



UNIVERSITÀ
DEGLI STUDI
FIRENZE

PhD in

Development Economics and Local Systems

CYCLE XXXVII

COORDINATOR: Prof. Donato Romano

**Essays on external debt issues in developing countries:
a post-Keynesian perspective**

Academic Discipline (SSD): SECS-P/01

Doctoral Candidate

Dott. Luca Frigerio

Supervisor

Prof. Marco Missaglia

Coordinator

Prof. Donato Romano

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Ringraziamenti

Un profondo grazie va al Professore Gianni Vaggi, che mi ha fatto scoprire un lato più umano della disciplina economica a suon di pugni affettuosi e chiacchierate. Un altrettanto profondo grazie va al Professore Marco Missaglia, che mi ha permesso di mettere assieme i cocci confusi di teoria che portavo nella mente, indicandomi una via per sviluppare un pensare economico più coeso e critico. Due ottimi Professori ed Economisti, ma ancora più ottime persone. Le ore passate a chiacchierare o a discutere le ho sempre sentite scorrere troppo velocemente. A entrambi devo tantissimo, al Prof Missaglia pure un salame dell'alessandrino.

Ringrazio i commissari, il Prof Alberto Botta e il Prof Gabriel Porcile, le cui valutazioni particolarmente positive sono motivo di grande soddisfazione.

Il mio più sincero affetto va a tutti gli incontri fatti a Novoli. Sono stati anni parecchio felici che difficilmente posso ricordare senza nostalgia. Firenze sarebbe risultata molto meno incantevole senza la vostra amicizia. Adam, Agnese, Annaelena, Ann, Carlo, Chiara, Costanza, Cynthia, Edoardo, Elisabetta, Emma, Filippo, Giovanni, Giulia, Guilherme, Iacopo, Imma, Joaquin, Jose, Lorenzo, Margherita, Mariachiara, Mehari, Sana, Tati, Teresa, Vinicius. Mi piace pensarci a fare festa in via dello Statuto n.1. Tra le bottiglie sul tavolo sicuramente una di Spuma.

Un pensiero va ai Professori del programma DeLos, che ringrazio per avermi dato l'opportunità di intraprendere il percorso del dottorato. Mi son sempre sentito accolto nonostante la distanza dovuta al mio oggetto di studio.

Ringrazio anche gli amici di Pavia, Andrea, Davide, Giacomo e Giacomo, per aver sempre trovato l'occasione di riunirci negli anni, nonostante la mia distanza. Ringrazio inoltre gli amici dell'Azione Cattolica di Pavia, luogo del cuore la cui formazione mi ha aiutato tanto ad affrontare la vita e le relazioni in questi ultimi anni di distanza.

Un particolare grazie va alla mia mamma, Lucia, e al mio papà, Francesco per il supporto costante in questo lungo percorso, soprattutto nell'ultimo periodo in cui sono tornato a Pavia, un periodo di grande incertezza. Un pensiero ai miei fratelli, Michele e Daniele per i quali non sono mai stato di particolare esempio, sperando di continuare a non esserlo, soprattutto nell'intraprendere un dottorato. Sono molto fortunato ad avere questa famiglia.

Infine, un grande grazie va a Sara, la mia compagna di vita, per l'amore e la fiducia incondizionati. Questa tesi non sarebbe completa senza le nostre passeggiate a Firenze o le giornate in cui sono stato accolto dal calore della tua famiglia.

General Overview

Recent historical developments, including wars and the global pandemic, have intensified the persistent challenge of external debt in developing countries. These nations have long relied on foreign currency inflows to finance structural current account deficits, a hallmark of their economies. These deficits arise from a historical lag behind advanced economies, rooted in colonial and core-periphery relations. With the exception of oil-rich nations, exports, foreign investment, and official development assistance (ODA) have consistently failed to provide sufficient foreign currency to meet the needs of countries striving to catch up with advanced economies. This catching-up process requires technological advancement, which depends on importing foreign capital and its associated know-how. Developing countries, constrained by limited capital, thus remain at the bottom of the technological ladder. Given that foreign currency is both critical for accessing foreign capital and a scarce resource, it is clear why these countries rely heavily on external borrowing.

External debt instability emerges when the cost of acquiring foreign currency outpaces the economic growth it finances. This creates a dilemma: during a crisis, should priority be given to servicing external debt or to funding development and social programs? We explore this issue in the first chapter of this thesis. In the initial sections, we provide an overview of the recent history of indebted developing countries, with a particular focus on Sub-Saharan Africa (SSA). Long before the pandemic, it was evident that SSA nations had not resolved their debt challenges. While debt relief initiatives in the mid-2000s temporarily alleviated the burden, the resulting fiscal space was insufficient to significantly re-shape the structural nature of SSA's current account deficits. Meanwhile, new concerns have arisen with the recent debt surge: official concessional debt has declined, losing room in favour of private debt held by international investors and foreign commercial banks. Additionally, SSA's bilateral debt is increasingly dominated by opaque loans from Chinese state-owned banks. This shift has led to a rising cost of external debt servicing, which erodes fiscal space and limits opportunities for development-oriented spending.

In the second part of the first chapter, we examine the implications of prioritizing development spending -aligned with the Sustainable Development Goals (SDGs) needs of these countries- on external debt accumulation, given current debt trajectories. We incorporate a human development factor into the Geometry of Debt Sustainability (GDS) model (Vaggi and Prizzon, 2014) and, following Pasinetti's (1998) analytical framework, we assess how external debt

sustainability is affected when countries increase foreign currency expenditures on health and education. These human development expenditures, central to the SDGs, have gained even greater importance due to the Covid-19 pandemic's impact on low-income countries (LICs). We use the GDS framework to evaluate external debt sustainability in two African contexts: Kenya and a composite country, "Ubuntu," which represents the average indebtedness conditions in Sub-Saharan Africa. Our findings confirm a trade-off between debt servicing and human development expenditures. Even before the pandemic, SSA countries were on unsustainable debt paths, with debt-to-GDP ratios stabilizing only at extremely high levels.

Despite these insights, the theoretical model in the first chapter remains static, analysing debt trajectories while holding variables such as GDP growth, current account, and interest rates constant. But how do these variables interrelate with external debt? Further investigation requires a dynamic theory with clear causal relationships and, ideally, stock-flow consistency. In the second chapter, we turn to post-Keynesian theory, specifically neo-Kaleckian models, to construct a survey of dynamic models with a focus on external debt dynamics. This literature provides the foundation for the open economy model developed in subsequent chapters.

In the opening sections of the second chapter, we explain the need for a post-Keynesian perspective in analysing external debt dynamics. We elaborate on concepts from the Structuralist/post-Keynesian approach, including ECLAC's core-periphery dependency theory and Thirlwall's Law (Thirlwall, 1979), to understand the causes of external debt accumulation and inform effective policy responses. While post-Keynesian theory emphasizes external constraints on aggregate demand, the mainstream view prioritizes macroeconomic stability through balanced fiscal budgets, positing that fiscal deficits drive current account deficits (the twin deficit hypothesis). Fiscal prudence, it is argued, reduces external vulnerabilities by attracting private capital flows, creating a virtuous cycle that addresses the need for external borrowing. However, historical evidence suggests that such policies have hindered the already slow process of catching up in developing countries, and recent trends indicate little improvement. Gabor (2021) compellingly argues that the Washington Consensus today has evolved into the "Wall Street Consensus," where public spending is relegated to de-risking private initiatives to attract substantial private investment for development projects. As highlighted at the UN Financing for Development conference in Seville (June-July 2025), this "blended finance" approach and sustainable finance legislation have failed to meet expectations, yet they continue to dominate global policy discussions. Post-Keynesian theory challenges this view, advocating that expansionary fiscal policies and demand-side measures are active

stabilizers, including in open economy contexts. Weakening these instruments could result in dangerous dynamics where not only the fiscal problem would remain unsolved, but severe social problems would spread.

One could argue that demand-side policies are largely irrelevant for developing countries, as Kalecki (1976) explained, because structural constraints (supply-side and/or open economy) could nullify the impact of aggregate demand policies. There is an immediate reference to Sir Arthur Lewis's (1954) view of Keynesian economics in the context of developing economies (i.e. countries with surplus labour): *"From the point of view of countries with surplus labour, Keynesianism is only a footnote to neoclassicism — albeit a long, important and fascinating one"*. However, we agree with Dutt (2010), who convincingly argues that aggregate demand still matters, even in open economies, despite the many constraints on developing economies. Firstly, in LICs, a capital constraint does not necessarily imply that the economy is limited by low levels of savings supply; rather, it could mean that investment is low. In this case, aggregate demand could play an active role in promoting investment and the capital accumulation necessary for structural change. Secondly, even in the case of full capacity utilisation, demand policies could still impact long-run growth. The price adjustment that this would provoke would indeed redistribute income in favour of profits, and higher profits might encourage firms to invest more, provided that the capital accumulation regime is profit-led. Thirdly, when facing macroeconomic constraints of any kind, aggregate demand policies are relevant because they can affect these constraints. For example, in the case of a foreign exchange constraint, Dutt (2010) explains that demand policies could positively impact certain elements of the balance of payments, thereby easing the constraint. Exports, which generally depend on competitiveness and productivity growth, can be enhanced at least partly through Kaldor–Verdoorn-type demand effects; consider infrastructure development, for example. With regard to imports, it could be argued that economic growth within an internal market and higher levels of learning will be associated with lower import coefficients. Furthermore, foreign capital flows depend on business confidence, making Keynesian uncertainty highly relevant. More generally, credible and stabilising policies will presumably lead to greater investor confidence, resulting in greater capital inflows and direct foreign investment and obtaining the foreign exchange that would otherwise have been borrowed. Fourthly, as previously emphasised, when designing policies to counter crises arising from current constraints, the role of aggregate demand in stabilisation must always be considered; failing to do so could lead to measures that exacerbate fragile equilibria, particularly in balance-of-payments crises where austerity measures often deepen

economic vulnerabilities rather than resolving them. Fifthly, a country may face multiple constraints during a crisis, each with country-specific conditions. When the economy is hit by a shock, it is very likely that the system will switch from one constraint to another, creating opportunities for tailored demand policy interventions. Thus, in the presence of multiple potential constraints and exogenous shocks affecting them, aggregate demand may be more depressed than it would have been in their absence. This makes it more likely that the economy will be demand-constrained than if the multiplicity of supply constraints were absent. Overall, when studying a modern developing country, the adopted theoretical framework should always consider aggregate demand as the backbone of any policy reasoning. As Ros (2001) notes, the problems that the founding fathers of developing economics were addressing would remain unresolved even if Keynesian issues were solved. Differently, Ros argues, the crisis and the lost convergence in the '80 of Latin America and Sub-Saharan Africa may have been aggravated by demand constrained growth path. Reducing Keynesianism to a footnote, in this case, would overlook many crucial macroeconomic implications, with a dramatic impact on socio-economic development: the neoliberal policies of the last 30 years in LICs are the overwhelming proof.

