of territorial governance (Barca et al., 2012; Ferrara et al., 2026; McCann, 2023). In particular, these models seem particularly appropriate, as they are capable of involving a diverse range of actors shaping local dynamics, while also operating within a multi-level governance perspective and across broader territorial scales. In this regard, this implies the implementation of coordination mechanisms able to engage both local and supra-local decision-makers, economic actors, as well as social and institutional organisations—such as universities—and, importantly, landowners, in order to collectively address local development challenges, including those related to land dynamics. At the same time, *place-based* approaches allow for the consideration of wider territorial scales, extending beyond administrative boundaries and enabling the involvement of broader territorial contexts according to functional linkages—thus reflecting the logic and promoting multipolar development models based on large-scale territorial areas, including so-called *bio-regional* (Becattini, 2015) and *metromontana* configurations (Barbera & De Rossi, 2021) seen in Chapter 3. This perspective supports the governance of extensive territorial networks, as discussed in the conceptual framework, recognising that

no territory can be understood in isolation, but rather as embedded within wider spatial and socio-economic dynamics. In this sense, *place-based* governance mechanisms allow such dynamics to be effectively valorised, also in light of underlying land-related characteristics (Vaño et al., 2026), thereby strengthening the development potential of rural contexts, and their connections with other territorial systems, such as urban and manufacturing areas. These mechanisms, therefore, not only reinforce rural local areas—reducing both intra- and inter-territorial inequalities—but also, as highlighted, generate positive spillover effects on neighbouring local systems. In particular, they can support, for instance, the strengthening and development of local value chains rooted in the specific endowments and vocations of land capital, thereby fostering more integrated and complementary relations across rural, urban, and industrial areas, while also contributing to the formation of broader territorial systems in which residential, employment, and productive dynamics are more closely interconnected. This, in turn, contributes to enhancing the overall resilience of these larger-scale territorial systems by diversifying economic linkages, leveraging local resources, improving adaptive capacity, and enabling more robust responses to external shocks.

Beyond these considerations, a further aspect that reinforces the need for *place-based* governance arrangements concerns the role of local power coalitions linked to land-related dynamics in shaping governance processes and, in turn, rural development pathways. In particular, the insights of this dissertation highlight how local contexts are often characterised by the presence of local elites—among which those composed of landowners play a particularly relevant role—capable of influencing both development trajectories and the functioning of governance mechanisms. In this respect, phenomena such as rent-seeking behaviour and the concentration of economic and political power—linked to the concentration of landownership structures—may emerge, potentially affecting the design and implementation of policies aimed at supporting local development, including through the renewal of local development pathways, also through land-related initiatives. At the same time, although through different mechanisms, highly fragmented land-tenure structures—characterised by a large number of landowners—may also hinder the effectiveness of local governance interventions, particularly when coordination across multiple actors is required. In this sense, a *place-based* approach can play a crucial role. By involving institutional actors who are both aware of these dynamics and operating across multiple levels—beyond the local, including regional, national, and supranational—such mechanisms enable the introduction of supra-local perspectives that can act as a trigger to overcome local lock-in dynamics associated with entrenched elites. These higher-level governance structures may indeed provide the capacity and legitimacy to counterbalance such dynamics, thereby supporting more inclusive and effective local development processes and initiatives,

including actions aimed at landownership structures. Moreover, in the presence of highly fragmented land-tenure structures, the involvement of higher-level institutions may also be justified by their greater financial capacity and policy leverage, which can be mobilised to address and potentially reverse such structural constraints.

Place-based governance arrangements should therefore be promoted as essential mechanisms, capable of coordinating different actors across diverse levels and contexts and of aligning them around local development challenges and priorities—including those related to land-tenure dynamics—while actively addressing them through targeted land policy measures and the implementation of local development projects.

In this respect, the findings of this thesis also suggest a set of guiding principles to support such policy initiatives. First and foremost, these initiatives should be tailored to the specific characteristics of local contexts which, alongside well-established *place-based* structural dimensions, must explicitly incorporate the specific configurations of land-tenure organisation. Both the theoretical and empirical results show that the implementation of measures that do not account for local specificities—including those related to land capital—namely, *place-blind* interventions, may nonetheless generate differentiated effects across territories. In the absence of an appropriate consideration of local diversity, such effects may contribute to exacerbating existing territorial divergences, reinforcing and perpetuating structural imbalances, and ultimately advantaging areas that are already relatively more developed or better positioned. For instance, this argument is further reinforced by the empirical evidence presented in Chapters 4 and 5 with reference to the Common Agricultural Policy. A related consideration therefore emerges: even broad *place-blind* policy frameworks—including those of the Common Agricultural Policy—when aimed at addressing specific land-related dimensions, may generate differentiated local effects, varying in both magnitude and scope, if underlying local land-tenure structures and other structural factors are not adequately taken into account. This underscores the need to design and tailor policy measures that appropriately account for such heterogeneity, thereby enhancing policy effectiveness and reducing territorial disparities.

Beyond this, policy interventions should also build upon and valorise the diverse resources and factors present at the local level, leveraging the specific vocations of land capital. In this respect, in rural contexts this may include, for instance, supporting high value-added agri-food productions, as well as value chains linked to the forest-based economy, while also promoting environmental sustainability and the provision of specific ecosystem services. At the same time, such strategies may foster processes of diversification, enabling integration with other activities—such as tourism and small-scale manufacturing—provided these remain coherent with the locally embedded vocations and potentials expressed by land capital

itself.

In this respect, although with varying intensity and forms, the findings of this thesis also suggest that support for virtuous and sustainable local development trajectories should translate into land measures capable of ensuring, over time, a synergistic and adaptive reconfiguration of landownership and productive structures in line with local vocations and territorial specificities—closely linked to the organisation of land capital—while also fostering the active participation of local communities in land management and the reinvestment of locally generated land rents and income at the local level.

In doing so, as also clearly shown in Chapter 3, which highlights the existence of diverse techno-organisational configurations (Pagano, 1991) in rural contexts—shaped by specific *place-based* conditions, including those related to land capital—land policy interventions should be designed to address differentiated challenges and, in turn, support virtuous dynamics in local development processes in a context-specific manner. More precisely, it appears essential that such support be ensured over time, extending beyond the initial equilibrium conditions. Indeed, it clearly emerges that in rural contexts characterised by dynamic local development pathways (i.e., those associated with Rural Local Systems or Local Systems characterised by Capitalistic Agricultural Enterprises, as discussed in Chapter 3), the transition towards more mature phases may require continued and adaptive policy engagement in order to sustain and further consolidate these development trajectories. In particular, in these settings, land policy measures should mitigate potential risks of speculative behaviour and rent capture by limiting excessive concentration in landownership structures and extractive land uses, while reinforcing the commitment of landowners to local development processes. Indeed, as highlighted in the dissertation, from a long-term perspective, part of the income derived from landownership should be reinvested in local productive activities. When such reinvestment is reduced or distorted—particularly by landowners seeking to benefit from rent positions—local development trajectories may shift from virtuous to more extractive dynamics. In these cases, even in the presence of apparent dynamism, local systems may become locked into suboptimal equilibria that, while remaining economically viable in the short term, risk undermining the sustainability and inclusiveness of development over time. These dynamics are often associated with rising inequalities within local contexts, the emergence of social tensions and conflicts—also, for instance, in the form of spatial segregation—and environmental drawbacks, including increased pollution and growing pressures on local resources. In this respect, such lock-in conditions may become inherently self-reinforcing, sustained by rent-seeking behaviours, and tend to exacerbate existing structural drawbacks over time; for this reason, there is a need for sufficiently ambitious land policy measures capable of addressing these challenges, not

only in the early stages of development, but also within already consolidated configurations and development equilibria, in order to effectively reshape and redirect local development trajectories over time.

Conversely, in more marginal and structurally fragile rural areas (i.e., those associated with the periphery of other local systems, or more broadly peripheral territories *tout court*, as discussed in Chapter 3), targeted land policy interventions may play a key role in breaking self-perpetuating negative development cycles over time, which are further reinforced by underlying land-tenure dynamics. In these cases, as observed in Chapter 3, a common pattern can relate to increasing land fragmentation and abandonment dynamics. From this perspective, what appears particularly relevant is the possibility of implementing and promoting innovative and flexible initiatives for land consolidation and the reorganisation of land uses, tailored to local specificities in order to address such land-related constraints. Examples discussed in this thesis include land associations (Pastorelli, 2016), but similar approaches may also be extended to other types of interventions—such as land banks (<https://www.ismea.it/banca-delle-terre>)—which, however, require stronger institutional recognition and closer integration within national and European policy frameworks.

This also provides a further point of reflection on the modalities of intervention: while land policy measures should be innovative and carefully tailored to specific local contexts, they nonetheless operate within an existing institutional policy framework at both national and European levels. In this respect, it becomes crucial to identify and implement mechanisms through which existing measures can be better integrated, adapted, and strategically reoriented to effectively address local land-related challenges. This implies building on existing instruments (e.g., land use policies, land management schemes, land use planning instruments)—by understanding their current scope and limitations—and then integrating and strategically reorienting them within innovative or renewed land instruments and initiatives.

Overall, land policy initiatives developed within *place-based* governance frameworks should therefore be embedded within broader local development strategies and projects. More fundamentally, effectively supporting local development trajectories across diverse rural contexts requires the definition of more structured and long-term visions of what such territories could become, taking into account their specific characteristics and vocations, including those expressed by the features of land capital. Such visions should also be complemented by coordinated initiatives targeting both the productive sphere and welfare provision, in order to ensure the viability and sustainability of local development pathways over time. In this regard, for instance, returning to the case of fragmented landownership structures associated with marginal rural areas, land consolidation instruments—such as

land associations—should be embedded within broader projects and strategic visions aimed at fostering new forms of local entrepreneurship, as well as supporting the attraction and retention of population and the provision of essential services—such as education and healthcare—which are often scarce in these areas, thereby contributing to the regeneration of the local social fabric.

Ensuring the effectiveness of such interventions thus requires a certain degree of systematisation. More specifically, land dynamics can be leveraged as a foundation for designing more structured and systematic local development interventions. In this respect, it is useful to recall that one of the main contributions of this work—the conceptual framework of the *land-tenure loop*—can serve not only as an analytical tool, but also as a practical operational lens to guide policy design. In particular, it enables a comprehensive view of the different components of land-tenure organisation and their interactions, as well as their relationships with other *place-based* dimensions of local development and the expected outcomes that can be effectively mobilised and targeted from a policy perspective.

From this perspective, innovative *place-based* governance instruments that not only aim to steer specific local dynamics, but also contribute to a better understanding of them—particularly in relation to land-related aspects, which remain relatively under-explored—should be promoted. In this sense, although only briefly discussed in Appendix A.9.1, mechanisms of action research, such as Living Labs, may represent promising local governance tools capable of effectively identifying context-specific needs and challenges, including those related to land-tenure dynamics, and of building concrete and effective local development projects around them. Indeed, Living Labs enable the development of initiatives centred on land capital that actively involve diverse actors operating at different levels and across multiple territorial scales, while also valorising local vocations and respecting the specific characteristics and dynamics of each territory. In doing so, they emerge as innovative *place-based* governance mechanisms that both enhance the understanding of land-related dynamics and provide a concrete framework for their effective integration into the design and implementation of context-sensitive local development strategies.

It follows, therefore, that promoting and designing more robust rural local development projects that explicitly incorporate land-related dynamics—and build upon them—can support more balanced and inclusive development trajectories and contribute to reducing persistent inequalities, both between and within local contexts, particularly in rural areas. This, in turn, represents a key condition not only for addressing place-specific challenges, but also for strengthening broader dynamics—such as those operating at the national level—and enhancing the capacity of local systems to respond to recurring external shocks, which have become increasingly frequent in a rapidly evolving and unstable international context. In

this way, it is emphasised that, by strengthening local places, these processes ultimately contribute to the resilience and sustainability of wider socio-economic systems.

In conclusion, although future research directions have already been extensively outlined in the previous sections—also through more specific lines of investigation—it is important to reiterate, given the relevance of the topic for local development dynamics, the need to further deepen the understanding of land-related processes across diverse local contexts, extending beyond rural areas. Land capital plays a crucial role in shaping local development trajectories not only in rural settings, but also in urban and manufacturing contexts.

In this respect, it is worth recalling that some contributions have already investigated the effects of land-related elements on urban development dynamics, highlighting, in particular, the interplay between land rents and broader urban development processes (Camagni, 1998), as well as the role of land market characteristics and real estate structures in shaping access to essential services and socio-economic and residential opportunities (Moulaert & Mehmood, 2025; Veltz, 2025). Building on this perspective, a promising avenue for future research lies in further exploring land-related dynamics within urban contexts, while at the same time examining their interconnections with rural areas. In particular, in line with a more comprehensive understanding of places as contexts whose development is driven not only by production dynamics but also by consumption patterns—consistent with the notion of “*anchoring milieu*” (Crevoisier & Rime, 2021)—constraints in urban land markets may limit the capacity of local systems to support both productive opportunities and consumption-related functions, including the spatial organisation of labour and everyday life (e.g. spaces of work and residence for workers and inhabitants), thereby constraining their ability to expand, sustain growth, and support long-term development trajectories. Such patterns can also contribute to the emergence of socio-economic inequalities and patterns of spatial segregation and differentiated access to services, especially in highly attractive and economically dynamic *supercities* (Buciuni, Corò, et al., 2023; Crevoisier & Rime, 2021; Florida, 2017; Veltz, 2025). From this perspective, these dynamics should be further investigated in light of the conceptual framework developed in this dissertation, while at the same time adopting a more integrated and relational view of urban and rural areas. In this sense, moving beyond a dichotomous perspective, land capital may be interpreted as a key element in shaping the interdependencies between these contexts, enabling more efficient, inclusive, and sustainable spatial organisation across wider territorial systems.

Moreover, in light of increasing environmental pressures, there is a growing need to further investigate the nature of land capital as a resource system—particularly its environmental and ecological functions—and its governance within local development dynamics. In this sense, it would be valuable to further develop the framework presented in this work

through engagement with other conceptual techno-organisational configurations—such as socio-ecological systems (Ostrom, 1990).

Finally, although the present work has, to some extent, addressed the links between land-related elements and governance mechanisms, these relationships still offer ample scope for further investigations. In this respect, future research could focus on rent-seeking dynamics and the behaviour of *rentiers* in more dynamic local settings, also looking at the structures of landed property, as well as, from a complementary perspective, on the effects of landownership in more fragile and structurally disadvantaged contexts, particularly in relation to governance interventions. This, in turn, also reinforces the need to recognise that, while increasing attention has been devoted to rent-related dynamics, land take and processes of land financialisation—often highlighted in relation to residential and farmland uses (see, for example, Gunnoe, 2014; Ryan-Collins & Murray, 2023; Ryan-Collins et al., 2017)—it is equally important to acknowledge that the abandonment of land capital represents a critical and, in some contexts, underestimated phenomenon, with significant implications for local development, territorial cohesion and governance, and environmental sustainability, and therefore warrants further investigation within the field of local development studies.

Advancing our understanding of land capital in all its dimensions therefore represents a necessary step not only towards designing more coherent and sustainable local development strategies, but also towards gaining deeper insight into the processes shaping the development trajectories of places.

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Appendix A

Appendices

A.1 Integrative Literature Review: Sources and Key Words

Table A.1: Sources and Key Words in the Integrative Literature Review

Sources	Type of Source	Key Words Round 1	Key Words Round 2
Google Scholar	Database	“land”; “land capital”; “capital”; “land improvements” combined respectively with “local development”; “rural development”; “rural local development”; “local socioeconomic development”; “territorial development”; “socio-cultural”; “social structure”; “economic dimension”; “economic impacts”; “economic processes”; “institution”; “institutional elements”; “culture”; “cultural dimension”; “political power”; “local dynamics”; “governance”; “territorial governance”.	“land”; “land capital”; “capital”; “land improvements” ; “land development”; “land rent”; “differential rent”; “spatial rent”; “monopolistic rent”; “absolute rent”; “property rights”; “private property”; “common property”; “public property”; “land ownership”; “landed property”; “agriculture”; “farmland”; “rural”; “rent”; “land speculation”; “land inequality”; “land concentration”; “land fragmentation”; “land ownership structures”; “property regimes”; “land regimes”; “common pool resources”; “land title”; “land tenure”; “climate change”; “land conflicts”; “land price”; “land use”; “land use changes”; “industrial land use”; “ecosystem services”; “manufacturing land use”; “rent-seeking”; “rent-seeking behaviour”; “real-estate”; “landed property development”; “land betterment”; combined respectively with “local development”; “rural development”; “local socioeconomic development”; “territorial development”; “socio-cultural”; “social structure”; “economic dimension”; “economic impacts”; “institution”; “institutional elements”; “culture”; “cultural dimension”; “political power”; “local dynamics”; “governance”; “territorial governance”; “local evolutions”; “local paths”; “local conflicts”; “rural inequality”.
Scopus	Database		
OneSearch.Unifi	Integrated Catalog		

Source: Author’s elaboration.

A.2 Landed Property Structures

A.2.1 Dimensions of landed property

Table A.2: Elements of land ownership structures and their description

Elements	Description
Dimension of properties	Four size-classes: • Large (over 50 Ha) • Medium (Between 50 Ha and 2 Ha) • Small (under 2 Ha) • Parcel (under 0.50 Ha)
Spatial distribution of properties	Degree of spatial dispersion of parcels that compose the property within a given area.
Number of properties	Total number of properties in a given area, classified according to their dimension in terms of surface area.
Type of property regime	Private; Public; Collective; Open Access
Type of landowner	Individuals; Companies; Public and Ecclesiastical bodies; Civil societies; Mixed and Collective entities; etc.
Number of landowners	Landowners and co-owners in a given area.

Source: Author's elaboration based on Golzio (1933), INEA (1956), Medici et al. (1962), Zangheri (1981), Cecchi (1983), Bromley (1989), Demetriou (2014). Note. Ha: hectares

A.2.2 Property rights and bundles of rights

Property rights constitute legally enforceable claims to perform specific actions within a given domain (Hardin, 1968). They govern the actions individuals are permitted to take in relation to others, in this case with respect to land capital. When one person holds a right, another bears a corresponding duty to respect that right (Ostrom, 2003). Modern property rights can be classified as follows:

- **Public property:** Public ownership refers to land capital held by public authorities (such as the State, Regions, local governments, or any parastatal body). These entities hold rights of use, access, and control over the resource. Individuals may be entitled to use the land capital, but only at the discretion of the State. However, as with any public asset, land capital is still indirectly owned by all citizens. In rural contexts, this

type of property title often concerns land capital of high historical or environmental value, such as forests and other natural environments (Bromley, 1991; Pettenella, 2020; Singhapathirana et al., 2022; Zangheri, 1981).

- **Private property:** This refers to the situation in which individuals or legal entities hold rights and duties over land capital in accordance with socially recognised uses, while “non-owners” are expected to respect those rights. Private property holders may include individuals, companies, cooperatives, collective organisations, and ecclesiastical institutions that maintain private ownership over land and its resources (Bromley, 1991).
- **Common property:** This occurs when ownership is vested in a defined group of individuals who hold collective rights and duties with respect to the resource, in contrast to non-members. Individual members of the group (or co-owners) also bear responsibilities related to the use, maintenance, and governance of the land capital respect to other participants. At the management group level, common property regimes can function similarly to private property, although rights are exercised collectively rather than individually (Bromley, 1991; Ostrom, 1990).
- **Non-property regime (or open access):** This refers to situations where neither an individual nor a group can be identified as the owner, and the benefits derived from the land capital are accessible to all. In such cases, individuals possess privileges rather than enforceable rights over the resource (Bromley, 1991).

On the ground, previous property systems may be articulated differently in terms of their formal structure. Specifically, they are often unbundled through a variety of agreements with differing degrees of formalisation. These may involve various local contractual arrangements which, in the case of agricultural activities, can include different types of agrarian contracts, such as leasehold arrangements (Cecchi, 1991). In this sense, ownership can be understood as a bundle of property rights (Ellickson, 2011), that is, a series of land titles that can be separated and allocated in different ways (Galik & Jagger, 2015; Ostrom, 2003).

From this perspective, this nested architecture can generally be articulated into five fundamental aggregate rights that, taken together, define full or formal ownership (Ostrom, 2003; Schlager & Ostrom, 1992). Specifically, as outlined by Ostrom (2003) and illustrated in Figure A.1, these rights can be summarised as follows:

- *Access:* the right to enter a defined physical area and enjoy non-subtractive benefits.

- *Withdrawal*: the right to obtain resource units or products.
- *Management*: the right to regulate internal use patterns and to transform the resources through improvements.
- *Exclusion*: the right to determine who is allowed to access the resources and under what conditions.
- *Alienation*: the right to sell or lease exclusion, management, or withdrawal rights.