With these concepts in mind, in our survey we identify nine studies that incorporate foreign debt dynamics within a neo-Kaleckian framework, grouped by the economic phenomena they analyse. First, Rocha and Oreiro (2013) examine the consequences of capital account liberalization and the relationship between external debt and growth, confirming a non-linear relationship where excessive debt hampers capital accumulation. Second, Porcile et al. (2011) and Birkan (2012) critique “financial globalization” by modelling the impact of interest rate policies on indebted economies. Porcile et al. explore long-run (de)stabilization under inflation and real exchange rate (RER) targeting, while Birkan focuses on short-run implications of interest rate hikes, noting that aggressive monetary policies can lead to instability. Third, Kohler (2017, 2019) highlights the destabilizing role of exchange rate movements, emphasizing balance sheet effects and their procyclical relationship with economic cycles. Excessive foreign debt can undermine the expansionary effects of nominal depreciations and increase volatility by affecting capital accumulation. Fourth, La Marca (2010) and Bortz et al. (2022) focus on income distribution conflicts arising from exchange rate movements, showing how foreign debt influences real exchange rate dynamics and exacerbates distributional issues. Fifth, Charles and Marie (2016) and Missaglia (2021) model distinct phases in the economic history of small, dollarized, indebted economies. Charles and Marie explore hyperinflation driven by distributive conflicts and its interaction with foreign debt, potentially leading to dollarization to reduce

volatility. Missaglia, however, demonstrates that even successful dollarization in an endogenous money framework can result in a debt trap and sluggish growth due to liquidity preference dynamics.

Building on these insights, the third chapter contributes to the literature by developing a stock-flow consistent (SFC) model. Our goal is to enhance the analytical rigor of Kaleckian growth models by ensuring coherence between real and financial stocks and flows, a feature sometimes overlooked in traditional Kaleckian literature. Before addressing the complexities of an open economy, we first establish the model's dynamics in a closed economy framework, given the potential for multiple equilibria and associated stability conditions in SFC models. Unlike many Kaleckian models that use continuous-time formulations, we adopt a discrete-time approach. We begin with a simple closed economy model, introducing its basic structure and equations, then progressively increase complexity by incorporating alternative investment functions and retained profits. Through analytical derivations and computer simulations, we analyse the multiplicity of equilibria and their stability under various parameter configurations. This dual approach clarifies the conditions for convergence to a steady state and highlights the limitations of overly simplified frameworks in addressing real-world economic phenomena. By establishing these dynamics in a closed economy, we lay the groundwork for an open economy extension, where external trade and capital flows further enrich the analysis.

The final chapter is divided into two sections. In the first one, we survey the key features of post-Keynesian open economy theory and contrast them with mainstream approaches, focusing on macroeconomic closures for different exchange rate regimes. We discuss the compensation thesis under a fixed exchange rate regime, present post-Keynesian theories of exchange rate determination in contrast to orthodox models and examine Taylor's (2004) critique of exchange rate determination via the balance of payments equation, reconciling it with the OPENFLEX model by Godley and Lavoie (2007). This section informs the modelling choices in the second part, where we extend the closed economy model from the third chapter to an open economy framework.

Despite its simplicity, our open economy model can simulate balance of payments crises triggered by extreme capital flight or foreign interest rate hikes. The primary source of instability is foreign currency-denominated debt, which is vulnerable to balance sheet effects from exchange rate depreciation and interest rates that incorporate a risk premium over the international currency's rate. These dynamics highlight the fragility of small, indebted

economies and provide a robust theoretical basis for analysing external debt sustainability within a post-Keynesian stock-flow consistent framework. By elucidating the interplay between external financial conditions, exchange rate dynamics, and domestic economic activity, this chapter offers valuable insights to analyse balance of payments crises, focusing on external rather than internal causes. The model also captures key dynamics of the escalating debt crisis in SSA countries. Debt relief programs offer only temporary relief, slowing the debt accumulation process. Phenomena such as illicit financial flows and profit repatriation are major drivers of debt instability, alongside declining export demand. Moreover, the shift toward market-driven capital inflows, which prioritize short-term returns over long-term development, has reduced the concessionality of borrowing. This results in a higher cost of external debt, which, as depicted in the model, is highly sensitive to the often-biased judgments of foreign financial institutions.

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1 The Myth (or Folly) of African Debt

With Gianni Vaggi

Published on the International Journal of Political Economy 2024, VOL. 53, NO. 3, 285–309,
September

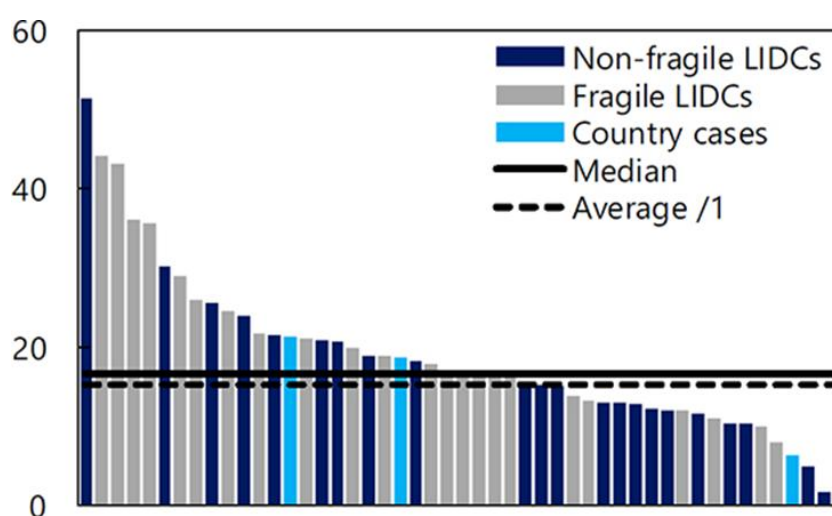
Abstract: Despite past debt relief initiatives, the external debt of Africa is rising again, and it has some new worrying features: diminishing concessionality and a rising private creditor. Sub-Saharan African countries devote a significant portion of their fiscal resources to service the debt, and this prevents them from increasing development expenditures (generally imports of strategic goods that can't be produced domestically). By adding a human development factor to the Geometry of Debt Sustainability model (GDS) (Vaggi and Prizzon 2014) and following the analytical framework of Pasinetti (1998), we assess how external debt sustainability changes when countries increase the foreign currency purchasing of health and education goods and services. Not only these types of human development expenditures are central to the Sustainable Development Goals (SDGs), but they have become even more important due to impact of the Covid-19 pandemic on many low-income countries (LICs). We evaluate external debt sustainability in two African contexts: Kenya and a composite country, called Ubuntu, which is representative of Sub-Saharan Africa average indebtedness conditions. The results confirm the existence of a trade-off between debt service and foreign currency human development expenditures. Even before the Covid-19 pandemic, the Sub-Saharan African countries were on unsustainable debt trajectories as the debt-to-GDP ratios would stabilize only at extremely high values.

1 Introduction: We need to talk about debt

1.1 A looming crisis

To close the gap in development in Low-Income Countries (LICs) by 2030, given also the adverse economic scenario of the current days, is becoming a sort of impossible mission. The International Monetary Fund (IMF) indeed estimated the additional spending required to meet the Sustainable Development Goals (SDGs) in 2030 in the different economic areas (Gaspar et al. 2019). The main findings: 0,5 USD trillion for LICs and 2,1 USD trillion for emerging economies, representing respectively an average annual additional spending of 15% of GDP and 4% of GDP (Figure 1.1). Today these numbers must be revised by considering the economic effects of the Covid crisis and of the war in Ukraine. To finance the development needs of such a size, LICs' governments must be able to raise enough financing to compensate for the inadequate fiscal revenues. Increasing borrowing from abroad therefore becomes necessary.

Figure 1.1 Variation in Additional Spending to meet SDGs in 2030 for 49 LICs



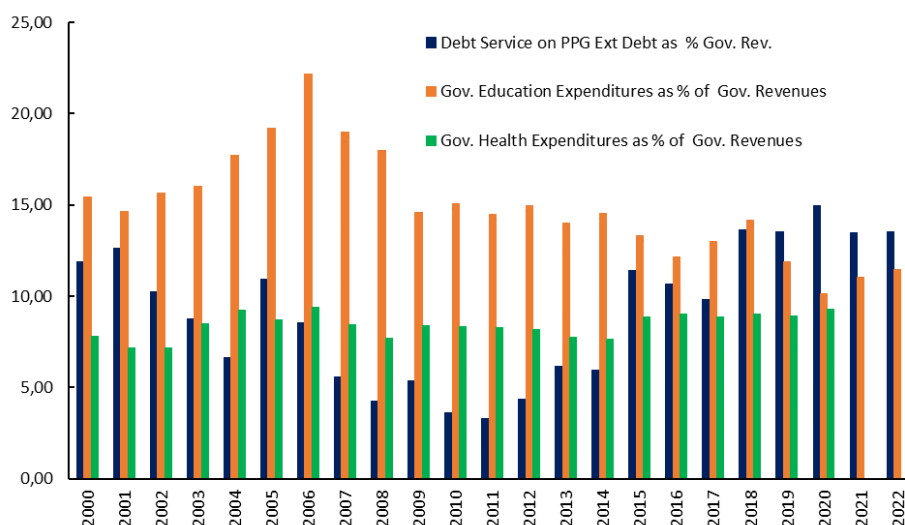
Source: Gaspar et al. 2019, p. 13

However, the LICs, especially in Sub-Saharan Africa (SSA) region, entered the pandemic with already growing debt levels (both domestic and foreign) and growing debt-services (IMF 2019a), which have likely constrained their fiscal response to the crisis. These countries could not afford to increase too much the budget deficits, therefore, they were forced to finance the response to Covid-19 mainly with on-budget financing by reducing their planned spending in favor of the emergency one (IMF 2020). A too high share of public revenues was still destined to pay external debt service (IMF 2020) until May 2020, when the World Bank and International Monetary Fund urged the G20 to set up the Debt Service Suspension Initiative (DSSI) to which

48 of 73 eligible countries participated, 36 of which were African countries. DSSI temporary suspended the external debt service payments to official creditors (Multilateral and Bilateral), but many economists and organizations claimed it wasn't enough as the policy was just delaying debt service hoping for an optimistic recovery in short run (Fresnillo 2020, Nye and Rhee 2020). Furthermore, in November 2020 the Paris Club and the G20 approved the Common Framework for Debt Treatments beyond DSSI (G20 and Paris Club 2020). The common framework was intended to update the DSSI and the restructuring process for low-income countries. However, the new process has not worked well (Chabert et al. 2022; Georgieva and Pazarbasioglu 2021; Shalal 2023). LICs that defaulted on their commercial bonds and LIBOR-linked loans from China's policy banks have mostly remained in default. The number of countries in extended default has grown over time, and countries that likely need to restructure have shied away from the process. Setser (2023) argues that these challenges were not entirely unexpected. The Common Framework, as it stands, is a minimal agreement that left numerous critical systemic issues unresolved. The bulk of the substantive details were deferred to be addressed during negotiations concerning the initial cases. It did not provide a comprehensive blueprint for determining the necessary amount of debt relief in the post-pandemic years. Furthermore, the practical experience with specific cases has underscored the distinct financial interests of China compared to other G20 members. Nearly three years after the initial agreement on the Common Framework, there remains no established model for an internationally coordinated debt restructuring that achieves substantial debt relief and encompasses the involvement of Chinese policy banks.

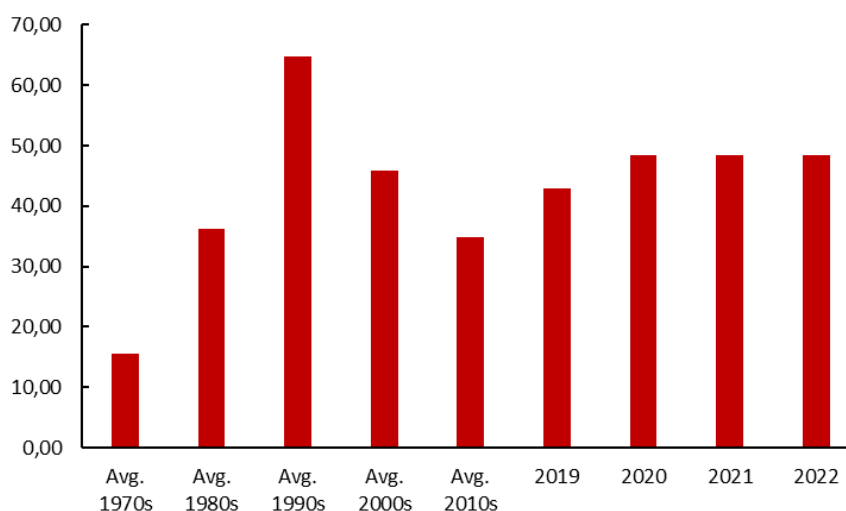
Indeed, despite the attempt to not increase the budget deficits and the adoption of the DSSI and the Common Framework, LICs' debt service still covers too much space on government revenues compared to other fundamental expenditures for development (education and health) (Figure 1.2). According to IMF (IMF 2022) the average total gross public debt in LICs remains broadly unchanged at around 50 percent of GDP in 2021 compared to the previous year (Figure 1.3). The main reason is the high level of inflation that eroded the nominal value of the debt stock (Gaspar et al. 2022). However, total public debt ratios continued to rise in almost two-thirds of countries, and generally the impact of inflation will vanish after investors ask for higher premia to account for the rise of prices. Indeed, over the medium term, LICs will face increasing debt vulnerabilities amid rising borrowing costs, mainly on external debt. Although the average total public debt is projected to decline moderately to 48 percent of GDP by 2024, it will remain well above the pre-pandemic level in almost two-thirds of countries (IMF 2022).

Figure 1.2 SSA: Debt service and other public expenditures as % of Government Revenues



Source: World Bank Database and International Debt Statistics 2022

Figure 1.3 LICs: Average total gross public debt as % of GDP

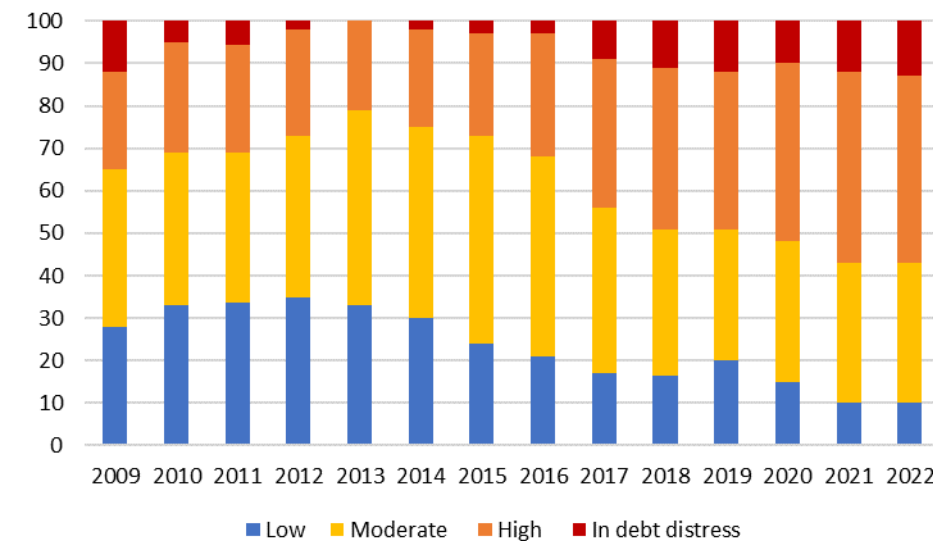


Source: Global Debt Monitor 2023

The median debt service to tax ratio is expected to remain above the pre-pandemic level and exceed 40 percent in several highly indebted countries. According to the Debt Sustainability Analysis (DSA) performed by IMF (Figure 1.4), about 60 percent of low-income developing countries are now at high risk or already in external debt distress (compared with slightly less than 30 percent in 2015) and continue to rely on international support to end the pandemic and ensure growth (Georgieva and Pazarbasioglu 2021). Now these countries are facing the economic damage of the war in Ukraine as energy and food prices are rising (McGuirk and Burke 2022). Also, central banks are raising interest rate to counter inflation in advanced countries,

increasing the cost of foreign debt, especially when it is denominated in dollar. Therefore, debt sustainability must be addressed as the fear of another “lost decade” is incumbent.

Figure 1.4 Proportion of LICs per DSA evaluation



Source: LIC DSA Database

1.2 A focus on Sub-Saharan Africa: is History repeating?

Among the LICs, Sub Saharan African countries are the most exposed to external debt distress. Indeed 21 out of 36 countries that are at high risk or in debt distress, are SSA countries¹. Of these 21, nine are currently in debt distress². Today, like in the ‘80s, the monetary tightening in response to the inflationary dynamics of the high-income countries is contributing to the worsening of the external debt burden of the developing countries. However, the economic downturn provoked by the pandemic and the current wars have just exacerbated a debt dynamic that was already following an unsustainable path. SSA region indeed has an history of debt burdens, as in the ‘80s African countries experienced their first major external debt crisis.

The earlier crisis started with two important global shocks, the rise of oil prices due to the wars in middle east, and the rise in global interest rates caused by Federal Reserve’s decision to raise US interest rates to 22 percent in 1981. In august 1982 Mexico defaulted on part of its foreign debt denominated in dollars; this was the beginning of a long sovereign debt crisis which involved more than 30 countries in four continents, and which led to two “lost decades”, 1980-2000, with GDP per capita stagnating in emerging and developing countries. After many years

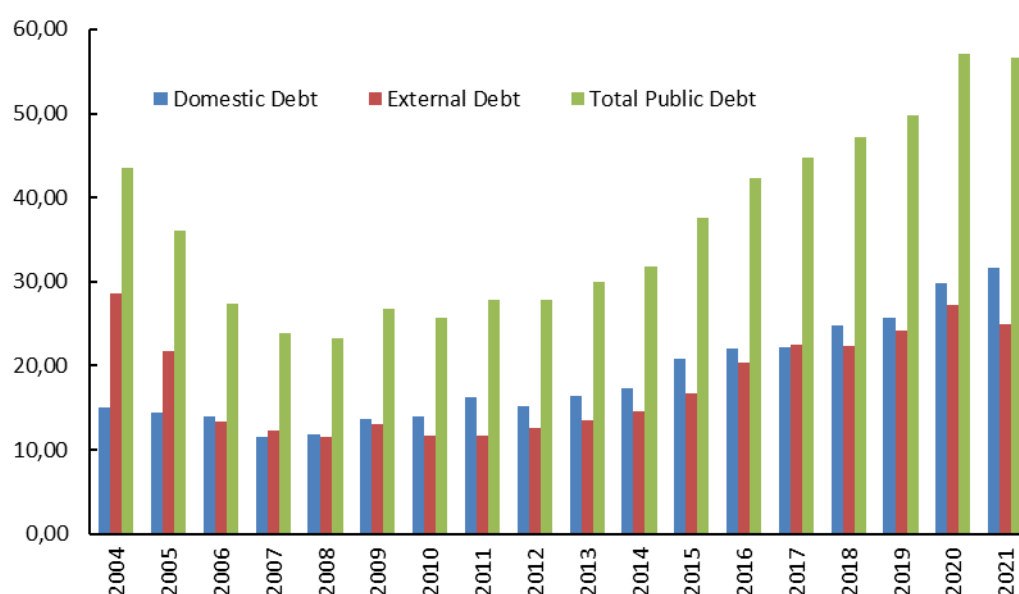
¹ IMF constantly updates the DSA List here: <https://www.imf.org/external/pubs/ft/dsa/dsalist.pdf>

While IFAD website provides an interactive chart for a better visualization <https://www.ifad.org/en/debt-sustainability>

² According to the October 2023 update, the distressed African countries are Mozambique, Sudan, Sao Tome and Principe, Somalia, Congo, Zimbabwe, Malawi, Ghana, and Zambia

of rescheduling in 1996 the World Bank promoted the Heavily Indebted Poor Countries Initiative (HIPC) which with the possibility of debt cancellation. The Initiative was strengthened in 1999 at the Cologne G7 meeting thanks also to an international advocacy campaign, Jubilee 2000. In 2005 the IMF and the World Bank launched the Multilateral Debt Relief Initiative (MDRI) for a partial cancellation of multilateral debt (Figure 1.6). Debt relief programs in 36 heavily indebted countries, 29 in SSA, reduced their nominal public debt for a total amount of 110 billion dollars: In 2008 the SSA region experienced a record low of 23 percent of total public debt to GDP and 11 percent of public external debt to GDP (Figure 1.5).