Figure A.1: **Bundles of Rights Associated with Positions**

	Full owner	Proprietor	Authorized claimant	Authorized user	Authorized entrant
Access	X	X	X	X	X
Withdrawal	X	X	X	X	
Management	X	X	X		
Exclusion	X	X			
Alienation	X				

Source: Ostrom (2003) based on Schlager and Ostrom (1992).

The breakdown of rights also makes it possible to distinguish between different categories of property-rights holders, each associated with specific bundles of rights. As shown in Figure A.1, these include the full owner, the proprietor, the authorised claimant, user, and entrant (Ostrom, 2003).

A.3 Land Rent

A.3.1 *Diverse forms of Land Rent*

A detailed definition of the main forms of land rent recognised in the scientific literature is provided below.

- **Differential Rent:** Differential rent was first introduced by Ricardo (1776c) and is primarily based on differences in the natural fertility of land (Ricardo, 1776c). Specifically, according to Ricardo (1776c), assuming all other conditions remain equal and considering only one type of agricultural production—wheat, in his example—the limited availability of fertile land for this crop generates a scarcity effect as demand rises. Since production cannot be expanded on the most fertile lands, the rising demand pushes the market price above the cost of production on those lands. As demand continues to grow, the market price rises further and eventually reaches a level that covers the production costs of less fertile, or marginal, land, thereby making its cultivation economically viable (González, 2015; Ricardo, 1776c). The market price then stabilises at the level of the production cost on marginal land, generating an extra profit on the more fertile plots—equal to the difference between the market price and the lower production cost on these soils. The existence of such extra profits ignites competition among farmers seeking access to the more productive land. Given that, landowners of these more fertile soils demand this extra profit in exchange for granting access to and use of such land (González, 2015). This extra profit is the land rent, namely the differential rent. The characteristics of the Ricardian differential rent are as follows (Bessaoud & Réquier-Desjardins, 2010; González, 2015; Landreth & Colander, 1994):

- Such rent has a differential nature, i.e., it arises from differences in land fertility or related production costs, and is present only on fertile land, while absent on poorer ones.
- Differential rent is determined by price, not the other way around; market prices tend to converge toward the production cost of marginal land.
- The ownership regime has no influence on this type of rent; rather, it is the interaction between supply and demand—particularly the dominance of the supply side—that determines its emergence.

Differential rent is not solely generated by variations in natural soil fertility; according

to Von Thünen (1826)¹'s model, as cited by Camagni (1998), fertility can also be interpreted as a function of location in relation to particular attractive centres (Capello, 2004; Jager, 2020; Reinert, 2020). In this view, differential rent arises from diverse spatial positions, as proximity to central areas results in savings on transport costs. These centres are attractive for various activities because they provide access to key markets (e.g., raw materials, labour), infrastructure, specialised knowledge, and other essential resources (Camagni, 1998; Jager, 2020). Differential rent is therefore also expressed in terms of savings on transport costs. It is higher for land capital located near central areas and progressively decreases—eventually disappearing—in marginal areas (Reinert, 2020). From this perspective, competition among different activities is governed by an economic logic whereby “*the activities able to locate in the most central areas are those that can pay higher rents for those areas*”, as they receive greater benefits in terms of savings on transport costs (Capello, 2004). This perspective adds further considerations to the concept of differential rent (Camagni, 1998; Capello, 2004):

- Differential rent, beyond the reduction in transport costs, also reflects the *situation value* of land capital—namely, the influence of the surrounding socio-economic environment and the level of development (for further details see Section 2.4.1).
- From a static perspective, differential rent functions as a mechanism of locational optimisation for productive activities: the actors willing to pay higher rents are those who benefit most from the location.
- This mechanism can ultimately contribute to defining an optimum for both landowners and society as a whole. In fact, differential rent enables an optimal allocation of resources, maximising the overall social value generated and minimising total transport costs. Specifically, it balances supply and demand and supports the most efficient territorial allocation of collective resources across different land uses.

The two forms of differential rent discussed above may be considered complementary, even if they are originally determined by two distinct factors: fertility and location. In both cases, however, firms, enterprises, or individuals can increase their revenues by reducing production costs—either due to the land capital's fertility, including artificial improvements, for a specific use, or due to its accessibility (Camagni, 1998).

¹Von Thunen, J. H. (1826). Der isolirte staat in beziehung auf landwirtschaft und nationalökonomie. Friedrich Perthes.

- **Monopoly Rent:** Monopoly rent, as primarily expressed in Marx (1867)²'s view, originates from the scarcity of land capital and its non-substitutable nature in relation to the specific demands placed upon it (Mazzucato et al., 2023). More specifically, unlike differential rent, it derives from the opportunity for landowners to capture a specific demand that recognises particular advantages in certain portions of land capital, thereby enabling them to exercise a certain degree of monopolistic power (Camagni, 1998; Parrinello & Cecchi, 1982). Indeed, the scarcity of this land in relation to a given level of demand constitutes a barrier to the expansion of certain production. It results in an overpricing of goods—namely, a monopoly price—produced on that land capital, which eventually translates into rent (González, 2015). Marx (1867)³, as interpreted by González (2015), distinguishes two forms of monopoly rent:

1. *Focused Monopoly Rent*, which emerges when the condition of scarcity is confined to a specific area;
2. *Generalised Monopoly Rent*, where this condition extends to a broader shortage of land capital as a whole.

- **Absolute Rent**

Marx (1867)⁴ first introduced an additional form of rent, namely Absolute Rent (Parrinello & Cecchi, 1982). In his view, this type of rent was meant to account for the empirical evidence of rent being paid even on marginal and less fertile land, thereby contrasting with the assumption of Ricardian differential rent. Specifically, at the root of this extra surplus for landowners lies the system of private property itself. In practice, landowners—faced with a specific demand expressing interest in their land capital—can claim an additional payment as an implicit condition for making that land available. This payment is indeed secured by the power of exclusion embedded in private property rights (Blaug, 1978; González, 2015).

Given that, the pioneering theorisation of absolute rent has been subject to several criticisms, due to inconsistencies in the theoretical demonstration proposed by Marx

²Marx, K. (1867). *Das Kapital: Kritik der politischen Ökonomie. Erster Band. Der Produktionsprozeß des Kapitals*. Hamburg: Verlag von Otto Meissner.

³Marx, K. (1867). *Das Kapital: Kritik der politischen Ökonomie. Erster Band. Der Produktionsprozeß des Kapitals*. Hamburg: Verlag von Otto Meissner.

⁴Marx, K. (1867). *Das Kapital: Kritik der politischen Ökonomie. Erster Band. Der Produktionsprozeß des Kapitals*. Hamburg: Verlag von Otto Meissner.

(1867)⁵ as quoted by González (2015). Nonetheless, the core intuition remains valid and continues to be debated in the literature (Bessaoud & Réquier-Desjardins, 2010; Jager, 2020; Park, 2014).

In line with this, Camagni (1998) proposes a further distinction within Absolute Rent, based on whether the prevailing effect is driven by supply or by demand. This division unfolds as follows:

1. *Absolute Rent of Type 1*: primarily determined by a prevailing supply-side effect. Specifically, in response to a given land demand, landowners can deliberately restrict the supply of land capital available on the market, artificially inflating the price of the land that remains accessible. More precisely, it takes the form of a scarcity rent resulting from an “economic or class-based limitation” within a certain area (Camagni, 1998). In this regard, it aligns with Marx’s initial conception, as it entails a form of retention power asserted by landowners, either overtly or implicitly.
2. *Absolute Rent of Type 2*: primarily determined by a prevailing demand-side effect. More precisely, it arises from the opportunity for landowners to leverage a specific land demand seeking to exploit certain localised economic advantages present within a given area. In Camagni (1998)’s view, this type of rent is an exclusively urban phenomenon, occurring in specific city contexts. In particular, “it is an absolute rent of agglomeration [...] generated by the demand to access the set of interactions and benefits—namely, agglomeration economies—that an urban context, and more specifically an urban local system, can offer” (Camagni, 1998). This formulation is therefore grounded in specific advantages localised within circumscribed areas and recalls both the concept of *situation value* (for further details see Section 2.4.1) and the notion of Marshallian atmosphere (Becattini, 1984; Marshall, 1920/2013). This, in turn, opens up further reflections on the possibility of identifying Absolute Rent of Type 2 in other contexts as well, where it may intersect with different forms of localised advantages—such as Marshallian external economies within district-based systems (Bellandi, 2011; Bellandi, Cecchetti, & Santini, 2023).

⁵Marx, K. (1867). *Das Kapital: Kritik der politischen Ökonomie*. Erster Band. Der Produktionsprozeß des Kapitals. Hamburg: Verlag von Otto Meissner.

A.4 Land Uses

Table A.3: **Rural Land Uses with Brief Descriptions**

Land Use	Description
Agro-forestry Use	Agro-forestry use corresponds to what Serpieri (1969) refers to as land-based production, encompassing activities directly linked to agriculture, pastoralism, and forestry.
Industrial Use	Depending on the degree of interaction with agro-forestry specialisation, the following industrial uses can be identified in the rural context. 1. <i>Industrial uses of land capital dissociated from agro-forestry specialisation.</i> This refers to cases in which land capital is used exclusively for industrial or manufacturing activities. Although these activities are located in rural areas and may draw on local natural and human resources, they are entirely dissociated from agricultural specialisations (Cecchi, 1988). The rural context may, in fact, host large industrial enterprises that choose to locate near key raw materials essential to their production processes. Examples include major energy companies or mineral extraction industries. 2. <i>Industrial uses of land capital exhibiting a certain degree of complementarity with agro-forestry specialisation.</i> Within this category, it is possible to distinguish three different degrees of complementarity: • <i>Complementarity between industrial and agricultural activities in the use of local productive resources.</i> Although agro-forestry and industrial activities remain specialised in distinct and unrelated production processes, they often share local resources such as labour and capital. In this regard, the literature reports cases of interconnection with artisanal and commercial activities, which may involve the sharing of part of the rural household's labour force (Brusco, 1979). Similar dynamics have also been observed in the context of industrial districts, particularly during their early stages of development (Cecchi, 1988; Musotti, 2001). • <i>Complementarity between industrial and agricultural production processes.</i> This situation reflects a local productive organisation in which industrial and agricultural activities are integrated through complementary production processes. In particular, agriculture supplies inputs for the industrial transformation of farm products positioned downstream in the value chain. Notable examples can be found across various local value chains, particularly in sectors such as wood and agri-food production (Cecchi, 1992b; Martinelli, 2020; Pettenella, 2020). • <i>Overlap between industrial and agricultural activities.</i> In this case, complementarity is expressed through the flexible overlapping of agricultural and manufacturing–artisanal uses of land capital across different production processes within the same productive unit, as in the case of multifunctional farms within the framework of <i>non-homologated agriculture</i> (Basile & Cecchi, 2001).

Continued on next page

Table A.3 – continued from previous page

Land Use	Description
Touristic Use	Touristic uses of land capital in rural contexts can likewise be distinguished by their degree of complementarity with agro-forestry activities. At one extreme, land capital is commodified through mass tourism activities, being used exclusively for consumption purposes aimed at extracting its cultural, historical, and natural value (Bell & Jayne, 2010; Bindi, 2022; Sacco, 2018). At the opposite end, a gradual overlap with agro-forestry functions can be observed, recurrently culminating in <i>non-homologated</i> agricultural framework, with agro-tourism activities and forms of slow tourism, such as the <i>albergo diffuso model</i> or community-based forms of management (Basile & Cecchi, 2001; Sacco, 2022; Teneggi, 2018; Varotto, 2020).
Residential Use	Land capital provides shelter and security, but its residential use may also overlap with productive functions—as in family-run businesses on multifunctional farms—or with speculative purposes, thereby becoming a source of economic rent extraction (Basile & Cecchi, 1997; OECD/Eurostat, 2015; Ryan-Collins & Murray, 2023; Ryan-Collins et al., 2017).
Environmental Uses	Two main and opposing perspectives can be identified concerning the local use of land capital for environmental purposes. • The first perspective refers more specifically to the non-use of rural land capital, aligned with a <i>wilderness philosophy</i> that regards preservation as a form of care and prevention against the damage and disadvantages generated by unsustainable modern progress produced elsewhere (Varotto, 2020). • On the other hand, there is a perspective that promotes the sustainable use of land capital, which, in addition to generating local economic value, can also produce environmental public goods and services remunerated through a system of Payments for Ecosystem Services. The Ecosystem services are positive environmental externalities that can result from specific uses of land capital. They may include: the provision of essential food and raw materials for human survival and productive activities; air filtration and water regulation; climate change mitigation through low-emission practices and carbon sequestration; protection against extreme events such as hydrogeological risks and wildfires; and the provision of cultural and recreational values (Becattini & Omodei Zorini, 2003; Pettenella, 2025; Varotto, 2020).
Speculative Uses	Land capital is also a store of value—a safe-haven asset that generally appreciates over time with little or no maintenance. It is therefore a suitable target for patrimonial, and at times speculative, investments (see, for instance Dei Ottati, 1990; Fairbairn, 2017; Gunnoe, 2014; Knuth, 2015; Povellato, 2012; Ryan-Collins et al., 2017).
Land Abandonment	Land abandonment refers to the withdrawal of land capital from civic and socio-economic uses and activities (Curci & Zanfi, 2018). In the specific case of farmland, it is the circumstance in which land capital ‘that was previously used for crop or pasture/livestock grazing production, but does not have farming functions anymore and has not been converted into forest (i.e., not referring to uncontrolled natural rewilding, but rather to woodland production, namely a deliberate conversion towards forest), or artificial areas either’ (Schuh et al., 2020).
Source: Author’s elaboration.	

A.5 Key Elements of the SCP Framework for the Marshallian Industrial District

Following Bellandi (2002), which takes the ideal model of the Marshallian Industrial District (MID) (see Becattini, 1979, 2004; Bellandi et al., 2025) as a reference, the main variables composing the SCP framework of local development models can be defined as follows:

- **Intermediate structure of industrial organisation (S_{io}).** It encompasses the key features of the local productive organisation, specifically the structural elements that define the pool of firms constituting a potential Local Productive System (LPS). Various local productive organisations can develop in different areas (Bellandi, Cecchetti, & Santini, 2023). In this sense, the Marshallian Industrial District (MID) is characterised by a set of specialised, predominantly local, small- to medium-sized, decentralised, and independent enterprises (Becattini, 2004).
- **Intermediate structure of specific public goods (S_{pg}).** It represents the specific structure of institutional support and public organisation that may characterise certain areas. In particular, it encompasses key aspects of finely tuned systemic conditions, typically manifested in goods with public or quasi-public features—such as club and common goods—that foster the productive efficiency of the local industrial organisation (Bellandi, 2021). Continuing the example of the MID, S_{pg} may include specific public goods (e.g., technical standards or sanction rules for inappropriate behaviour (Brusco, 1999)), targeted club assets such as specialised vocational schools or joint university–industry laboratories (Freddi & Rizzo, 2016), and common-pool resources such as environmental assets, mobility networks, and ICT infrastructure.
- **Basic local structure (S_{bl}).** It comprises specific traits of what Dardi (1997)⁶, as quoted by Bellandi (2002), identifies as local factors of areas characterised by a certain degree of dynamism. In particular, certain virtuous contexts exhibit a set of shared local features, or socio-institutional nexuses, that provide regulatory and cognitive resources sustaining the vitality of the local productive organisation and that may be propaedeutic to the reproducibility of the same local development path (Becattini, 2015). Based on the MID experience, S_{bl} can include (Becattini et al., 2014):

1. accumulation and traits of complementary contextual knowledge;
2. redundancy of savings and time devoted to productive purposes;

⁶Dardi, M.(1997). Il fattore locale nell'analisi del distretto industriale. *38th annual meeting of the Società Italiana degli Economisti*

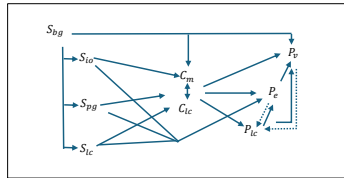
3. widespread local socio-economic mobility favouring entrepreneurial initiative;
 4. local transaction-coordination mechanisms, such as communitarian market mechanisms (Dei Ottati, 2003a). These mechanisms consist of formal and informal rules derived from the dense network of interactions among local socio-economic agents who have internalised common attitudes and motivations linked to a specific local identity, thereby supporting trust relationships and reducing transaction costs and negative externalities stemming from a decentralised division of labour.
- **Basic global structure (S_{bg}).** Each model of development represents a local economy embedded in a global context. The basic global structure includes fundamental characteristics of this extra-local economy, encompassing the main features of the general structure of markets, technologies, and institutions (Bellandi, 2002). In the MID, S_{bg} is, for instance, characterised by the presence of final markets that demand differentiated and customised products (Becattini, 2001).
 - **Market Conduct (C_m).** This refers to the set of market (non-strategic) behaviours of local players, according to structural elements. In the MID, C_m can be exemplified by the definition and integration of different and changeable teams of specialised firms along a productive process (Bellandi, 2002).
 - **Strategic Conduct (C_{st}).** This refers to the set of actions undertaken by strategic agencies specialised in supporting the system. From a dynamic perspective, the literature recognises the need for the intervention of specific agencies to facilitate the readjustment of structural features of models when facing local and global changes. In this context, incremental adaptation mechanisms of intermediate structures (S_{io} and S_{pg}) and processes of quasi-automatic regulation, supported through S_{bl} , may be insufficient to address new challenges. Public intervention, or the direct initiative of specific territorial governance—possibly within a multi-scale coordination framework—is therefore essential to ensure the reproduction of local development pathways (Barca et al., 2012; Bellandi, 2021; Torre, 2023).
 - **Value of Performance (P_v).** This denotes the performance attained at the firm or agent level. It arises from the interaction of specific structural elements and conduct. In the case of the MID, it is exemplified by the reduction of production costs resulting from adherence to a local division of labour (Bellandi, 2002).
 - **External Performance (P_e).** This denotes the performance attained at the system level—here, at the level of the MID—which is directly relevant to the pool

of firms located within this bounded area. In the case of the MID, the literature recognises that, under certain conditions, interactions among the elements outlined above—namely, intermediate and basic structures together with competitive and strategic conduct—can generate localised competitive advantages in the form of Marshallian external economies (Bellandi, [2002](#); Bellandi et al., [2025](#)).

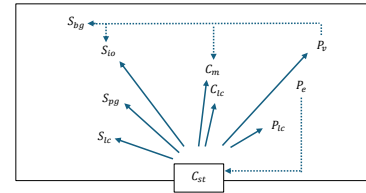
A.6 Multi-Layered Framework

A.6.1 Multi-Layered Framework of Agricultural Local System

Figure A.2: The Competitive and Strategic Loop of ALS



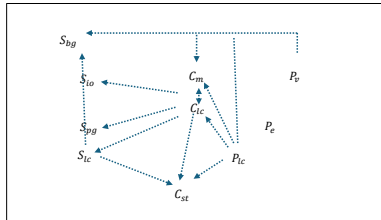
(a) Competitive Loop



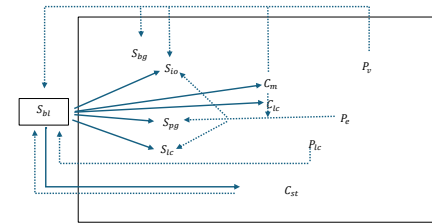
(b) Strategic Loop

Source: Author's elaboration, based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. The larger rectangle in panel (b) is a simplified version of the figure in panel (a).

Figure A.3: The Evolutionary and Territorial Loop of ALS



(a) Land tenure Loop

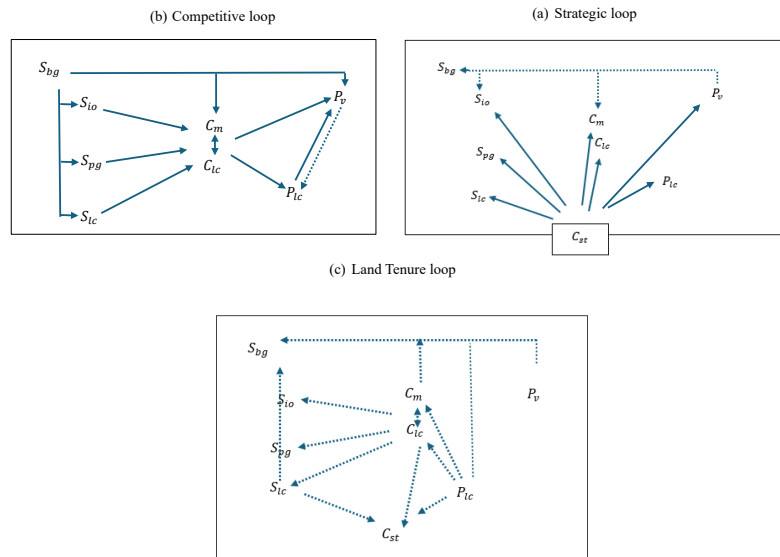


(b) Evolutionary Loop

Source: Panel (a) Author's elaboration. Panel (b) Author's elaboration based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects. The larger rectangle in panel (b) is a simplified version of the figure shown in panel (a), while panel (a) itself represents a simplified version of the figures presented in Figure A.2.

A.6.2 The LS characterised by Capitalistic Agricultural Enterprises

Figure A.4: **The Competitive, Strategic, and Land Tenure Loops**

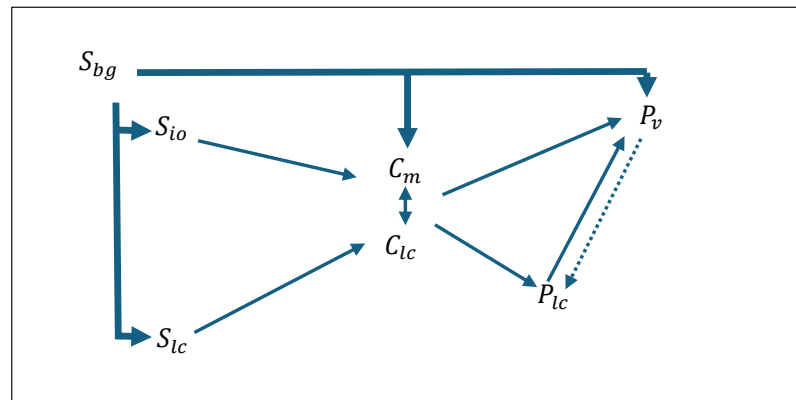


Source: Panels (a) and (b): author's elaboration based on Bellandi (2002). Panel (c): author's elaboration.

Note: Continuous arrows represent linear effects; dotted arrows represent feedback effects. The larger rectangle in panel (b) is a simplified version of the pale-shaded figure in panel (a); panel (c) is a simplified version of panel (b).

A.6.3 The competitive loop of of the rural context as a periphery of other LSs

Figure A.5: **The competitive loop of the rural context as a periphery of other LSs**



Source: Author's elaboration, based on Bellandi (2002). *Note:* Continuous arrows represent linear effects; dotted arrows represent feedback effects.

A.7 Supplementary Materials for Chapter 4

A.7.1 Dataset coverage scope

The following table shows the dataset’s coverage scope (ARTEA) by comparing figures on AL and UAA with those from the latest national census (ISTAT, 2022).

Table A.4: Dataset coverage scope

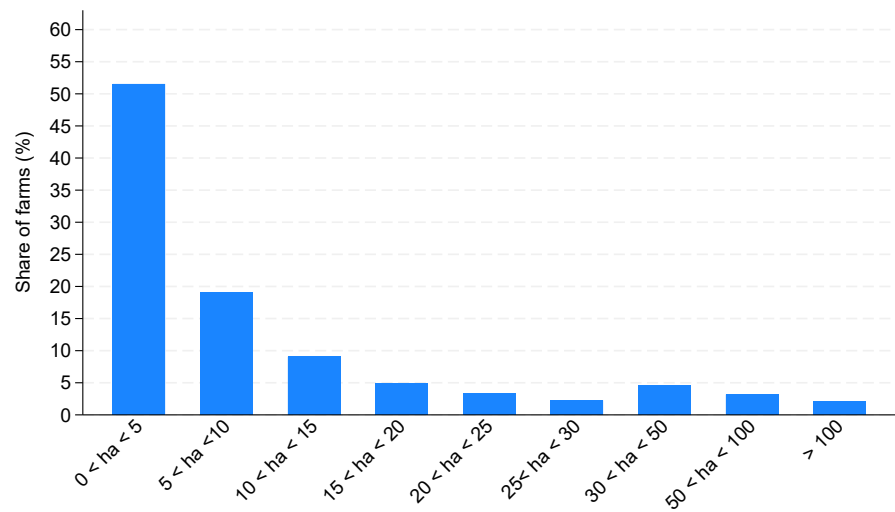
Source	Category	Surface (Ha)
ISTAT (2022)		
	UAA Tuscany (2020)	640,110
	AL Tuscany (2020)	440,829
ARTEA DATASET		
	UAA Tuscany (2022)	611,657
	AL Tuscany (2022)	416,117

Source: Author’ elaboration based on ARTEA dataset and ISTAT (2022).

Note: UAA = Utilised Agricultural Area; AL = Arable Land.

A.7.2 Distribution of farms benefiting from Greening Payments by AL size classes (2022)

Figure A.6: Share of GP beneficiary farms by AL class



Source: Author’ elaboration based on ARTEA dataset (percentages values, 2022).

A.7.3 Data Cleaning Procedures

The data cleaning process entails the exclusion of the following farm categories: i) farms with incomplete information, such as those for which the Graphic Crop Plan is erroneously missing; (ii) farms included only because they applied for non-CAP subsidies; (iii) farms managing parcels in Tuscany but headquartered outside the region, whose payments are therefore administered by other Italian regional paying agencies; (iv) farms participating in CAP measures but not in GPs; (v) holdings exempt from the CD requirements under Article 44(3) of Regulation (EU) No 1307/2013 (European Commission, 2013), including farms with more than 75% of their arable land under fallow, grasses or other herbaceous forage, or leguminous crops, as well as farms with more than 75% of their eligible agricultural area under permanent grassland, grasses or other herbaceous forage, or crops cultivated under water; (vi) organic farms, which are entitled *ipso facto* to the *greening* payment under Article 43(11) of the Regulation; and (vii) farms without AL.

A.7.4 Crop Diversification Categories

The table presents the macro-categories used to classify arable land (AL) crops cultivated by farms.

Table A.5: Crop Diversification Categories

Categories	
1. AROMATIC	17. LEGUMINOUS
2. BERRIES	18. MIX
3. CEREALS	19. NUTS
4. CITRUS	20. OILSEED
5. ENERGY	21. OTHER
6. EXTRA: e.g., lake	22. PERMANENT_GRASS
7. FALLOW	23. RICE
8. FIBER and TOBACCO	24. ROOT
9. FOREST	25. TEA
10. FRUIT_TREES	26. TEMPORARY_GRASS
11. GRASSES	27. TREES
12. INDUSTRIAL_OTHER	28. TROPICAL
13. LEGUMINOUS	29. VEGETABLES
14. MIX	30. ORNAMENTAL_PLANTS_FLOWERS
15. GRASSES	31. VINES
16. INDUSTRIAL_OTHER	32. OLIVE TREES
	33. OTHER ARABLE

Source: Author' elaboration based on European regulatory framework.

A.7.5 Descriptive Statistics

Table A.6: Summary Statistics

Category	Variable	Obs	Mean	SD	Min	Max
<i>Running Variable</i>	Arable Land	14,512	11.94	33.84	0.00	1,070
<i>Economic Outcomes</i>	Standard Output	14,512	50,446	205,342	200	1.15e+07
	Standard Output/UAA	14,508	3,797	12,465	27.43	1,050,547
<i>Land-use practices</i>	Number of crops	14,512	1.99	1.20	1	12
	Share of main crop (%)	14,512	81.32	22.18	24.32	100
	Share of two main crops (%)	14,512	95.80	8.74	45.69	100
<i>(Ind.) Environmental Outcomes</i>	Shannon Index	14,512	0.38	0.44	0	1.73
	CS _{max}	7,417	3.27	2.10	0	6
	CS _{avg}	7,417	2.48	1.77	0	6
	CS _{index}	7,417	2.53	1.81	0	6

Source: Author's elaboration based on ARTEA dataset (2022).

A.7.6 Crop Rotation Categories

Table A.7: Crop-Rotation Categories

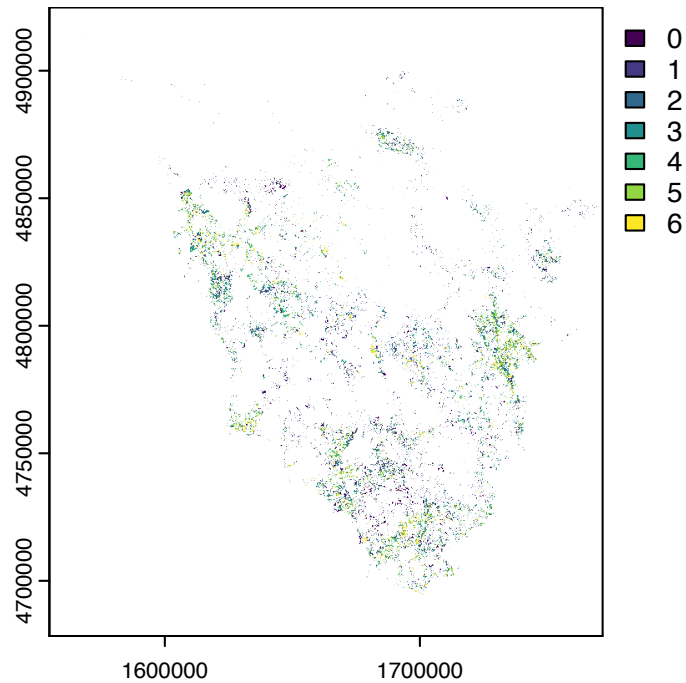
Categories	
1. Cereals	4. Aromatic/Medicinal
2. Legumes	5. Industrial
3. Renewable Crops*	6. Horticultural Crops

Source: Author' elaboration.

*Renewable crops are short-cycle crops that require deeper soil tillage and are grown to renew and revitalise the soil. They help maintain fertility, control pests, and mitigate soil degradation, thereby supporting crop rotation. In our case, this category includes, for example, sorghum, rapeseed, potatoes, sunflower, sugar beet, fodder beet, and turnip.

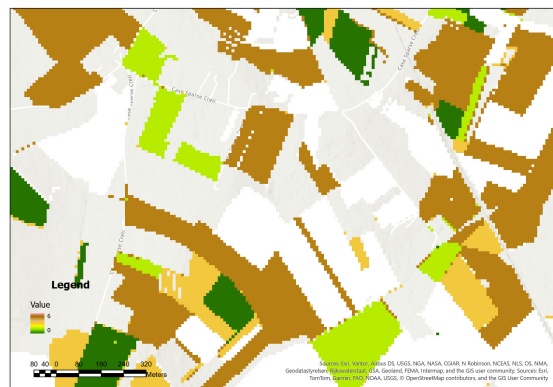
A.7.7 Sum of transition at the pixel level

Figure A.7: Sum of transitions in Tuscany from 2016 to 2022 at the pixel level.



Source: Author's elaboration based on dataset ARTEA.

Figure A.8: Sum of crop transitions from 2016 to 2022 at the pixel level (zoom on a selected area of Tuscany).



Source: Author's elaboration based on the ARTEA dataset.

A.7.8 Regression Discontinuity within a Fuzzy Design

As illustrated in Table A.8, a two-sided non-compliance pattern emerges: some farms located above the cutoff (T assignment = 1), although eligible, do not comply with the crop diversification (CD) requirements, while others, albeit few, below the cutoff (T assignment = 0) do implement it. Although the reasoning appears intuitive for units above the threshold, it may be more complex for those below it (namely, farms whose share of arable land eligible for Green Payments exceeds their currently cultivated area). While specific interactions between the Basic Payment and the Green Payment within these units cannot be ruled out, it is plausible that such cases reflect minor inconsistencies in the administrative records. In the case of the 10-hectare threshold, given their extremely limited incidence (1.36% of eligible farms in the relevant subsample), these observations can reasonably be disregarded, as they do not alter the nature of the identification strategy. With reference to the 30-hectare threshold, such cases account for 13.52% of eligible farms. Although this represents a higher share compared with the lower threshold, the decision to retain these observations is motivated by the reduced overall sample size in proximity to this cutoff. Excluding them would further restrict local variability around the threshold, with potential implications for bandwidth selection and the statistical power of the analysis, which at 30 hectares is structurally more limited.

Table A.8: **Fuzzy Design Representation**

T assignment	T take-up		Total	T assignment	T take-up		Total
	0	1			0	1	
0	11,265	156	11,421	0	486	76	562
1	257	1,099	1,356	1	96	1,077	1,173
Total	11,522	1,255	12,777	Total	582	1,153	1,735

(a) Fuzzy Design at the 10-ha threshold

(b) Fuzzy Design at the 30-ha threshold

Source: Author's elaboration based on ARTEA dataset (2022). Note: T indicates Treatment.

A.7.9 Design Validation

A.7.9.1 Compliance or Manipulation? Strategic Responses to the CD Threshold

RDD is a valid empirical design if it successfully replicates the conditions of local randomization. In this regard, units should not be able to actively manipulate their score values by changing their treatment status at the cutoff; otherwise, such behaviour would introduce bias and violate the core identifying assumptions of the RDD design.

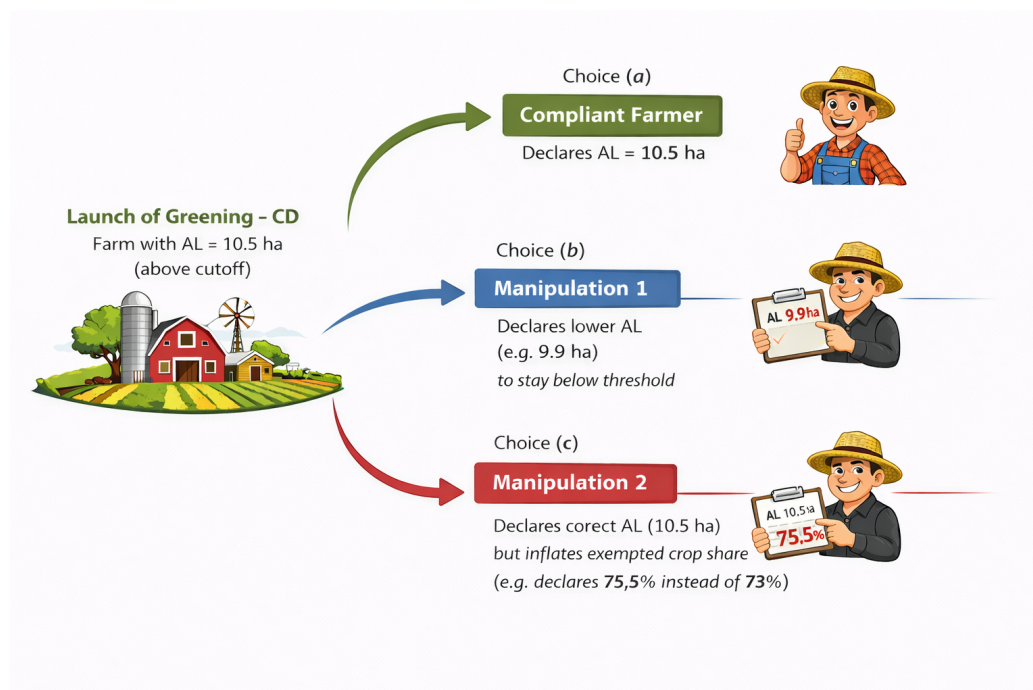
Let us see how such manipulation could potentially arise within the CD measure and assesses whether it can be ruled out in the present study.

Looking at the design of the CD initiative, two main forms of potential manipulation can be identified. The first—also the most extensively discussed in the literature (see, Brutti et al., 2026)—concerns the possibility that farmers may declare a total amount of arable land (AL) lower than the one actually farmed, thereby remaining below the policy threshold and receiving the greening payment without having to comply with the CD requirements. The second potential source of manipulation relates to the possibility of exploiting the exemptions provided by the regulation—specifically those established under Article 44 of Regulation (EU) No. 1307/2013 (European Commission, 2013). In particular, paragraphs 1 and 3 of the regulation provide an exemption for farms that devote more than 75% of their AL to fallow land and/or forage crops, leguminous crops, rice, or permanent grassland, as well as for farms whose entire agricultural area is under flooded cultivation. In this context, farms may have an incentive to declare a share of AL allocated to these uses above the 75% threshold in order to qualify for the exemption. The regulation also provides an exemption for farms already complying with environmentally friendly practices, such as organic farms. However, this kind of exemption is unlikely to represent a relevant source of manipulation. Aside from the fact that eligibility for this exemption generally requires the farm to already hold organic status, transitioning to organic farming typically requires several years and involves substantial structural organisational adjustments and certification costs; therefore, adopting such a strategy solely to avoid the CD requirements would be highly unlikely and economically irrational.

Based on this, Figure A.9 presents a simplified representation of the potential choices available to eligible farms at the CD cutoff of 10 hectares, which represents the main threshold determining eligibility for treatment (i.e., all farms with $AL > 10$ hectares are potentially treated). Consider, for instance, a farm with a total AL of 10.5 hectares. The farm holder may face three possible behavioural choices—besides the option of not applying for any CAP subsidy: (a) complying with the CD requirements or legitimately qualifying for one of the exemptions provided under Article 44 (i.e., a compliant farmer) (choice (a)

in Figure A.9); (b) declaring a lower amount of AL than actually managed, for instance reporting 9.9 hectares in order to remain below the threshold (choice (b) in Figure A.9). If farms misreported their AL strategically, it would be more plausible for them to declare a value just below the threshold (e.g., 9.9 ha) rather than a substantially lower value (e.g., 7.7 ha), since declaring much lower levels would imply misreporting a larger share of land and could increase the likelihood of detection through administrative checks; or (c) declaring the correct total amount of AL but applying for one of the exemptions under Article 44 while misreporting the eligibility requirements—for instance by declaring a share of AL devoted to the exempted crops that is higher than the one actually cultivated (choice (c) in Figure A.9).

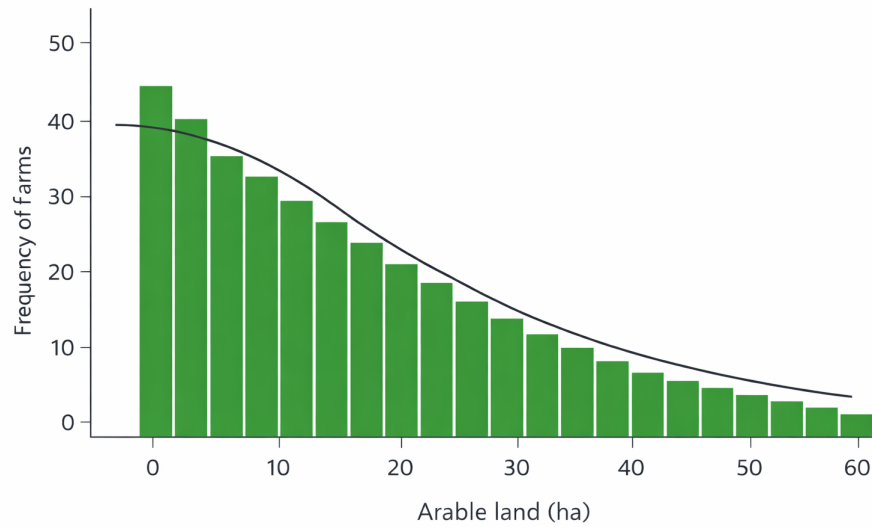
Figure A.9: **Potential behavioural responses of farms around the 10-hectare CD threshold**



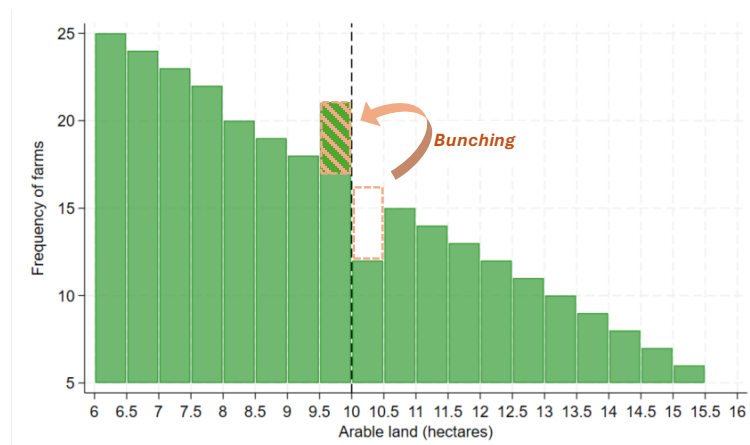
Source: Author's elaboration. *Note:* The figure illustrates the possible behavioural responses of a farm located just above the 10-hectare arable land threshold determining eligibility for the Crop Diversification (CD) requirement. Farms may either comply with the policy requirements or strategically manipulate declarations by underreporting arable land or inflating the share of crops qualifying for exemption under Article 44 of Regulation (EU) No. 1307/2013.

Against this background, how can we evaluate whether farms located around the cutoff predominantly comply with the policy requirements (choice (a)) rather than strategically manipulating their declarations (choice (b) or (c)), thereby supporting or challenging the validity of the RD design?