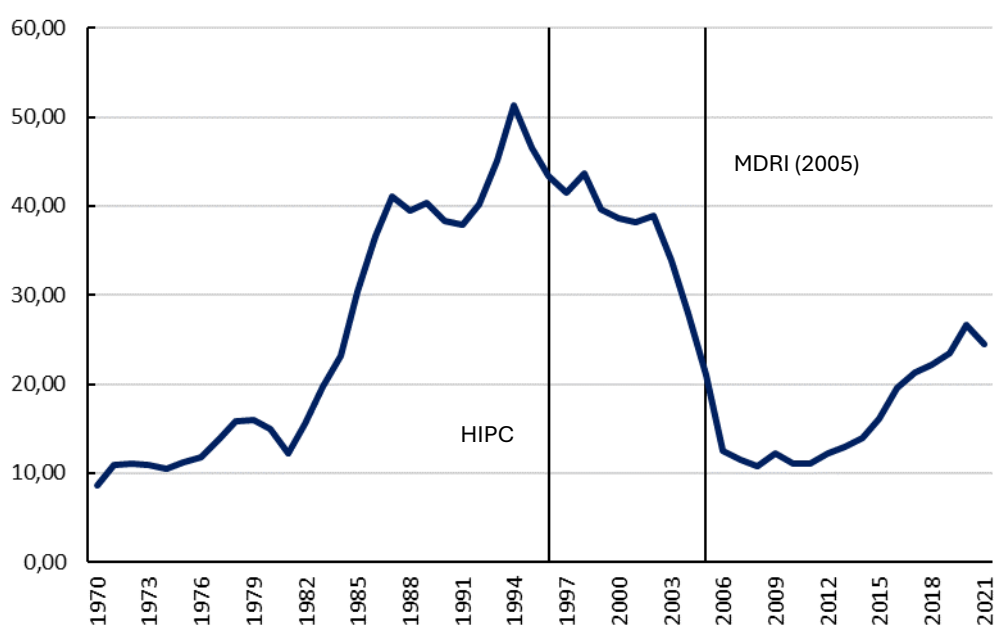
Figure 1.5 SSA: Domestic, External and Total Public Debt as % of GDP



Source: IDS and Global Debt Statistics 2023

However, despite the temporary success of the Debt Relief programs, the average public debt ratio in sub-Saharan Africa has almost doubled in less than a decade: from 30 percent of GDP at the end of 2013 to almost 57 percent of GDP by end-2021 (Figure 1.5). Public external debt instead rises from 14 percent of GDP to 25% of GDP on average (Figure 1.6) but in many countries external debt is well above 50 percent of GDP. This growing trend is certainly shared with the debt service. As we have seen in Figure 1.2, nowadays the debt service covers a bigger share of government revenues than health and education spending. From a low of 3 percent of revenues in 2011, in the last years before the pandemic it became three times higher, with an average of 13 percent of revenues circa.

Figure 1.6 SSA: PPG External Debt as % of GDP

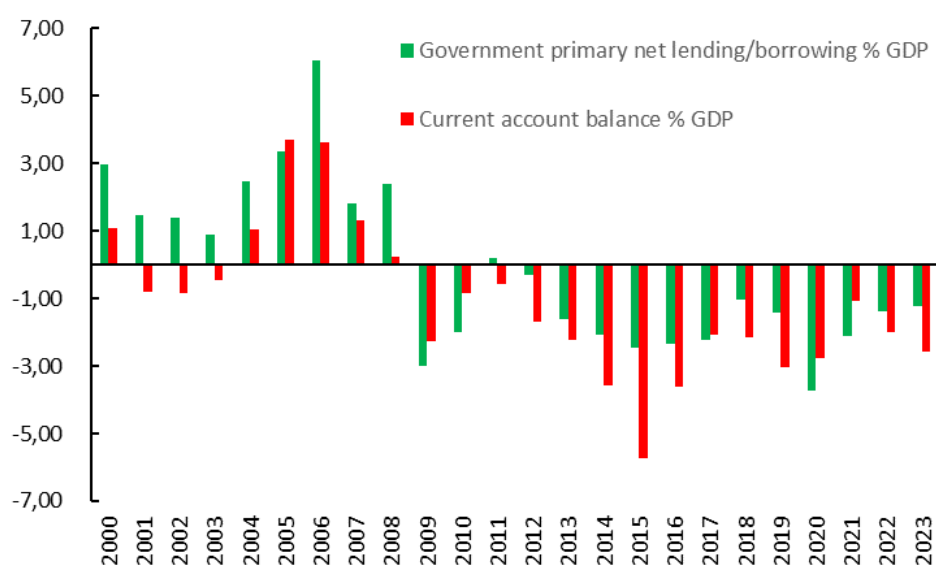


Source: IDS 2022

Drivers of the new debt accumulation

What are the main drivers of the rapid external debt accumulation that African countries observed in the last decade? Certainly, the renewed debt problems differ from the '80s crisis because of new worrying features that developed since the Global Financial Crisis in 2008. We can briefly look at some of them.

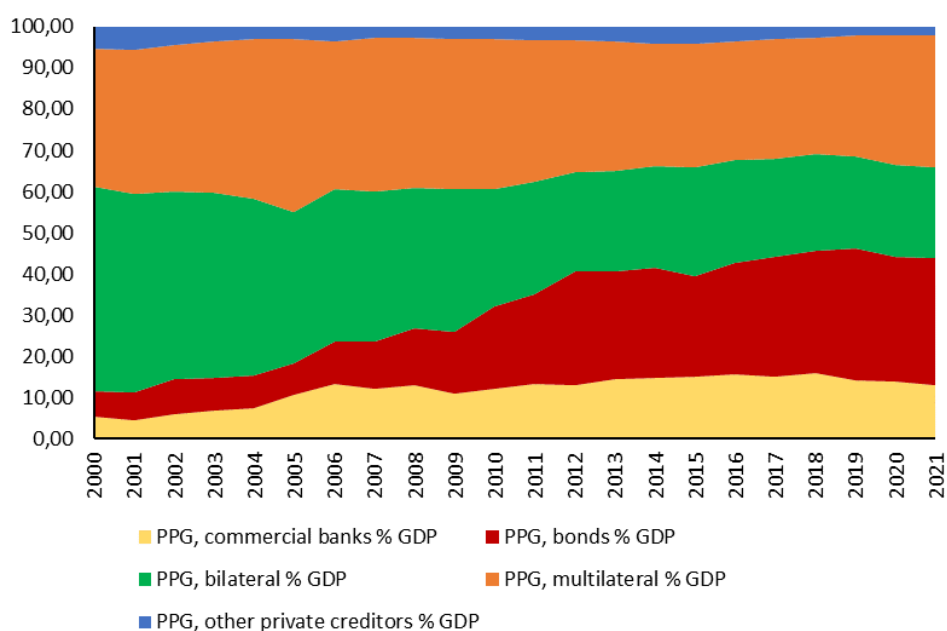
Figure 1.7 SSA: Government net Lending and Current Account as % of GDP



Source: WEO 2023

First, the combined effect of the global financial crisis of 2008 and the commodity price crisis in 2014 implied a reduction in foreign aid and capital flows, exchange rate depreciation and a declining term of trade (IMF 2019b). This led to lower values of exports and to an increase in current account deficits, particularly in resource-intensive countries. At the same time growing financing needs could not be covered by higher revenues since the already scarce revenue mobilization in SSA was hit by the recession (IMF 2019b). Due to these shocks, SSA has entered a period of twin deficits (World Bank 2016): since 2009 both the overall fiscal and the current account balance have been in deficit, way before the Covid-19 pandemic (Figure 1.7). This seems to be a structural break from which African countries never recovered.

Figure 1.8 SSA: Creditors composition as % of total PPG external debt

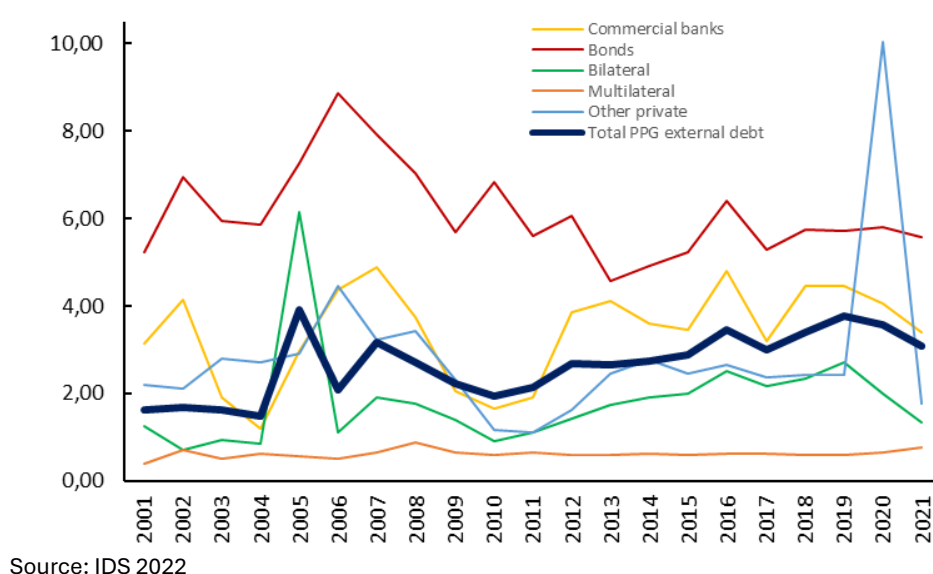


Source: IDS 2022

Second, a current account deficit implies inflows of capital. When the capital inflows are mainly in form of debt, interest payment increases the current account deficit. Therefore, it's fundamental to manage the different sources of loans in order to minimize its cost. This is a lesson that African countries are learning at their expenses: in the SSA the overall debt structure has shifted toward more costly debt, in particular toward debt owed to private investors. Indeed, in the last decade, the lack of fiscal space was compensated for by a larger access to international financial markets favored by a period of low global interest rates. Following the 2008 financial crisis USA and Europe introduced unconventional expansionary fiscal and monetary policies: the US Troubled Assets Relief Program (TARP) and the EU Quantitative Easing (QE) adopted by many Central banks. These measures have led to very low interest rates,

even with negative values, in international capital markets, the so called zero-bound-level (see Baldwin and Teulings 2014). Hence private investors were looking for higher yields in emerging market economies but also in Low Income countries in Africa, whose bonds were offering higher rates and whose debt indicators had improved thanks to HIPC and MDRI. Starting in 2006 with Seychelles many SSA countries initiated the issuance of bonds on international financial market and these issuances have been increasing since 2013 to reach around 17 billion of dollars in 2018. Bonds issuances brought financial resources to African Countries, but they boost the external debt and the cost of the debt service (Figure 1.8 and 1.9).