In principle, the distribution of the population of farms by AL size typically follows

Figure A.10: **Distribution of farms by arable land size and manipulation type 1**

(a) Generic distribution of farms by AL size



(b) Bunching around the threshold (Manipulation 1)

Source: Author's elaboration.

a smooth declining pattern, whereby the frequency of farms decreases as farm AL size increases, without exhibiting discontinuities or jumps at specific thresholds. An example of such a distribution is depicted in Figure A.10 panel (a). Starting from this premise, the observation of a distribution of this type allows us to rule out manipulation of the first type. Indeed, if farms strategically underreported their total AL in order to remain below the policy cutoff (as in choice (b) of the example illustrated in Figure A.9), such behaviour would generate an abnormal accumulation of farms just below the threshold—i.e., a sorting of units around the cutoff. This, in turn, would produce a visible discontinuity in the density of observations at the threshold, reflecting the relocation of units from just above to just below the cutoff, as schematically illustrated by the pink dashed rectangle in Figure A.10, panel (b). The presence of such patterns, especially when confirmed by density tests, may suggest potential manipulation of AL by farmers (manipulation type 1) and thus threaten the validity of the RD design (Cattaneo et al., 2019).

However, some important qualifications must be made in this regard. First, it is necessary to examine the distribution curve in its entirety. Depending on the type and amount of data available, the overall distribution may appear irregular or “jagged”, reflecting the limited number of observations in certain bins (Brutti et al., 2026; Cattaneo et al., 2019). This is also the case in our study, particularly when examining the 30-hectare threshold, as depicted in Figure 4.2. Indeed, despite the dataset providing good coverage of the entire population of Tuscan farms, the number of observations within specific bins remains relatively limited. In such cases, the presence of local fluctuations in the distribution cannot be interpreted as evidence of manipulation type-1 per se. In particular, if the entire distribution displays this jagged pattern, the mere occurrence of one of these fluctuations at the policy threshold cannot be taken as proof of strategic manipulation type-1 by farmers. In this respect, moreover, the density tests conducted at both the 10- and 30-hectare thresholds confirm, at least in our case, the absence of potential type-1 manipulation.

Secondly, the case illustrated in Figure A.10, panel (b), highlights manipulation type-1 behaviour concentrated among farms located within the first 0.5 hectares below the threshold. More generally, manipulation type-1 may also occur within a wider range around the cutoff. If manipulation type-1 extended over a wider range, the density of observations above the threshold would become progressively depleted, while the segment immediately below the policy cutoff would become increasingly crowded as farms bunch just below the threshold. This would generate a sharp drop in the distribution at the cutoff. Above the threshold, a local depression in the density would emerge—potentially larger than the one depicted in Figure A.10 panel (b)—plausibly reflecting the same mass of units that accumulated immediately below the cutoff. More generally, the wider the potential range of

manipulation, the wider this depressed segment of the distribution would appear. As farm AL size increases further, however, the density would gradually return to its underlying pattern, as the scope for manipulation is expected to diminish. Indeed, it is reasonable to expect that the extent of such behaviour declines as the distance from the threshold increases. Farms located further away from the cutoff would need to underreport a larger share of their AL in order to appear non-eligible, thereby increasing both the magnitude of the misreporting and the likelihood that such discrepancies are detected.

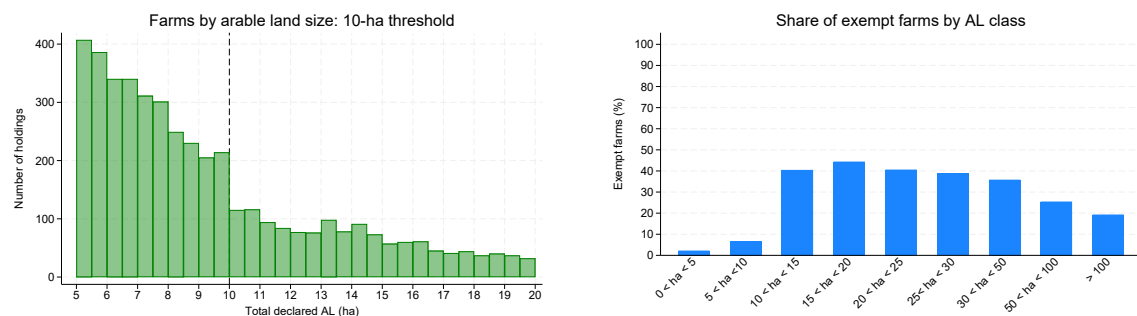
Third, it is important to note that, without further specific investigation, this type of analysis does not allow other forms of manipulation to be ruled out, such as the behaviour we define as manipulation type 2 in Figure A.9. This therefore raises an additional issue that, in our view, deserves specific consideration.

In particular, attempting to account for manipulation type 2 through the analysis of manipulation type 1 should not involve removing such farms from the observed sample. Excluding these units would mechanically generate a discontinuity in the distribution starting at the 10-hectare threshold. Given the design of the policy, exemption mechanisms determined by art. 44 (1) and (3), can only apply to farms located above this threshold. As a result, farms qualifying for these exemptions are, by construction, predominantly concentrated above 10 hectares. If these observations were removed from the dataset used to test the density of observations around the cutoff, the resulting test would artificially generate a spurious discontinuity in the distribution. This situation also differs from other types of exemptions, such as organic farms, whose presence, by construction, is independent of the policy threshold and therefore plausibly distributed along the entire AL size distribution. By contrast, farms exempted under Article 44(1) and (3) are structurally linked to the policy design and thus appear primarily above the threshold.

This is confirmed by our data. Figure A.11, panel (a), shows that removing these farms generates a noticeable depression in the distribution after the 10-hectare threshold. However, it is worth noting that this pattern differs from what would be expected under type-1 manipulation. In this case, indeed, the sharp drop immediately after the threshold is followed by a relatively flat segment extending over a wider range than that typically expected under type-1 manipulation. Under this scenario, the density remains relatively stable above the cutoff rather than quickly returning to its underlying trend, reflecting the fact that the observed discontinuity is driven by the removal of exempted farms, which are likely to be distributed across different farm sizes above the 10-hectare threshold. This interpretation is further supported by the absence of any concentration of observations (sorting) just below the cutoff corresponding to the units missing above it. In other words, the typical bunching pattern illustrated in Figure A.10, panel (b), does not emerge when

exempted farms are removed.

Figure A.11: **Exempted farms according to art 44 EU Reg. N 1307/2013**



(a) Distribution of farms by AL excluding exempted farms

(b) Percentage of exempted farms by AL classes

Source: Author's elaboration.

Based on this, the dataset used in our analysis is therefore enriched with these exempted farms only when assessing the potential presence of type-1 manipulation. These observations are subsequently removed when conducting the counterfactual analysis, as it is essential to compare homogeneous groups above and below the cutoff.

This, in turn, calls for additional checks to detect potential patterns of type-2 manipulation, the extent of which also depends on the richness of the information contained in the dataset. One of these concerns the expected shape of the distribution of farms subject to these exemptions. In principle, such farms should not be disproportionately concentrated immediately above the 10-hectare eligibility threshold; rather, they are plausibly distributed along the range of farms located above the cutoff. This is indeed what can be observed in our dataset, as illustrated in Figure A.11, panel (b), which depicts the share (percentage) of these farms across AL size classes. The figure clearly shows—consistently with the expected pattern—that the share of exempted farms rises sharply immediately after the 10-hectare threshold (while the few observations below this threshold are negligible and likely due to reporting or classification errors) and then remains relatively stable, in proportional terms, up to the AL class of 50 hectares.

Further checks may involve cross-referencing information derived from exemption requests with data on the crops actually cultivated in the fields. In our case, such checks were conducted and reveal no explicit signs of type-2 manipulation. This evidence further supports the interpretation of the density analysis related to manipulation type 1 and strengthens the validity of our RD design and RD manipulation test as seen in Section 4.5.

A.7.9.2 Density test

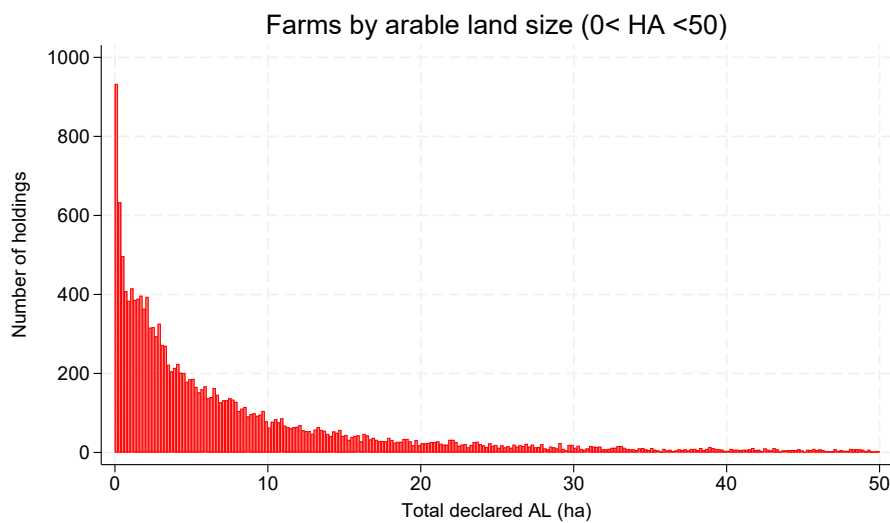
Table A.9: RD manipulation test: density continuity at the cutoff

	cutoff = 10	cutoff = 30
<i>Test statistic (T)</i>	−1.384	−0.502
<i>P-value</i>	0.166	0.615
<i>Eff. observations</i>	2621	291
<i>h left of c</i>	2.933	2.285
<i>h right of c</i>	3.037	2.288

Source: Author' elaboration. *Notes:* “Eff. observations” denotes the effective sample used around the cutoff; *h* are side-specific bandwidths from the local polynomial density estimator.

A.7.9.3 Farms distribution between 0 and 50 hectares

Figure A.12: Farms by AL size classes



Source: Author' elaboration based on ARTEA dataset.

A.7.10 Results at 30-Ha threshold

Table A.10: ITT: policy assignment on CD outcomes (c=30 ha)

	<i>RD Estimator</i>	<i>Robust 95% CI</i>	<i>h</i>	<i>Eff. Observations</i>
Economic Outcomes				
<i>Standard Output</i>	-16243	[-78742, 23146]	7.419	590
<i>Standard Output_UAA</i>	-344.90	[-2082, 794]	8.236	679
Land-use practices				
<i>Number of Crops</i>	0.166	[-0.379, 0.517]	8.425	698
<i>Share of main crop</i>	-5.020*	[-13.50, 0.484]	7.869	635
<i>Share of two main crops</i>	-3.943*	[-9.370, 0.256]	9.034	752
(Ind.) Environmental Outcomes				
<i>Shannon Index</i>	0.091	[-0.032, 0.236]	8.811	731
<i>CS_{max}</i>	-0.020	[-0.872, 0.484]	8.213	619
<i>CS_{avg}</i>	0.267	[-0.499, 0.754]	9.214	704
<i>CS_{index}</i>	0.383	[-0.381, 0.860]	9.416	721

Source: Author' elaboration. *Notes:* ***, **, * denote 1%, 5%, and 10% significance levels; *h* = MSE bandwidth; c= cutoff; Kernel: triangular.

A.7.11 Robustness Checks

A.7.11.1 Predetermined covariates

Figure A.13: Robustness check with predetermined covariates

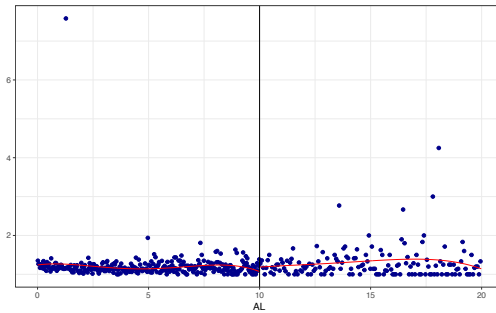


Figure A.14: No. of partners

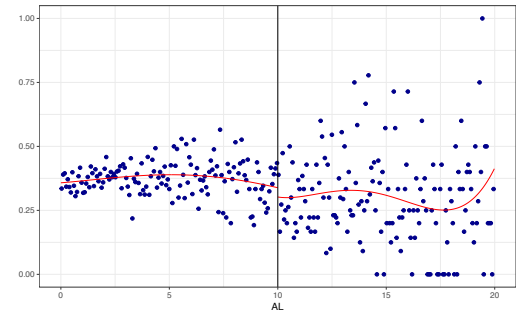


Figure A.15: Only women

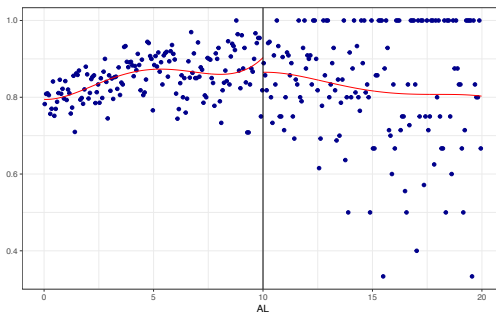


Figure A.16: Sole Proprietorship

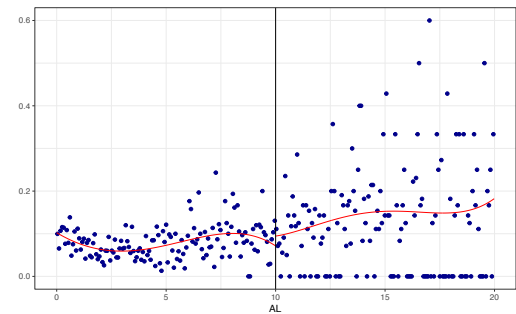


Figure A.17: Partnership

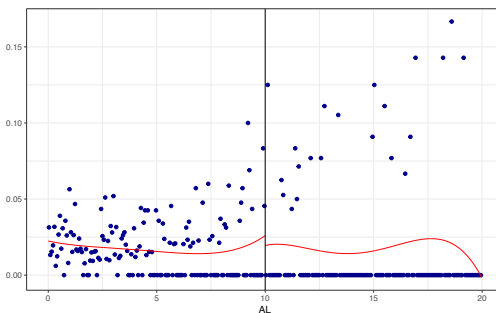


Figure A.18: Joint-stock companies

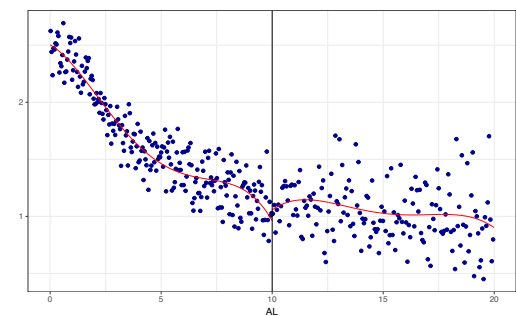


Figure A.19: No. of parcels

Source: Author' elaboration. Note: ES bins.

Table A.11: Formal continuity-based analysis for covariates

Variable	CER-Optimal bandwidth	RD Estimator	Robust Inf. P-value	Robust Inf. CI	Eff. Numb Obs
No. of partners	1.639	0.045	0.531	[-0.116,0.225]	1067
Only women	1.524	-0.063	0.395	[-0.205, 0.080]	984
Sole proprietorship	1.893	0.015	0.739	[-0.076, 0.108]	1234
Partnership	2.178	0.002	0.888	[-0.068, 0.078]	1437
Joint-stock companies	2.099	-0.005	0.769	[-0.047, 0.034]	1373
No. of parcels	1.889	0.006	0.944	[-0.177, 0.190]	1231

Source: Author' elaboration.

A.7.11.2 Placebo cutoffs

Table A.12: Placebo cutoffs: First Stage Effects

Alternative cutoffs	MES-Optimal bandwidth	RD Estimator	Robust Inf. P-value	Robust Inf. CI	N. obs left	N. obs right
7	1.217	-0.008	0.705	[-0.053,0.035]	854	718
8	1.013	-0.025	0.329	[-0.096, 0.032]	620	486
9	1.732	-0.102	0.003	[-0.186, -0.036]	925	583
10	3.085	0.476	0.000	[0.362, 0.556]	1563	584
11	1.410	-0.174	0.015	[-0.384, -0.041]	399	242
12	1.936	-0.004	0.700	[-0.128, 0.191]	391	318
13	1.752	-0.109	0.115	[-0.303, 0.032]	281	306

Source: Author' elaboration.

Table A.13: ITT estimates for alternative cutoffs

Cutoffs	ITT: Shannon Index		ITT: N.crops		ITT: Main.crop		ITT: Two.main.crops	
	RD Estimator	Robust 95% CI	RD Estimator	Robust 95% CI	RD Estimator	Robust 95% CI	RD Estimator	Robust 95% CI
7	-0.026	[-0.089, 0.058]	-0.015	[-0.168, 0.209]	1.482	[-2.896, 5.495]	-0.335	[-1.843, 0.987]
8	-0.007	[-0.085, 0.109]	-0.034	[-0.239, 0.266]	0.152	[-6.022, 4.297]	0.201	[-1.964, 1.844]
9	-0.084**	[-0.198, -0.002]	-0.142	[-0.421, 0.068]	4.786**	[0.430, 10.949]	1.003	[-0.754, 3.073]
10	0.216***	[0.133, 0.315]	0.491***	[0.252, 0.785]	-10.778***	[-15.963, -6.266]	-2.621**	[-5.051, -0.598]
11	-0.023	[-0.153, 0.075]	-0.043	[-0.399, 0.330]	1.833	[-3.011, 8.698]	-0.969	[-4.058, 2.130]
12	-0.039	[-0.066, 0.180]	0.036	[-0.323, 0.368]	-1.803	[-8.986, 3.700]	-0.295	[-4.033, 3.090]
13	-0.014	[-0.154, 0.108]	0.113	[-0.330, 0.520]	1.258	[-5.164, 8.484]	-0.543	[-4.653, 2.967]

Source: Author' elaboration. Note: ***, **, * denote 1%, 5%, and 10% significance levels, respectively.

Table A.14: **FRD Estimates for the 9 ha Cutoff**

Cutoff	FRD: Shannon Index		FRD: Main Crop Share	
	RD Estimator	Robust 95% CI	RD Estimator	Robust 95% CI
9	1.115	[-1.259, 3.120]	-73.53	[-193.3, 73.17]

Source: Author' elaboration.

Notes: ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

A.7.11.3 RDD Replication for 2021

Table A.15: **RD results at 10-ha in 2021**

	<i>RD Estimator</i>	<i>Robust 95% CI</i>	<i>h</i>	<i>Eff. Observations</i>
First Stage	0.226**	[0.053, 0.342]	1.459	928
Intention-to-Treat Results				
Economic Outcomes				
<i>Standard Output</i>	5062	[-10129, 23529]	1.721	1106
<i>Standard Output_UAA</i>	365.9	[-497, 1413]	3.047	2100
Land-use practices				
<i>Number of Crops</i>	0.504***	[0.266, 0.772]	4.125	3030
<i>Share of main crop</i>	-10.09***	[-14.74, -4.215]	2.825	1934
<i>Share of two main crops</i>	-1.773	[-3.919, 0.874]	2.630	1780
(Ind.) Environmental Outcomes				
<i>Shannon Index</i>	0.200***	[0.096 , 0.288]	3.178	2200
Fuzzy Parameter				
Economic Outcomes				
<i>Standard Output</i>	19613	[-44469, 90429]	1.736	1120
<i>Standard Output_UAA</i>	1626	[-1121, 5091]	2.407	1610
Land-use practices				
<i>Number of Crops</i>	1.415***	[0.710, 2.444]	3.258	2271
<i>Share of main crop</i>	-28.39***	[-44.38, -17.12]	3.640	2607
<i>Share of two main crops</i>	-5.324*	[-12.44, 1.037]	3.055	2109
(Ind.) Environmental Outcomes				
<i>Shannon Index</i>	0.547***	[0.333, 0.855]	3.648	2612

Source: Author' elaboration. *Notes:* ***, **, * denote 1%, 5%, and 10% significance levels; h = MSE bandwidth; Kernel: triangular.

A.7.11.4 Sensitivity to Bandwidth Choice

Table A.16: **Bandwidth robustness check: First-stage estimates at the 10-hectare cutoff**

	MSERD	MSESUM	CERRD
First stage	0.476***	0.477***	0.454***
Robust 95% CI	[0.362, 0.556]	[0.354, 0.557]	[0.333, 0.563]
Bandwidth (h)	3.085	3.169	1.923
Effective observations	2147	2211	1253
Kernel	Triangular	Triangular	Triangular

Source: Authors' elaboration. Notes: Robust bias-corrected estimates are reported. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. h denotes the optimal bandwidth selected by each bandwidth selection procedure.

Table A.17: **Bandwidth robustness checks for ITT estimates at the 10-hectare cutoff**

Outcome	MSERD				MSESUM				CERRD			
	RD Est.	Robust 95% CI	h	Eff. Obs.	RD Est.	Robust 95% CI	h	Eff. Obs.	RD Est.	Robust 95% CI	h	Eff. Obs.
Economic outcomes												
Standard Output	6804	[-12688, 22586]	1.424	912	1177	[-14853, 20057]	1.696	1105	14555*	[-2165, 29822]	0.888	579
Standard Output/UAA	370.35	[-737.9, 1444]	2.836	1950	288.21	[-921.04, 1434.12]	2.309	1534	347.62	[-818.71, 1500.40]	1.767	1147
Land-use practices												
Number of crops	0.491***	[0.252, 0.785]	2.948	2041	0.486***	[0.255, 0.779]	3.161	2204	0.436***	[0.144, 0.750]	1.838	1200
Share of main crop	-10.778***	[-15.963, -6.266]	3.277	2294	-10.730***	[-15.563, -6.564]	3.775	2744	-11.106***	[-16.790, -5.683]	2.042	1335
Share of two main crops	-2.621**	[-5.051, -0.598]	3.657	2574	-2.755***	[-5.457, -0.559]	3.107	2165	-2.792**	[-5.454, -0.285]	2.229	1475
Indirect environmental outcomes												
Shannon Index	0.216***	[0.133, 0.315]	3.316	2328	0.215***	[0.137, 0.310]	3.668	2653	0.221***	[0.119, 0.329]	2.067	1350
CS _{max}	0.157	[-0.526, 0.669]	2.245	1094	0.206	[-0.444, 0.674]	2.700	1339	0.119	[-0.597, 0.762]	1.455	693
CS _{avg}	-0.067	[-0.722, 0.392]	2.146	1049	0.012	[-0.624, 0.386]	2.872	1421	-0.108	[-0.799, 0.499]	1.391	659
CS _{index}	-0.065	[-0.741, 0.408]	2.056	994	-0.010	[-0.672, 0.381]	2.685	1334	-0.114	[-0.825, 0.511]	1.333	635

Source: Authors' elaboration.

Notes: The table reports RD estimates obtained using alternative bandwidth-selection procedures. Robust bias-corrected confidence intervals are reported. MSERD denotes the mean squared error-optimal bandwidth for the RD treatment-effect estimator; MSESUM denotes the mean squared error-optimal bandwidth based on the sum of the two regression estimators; CERRD denotes the coverage error rate-optimal bandwidth for the RD treatment-effect estimator. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. *h* denotes the selected bandwidth. Effective observations are the sum of the observations included to the left and right of the cutoff. A triangular kernel is used in all specifications.

Table A.18: **Bandwidth robustness checks for FRD estimates at the 10-hectare cutoff**

Outcome	MSERD				MSESUM				CERRD			
	RD Est.	Robust 95% CI	<i>h</i>	Eff. Obs.	RD Est.	Robust 95% CI	<i>h</i>	Eff. Obs.	RD Est.	Robust 95% CI	<i>h</i>	Eff. Obs.
Economic outcomes												
Standard Output	12772	[-23310, 56186]	1.535	990	12264	[-23819, 55502]	1.542	993	41690*	[-4724, 92068]	0.957	623
Standard Output/UAA	783.3	[-1169, 2761]	3.535	2546	773.3	[-1138, 2711]	3.713	2693	577.7	[-1720, 2878]	2.203	1456
Land-use practices												
Number of crops	1.045***	[0.506, 1.742]	2.601	1772	1.037***	[0.517, 1.733]	2.754	1888	0.957**	[0.219, 1.760]	1.621	1053
Share of main crop	-23.31***	[-36.53, -12.63]	2.743	1881	-23.24***	[-36.43, -12.71]	2.815	1932	-24.81***	[-40.35, -10.37]	1.710	1113
Share of two main crops	-5.885**	[-11.89, -1.071]	2.749	1884	-5.894**	[-11.88, -1.175]	2.847	1956	-5.793*	[-12.90, 0.819]	1.713	1115
Indirect environmental outcomes												
Shannon Index	0.471***	[0.266, 0.727]	2.588	1762	0.468***	[0.270, 0.723]	2.744	1881	0.486***	[0.201, 0.793]	1.613	1046
CS_{max}	0.649	[-0.249, 1.401]	3.959	2036	0.658*	[-0.238, 1.401]	4.048	2084	0.370	[-0.659, 1.325]	2.567	1267
CS_{avg}	0.201	[-0.923, 0.864]	3.357	1694	0.211	[-0.910, 0.870]	3.381	1704	-0.134	[-1.299, 0.813]	2.177	1063
CS_{index}	0.303	[-0.747, 0.945]	3.661	1871	0.309	[-0.737, 0.948]	3.690	1888	-0.097	[-1.196, 0.809]	2.374	1158

Source: Authors' elaboration.

Notes: The table reports fuzzy RD estimates obtained using alternative bandwidth-selection procedures. Robust bias-corrected confidence intervals are reported. MSERD denotes the mean squared error-optimal bandwidth for the RD treatment-effect estimator; MSESUM denotes the mean squared error-optimal bandwidth based on the sum of the two regression estimators; CERRD denotes the coverage error rate-optimal bandwidth for the RD treatment-effect estimator. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. *h* denotes the selected bandwidth. Effective observations are the sum of the observations included to the left and right of the cutoff. A triangular kernel is used in all specifications.

A.7.11.5 Sensitivity to Kernel Choice

Table A.19: Kernel robustness check: First-stage estimates at the 10-hectare cutoff

	Triangular	Uniform	Epanechnikov
First stage	0.476***	0.479***	0.482***
Robust 95% CI	[0.362, 0.556]	[0.371, 0.551]	[0.371, 0.560]
Bandwidth (h)	3.085	2.654	2.968
Effective observations	2147	1824	2051
Bandwidth selector	MSERD	MSERD	MSERD

Source: Authors' elaboration.

Notes: Robust bias-corrected estimates are reported. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. h denotes the optimal bandwidth selected using the MSERD procedure. Effective observations are the sum of the observations included to the left and right of the cutoff.

Table A.20: Kernel robustness checks for ITT estimates at the 10-hectare cutoff

Outcome	Triangular				Uniform				Epanechnikov			
	RD Est.	Robust 95% CI	h	Eff. Obs.	RD Est.	Robust 95% CI	h	Eff. Obs.	RD Est.	Robust 95% CI	h	Eff. Obs.
Economic outcomes												
Standard Output	6804	[-12688, 22586]	1.424	912	3981	[-15745, 23781]	1.150	739	5947	[-15348, 22250]	1.366	871
Standard Output/UAA	370.35	[-737.9, 1444]	2.836	1950	415.96	[-725.68, 1605.98]	2.151	1419	407.82	[-647.09, 1434.16]	3.018	2091
Land-use practices												
Number of crops	0.491***	[0.252, 0.785]	2.948	2041	0.560***	[0.310, 0.879]	2.118	1388	0.511***	[0.269, 0.815]	2.632	1805
Share of main crop	-10.778***	[-15.963, -6.266]	3.277	2294	-10.595***	[-15.008, -6.654]	3.420	2428	-10.721***	[-15.803, -6.383]	3.191	2223
Share of two main crops	-2.621**	[-5.051, -0.598]	3.657	2574	-3.022***	[-5.512, -0.763]	2.563	1744	-2.629***	[-5.008, -0.647]	3.413	2417
Indirect environmental outcomes												
Shannon Index	0.216***	[0.133, 0.315]	3.316	2328	0.211***	[0.136, 0.295]	3.381	2388	0.217***	[0.136, 0.315]	3.152	2198
CS_{max}	0.157	[-0.526, 0.669]	2.245	1094	0.148	[-0.487, 0.656]	2.008	972	0.176	[-0.520, 0.687]	2.021	976
CS_{avg}	-0.067	[-0.722, 0.392]	2.146	1049	-0.046	[-0.658, 0.397]	1.885	914	-0.051	[-0.706, 0.403]	1.961	949
CS_{index}	-0.065	[-0.741, 0.408]	2.056	994	-0.047	[-0.676, 0.402]	1.841	894	-0.054	[-0.736, 0.420]	1.847	897

Source: Authors' elaboration.

Notes: The table reports RD estimates obtained using alternative kernel functions. Robust bias-corrected confidence intervals are reported. The bandwidth selector is kept fixed at the default MSERD criterion in all specifications. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. h denotes the selected bandwidth. Effective observations are the sum of the observations included to the left and right of the cutoff.

Table A.21: **Kernel robustness checks for FRD estimates at the 10-hectare cutoff**

Outcome	Triangular				Uniform				Epanechnikov			
	RD Est.	Robust 95% CI	<i>h</i>	Eff. Obs.	RD Est.	Robust 95% CI	<i>h</i>	Eff. Obs.	RD Est.	Robust 95% CI	<i>h</i>	Eff. Obs.
Economic outcomes												
<i>Standard Output</i>	12772	[-23310, 56186]	1.535	990	3567	[-31483, 43826]	1.480	955	-2824	[-43326, 41178]	2.058	1343
<i>Standard Output/UAA</i>	783.3	[-1169, 2761]	3.535	2546	912.8	[-1165, 2829]	2.767	1899	574.9	[-1782, 2942]	2.385	1600
Land-use practices												
<i>Number of crops</i>	1.045***	[0.506, 1.742]	2.601	1772	1.067***	[0.563, 1.679]	2.247	1482	1.059***	[0.543, 1.737]	2.494	1679
<i>Share of main crop</i>	-23.31***	[-36.53, -12.63]	2.743	1881	-22.27***	[-34.33, -12.66]	2.410	1615	-22.92***	[-35.60, -12.74]	2.672	1838
<i>Share of two main crops</i>	-5.885**	[-11.89, -1.071]	2.749	1884	-5.453**	[-10.99, -1.090]	2.396	1611	-5.860**	[-11.87, -1.106]	2.512	1692
Indirect environmental outcomes												
<i>Shannon Index</i>	0.471***	[0.266, 0.727]	2.588	1762	0.464***	[0.279, 0.698]	2.157	1422	0.467***	[0.274, 0.710]	2.526	1707
<i>CS_{max}</i>	0.649	[-0.249, 1.401]	3.959	2036	0.563	[-0.613, 1.439]	2.568	1268	0.686*	[-0.281, 1.432]	3.570	1822
<i>CS_{avg}</i>	0.201	[-0.923, 0.864]	3.357	1694	0.071	[-1.048, 0.822]	2.551	1258	0.201	[-0.912, 0.853]	3.150	1574
<i>CS_{index}</i>	0.303	[-0.747, 0.945]	3.661	1871	0.330	[-0.801, 0.973]	2.808	1390	0.368	[-0.631, 1.012]	3.516	1790

Source: Authors' elaboration.

Notes: The table reports conventional FRD point estimates obtained using alternative kernel functions. Robust bias-corrected 95% confidence intervals are reported. The bandwidth selector is kept fixed at the default MSERD criterion in all specifications. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively. *h* denotes the selected bandwidth. Effective observations are the sum of the observations included to the left and right of the cutoff.

A.7.12 Descriptive Statistics for Farms Immediately Below the 30-Ha Threshold

Table A.22: Descriptive Statistics for Farms Immediately Below the 30-Hectare Threshold (27–30 ha)

Outcome Variable	Mean	Std. Err.	95% Confidence Interval	<i>N</i>
Number of cultivated crops	3.305	0.099	[3.109, 3.500]	128
Farms with at least three crops	0.742	0.039	[0.665, 0.819]	128
Main crop share $\leq 75\%$	0.820	0.034	[0.753, 0.888]	128
Two main crops share $\leq 95\%$	0.609	0.043	[0.524, 0.695]	128

Notes: The table reports descriptive statistics for farms with an eligible agricultural area between 27 and 30 hectares. Binary variables are reported as proportions.

A.8 Supplementary Materials for Chapter 5

A.8.1 Methodological approach to measuring landed property structures

The analysis of landed property structures first considers the possibility of investigating them through their different dimensions. As reported in Table A.2, these dimensions include the size and spatial distribution of properties, their number, as well as the type of property regimes and the characteristics of landowners associated with these properties. Different combinations of these elements indeed give rise to distinct configurations of landownership structures.

The empirical measurement of these dimensions depends on two main methodological conditions. First, the ability to reconstruct properties as the relevant unit of analysis at the local level. Second, the construction of consistent indicators capable of capturing the different dimensions of these properties. Both aspects are discussed below.

Data on landed property are typically available at the parcel level, which represents the smallest spatial unit recorded in land registers (Stefani, Cecchetti, et al., 2025). The reconstruction of properties as the relevant unit of analysis therefore requires aggregating all parcels (or plots) attributed to or owned by the same individual, group of individuals, or legal entity. This operation is methodologically supported by the procedure known as the “*cumulation of cadastral holdings*” (*cumulazione delle partite catastali*), as defined by INEA (1956). This procedure therefore allows the reconstruction of property units from parcel-level information, thereby enabling the empirical analysis of landownership structures. While such reconstruction can be carried out at different territorial levels depending on the boundaries adopted to identify properties belonging to the same ownership entity, in this study the resulting indicators are constructed at the municipal level.

On this basis, and drawing on insights from the existing literature (see Stefani, Cecchetti, et al., 2025), the following indicators are proposed to capture the different dimensions of landed property structures at the municipal level (Cecchi, 1983, 1988; Demetriou, 2014; Golzio, 1933; Medici et al., 1962, see). Although not intended to be exhaustive, this set of indicators provides a representative selection of measures used to characterise landownership structures. Table A.23 provides a synthesis of the dimensions considered and the corresponding indicators.

- *Gini index*: a measure of inequality in the distribution of a resource, here referring to the distribution of land capital through properties. It ranges from 0, when land capital is perfectly equally distributed across the population, to 1, when it is entirely concentrated in the hands of a single landowner. This indicator captures both the

number of properties and landowners.

- *Percentage of properties with an area < 2ha*: a measure of fragmentation in the structure of landownership, capturing the prevalence of very small properties. This indicator reflects both the size and the number of properties.
- *Percentage of properties with an area > 50ha*: a measure of concentration in the structure of landownership, capturing the presence of large properties. This indicator reflects both the size and the number of properties.
- *Average property size*: a measure used to better understand the physical organisation of land capital across properties, capturing the average size of property units.
- *Holders per 100 inhabitants*: a measure capturing the imbalance between the resident population and the owners of land capital. Values above 100 may indicate a potential lack of interest among landholders in the direct local management of land (captures the number of landowners).
- *Holders per property*: an indicator capturing co-ownership patterns. Higher values indicate a greater prevalence of shared ownership and may reflect stronger property fragmentation and more complex land management structures.
- *Percentage of public, private, or common property*: an indicator capturing the prevailing property-rights regime in a territory and helping to characterise the institutional configuration of landownership structures.
- *Simmons index*: a fragmentation index ranging between 0 and 1 used to capture the degree of fragmentation in landownership structures (this indicator reflects both the size and the number of properties). It is computed as

$$S = \frac{\sum_{i=1}^n a_i^2}{A^2}$$

where n is the number of parcels composing the property, a_i is the area of parcel i , and A is the total area of the property. A value equal to 1 indicates a fully consolidated property composed of a single parcel, whereas values approaching 0 indicate highly fragmented properties.

- *Januszewski index (K)*: another land fragmentation index, computed as

$$K = \frac{\sqrt{\sum_{i=1}^n a_i}}{\sum_{i=1}^n \sqrt{a_i}}$$

where n is the number of parcels and a_i represents the area of parcel i . As in the case of the Simmons index, the indicator assumes a value of 1 for fully consolidated properties and approaches 0 as fragmentation increases. The Januszewski index decreases inversely with the number of parcels and increases when the range of parcel sizes becomes smaller and when the total area of larger parcels increases relative to smaller ones (again, an indicator that reflects both the size and the number of properties).

Table A.23: **Elements of land ownership structures and corresponding indicators**

Elements	Indicators
Dimension, spatial distribution and number of properties	Average property size Percentage of properties with area < 2 ha Percentage of properties with area > 50 ha Gini index of property distribution Simmons index Januszewski index (K)
Type of property regime	Percentage of public property Percentage of private property Percentage of collective/common property
Type and number of landowners	Holders per property Holders per 100 inhabitants

Source: Author's elaboration based on Golzio (1933), INEA (1956), Medici et al. (1962), Zangheri (1981), Cecchi (1983), Demetriou (2014), Stefani, Cecchetti, et al. (2025).

A.8.2 *Validation of historical landownership data as a proxy for current structures*

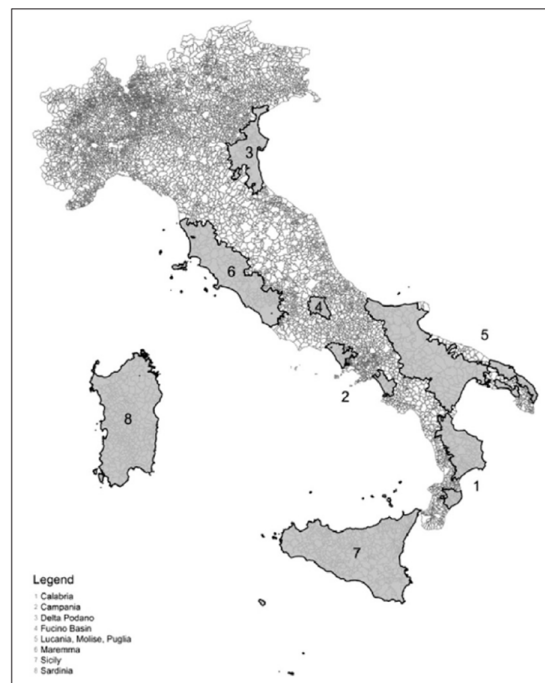
Table A.24 reports the correlation between landownership structure indicators in 1948 and 2022. These indicators were calculated for a sample of 14 municipalities located between the provinces of Florence and Prato (Tuscany-Italy), in the areas of Val di Bisenzio, Mugello, Valdisieve, and Romagna Toscana. As clearly shown, the correlations are generally positive, strong and statistically significant, indicating that the structural characteristics and spatial configuration of landownership tend to persist over time.

Table A.24: **Correlation between landownership structure indicators (1948–2022)**

Variables	Corr 48-22
Holders per 100 inhabitants	0.7582*
Holders per property	0.2967
Gini index	0.6667*
Percentage of properties with area <2 Ha	0.6659*
Percentage of properties with area >50 Ha	0.7129*
Average property size	0.7758*
Percentage of public property area	0.0813

Source: Author's elaboration based on INEA (1948) and Agenzia delle Entrate (2022) data. Note: * denotes 10% of significance level

A.8.3 Land reform areas

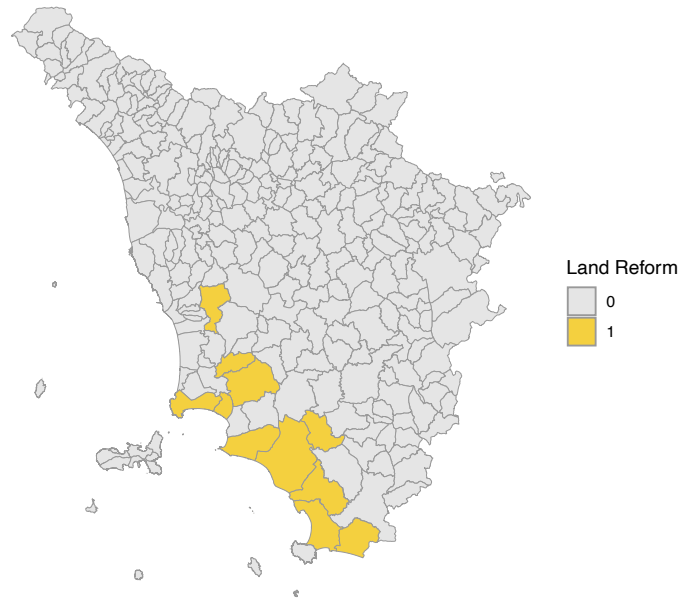
Figure A.20: **Land reform zones in Italy (municipality level)**

Source: Albertus, [2023](#)

A.8.4 Share of expropriable estates (value)

Using data from INEA ([1956](#)), a share of expropriable estates is constructed at the municipal level. Specifically, estates are classified according to 11 separate categories of estate value

Figure A.22: **Municipalities affected by the 1950 Land Reform after reclassification based on the Land Reform Intensity Index**



Note: Municipalities originally affected by the 1950 land reform are reclassified on the basis of the land reform intensity index measured following Caprettini et al. (2021). Municipalities where the share of expropriable estates—computed on the basis of the taxable income of estates—is lower than 75% of the total taxable income of landed property at the municipal level are reclassified as non-treated. The map therefore displays only the remaining municipalities classified as treated after this reclassification (11 municipalities in total).