Figure 1.9 SSA: Effective Interest³ per debt Creditor

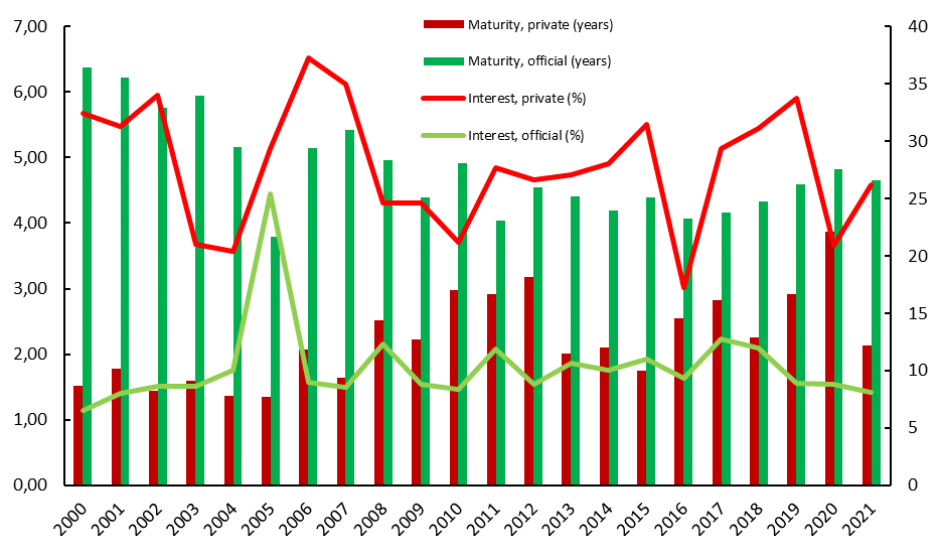


Different creditors, higher debt service, higher risks

As we have already stressed, compared to the African debt crisis in '80s in Africa, today the novelty is related to the different composition of creditors. From Figure 1.8 we observe that the share of official debt (Multilateral and Bilateral) is losing room to private debt. Today the bonds component represents on average more than 30 percent of the SSA region's external debt, and, overall, the private debt weights 40 percent of it. While official loans feature a high degree of concessionality, high maturities and an interest below market rate, private loans and bonds require lower maturities and higher interest rate (Figure 1.10).

³ The "Effective Interest" is a measure of the implicit interest paid each year on the stock of external debt given the actual interest payment. Indeed, it is calculated as: $EI = \frac{Interest\ Payment_t}{Debt\ Stock_{t-1}}$. Therefore, we consider the interest debt service net of arrears and debt forgiveness.

Figure 1.10 Interest and Maturities of new external debt commitments



Source: IDS 2022

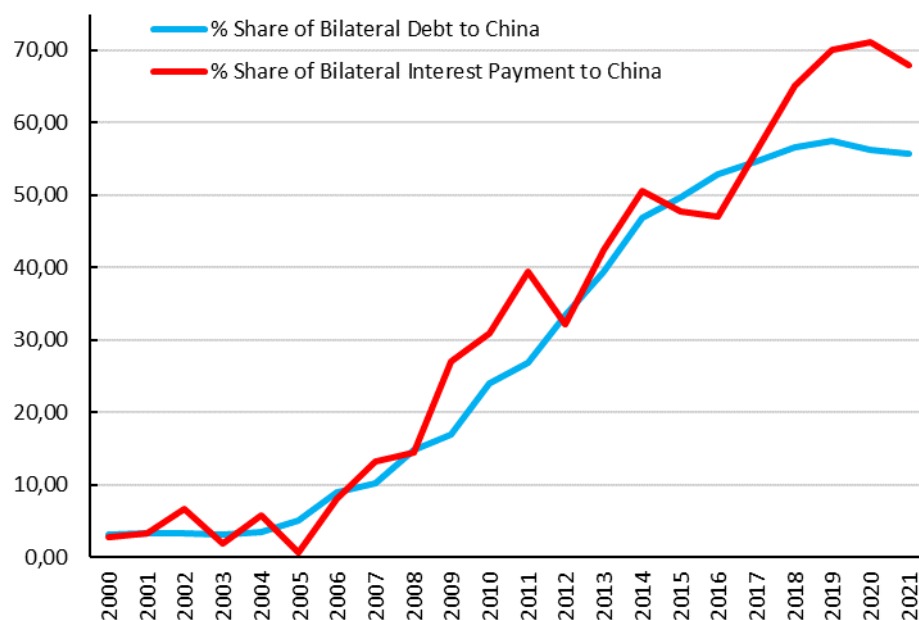
The interest on international bonds is so high (in some African countries it could be above 15%, Senga et al. 2018) because the SSA governments must ensure the attractiveness of the returns and reward the risk of insolvency and exchange rate to private investors. Bonds also entail many risks for the issuing country: more exposure to international finance volatility and the risk of long legal disputes. The experience has shown that “vulture funds” buy sovereign debt on the secondary market at a very high discount and then start a cause against the issuing country (Paciulo 2023). The legal characteristics of bonds may make them difficult to restructure (Bonizzi et al. 2020) as they are issued in unfavorable western institutions (ex. Wall Street or London Exchange). In general, the more debt is in the hand of private actors, the harder it will be to negotiate in case of insolvency or lack of liquidity as private investors are very reluctant to participate to debt restructuring/debt forgiveness programs. Or even worst, by not participating, they could make money from it (Jubilee Debt Campaign 2021).

A changing Bilateral debt Landscape: the role of China

Another element that denoted the recent rise of debt accumulation and debt service in the SSA region is the drastic change of the bilateral creditor composition. Historically, the main bilateral lenders of African countries were the countries part of the Paris-Club, the main participants of the debt relief program along the '00s. Generally, the Paris club offer highly concessional debt with moderate interest rates and consolidated procedures of debt relief or rescheduling in case of distress. In the last decade however, China promoted an astonishing amount of loans to Africa, becoming the main bilateral creditor. Indeed, if one considers only bilateral debt, China in 2021

accounted for 56 percent of total bilateral PPG debt and 71% of bilateral interest payments by African countries (Figure 1.11).

Figure 1.11 SSA: Proportion of Chinese loans on total bilateral external debt



Source: IDS 2022

China first official loan to Africa was negotiated in 1960 with Guinea, but a more constant lending activity of Chinese banks to Africa started in 1994 (Brautigam et al. 2020). Since then, Chinese financing has proliferated in all SSA, and in particular accelerated in 2013 with the Belt and Road Initiative (BRI). China indeed, saw the African countries as an opportunity to invest in infrastructural development ensuring strong economic relations. On the other hand, many African countries were attracted by the “win-win” narrative of the Chinese financing as huge infrastructural projects were financed by loans with a good degree of concessionality (Morris et al. 2020). Also, China was seen as a good alternative to traditional western lenders with less dogmatic conditionalities and no controversial colonial past (Were 2018).

According to the China Africa Research Initiative (CARI), 80 percent of the Chinese loans comes from the Chinese government or state-owned banks like the Export Import Bank of China (EximBank), China Development Bank, and other industrial and commercial banks; the remaining 20 per cent is by companies (mainly state-owned). Despite many claims of “Debt Trap” diplomacy⁴, in more than half of SSA countries at high risk of debt distress China has less

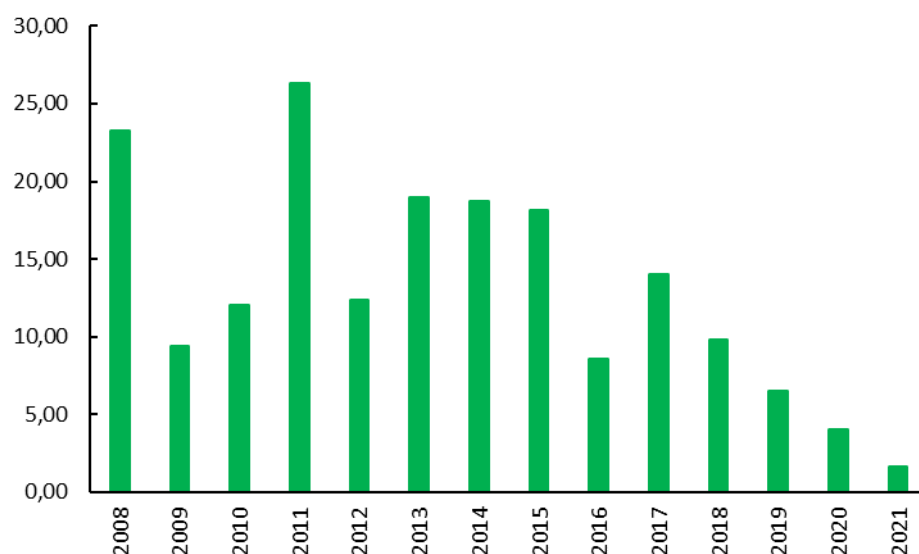
⁴Debt-trap diplomacy” refers to the claim that China deliberately seeks to entrap countries into a web of debt to secure some kind of strategic advantage or an asset of some type. The term has been extremely appreciated by media, and China and BRI detractors, as it spread all over the world, landing also in the US Congress and the political elites. For example, in 2018 US vice-president Mike Pence accused China of promoting debt trap diplomacy in an open speech.

than 15 percent of total Public and Publicly Guaranteed, PPG, external debt and only in seven countries China accounts for more than 25 per cent of all PPG debt (Brautigam et al. 2020). Also, as reported by Brautigam and Huang (2023), China miraculously participated to the DSSI framework during the pandemic: in the 46 indebted countries that participated to the DSSI, Chinese creditors accounted for 30 percent of all claims, and contributed 63 percent of debt service suspensions. Instead, the Common Framework promoted by the G20, and the Paris Club failed to include China. According to Brautigam and Huang, this was mainly due to a creditor coordination failure, as China perceived during the DSSI that other creditors were free riding on Chinese suspensions. From the perspective of Setser (2023) instead, the community of official creditors is still too divided by geopolitics, divergent methods of assessing countries' payment capacities, and different conceptions of acceptable restructuring terms: while China still seeks commercial returns from distressed countries, traditional official lenders opt for concessionality and conditionalities.

In any case the Chinese debt carries many risks. First, in the last years Chinese loans are more costly on average compared to the other bilateral creditors (Morris et al. 2020). Second, many negotiations and debt contracts are opaque, containing clauses that can't be disclosed: Chinese lenders seek advantage over other creditors, using collateral arrangements such as lender-controlled revenue or assets and promises to keep the debt out of collective restructuring ('no Paris Club' clauses) (Gelpern et al. 2023). Third, the lack of transparency allows SSA countries to hide debt contracts (half of the Chinese debt could be hidden) and thus continue to borrow despite debt distress (Brown 2023). Fourth, cancellation, acceleration and stabilization clauses in Chinese contracts potentially allow the lenders to influence debtors' domestic and foreign policies (Gelpern et al. 2023).