A.8.5 Long-term persistence of landownership structures

Table A.25: **Descriptive statistics for land-tenure systems in 1961**

Variable	<i>N</i>	Mean	Std. Dev.	Min	Max
Sharecropping land share	271	0.343	0.181	0.000	0.713
Direct cultivation land share	271	0.303	0.201	0.002	0.888
Wage-labour farming land share	271	0.347	0.184	0.010	0.820
Other tenure systems land share	271	0.007	0.010	0.000	0.069

Notes: Land shares are measured at the municipal level. Descriptive statistics refer to the 271 Tuscan municipalities included in the empirical analysis.

Source: Authors' elaboration based on the 1961 Italian Agricultural Census (ISTAT, 1966).

A.8.6 Variables construction

Two dependent variables are constructed to capture the intensity of participation in CAP Pillar I at the municipal level.

The first indicator measures the share of farms receiving CAP direct payments relative to the total number of farms within each municipality. Formally, for each municipality m , the indicator is defined as:

$$Farm_share_under_Pillar_I_m = \frac{N_m^{DP}}{N_m} \quad (A.1)$$

where N_m^{DP} denotes the number of farms receiving CAP Pillar I direct payments in municipality m in 2022, while N_m represents the total number of farms located in the same municipality.

The second indicator captures the presence of farms displaying a higher degree of participation in CAP Pillar I. In particular, at the farm level we compute the ratio between the utilised agricultural area receiving direct payments and the total utilised agricultural area of the farm. Farms are then classified as high-intensity participants if this ratio exceeds the threshold corresponding to the upper tercile of the distribution of the indicator across farms at the regional level. The municipal-level indicator is subsequently constructed as the share of such farms over the total number of farms in the municipality:

$$High_intensity_CAP_farms_share_m = \frac{N_m^{HI}}{N_m} \quad (A.2)$$

where N_m^{HI} denotes the number of farms classified as high-intensity participants in municipality m and N_m represents the total number of farms in the same municipality.

As indicators used to characterise landownership structures at the municipal level, we measure the share of small properties (below 2 hectares), defined as the ratio between the number of small properties and the total number of properties, and the Gini index, computed according to the following formula(Stefani, Cecchetti, et al., 2025):

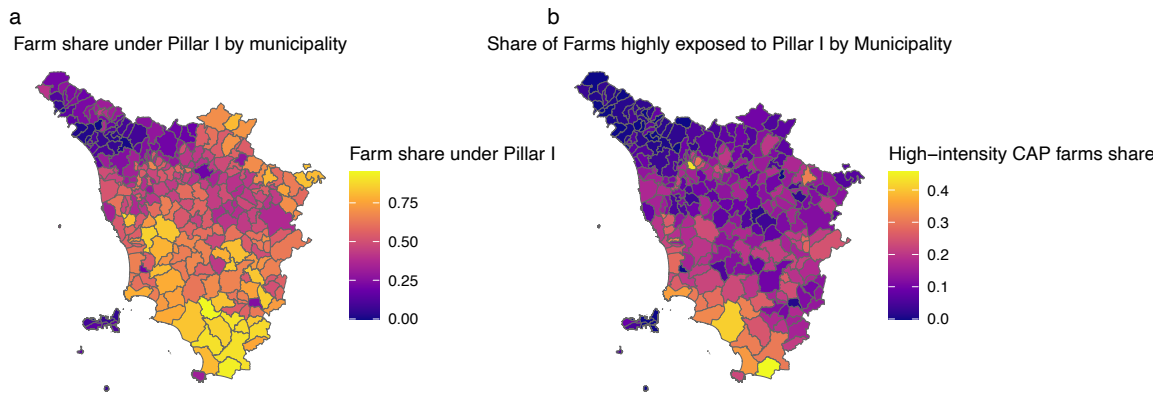
$$R_G = \frac{\sum_{i=1}^{n-1} (P_i - Q_i)}{\sum_{i=1}^{n-1} P_i} \quad (A.3)$$

where P_i denotes the cumulative percentage of properties and Q_i represents the cumulative percentage of landowners associated with those properties.

A.8.7 Spatial patterns and correlation matrix of the variables of interest

Figure A.23 shows the spatial patterns of the Farm share under Pillar I and the High-intensity CAP farms share, reported in panels (a) and (b), respectively. These Spatial patterns are already discussed in the paper.

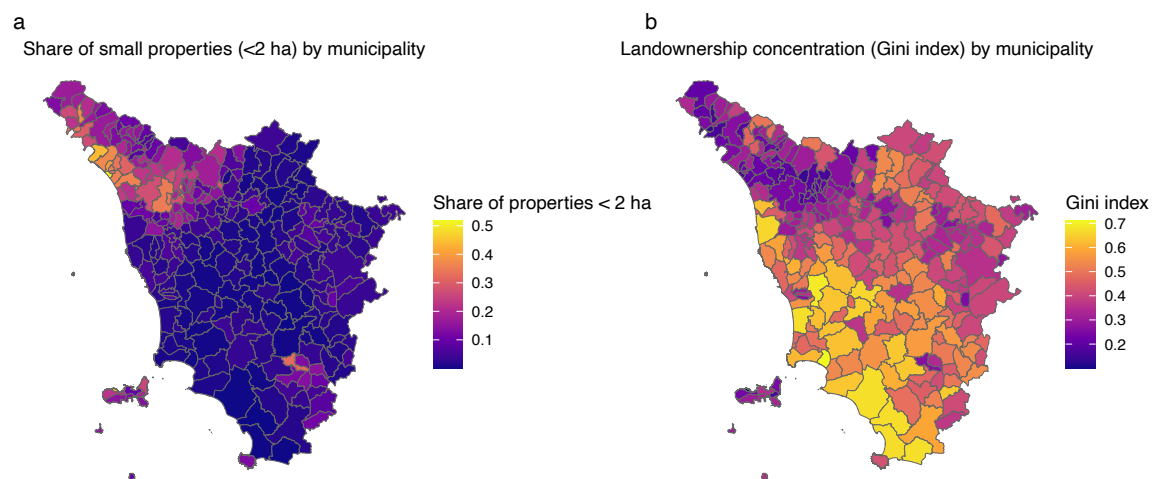
Figure A.23: **Spatial patterns of participation intensity in CAP Pillar I**



Source: Author's elaboration.

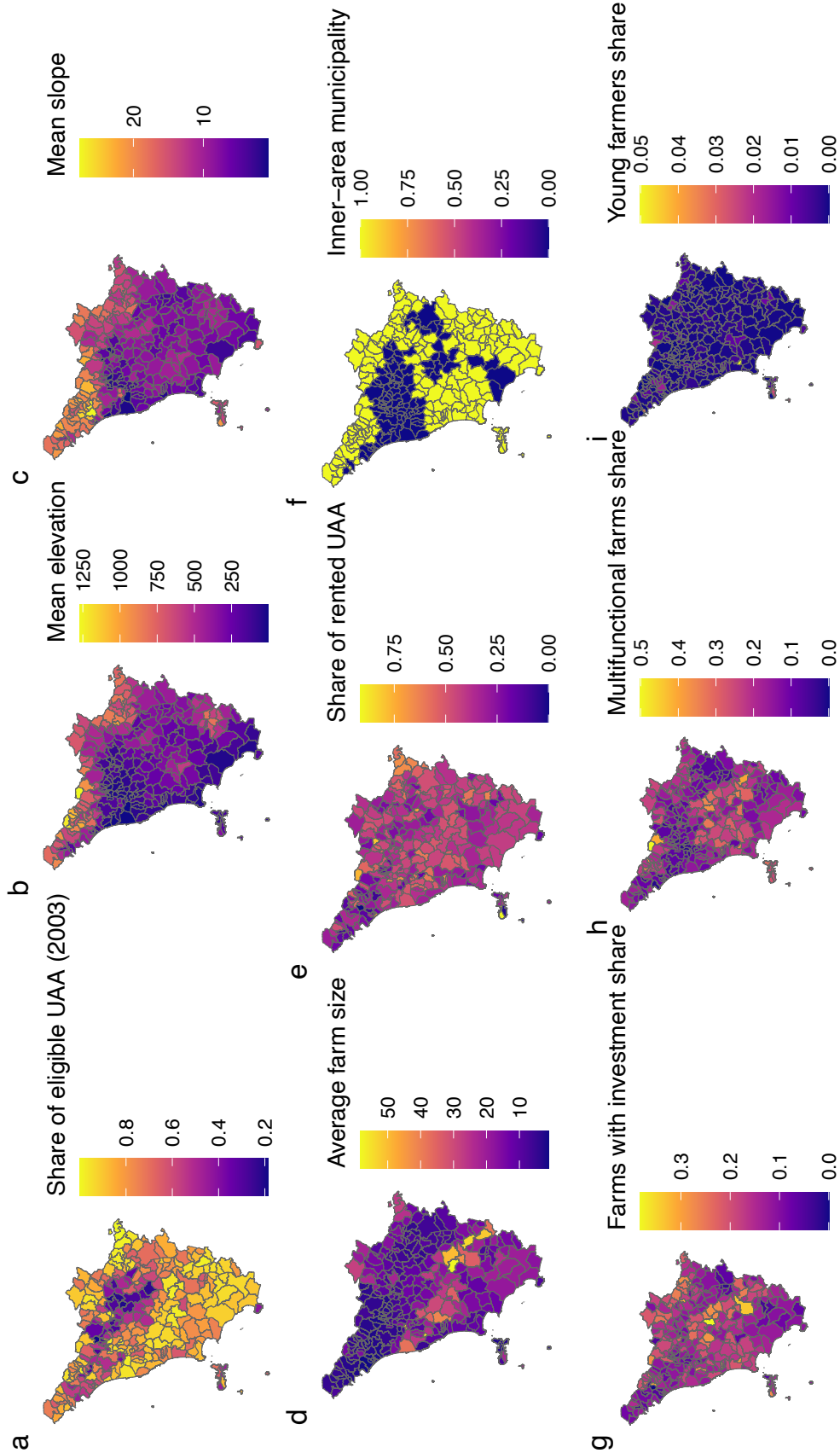
Figure A.24 shows the spatial patterns of the share of properties $< 2ha$ and the Gini Index, reported in panels (a) and (b), respectively. While figure A.25 reports the spatial distribution of the control variables.

Figure A.24: **Spatatial distribution of explanatory variable**



Source: Author's elaboration.

Figure A.25: Spatial patterns of covariates



Source: Author's elaboration.

Table A.26: Pairwise correlation matrix

	Farm share Pillar I	High-int. CAP farms	Share prop. < 2ha	Gini index	Eligible UAA	Reform	Elev.	Slope	Avg. farm size	Rented UAA	Inner area	Invest. farms	Multi. farms	Young farmers
Farm share under Pillar I	1.000													
High-intensity CAP farms share	0.74***	1.000												
Share of properties < 2ha	-0.65***	-0.46***	1.000											
Gini index	0.67***	0.52***	-0.73***	1.000										
Share of historically eligible UAA	0.43***	0.25***	-0.18***	0.36***	1.000									
Land reform	0.32***	0.42***	-0.17***	0.39***	0.14**	1.000								
Mean elevation	-0.18***	-0.44***	0.03	-0.10	0.06	-0.17***	1.000							
Mean slope	-0.51***	-0.59***	0.26***	-0.28***	-0.23***	-0.14**	0.80***	1.000						
Average farm size	0.64***	0.33***	-0.48***	0.60***	0.48***	0.13**	-0.10*	-0.30***	1.000					
Share of rented UAA	0.33***	0.17***	-0.22***	0.16***	0.24***	-0.02	-0.06	-0.26***	0.27***	1.000				
Inner-area municipality	0.15**	-0.03	-0.18***	0.18***	0.29***	0.05	0.49***	0.39***	0.16***	0.02	1.000			
Farms with investment share	0.17***	-0.06	-0.31***	0.24***	-0.02	-0.04	0.17***	0.07	0.31***	0.18***	0.16***	1.000		
Multifunctional farms share	0.13**	-0.12*	-0.30***	0.30***	0.09	0.12**	0.32***	0.27***	0.36***	0.08	0.44***	0.58***	1.000	
Young farmers share	-0.20***	-0.17***	0.07	-0.10	0.07	-0.08	0.08	0.19***	0.03	-0.18***	0.13**	0.04	0.10*	1.000

Source: Author's elaboration. Notes: Pearson pairwise correlation coefficients are reported. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.8.8 OLS diagnostics and tests for spatial dependence

Table A.27: OLS estimates for the two dependent variables

	(1)	(2)	(3)	(4)
Share of properties < 2 ha	-4.748*** (0.493)		-5.455*** (0.588)	
Gini index		2.695*** (0.480)		3.549*** (0.560)
Land reform	1.337*** (0.398)	7.348 (4.496)	0.789* (0.474)	3.196 (5.239)
Mean elevation	0.00175*** (0.000274)	0.00206*** (0.000297)	-0.00001 (0.000326)	0.00029 (0.000346)
Mean slope	-0.122*** (0.0143)	-0.142*** (0.0154)	-0.0755*** (0.0170)	-0.0952*** (0.0179)
Multifunctional farms share	-1.271* (0.725)	-0.821 (0.793)	-4.189*** (0.863)	-3.727*** (0.924)
Farms with investment share	-0.011 (0.858)	0.616 (0.935)	0.017 (1.022)	0.717 (1.089)
Young farmers share	-20.200** (8.569)	-18.166* (9.442)	-15.760 (10.210)	-12.520 (11.000)
Average farm size	0.0325*** (0.00514)	0.0296*** (0.00615)	0.0125** (0.00612)	0.00631 (0.00717)
Share of rented UAA	0.606* (0.322)	0.743** (0.355)	0.407 (0.384)	0.611 (0.414)
Share of properties < 2 ha × Land reform	-20.450 (57.900)		9.175 (68.980)	
Gini index × Land reform		-9.831 (6.887)		-4.258 (8.024)
Constant	0.461** (0.200)	-1.120*** (0.259)	-0.640*** (0.239)	-2.627*** (0.302)
Observations	271	271	271	271
R-squared	0.728	0.672	0.603	0.542
Adj. R-squared	0.717	0.659	0.588	0.525
Residual Std. Error	0.666	0.731	0.793	0.851
F-statistic	69.51	53.22	39.52	30.82
Breusch–Pagan test	33.46	21.11	33.46	21.11
BP p-value	0.000	0.020	0.000	0.020

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Models (1) and (2) use the ALR transformation of the share of farms under CAP Pillar I.

Models (3) and (4) use the ALR transformation of the share of high-intensity farms under CAP Pillar I.

Source: Author's elaboration.

Table A.28: Moran's I test for spatial autocorrelation of OLS residuals

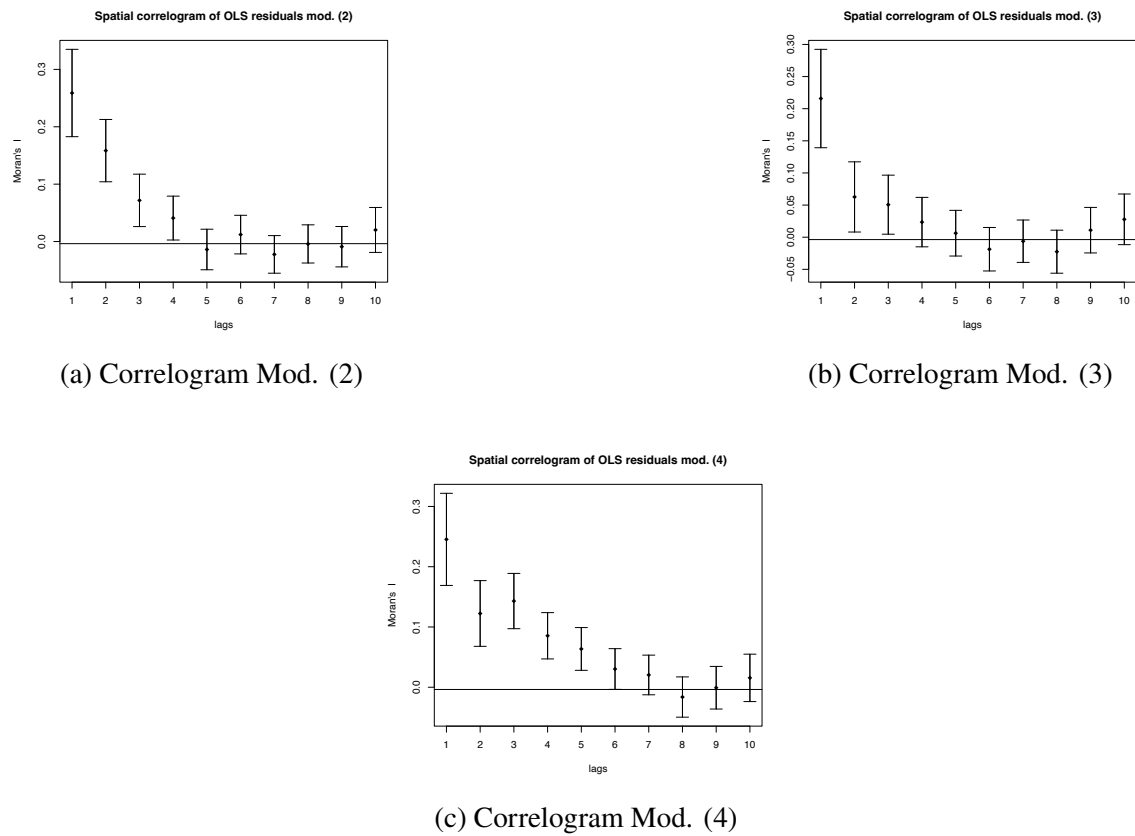
	(1)	(2)	(3)	(4)
Moran's I statistic	0.228	0.259	0.216	0.245
Expected value	-0.0037	-0.0037	-0.0037	-0.0037
Variance	0.00145	0.00145	0.00147	0.00146
Std. deviate (z)	6.083	6.898	5.733	6.517
p-value	0.000	0.000	0.000	0.000
Observations	271	271	271	271

Moran's I test computed on residuals from OLS models reported in Table A.27.

Spatial weights matrix based on queen contiguity.

Source: Author's elaboration.

Figure A.26: Spatial correlograms of OLS residuals



Source: Author's elaboration.

A.8.9 Causal Discovery Analysis

To inform the empirical specification, we conducted a causal discovery analysis (see, Zanga et al., 2022) using the open-source desktop application *Tetrad*, developed by the Carnegie Mellon University and the Center for Causal Discovery (the Tetrad software is available at <https://www.cmu.edu/dietrich/philosophy/tetrad/use-tetrad/tetrad-application.html>. Further information on the Center for Causal Discovery can be found at <https://www.ccd.pitt.edu/>).

Causal discovery refers to a family of data-driven methods aimed at identifying plausible causal relationships among variables using statistical information contained in the data. These approaches are particularly useful in contexts where background knowledge about the underlying causal structure is incomplete or only partially available. By exploiting patterns of conditional independence in the data, causal discovery algorithms attempt to infer the causal graph that best represents the relationships among the variables under study (Zanga et al., 2022).

In practice, the use of causal discovery allows the researcher to refine the empirical specification by systematically exploring the relationships among the variables included in the dataset. Through the application of dedicated algorithms, it is possible to detect potential causal links as well as identify variables that may act as latent confounders or mediators within the system⁷. In this sense, causal discovery can be understood as a data-driven procedure that complements traditional model selection approaches, such as forward or backward variable selection, by relying on formal statistical tests of conditional independence implemented through dedicated algorithms (Zanga et al., 2022).

In this study, the causal discovery analysis was conducted separately for each dependent variable considered in the empirical analysis. The procedure combines the incorporation of prior background knowledge on some relationships between variables with an algorithmic exploration of the remaining possible causal connections.

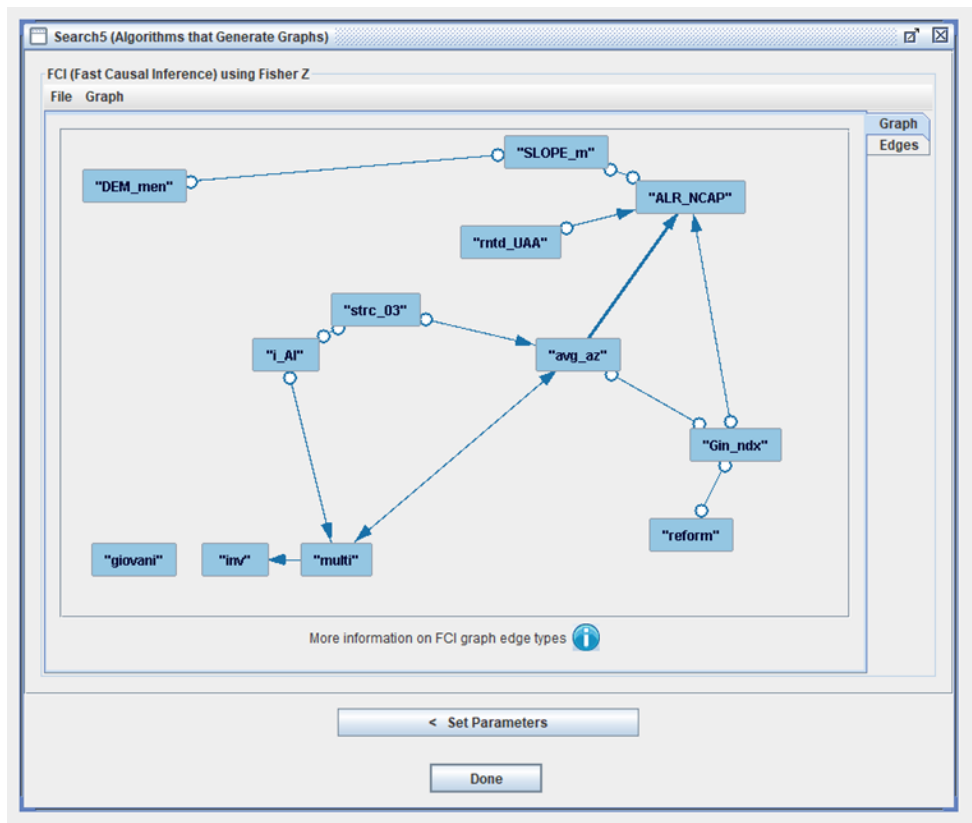
More specifically, the analysis was implemented using the *Fast Causal Inference* (FCI) algorithm together with Fisher's conditional independence test. The FCI algorithm is a constraint-based causal discovery method designed to infer causal structures from observational data while allowing for the possible presence of latent (unobserved) confounders. Constraint-based algorithms operate by identifying causal graphs that are consistent with the set of conditional independence relations observed in the data. In this framework, the

⁷A confounder is a variable that influences both the explanatory variable and the outcome, potentially biasing the estimated relationship between them. A mediator is a variable that lies on the causal pathway between the explanatory variable and the outcome, transmitting part or all of the effect from the former to the latter.

causal structure is represented through a *Directed Acyclic Graph* (DAG), in which nodes correspond to variables and edges represent potential causal relationships between them. As an illustrative example, Figures A.27 and A.28 report the DAGs associated with the two dependent variables, using the Gini index as the main explanatory variable. The corresponding patterns obtained when using the share of small properties are qualitatively similar.

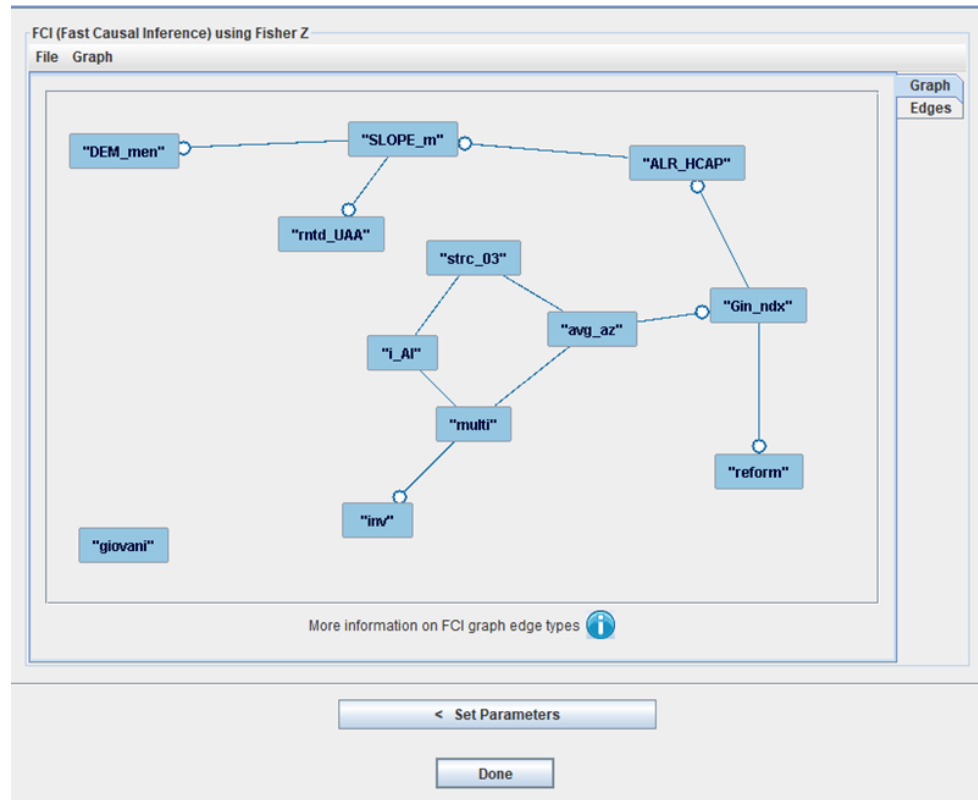
The FCI algorithm proceeds in two main phases. First, in the adjacency phase, the algorithm starts from a complete undirected graph and performs a sequence of conditional independence tests. When two variables are found to be conditionally independent given a subset of other observed variables, the edge connecting them is removed. The conditioning sets that lead to the removal of each adjacency are stored for later use. In the second phase, the orientation phase, the algorithm uses the previously stored conditioning sets to orient as many edges as possible, thereby identifying the direction of potential causal relationships. The resulting output is an equivalence class of causal graphs that are compatible with the conditional independence relations detected in the data, including structures that may involve latent confounders. The graphs obtained from this procedure were then used to guide the specification of the empirical models, particularly with respect to the identification of plausible confounders and mediators among the variables included in the analysis.

Figure A.27: Illustrative DAG for the ALR transformation of the share of farms under CAP Pillar I, using the Gini index as the main explanatory variable



Notes: DEM_men = mean elevation; SLOPE_m = mean slope; ALR_NCAP = ALR-transformed share of farms under CAP Pillar I; rntd_UAA = share of rented UAA; strc_03 = share of eligible UAA (2003); avg_az = average farm size; Gin_ndx = Gini index; i_AI = Inner Areas dummy; multi = share of multifunctional farms; inv = share of farms undertaking investments; giovani = share of young farmers; reform = land reform indicator. Source: Author's elaboration with Tetrad software.

Figure A.28: **Illustrative DAG for the ALR transformation of the share of high-intensity farms under CAP Pillar I, using the Gini index as the main explanatory variable**



Notes: DEM_men = mean elevation; SLOPE_m = mean slope; ALR_HCAP = ALR-transformed share of high-intensity farms under CAP Pillar I; rntd_UAA = share of rented UAA; strc_03 = share of eligible UAA (2003); avg_az = average farm size; Gin_ndx = Gini index; i_AI = Inner Areas dummy; multi = share of multifunctional farms; inv = share of farms undertaking investments; giovani = share of young farmers; reform = land reform indicator. Source: Author's elaboration with Tetrad software.

A.8.10 Robustness Check

Table A.29: SEM estimates: Robustness checks Model (1) and (2)

Variables	(1) Baseline (Small properties)	(2) + Mean elevation	(3) + Multifunctional farms	(4) + Investing farms	(5) Baseline (Gini Index)	(6) + Mean elevation	(7) + Multifunctional farms	(8) + Investing farms
Share of properties < 2 ha	-4.316*** (0.631)	-3.983*** (0.665)	-4.280*** (0.640)	-4.303*** (0.634)				
Gini index					1.733*** (0.473)	1.580*** (0.478)	1.689*** (0.474)	1.719*** (0.475)
Land reform	0.600 (0.376)	0.698* (0.376)	0.592 (0.377)	0.601 (0.376)	5.579* (3.181)	5.064 (3.162)	5.370* (3.177)	5.496* (3.186)
Slope	-0.0455*** (0.0113)		-0.0461*** (0.0116)	-0.0456*** (0.0113)	-0.0364*** (0.0123)		-0.0386*** (0.0125)	-0.0367*** (0.0123)
Mean elevation		-0.000537** (0.000260)				-0.000383 (0.000278)		
Share of rented UAA	0.886*** (0.264)	0.949*** (0.262)	0.883*** (0.264)	0.881*** (0.265)	0.960*** (0.265)	0.997*** (0.264)	0.949*** (0.264)	0.948*** (0.266)
Share of eligible UAA (2003)	0.099 (0.249)	0.325 (0.243)	0.100 (0.250)	0.103 (0.251)	-0.018 (0.261)	0.198 (0.248)	-0.005 (0.260)	-0.007 (0.262)
Average farm size	0.0286*** (0.0053)	0.0292*** (0.0054)	0.0282*** (0.0056)	0.0284*** (0.0055)	0.0291*** (0.0056)	0.0292*** (0.0056)	0.0273*** (0.0058)	0.0285*** (0.0058)
Multifunctional farms			0.172 (0.640)				0.661 (0.652)	
Investing farms				0.122 (0.704)				0.296 (0.716)
Fragmentation × Reform	-0.454 (49.413)	-15.414 (49.106)	-0.641 (49.378)	-0.612 (49.413)				
Gini × Reform					-7.925 (4.904)	-7.084 (4.874)	-7.644 (4.895)	-7.793 (4.913)
Constant	-0.113 (0.286)	-0.619** (0.256)	-0.132 (0.294)	-0.129 (0.300)	-1.240*** (0.331)	-1.595*** (0.306)	-1.286*** (0.335)	-1.270*** (0.339)
Spatial error coefficient (λ)	0.669*** (0.054)	0.729*** (0.047)	0.671*** (0.054)	0.669*** (0.054)	0.762*** (0.044)	0.793*** (0.040)	0.765*** (0.043)	0.762*** (0.044)
Observations	271	271	271	271	271	271	271	271
Log Likelihood	-251.302	-256.171	-251.266	-251.287	-262.119	-265.132	-261.608	-262.034
AIC	522.60	532.34	524.53	524.57	544.24	550.26	545.22	546.07

Source: Author's elaboration.

Notes: Dependent variable: ALR-transformed municipal share of farms receiving Pillar I direct payments.

Models (1) and (5) correspond to the baseline specification reported in Table 5.3.

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.30: SEM estimates: Robustness checks Model (3) and (4)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline (Small properties)	+ Mean elevation	+ Avg size	+ Rented UAA	Baseline (Gini index)	+ Mean elevation	+ Avg size	+ Rented UAA
Share of properties < 2 ha	-4.905*** (0.691)	-5.097*** (0.740)	-4.818*** (0.726)	-4.854*** (0.694)				
Gini index					2.974*** (0.547)	2.922*** (0.549)	2.934*** (0.586)	2.962*** (0.546)
Land reform	0.243 (0.486)	0.154 (0.472)	0.248 (0.486)	0.252 (0.486)	3.283 (4.253)	2.582 (4.031)	3.268 (4.254)	2.897 (4.257)
Slope	-0.0788*** (0.0125)		-0.0783*** (0.0126)	-0.0777*** (0.0126)	-0.0682*** (0.0137)		-0.0681*** (0.0137)	-0.0668*** (0.0137)
Mean elevation		-0.001751*** (0.000289)				-0.001602*** (0.000310)		
Share of eligible UAA (2003)	0.065 (0.287)	0.553** (0.275)	0.023 (0.307)	0.037 (0.289)	-0.061 (0.305)	0.366 (0.286)	-0.080 (0.320)	-0.107 (0.306)
Average farm size			0.00261 (0.00673)				0.00136 (0.00711)	
Share of rented UAA				0.258 (0.352)				0.410 (0.350)
Fragmentation × Reform	7.556 (65.193)	-2.492 (62.204)	5.735 (65.327)	7.303 (65.120)				
Gini × Reform					-5.161 (6.546)	-4.228 (6.209)	-5.135 (6.548)	-4.550 (6.554)
Constant	-1.109*** (0.298)	-1.644*** (0.267)	-1.124*** (0.300)	-1.204*** (0.324)	-2.758*** (0.354)	-3.189*** (0.316)	-2.746*** (0.359)	-2.890*** (0.371)
<i>Spatial error coefficient (λ)</i>	0.493*** (0.069)	0.612*** (0.059)	0.495*** (0.069)	0.494*** (0.069)	0.589*** (0.062)	0.678*** (0.053)	0.588*** (0.062)	0.587*** (0.062)
Observations	271	271	271	271	271	271	271	271
Log Likelihood	-316.280	-311.230	-316.205	-316.011	-322.306	-317.228	-322.287	-321.623
AIC	648.56	638.46	650.41	650.02	660.61	650.46	662.57	661.25

Source: Author's elaboration.

Notes: Dependent variable: ALR-transformed municipal share of high-intensity CAP farms.

Models (1) and (5) correspond to the baseline specification reported in Table 5.4.

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.9 Further Developments of the Analysis

A.9.1 *The Added Value of Living Labs as a Governance Instrument for Rural Local Development and Knowledge Building*

A.9.1.1 *Introduction, Assumption, Methodology*

The working paper presented in this section is based on research activities conducted during a visiting period at the Countryside and Community Research Institute⁸ (CCRI) in Cheltenham, UK. Part of this research also contributed to the *Final Report on Living Labs Application and Lessons Learned* (see, Goodwin-Hawkins et al., 2026). Specifically, this work is developed within the framework of the RUSTIK project—a four-year trans-disciplinary research initiative aimed at supporting rural communities and policymakers in designing strategies, initiatives, and policies fostering sustainability transitions in rural areas through the implementation of 14 Living Labs (LLs) across Europe. Co-funded by Horizon Europe and Innovate UK, the project contributes to advancing the understanding of diverse rural contexts and their development dynamics within a broader framework of ongoing transitions and emerging challenges (RUSTIK Project, 2025).

In this regard, the Living Lab (LL) can be understood as both “*a space and an approach*” (Knickel et al., 2023), namely a co-creative environment for governance initiatives and a methodological framework to design, test, and learn from social and technical innovation in real time. Accordingly, LLs share a number of common characteristics: they are place-based and embedded in specific local contexts; they experiment with innovative approaches, data, and methods in order to generate lessons; they rely on cross-sectoral partnerships involving final users and beneficiaries; they are supported by clear leadership structures coordinating the project; they incorporate continuous processes of reflection and refinement of both activities and objectives; they adopt co-creation processes involving multiple actors; and they operate through experimentation with real users in real-world contexts (Goodwin-Hawkins & Keech, 2022; Nguyen et al., 2022).

This methodology thus functions as a mechanism of experimentation, reflection, learning, interaction, and co-creation, thereby generating context-specific knowledge and insights through means of action research. At the same time, when operationalised, it also acts as a governance mechanism, mobilising these processes as tools to coordinate actors, align interests, and guide collective action. This highlights the complex nature of the Living Lab approach, which resists rigid definitions and boundaries. Its flexible and experimental character suggests that its features are inherently dynamic, evolving over time through in-

⁸<https://ccri.ac.uk/>

novative applications and continuous methodological developments (Paskaleva & Cooper, 2021; Rodrigues & Franco, 2018; Van Geenhuizen, 2018).

Based on this, the following considerations build on a qualitative study evaluating the added value of the LL methodology as a tool for knowledge building in research and for supporting governance initiatives aimed at local—specifically rural—development. The analysis draws on the assumption that the Living Lab represents a multidimensional and dynamic environment capable of influencing rural local development through different channels, depending on the combination of its features and their interaction with specific territorial conditions, encompassing socio-economic, institutional, land-tenure, environmental, and political dimensions. In this perspective, the evaluation aims to identify and assess these features and linkages, in order to better understand how the Living Lab approach can support the design of more effective and context-sensitive rural development strategies and governance initiatives.

To this end, the analysis adopts a Theory of Change (ToC) framework, which provides a structured approach to identifying and interpreting causal linkages between activities, outputs, and outcomes (DEFRA, 2022; Rogers, 2014). The empirical basis of the evaluation relies on qualitative evidence derived from the analysis of 14 LLs implemented within the RUSTIK project, drawing in particular on project deliverables and technical reports produced during the different phases of implementation (Goodwin-Hawkins, 2024; Goodwin-Hawkins & Dwyer, 2023; RUSTIK Project, 2025; Sterly et al., 2025).

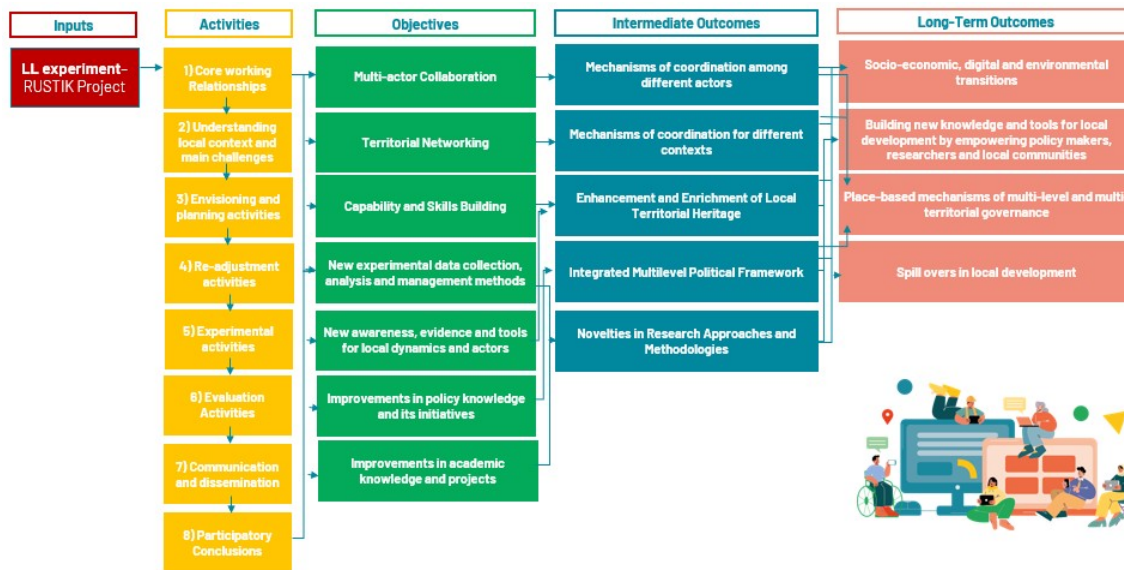
Against this background, the Living Lab approach can be framed as a promising avenue to address some of the limitations of the present analysis, particularly those related to the qualitative nature of the investigation. By operating simultaneously as a research methodology and as a governance instrument, LLs provide a framework that not only generates context-specific knowledge, but also actively supports *place-based* governance initiatives. In this sense, they offer a particularly relevant tool to investigate and manage the complex interactions between land tenure organisation and rural local development. Let us consider these aspects in more detail.

A.9.1.2 The Logic Model

The results of the qualitative evaluation can be synthesised in the Logic Model presented in Figure A.29. The model provides a structured representation of the LL methodology, conceptualising it as a process based on a set of interrelated activities, whose implementation depends on a series of underlying assumptions. Under specific conditions, these activities enable the development of key capabilities, which in turn support the achievement of tangible objectives. These objectives ultimately contribute to the emergence of intermediate and

long-term outcomes within rural development dynamics.

Figure A.29: **Logic Model of the Living Lab approach**



Source: Author's elaboration, developed in collaboration with the Countryside and Community Research Institute (CCRI) within the RUSTIK project.

The starting point of the model (input) is the establishment of a Living Lab experiment embedded within a specific rural context. Building on a set of underlying assumptions, the LL methodology unfolds through a sequence of interconnected and iterative activities. Specifically, the launch of a LL first involves defining the leading team and thereby establishing the core working relationship (Activity 1). For instance, in the RUSTIK project, this phase included the identification of and agreement between the Living Lab Coordinator and the Pilot Region Partner. Subsequently, the leading group, aiming to set up the LL and define its main objectives, delineates the empirical area and identifies its key local socio-economic, institutional, physical, and environmental features, as well as the main challenges and opportunities for local development (Activity 2). This phase requires the ability to recognise the specificity and diversity of the rural context, including its priority issues and ongoing transitions, and to translate them into relevant intervention areas. It also assumes the availability of sufficiently detailed data to support such an analysis, or, alternatively, the capacity to identify appropriate strategies for data collection where gaps exist.