To conclude, we note that given the recent conditions of African debtor countries China seems to have lost some interests in the region: in Figure 1.12 we note that the new SSA bilateral commitments to China as a share of total PPG commitments have drastically decreased starting from 2018. This could mean that China is losing interest as lending to Africa has become more risky and less profitable, especially after Zambia's distress in 2022 (Brautigam 2022).

Figure 1.12 SSA: Bilateral commitments to China as a share of total PPG debt

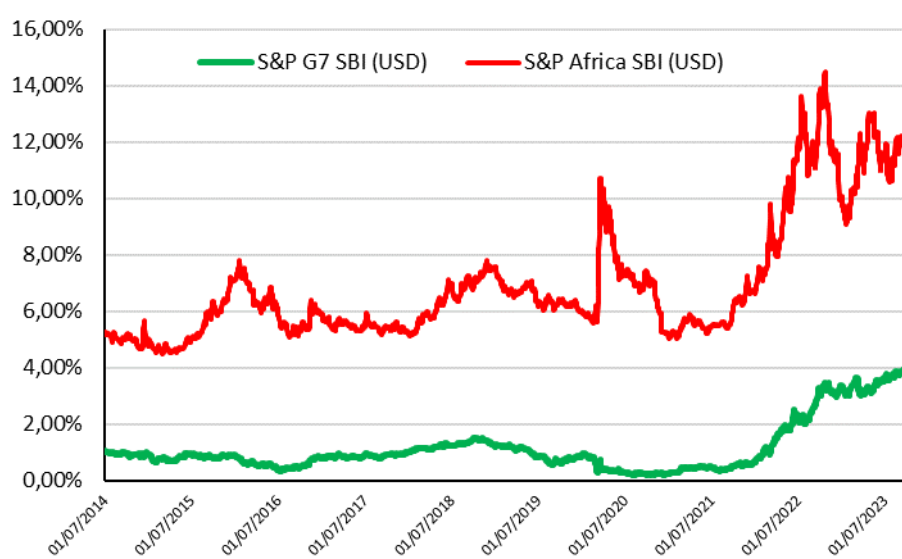


Source: IDS 2022

1.2 A trade-off: social vs fiscal sustainability.

LICs face a significant constraint on public spending. On one hand, governments must support development and provide social assistance. On the other hand, a substantial portion of their revenue must be allocated to servicing their debt, which is primarily denominated in foreign currency. The trade-off becomes even more complex when there is a need for additional spending to counter unexpected crises, such as those experienced in recent years. What emerges is a conflict between promoting development through public spending to achieve SDGs and the obligation to repay foreign creditors. Repaying the debt is crucial to avoid default and to maintain accountability for future debt issuances. Furthermore, today, debt sustainability is more dependent than ever on investors' expectations. Any sign of fiscal strain can raise negative expectations regarding a country's solvency, which, in turn, leads to an increase in the insolvency risk premium applied to interest rates. In Figure 1.13, we can observe how the recent crisis has had different impacts on the yield to maturity of the average African bond compared to that of the average G7 countries. Prior to the pandemic, the spread was approximately 500 basis points. By 2022, it had risen to 1000 basis points, and as of the time of writing in October 2023, it stands at around 900 basis points.

Figure 1.13 Standard & Poors Sovereign Bond Index, Yield to Maturity, Africa and G7



Source: Standard & Poors

The premiums on bonds should ideally be based on the credibility and creditworthiness of a country. However, it is often difficult and costly for individual investors to gather precise information of this kind. Investors typically rely on the evaluations provided by Credit Rating Agencies (CRAs), which assign grades to each country's bonds based on their own assessments of creditworthiness. Table.1 shows that in the last three years, nearly every SSA country that has issued bonds has experienced at least one credit rating downgrade. On average, African bonds are commonly referred to as 'Junk Bonds,' typically rated at BB+ or lower. In conclusion, expectations can create a vicious circle: following an external shock, investors react by raising their expectations of insolvency, increasing the likelihood of a credit rating downgrade. Consequently, the risk premium for solvency increases, causing bond interest rates to rise, which, in turn, raises the likelihood of insolvency due to constraints on bond issuance. In the worst-case scenario, this can lead to the self-fulfilling 'prophecy' of insolvency, resulting in default (Cole and Kehoe 1996; Ferri, Lui and Stiglitz 1999; Griffith Jones and Kraemer 2021). For this reason, governments of debt-distressed countries are often advised to reduce spending in favor of servicing their debt. This signals to external investors their commitment to servicing the debt and their ability to do so.

Table 1.1 SSA: Fitch Sovereign Credit Ratings, 2019-2022

Countries	2019	2020	2021	2022
Angola	B	B-	B-	B-
Benin	B	B	B+	
Botswana		A	A-	
Burkina Faso	B	B	B	CCC+
Cabo Verde	B	B-	B-	
Cameroon	B	B		
Côte d'Ivoire	B+		BB-	
DR Congo				B-
Ethiopia	B	B	CCC	CCC-
Gabon	B	CCC	B-	
Ghana	B	B		B-
Kenya	B+		B	B
Lesotho	B	B	B	B
Mauritius		BBB+	BBB	BBB
Mozambique	CCC			CCC+
Namibia	BB	BB	BB	BB-
Nigeria	B+	B	B	B-
Rep. Congo	CCC	CCC	CCC	CCC+
Rwanda	B+	B+	B+	B+
Senegal	BB-	BB-		BB-
Seychelles	BB	B+	B+	BB-
South Africa	BB+	BB		BB
Uganda	B+	B+	B+	B+
Zambia	CCC	CC	RD	RD

Source: Fitch Ratings Orange: downgrade, Green: upgrade, Red: Distress

2 The Geometry of Debt Sustainability

The first definition of sustainability on which IMF built its Debt Sustainability Analysis (DSA) considered a public debt sustainable ‘*if it satisfies the present value budget [i.e., solvency] constraint without a major correction in the balance of income and expenditure given the costs of financing it faces in the market*’ (IMF 2002, italics added). Wylopsz (2011) calls the debt sustainability analysis a ‘mission impossible’ as solvency is a forward-looking concept with a very long horizon. While it is indeed possible to precisely estimate and actualize future debt cash flows, owing to the contractual terms stipulating the amount and timing of principal and interest repayments, the absolute level of the debt stock alone is not sufficient for sustainability assessments. DSA has many limitations for the design of long-term development policies such as the implementation of Agenda 2030. Indeed, in a standard DSA, fiscal concerns take precedence over SDGs, and, in many cases, will effectively suggest sacrificing their active pursuit. As long as the analysis focuses on fiscal solvency, SDG requirements fall out of sight.

According to UNCTAD, the current framework potentially locks countries on low debt and low investment scenarios, favouring creditors rather than the borrowers (UNCTAD 2020).

However, ever since the 1990s many authors have approached the issue of foreign debt sustainability from the borrowing country's perspective, sometimes called 'affordability'. Different sustainability criteria have been proposed, but in general a debt stock is considered to be affordable if it can be serviced without compromising human development objectives.⁵ While quite often the service of foreign debt is a priority and crowds out public spending on health and education, affordability prioritises human development expenditures.

To examine the sustainability/affordability conditions of SSA we adopt the Geometry of Debt Sustainability (GDS) model by Vaggi and Prizzon (2014). As in the case of Pasinetti (1998), the GDS approaches sustainability based on the stabilization of the debt-to-GDP ratio (see Blanchard et al. 1991).⁶ GDS is a simple and stylized model with a few differences with Pasinetti's original methodology. First, Pasinetti's debt stabilization method considers mainly the changes of the debt ratio from one year to the next one, while the GDS focuses on the long-term dynamic of the debt ratio, and it shows *if* and *at which level* it will eventually stabilize. Second, the GDS does not imply a required debt/ratio or a required fiscal deficit/ GDP ratio as the Maastricht parameters at the centre of Pasinetti's analysis. Third, the GDS deals with foreign debt, denominated in a foreign currency (say, dollars, hence it must be repaid with dollars), which can only come from either continuous borrowing or from a surplus in the Current Account⁷. Fourth, while Pasinetti only considers public debt, the GDS looks at the total external debt dynamic comprehensive of public and private debt. The reason is that external debt accumulation is due to the Current Account deficit position of an economy where both private and public sectors could be indebted to the rest of the world.

A Current Account deficit is not necessarily financed through debt issuance; Foreign Direct Investments (FDI) and other forms of equity could play an important role in the financial account. One could consider gross flows of capital rather than net debt accumulation, but we preferred this second option which makes the GDS model more manageable without altering its implications. As we shall see the GDS model highlights the financial constraints due to a very weak structure of the trade balance, a typical condition of many low income and African

⁵ See Northover, Joyner, and Woodward 1998; Berlage, Cassimon, Dreze and Reding 2003; Sachs 2002; Birdsall and Williamson 2002; Vaggi 1993.

⁶ This approach was first adopted by Evsey Domar in two papers of 1944 and 1950. An interesting extension of the GDS methodology is also in Botta et al. 2023.

⁷ Only a surplus in the current account guarantees that the debt will be repaid in full; this is a long run solvency condition (see Cohen 1985).

economies (see Figures 2 and 9). In these countries, with few exceptions, FDI and other equity flows are not particularly relevant. Notice also that equity flows might lead to profit repatriation (Abala 2014), thus reducing the gross national disposable income. From an accounting point of view, profit repatriation is an outflow in the Primary Income components of the Current Account, like international interest payments. Thus, BoP and foreign exchange constraints would be even more stringent (Singh 2003).⁸

In the GDS scheme, changes in the debt-to-GDP ratio depend on three magnitudes: the growth rate of the economy, the interest rate on foreign debt, and the Current Account balance.⁹ A better indicator of the ability of a country to generate foreign currency and hence to service its foreign debt is that part of the CA which does not include interest payments on foreign debt: the Non-Interest component of the Current Account (NICA), which has a role similar to the primary balance in the case of public domestic debt.

2.1 The Model

We start from the equilibrium of the Balance of Payments (BoP) where the sum of the Current Account (CA) and the financial account (FA) is equal to zero. As we said previously, we assume that the FA includes only debt related flows, that is to say the repayment of the yearly share of the debt stock. Following Vaggi and Prizzon (2014) the BoP equilibrium is:

$$C - iD = -\dot{D} \quad (1)$$

C is the NICA, i is the nominal interest rate, D the total external debt stock, iD is the interest component of debt service, $\dot{D}$ is the change of the value of debt over time.¹⁰ If we scale every variable to GDP, Y , and multiply the term on the left-hand side by $\frac{D}{Y}$, it is:

$$\frac{C}{Y} = i \frac{D}{Y} - \frac{D}{Y} \frac{\dot{D}}{D}$$

⁸ Assume that the financial inflows are both in debt and equity: $FA = \dot{D} + \dot{E}$. If we consider profit repatriation, the current account becomes: $CA = NFICA - iD - \theta rE$, where the NFICA is the Non-Foreign Income Current Account, r is the return on equity rate and θ is the share of profits that are repatriated. We see that in terms of external position accounting profit repatriation θrE has the same impact on CA of the debt service iD . Thus, in this simple framework the dynamic of E would behave in a similar way as long as there is no long-run implication on growth.

⁹ It is important to recall that the current account is made up of the balance of goods and services (X-M); Net Primary Incomes, which include interest payment on external debt and Net Secondary Incomes which are composed by transfers not related to the liabilities of a country, in particular personal remittances. For the composition of the CA see IMF *Balance of payments manual* 2009. <https://www.imf.org/external/pubs/ft/bop/2007/pdf/bpm6.pdf>

¹⁰ Thanks to the assumption of constant exchange rate in equation (1) all magnitudes are measured in the same currency, changes in the exchange rate will be examined in section 5.

Finally, we have:

$$c = (i - \theta)d \quad (2)$$

Where $c = \frac{c}{Y}$ is the *NICA* to GDP ratio; $d = \frac{D}{Y}$ the external debt stock to GDP ratio, $\theta = \frac{\dot{D}}{D}$ is the growth rate of the debt stock and g is the nominal growth rate of GDP. The debt ratio is either stable or decreasing if $\theta \leq g$.¹¹ In the GDS framework, this condition is met if:

$$c \geq (i - g)d \quad (3)$$

In the model, we make three main assumptions that better fit the case of a low income country, LIC: first, the country is a net debtor, meaning that its debt ratio, $d = \frac{D}{Y}$ is positive; second, the country has a persistent *NICA* deficit, $c < 0$; third the rate of interest on foreign debt is smaller than the growth rate, thus $i - g > 0$.

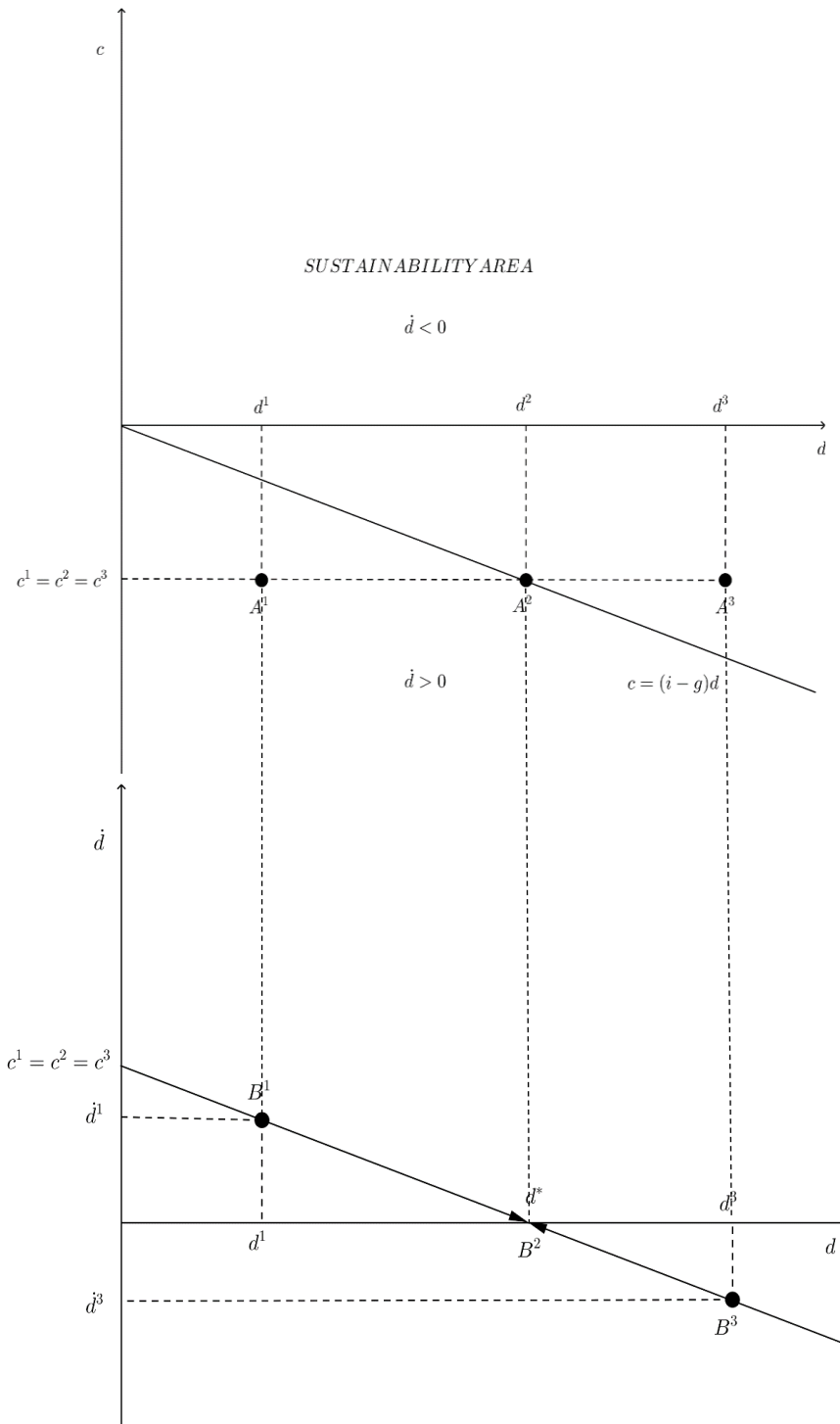
The GDS scheme is illustrated in Figure 2.1; equation (3) is the ‘boundary relation’ and is plotted in the upper panel, where the vertical axis represents the *NICA*-to-GDP ratio, c , and the horizontal axis is the debt-to-GDP ratio, d . The slope of the relation depends on the value of $(i - g)$ and we provisionally assume it is negative: for many years $i < g$ has been a typical condition in most African LICs, who benefited from low interest rates thanks to the predominant share of concessional borrowing.¹²

Following the model of Pasinetti, the position of a country in the upper panel of the diagram depends on the combination of c and d (in Pasinetti it depends on the level of the primary balance instead of the *NICA*). The points on the boundary line, like A^2 , represent all the possible combinations of c and d for which the debt ratio d is stable ($\dot{d} = 0$). The sustainability area, which includes the boundary line, is the part of the diagram above the boundary line ($\dot{d} < 0$). Indeed, if a country is in A^3 the debt ratio is decreasing while below the boundary line, as in the case of A^1 , the debt ratio is growing ($\dot{d} > 0$).

¹¹ The debt ratio dynamic is: $\dot{d} = \left(\frac{\dot{D}}{Y}\right) = \hat{D} - \hat{Y}$. If we define $\hat{D} = \theta$ and $\hat{Y} = g$, a decreasing or stabilized debt ratio requires $\hat{d} \leq 0$ $\theta \leq g$

¹² $(i - g)$ is also referred to as interest-growth differential, see Mauro and Zhou 2020.

Figure 2.1 The Basic GDS Framework



In the GDS framework the original Pasinetti's model has been integrated with the lower panel of Figure 2.1, which describes long-term dynamic of a debt ratio (see Harck 2000). The change of the debt ratio over time can be expressed as:

$$\frac{\dot{d}}{d} = \frac{\dot{D}}{D} - \frac{\dot{Y}}{Y} = \theta - g \quad (4)$$

By substituting θ from equation (2) into (4) we obtain:

$$\frac{\dot{d}}{d} = i - \frac{c}{d} - g$$

And:

$$\dot{d} = -c + (i - g)d \quad (5)$$

We call (5) the ‘state equation’ and we can represent it as in the lower panel of Figure 2.1. On the vertical axis we have the variation in the debt ratio $\dot{d}$ while on the horizontal axis we still have d . The state equation describes the differential equation (in continuous time) of the debt ratio d , when i , g and c are assumed to stay constant through time.

The intercept of the state equation is the negative value of the NICA ($-c$). Since in our case we are assuming a NICA deficit, the intercept of the state equation thus becomes positive. On the contrary, positive values of c , NICA surpluses, appear below the origin, along the vertical axis. Countries position themselves on the state equation according to their level of the debt ratio d , from which we can derive the debt variation value $\dot{d}$.

The stable debt ratio, d^* , is the same in both panels, in the lower panel it is at the point where the state equation crosses the horizontal axis, where $\dot{d} = 0$. If a country is inside the sustainability area, points A^3 and B^3 d decreases to d^* , the opposite if the country is outside the sustainability area, A^1 and B^1 . The two countries have very different initial conditions but the same stable debt ratio, because c and $(i - g)$ are the same. If a country is on the boundary line, A^2 , then it must be at B^2 because both positions correspond to the steady state value d^* .

The GDS highlights the two main components of foreign debt dynamics; usually the focus is on $(i - g)$, but for a low-income country the Current Account is much more relevant. In fact, the ways through which the country is linked to the international economy (the balance of goods and services, the import and export structure, and the NICA) are constraints to debt sustainability and also to economic growth.¹³

¹³ This is in line with the gaps (twin deficit) literature, which highlights the impact on economic growth of low domestic savings and of foreign resources (see Taylor 1994, Bacha 1990).

2.2 Affordability, Debt Sustainability and Human Development

The GDS can be adapted to evaluate the affordability of foreign debt in low-income countries with limited resources, where there might be a trade-off between servicing the debt and increasing expenditures to improve human development. Let us recall a national accounting identity, where domestic savings must equal the Current Account balance:

$$(S_p - I_p) + (T - G) \equiv CA \quad (6)$$

with S_p and I_p as private savings and investments respectively, while T as taxes and G as government expenditures. Suppose that, in order to improve human development conditions, a country increases permanently public expenditures on health and education.¹⁴ We assume that this additional public expenditure is in the form of imports and thus must be made in foreign currency. Let's say that more medicines, medical tools, and better equipment for vocational training schools must be purchased abroad by the government every year, because these products and equipment cannot be produced efficiently within the country. G increases permanently by an amount equal to the additional public spending, G_h , but this component has no impact on the domestic production,¹⁵ at least in the short run, as the government is not purchasing domestic output. In the long run these measures might stimulate both public and private investments in the health and educational sectors, but for the sake of simplicity, we do not investigate these possible long-run crowding-in effects (impact on g .) Therefore, the additional expenditures in health and education, G_h , imply a worsening of CA ,¹⁶ and in particular of the non-interest part of it: in our GDS scheme, NICA deficit increase from c^1 to c_h , see equation (7)

$$c_h = NICA - G_h = c^1 - G_h \quad (7)$$

¹⁴ Health and education are the topics of Sustainable Development Goals 3 and 4 respectively. However, the sectors which involve human development are much broader than health and education, next sections. According to UNICEF poor indebted countries are already cutting down on these types of expenditures (UNICEF 2021). On the trade-off between debt service and public expenditures see Fosu (2007).