Building on this understanding, the process moves into two additional operational phases. First, the group engages in envisioning the experiment, co-designing and co-imagining its subsequent operational stages (Activity 3). This includes defining activities,

methods, objectives, partnerships, and implementation strategies, and is characterised by the hybridisation of diverse forms of knowledge within multi-actor settings. Subsequently, Activity 4 translates this design into practice through a preparatory phase, which may involve the engagement of additional actors, the consolidation of partnerships, and the collection of initial feedback from potential beneficiaries. Importantly, this phase is accompanied by an iterative, back-and-forth dynamic across previous steps, aimed at ensuring coherence between local challenges, underlying assumptions, research questions, and methodological choices. This highlights the importance of flexibility and iterative adjustment in the LL process, allowing for the alignment between the problem addressed, the intervention design, and the expected outcomes.

After that, the LL then enters the core experimental phase (Activity 5), during which the co-designed ideas are implemented through innovative methods of data collection and/or analysis, leading to the generation of tangible results. This stage relies on the ability of participants—particularly the core group—to operate in a flexible, co-participatory manner within an inherently uncertain experimental environment, while effectively implementing and adapting innovative methods in line with evolving research questions.

Building on the results generated during this experimental phase, Activity 6 begins with the evaluation phase, in which both processes and results are systematically assessed. This phase enables the identification of success factors and critical issues, while also generating reflections and lessons, including potential policy implications. Subsequently, the results should be communicated through appropriate channels and tools tailored to different audiences, including policymakers, researchers, business actors, and local communities (Activity 7). This phase plays a crucial role in disseminating the knowledge generated and in unlocking the broader potential of the LL, ensuring that insights are effectively shared and transferred across different local contexts. Finally, co-participatory conclusions are established (Activity 8), through a collective process of reflection and synthesis of the results achieved, as well as the identification of remaining challenges and future directions. This phase is necessary to ensure the self-replication of the mechanisms and analysis processes employed, and to promote the long-term sustainability of the work carried out within the LL.

The implementation of these activities enables the development of a set of capabilities, including the ability to operate in a co-participatory and experimental environment, to manage and generate data, to understand local dynamics, and to coordinate diverse actors and interests. These capabilities constitute a crucial intermediate layer of the framework, as they represent both a prerequisite and a result of the LL process, reinforcing its cumulative and learning-oriented nature.

Building on the development of these capabilities, LLs enable the achievement of a set of key objectives that represent the core added value of the approach. First, LLs foster multi-actor collaborations by creating or strengthening relationships among heterogeneous stakeholders, both local and external stakeholders, around shared and novel development projects. Second, in doing so, they usually also support territorial networking by establishing new or renewed linkages across different contexts, including rural–rural and rural–urban interactions. Third, they contribute to capabilities and skills building through continuous processes of learning, exchange, and feedback among participants. Fourth, they enable the development of innovative methods for data collection, analysis, and management at the local level, often combining qualitative and quantitative approaches and generating more granular and context-specific information. Fifth, they enhance awareness and produce new evidence and tools for understanding local dynamics, thereby supporting both local actors and external stakeholders. Sixth, they contribute to improving policy knowledge and initiatives by providing context-sensitive insights and supporting the design of more effective and place-based policy actions within multi-level governance frameworks. Finally, LLs advance academic research by generating new empirical evidence and methodological approaches for the study of rural local development dynamics.

These objectives, in turn, lay the foundation for a set of intermediate and long-term outcomes that highlight the broader contribution of the LL approach to rural development processes. In particular, by fostering multi-actor and multi-territorial interactions, LLs act as coordination mechanisms that support the emergence of *place-based* systems of multi-level and multi-territorial governance centred around future shared initiatives, while also supporting socio-economic, environmental, and digital transitions in an innovative way. This process facilitates the development of new collaborative initiatives and projects, arising from the hybridisation of knowledge across actors and contexts. At the same time, the generation of new awareness, tools, and capabilities contributes to strengthening territorial capital, potentially activating processes of community empowerment and enhancing the ability of local actors to recognise and mobilise their development potential.

Moreover, improvements in policy knowledge and the design of policy initiatives contribute to the consolidation of more integrated governance frameworks, enabling policy-makers to better address complex rural dynamics and to support ongoing socio-economic, environmental, and digital transitions. Similar dynamics can also be observed with respect to advancements in academic research, which further reinforce the overall knowledge base underpinning local development processes. Given the breadth of these mechanisms, it is also possible to envisage how the Living Labs approach may generate spillover effects, extending its impact beyond the immediate scope of individual experiments and potentially

contributing to broader rural development pathways.

Overall, the analysis suggests that LLs can constitute a valuable tool not only for knowledge production, but also for participatory research and for the activation of *place-based* governance mechanisms. By combining analytical and operational dimensions, the Living Labs approach enables both the generation of context-specific evidence and its direct mobilisation within local development processes, often in innovative ways.

Alongside these findings, it is also important to note that the framework developed so far presents a number of limitations. First, it has been developed primarily on the basis of the 14 Living Labs implemented within the RUSTIK project. While the number and diversity of cases provide a meaningful empirical basis, they remain embedded within a single project framework. Extending the analysis to additional cases beyond RUSTIK could therefore reveal further elements that remain underexplored here and contribute to a more robust validation of the framework. Second, both the RUSTIK project and the LL processes are still ongoing, implying that additional observations and insights may emerge over time. Finally, given its scope, the framework represents a theoretical generalisation of the dynamics underpinning Living Labs, and therefore does not explicitly incorporate the full range of context-specific internal and external factors that shape and interact with local development pathways.

In line with the overall goals of the dissertation, the work developed so far represents a starting point for further deepening the analysis of additional relationships within the theoretical framework. In particular, having demonstrated the added value of the Living Lab methodology both as an innovative and informative tool for capturing local dynamics, and as an operational instrument for intervening in such dynamics, it can contribute to a deeper interpretation of the interactions among the different elements of land-tenure organisation and rural development, as well as of the impacts of governance actions on these dynamics. Indeed, it effectively constitutes a *place-based* governance tool to implement around land-related issues and broader local development processes.

In this perspective, the following section presents an illustrative case of a LL implemented within the RUSTIK project that addresses land-related issues, providing preliminary insights into how LLs may function as both knowledge-generating and action-oriented tools in shaping rural development processes through initiatives involving land capital.

A.9.1.3 A Living Lab Addressing Land Tenure Dynamics for Rural Development: The Galician Case

The relevance of the LL approach for the present dissertation can be further illustrated through an ongoing case developed within the RUSTIK project in Galicia, Spain, drawing

on evidence from project reports and related work (Goodwin-Hawkins, 2024; Goodwin-Hawkins & Dwyer, 2023). This case is particularly significant because it directly addresses one of the central dimensions discussed throughout this thesis, namely the relationship between landed property structure, land use, and rural development dynamics, as well as the governance mechanisms that mediate and shape these interactions (thus involving the relationship between S_{lc} , C_{lc} , C_{st} , and $P_{lc,e,v}$ in the well-known theoretical framework depicted in Figure 4.1). More specifically, the LL focuses on a context characterised by highly fragmented landownership, which is associated with widespread farmland abandonment, declining agricultural activity, and increasing wildfire and environmental risks.

Within this context, the added value of the LL lies precisely in its ability to combine knowledge production with action-oriented governance support. On the one hand, the project makes it possible to identify more clearly the local problem structure, showing how the mismatch between landownership and land use represents a key constraint on rural local development. In particular, fragmented ownership, associated with absentee owners, multiple heirs, and high transaction costs, is recognised as a major barrier preventing access to land for farmers and new entrants, with negative implications not only for agricultural activity, but also for broader socio-economic dynamics, landscape management, and environmental risk.

On the other hand, the LL did not stop at diagnosing the problem, but translated this understanding into operational responses aimed at supporting local and regional decision-making. In this sense, it functioned as a governance mechanism embedded within a broader multi-level policy framework. More specifically, the LL engaged with existing regional policy instruments aimed at addressing farmland abandonment and its associated challenges, particularly those introduced by the regional law for the recovery of agricultural land (Law 11/2021). These instruments are intended to reconcile landownership and land use, promote the reactivation of abandoned land, and reduce wildfire risk around inhabited areas. It is precisely within this governance framework that one of the most relevant outcomes of the LL emerged: the development of a decision-support tool intended to guide the selection and prioritisation of future interventions. Rather than merely mapping ownership structures, this tool combines available spatial and non-spatial information in order to identify locations where interventions are expected to be both more feasible and more impactful. In this respect, the LL not only interacted with existing policy tools, but also contributed to making them more effective, by producing context-specific evidence and translating it into an operational instrument for policy implementation. From a governance perspective, this is especially important, as it strengthens the capacity of public actors to allocate resources more strategically, to prioritise projects with greater potential for success,

and to increase the effectiveness of policy instruments aimed at reactivating underused land capital.

At the same time, the process also generated additional knowledge that is highly relevant from a research perspective, particularly for enriching the theoretical understanding of local development in connection with land-related dynamics. Beyond the construction of the tool itself, the LL made it possible to identify a number of deeper dynamics shaping the relationship between land tenure organisation and rural development. In particular, it highlighted that the problem is not simply one of land abandonment as such, but of the misalignment between ownership structures, land-use opportunities, and the institutional capacity to reconnect them. It also revealed how barriers to land reactivation depend not only on biophysical or spatial conditions, but also on informational asymmetries, data limitations, fragmented property rights, local institutional mediation, and landowners' perceptions and motivations—some of which are not easily observable through quantitative data alone.

The case thus constitutes a clear example of how a LL may function both as a *place-based* governance instrument and as a knowledge-generating process, involving land capital—particularly its organisation in fragmented landownership structures—and supporting processes aimed at reconciling landownership and land use through locally relevant governance interventions. In doing so, the project also contributes to re-framing land capital not as a passive asset, but as a key element whose organisation shapes the possibility of activating rural economic and social functions.

Moreover, although the Galician case is still ongoing and no definitive evidence can yet be provided on its long-term territorial effects, it already offers meaningful insights that are consistent with the framework presented above and that help validate the added value of Living Labs, by confirming their role in enabling the co-production of knowledge, the experimentation with innovative methods, the strengthening of policy capacity, and the activation of place-based governance processes.

Taken together, these elements provide preliminary support to the idea that Living Labs may represent a valuable approach for both advancing research and informing governance practices in contexts where rural development dynamics are closely intertwined with distinct land tenure organisations.

A.9.2 *Exploring the Effects of Landownership Patterns on Farmland Abandonment Dynamics: A Preliminary Overview*

Building on the conceptual framework developed in this dissertation (see Figure 4.1, based on Figure 3.1 in Chapter 3), a further line of research focuses on the empirical investigation of additional interactions between the key dimensions of land capital and rural development dynamics. Specifically, in order to empirically address some of the limitations related to both the type and the number of theoretical linkages directly examined in the present study, this line of research aims to shed light on the relationship between landownership structures and land-use dynamics, with direct implications for local development processes (that is, the direct relationship from S_{lc} to C_{lc} , and in turn to $P_{lc,e,v}$, in Figure 4.1).

In this respect, particular attention is devoted to processes of land abandonment—more specifically, farmland abandonment—which represent a central phenomenon affecting socio-economic, environmental, and landscape dynamics across rural contexts (Lasanta et al., 2017; Schuh et al., 2020). The abandonment of land capital (see Table A.3 in Appendix A.4 for a definition) is indeed closely linked to processes of out-migration, the weakening of local productive structures—especially those related to agro-forestry specialisations—and the loss of opportunities for local value creation. This includes, for instance, the reduced capacity to activate sustainable uses of land capital capable of generating ecosystem services as well as local value chains (Bevilacqua, 2018; Rossi-Doria, 2005). At the same time, land abandonment is associated with increasing environmental risks, such as hydrogeological instability, wildfire hazards, and the uncontrolled expansion of forest cover (Mottet et al., 2006; Rey Benayas et al., 2007; Sella et al., 2024; UNCEM, 2025).

Cropland abandonment is also associated with a progressive decline in land profitability, often resulting in zero or even negative land rents, which in turn contributes to a growing disinterest among private landowners in maintaining their property over time—both in terms of its physical integrity and its effective management—as land use becomes economically unsustainable (Bromley, 1989). In systems based on equal inheritance, this dynamic may underpin long-term processes of land fragmentation, including the emergence of *silent* ownership, thereby reducing the availability of land suitable for local activities and related entrepreneurial initiatives (Cecchi, 1988), ultimately constraining the land market (Lasanta et al., 2017; Povellato & Gava, 2025).

Overall, farmland abandonment appears to exert negative effects on local development dynamics in rural contexts, contributing to the emergence of processes of territorial structural fragility. It is therefore not surprising that land abandonment tends to be more pronounced in less favoured areas, typically characterised by remoteness and marginality (Schuh et al., 2020). Evidence from Italy further supports this pattern. For instance, Povel-

lato and Gava (2025) report that, over the last fifty years, utilised agricultural area (UAA) declines by approximately 28% at the national level, while the reduction is significantly more pronounced in mountain areas (-43%), compared to hilly (-27%) and lowland areas (-16%).

Building on these considerations, the phenomenon attracts increasing policy attention at both international and European levels. Several institutions—including UNESCO, the European Landscape Convention, and the European Union through the Common Agricultural Policy—promote initiatives aimed at preserving traditional landscapes and supporting the sustainable management of land resources, recognising their role in fostering balanced socio-economic and environmental development (Lasanta et al., 2017; Schuh et al., 2020; Weissteiner et al., 2011). At the same time, the growing relevance of the phenomenon leads to the development of dedicated analytical tools to monitor and assess its spatial distribution. In particular, the European Commission, through the Joint Research Centre (JRC), produces EU-wide risk assessments of agricultural land abandonment, highlighting the regions most exposed to this process and reinforcing the need for targeted and place-based policy responses (Schuh et al., 2020).

The scientific literature, on the other hand, identifies multiple drivers underlying farmland abandonment processes. These factors can be broadly classified, following Lasanta et al. (2017), into external and internal drivers. Among the former, several dynamics operate beyond the local context. In particular, the increasing attractiveness of urban areas—urbanisation phenomena—tends to reinforce migration processes, contributing to the outflow of population from rural regions and, consequently, to processes of farmland abandonment. This phenomenon has been interpreted, for instance, as part of broader capitalist development dynamics, whereby structural transformations in the economy drive the relocation of population and activities towards more attractive centres (Basile & Cecchi, 2001). Technological change represents another key driver, as it tends to widen competitiveness gaps between more fertile and accessible areas and more marginal ones, while simultaneously enabling the concentration of agricultural production in increasingly limited and more productive land areas. In addition, political-institutional factors—such as regional development institutions and public policy interventions—also play a crucial role, either mitigating or reinforcing these dynamics depending on their design and implementation. In this respect, it is worth noting that a commonly held view—particularly in lowland areas—is that farmland abandonment has also been influenced by the design of the Common Agricultural Policy between the late 1980s and the 2000s. In particular, in order to control production and avoid surplus, policy measures were deliberately implemented to encourage farmers to withdraw part of their land from production. Nevertheless, empirical evidence

supporting this argument remains limited (Lasanta et al., 2017). Finally, market-related factors, including changes in food demand and quality requirements, further contribute to shaping the economic viability of agricultural activities and, consequently, patterns of land abandonment (Povellato & Gava, 2025; Schuh et al., 2020; Weissteiner et al., 2011).

Conversely, local drivers refer to a set of context-specific conditions that directly influence land-use decisions, as they affect the productivity and profitability of agricultural holdings. These include agro-ecological and biophysical factors, such as soil quality and pedo-climatic conditions; demographic characteristics, particularly the availability of labour force; and structural features of the agricultural sector, including competition from alternative economic activities, farm and plot size, production specialisation, and crop profitability (Mottet et al., 2006; Rey Benayas et al., 2007; Schuh et al., 2020; Wang et al., 2022; Weissteiner et al., 2011).

While farmland abandonment has been widely studied, the role of landownership structures in shaping these dynamics remains comparatively underexplored in the scientific literature (Lasanta et al., 2017; Schuh et al., 2020; Turchetti, 2025). In particular, limited attention has been devoted to jointly considering both the physical organisation of landownership and its institutional configuration—despite their potential relevance in influencing land-use dynamics and abandonment processes (Rey Benayas et al., 2007).

Landownership structures may vary significantly, ranging from highly fragmented to more concentrated configurations, and such differences can shape local agricultural production systems in distinct ways⁹. As discussed throughout the dissertation, land capital represents a fundamental productive factor in agriculture (Serpieri, 1969), and its parcel-based organisation shapes both the density and the typology of productive units that agricultural enterprises can establish, ultimately affecting the economic viability of specific farming techniques (Dale, 1997) and determining the range and scale of feasible production processes (Brusco, 1979; Latruffe & Piet, 2014; Rocchi & Stefani, 2002). In this respect, the physical organisation of landownership structures—by shaping the feasibility and profitability of specific agricultural practices—ultimately influences cropland abandonment dynamics and, more broadly, processes of non-use of land capital in rural contexts.

Alongside the physical organisation of landownership patterns, its institutional structure—particularly in terms of the number of (private) landowners involved—represents

⁹More precisely, landownership structures can vary across a continuum between two extremes: land concentration and fragmentation. Concentrated landed property structures are usually characterised by a small number of landowners holding large and contiguous estates. On the other hand, land fragmentation refers to a pulverisation of the physical structure of landownership into parcels and micro-properties. Under such circumstances, properties are often spatially dispersed and held by a large number of landowners and co-owners (Golzio, 1933; Medici et al., 1962; Zangheri, 1981).

an additional and promising underexplored dimension. This aspect is especially relevant, as different numbers of landowners imply varying degrees of participation in and control over land capital at the local level (Cecchi, 1983, 1988; Golzio, 1933). High numbers of landowners—especially when disproportionate relative to the resident population—not only signal fragmentation, but also reflect a structural condition that constrains both the activation of agricultural activities and the effective functioning of land markets. In particular, the presence of multiple landowners—and thus of co-ownership structures¹⁰—increases coordination and transaction costs, making it more difficult not only for potential users to access land, but also for existing owners to effectively use and manage it. This is especially the case when land-use decisions require agreement among several actors, particularly under co-ownership arrangements. At the same time, the need to negotiate, in the case of land transactions, with a large number of actors—often spatially dispersed, sometimes absentee, and weakly connected to the local context—reduces transaction efficiency, limits land mobility, and ultimately increases frictions in the land market (Lasanta et al., 2017; Povellato & Gava, 2025).

Such physical and institutional constraints may therefore hinder the efficient allocation of land capital to socio-economic activities, thereby contributing to processes of farmland abandonment with negative outcomes in rural contexts. In turn, these dynamics may reinforce adverse effects on the organisation of landed property—further promoting fragmentation—while also contributing to the disintegration of the local socio-cultural and productive fabric, as well as to additional environmental degradation. Attempts to reverse these dynamics may themselves be hindered by the existing land-tenure organisation. Indeed, land-related initiatives aimed at addressing these critical issues often entail costs that exceed current land values, thereby discouraging their implementation not only by private actors but also by public ones, and reinforcing a vicious cycle of fragmentation and abandonment. As already noted, this structural weakness of the land system—together with other local structural constraints—is also associated with a limited capacity for governance intervention in already fragile contexts.

Thus, while farmland abandonment has been widely studied (Lasanta et al., 2017), limited attention has been devoted to the role of landownership structures—and particularly their institutional configuration—in exacerbating such patterns and their negative consequences for rural local development. This gap therefore provides the basis for further developments within the context of the present dissertation.

To provide a first empirical grounding to this line of inquiry, a georeferenced dataset has been constructed for all municipalities in Tuscany (Italy), building on and extending the

¹⁰In institutional systems where co-ownership is permitted, as in the case of the Italian legal framework.

dataset developed in Chapter 5. In this context, a specific dependent variable has been defined as a proxy for farmland abandonment, based on land-use transitions from agricultural to forested areas between 1954 and 2013 in Tuscany. Specifically, the measure relies on data from the project “*Analisi dei cambiamenti della superficie forestale 1954–2013 della Regione Toscana (Geoscopio)*” (Angeli et al., 2014), which provides georeferenced information derived from the photointerpretation of aerial images from 1954 and orthophotos from 2013. These data allow the identification of land-use changes over time, distinguishing between agricultural and natural land-cover classes. Farmland abandonment is thus defined as the share (0-1) of land capital that was not classified as forest in 1954 and had transitioned to forest cover by 2013, thereby capturing processes of natural reforestation following the cessation of agricultural activities. To obtain a municipal-level measure, the dataset is spatially overlaid with administrative boundaries, and the corresponding statistics on abandoned land are computed for each municipality (Stefani, Cecchetti, et al., 2025).

The dataset further integrates information on landownership structures—also incorporating measures related to the institutional dimension of these structures—agricultural systems, and morphological characteristics at the municipal level, providing a comprehensive basis for exploring the relationship between physical and institutional landownership configurations and land-use dynamics. Building on this framework, the analysis represents a preliminary step within a broader research agenda, which will be further developed to more rigorously assess the role of landownership structures in shaping farmland abandonment processes and their implications for rural local development.



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