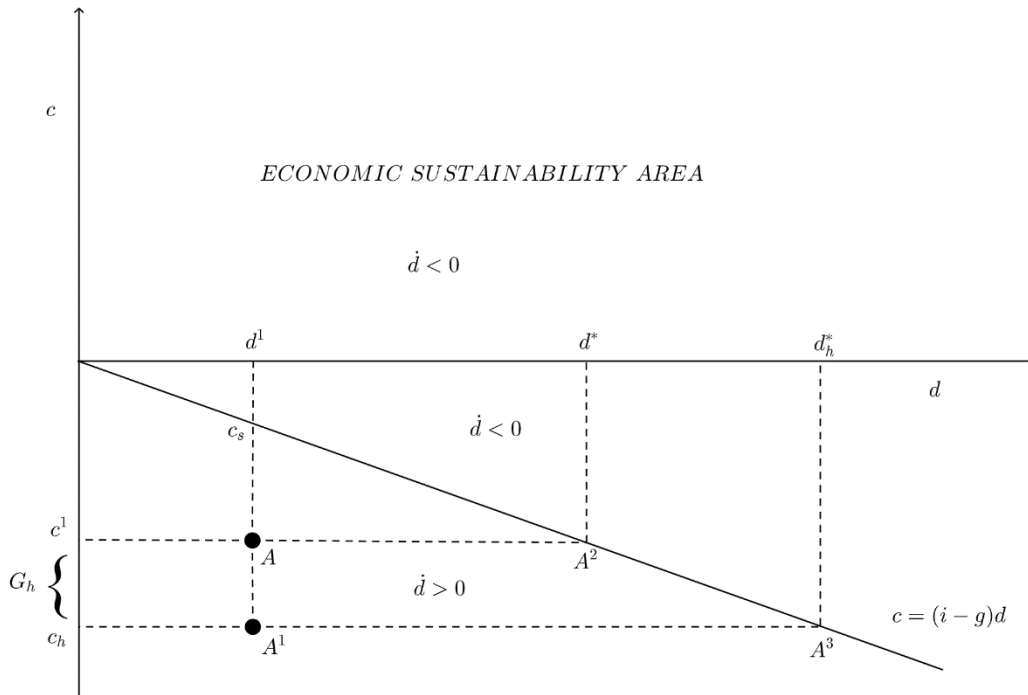
¹⁵ In a Keynesian framework, higher public expenditures do not necessarily entail a rise in the debt ratio because of the positive effects on both domestic output and on tax revenues. Of course, LICs have limited productive capacity, thus additional domestic demand could have inflationary effects and induce perverse dynamics in terms of international competitiveness. However, in this kind of countries productive capacity creation requires to import know-how and equipment.

¹⁶ If the additional resources for health and education should come from grants and donations from abroad this would improve CA because international cooperation is part of the secondary incomes in the balance of payments, or unilateral transfers (IMF 2009).

In Figure 2.2 we represent the GDS when additional Human Development spending is taken into consideration. The new scheme allows us to highlight the conditions to have both economic and human development sustainability.

Let's focus first on the upper panel of Figure 2.2, the boundary equation. Additional spending G_h implies a higher NICA deficit from c^1 to c_h . The NICA ratio shifts downward from A to A^1 . Given the initial values of c^1 , d and $(i - g)$, additional spending on health and education makes increase the long run value of the stable debt ratio to d_h^* , much higher than before.

Figure 2.2 Sustainability with additional spending in human development



If a country is already outside the sustainability area, A^1 , the additional deficit will make much more difficult to reach it at point A^3 . If a country is on the boundary line, point A^2 , its debt ratio is stable, d^* . Additional social expenditures G_h would move the country outside the sustainability area. $(d_h^* - d^*)$ is the increase in the stable debt ratio necessary to reach the sustainability area in point A^3 .

The increase in the stable debt ratio, $(d_h^* - d^*)$, depends on the slope of the boundary relation, that is to say $(i - g)$, still assumed to be negative.

Of course, one has to assume that the international community and above all financial markets 'accept' the new, higher, stable debt ratio. Indeed, there should be an acceptance of the fact that these countries should be allowed to carry new debt, either through fresh borrowing or by not repaying old debts. Recent default experiences of some LICs (Mozambique, Zambia, Ghana, Sri

Lanka to mention a few), show that this is not the case and that some limit to the raising debt ratio emerges at some point.

Now look at Figure 6. Given the initial parameters, more expenditures in human development imply a higher debt-to-GDP ratio, but the GDS scheme allows us to highlight the conditions to have both economic and human development sustainability *without increasing the debt ratio*. Given i and g this implies an improvement in the NICA-to-GDP ratio, c . It is possible to calculate the level of the NICA ratio, call it c_{hs} , which would ensure both a timely debt service and additional expenditures (public imports) on health and education. G_h is now a sort of priority policy target which must be fulfilled as it is an exogenously given parameter in equation (3), which becomes:

$$c \geq (i - g)d + G_h \quad (8)$$

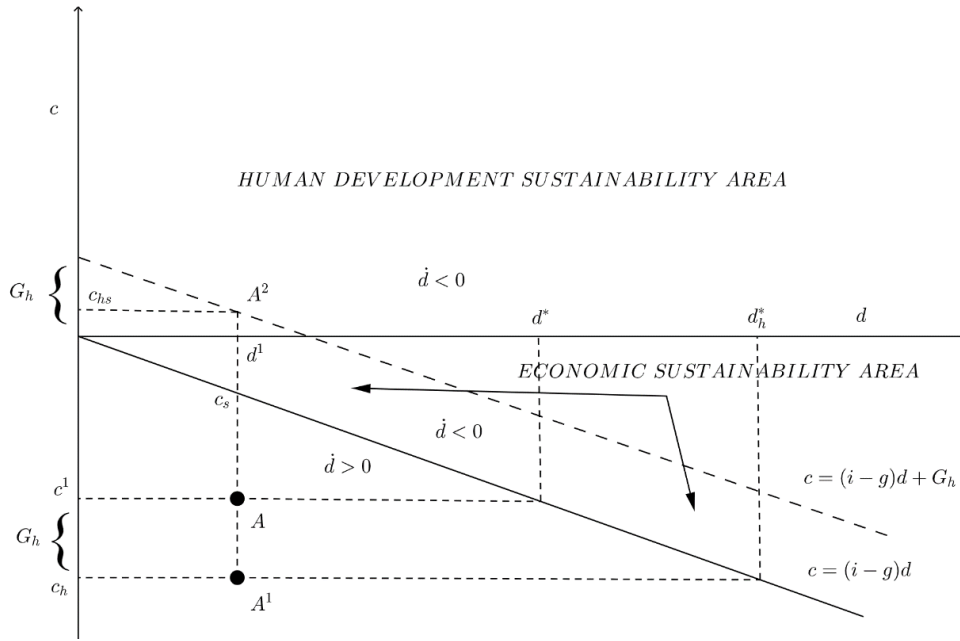
In Figure 6 we see that because of G_h the boundary line shifts upwards and above all it does not start from the origin, but from a NICA surplus equal to G_h , where $d = 0$. The old boundary line is the economic sustainability area, which however does not guarantee the fulfilment of the targets in human development expenditures. The new dashed line defines the area in which both economic and human development sustainability are guaranteed.

Suppose a country is in point A , with a debt ratio d^1 and a stable debt ratio d^* : the new expenditures in health and education increase the NICA deficit from c^1 to c^h and the country moves to A^1 , with a much higher stable debt ratio. Theoretically both economic and human development sustainability can be achieved, but that would be possible only with a NICA surplus equal to c_{hs} as it would bring the country to point A^2 on the dotted boundary line. Certainly, the shift from a NICA deficit to a surplus is not an easy task to perform in a short time. Assuming a successful shift to a NICA surplus c_{hs} (point A^2), the initial debt ratio of the country d^1 would coincide with the stable debt ratio as the equality of (8) is satisfied.

Let us derive some policy implications of the exercises described in Figures 2.2 and 2.3. First, the international community could increase aid to cover the additional expenditures, in this case NICA will improve by G_h as the aid transfers would improve the Current Account. Indeed, in a LIC, Official Development Assistance (ODA) is a positive item in the Current Account and is part of the Secondary Incomes, together with remittances.¹⁷ In a sense the international community faces a trade-off between accepting higher debt ratio and providing more aid.

¹⁷ This case is discussed in Vaggi and Prizzon 2014, section 4.

Figure 2.3 Human Development Sustainability Area



Second, the difference $(i - g)$ sets the slope of the boundary relation and of the state equation and plays the decisive role in the general framework which leads to a stable debt ratio. The higher the difference in absolute terms, the steeper the two lines are and the lower the stable debt ratio. Moving the borrowing from private creditors in international financial markets to Multilateral Development Banks (MDB), can lead to lower interest rates, with a higher negative value of $(i - g)$ and a lower stable debt ratio.

2.3 Debt sustainability when accounting for exchange rate variations

In the next paragraphs we will attempt to fit actual data within the GDS framework. This requires us to deal with data availability and nominal values. The main external debt databases we utilize (IDS and WEO) express debt stocks in USD, as most of the external debt issued in SSA region is denominated in USD.¹⁸ This entails that exchange rate movements have an important role in shaping the debt ratio configuration: an appreciation of the Local Currency (LCU) leads to a decrease the foreign debt stock and vice versa. Also, the fact that debt is in USD implies that we must normalize it with the nominal domestic GDP expressed in dollars.¹⁹ Therefore, for a more realistic perspective on the debt dynamic, we must capture the three main forces that determine movements in the denominator of the debt ratio: exchange rate variation, domestic

¹⁸ According to the International Debt Statistics data, in the last 5 years on average 75 per cent of PPG debt is denominated in USD.

¹⁹ On the impact of exchange rate variations on debt sustainability see FitzGerald 2005, pp. 21-22.

inflation of the GDP deflator, and real GDP growth. First, we define the debt ratio d starting from USD denominated variables:

$$d = \frac{D_{\$}}{Y_{\$}} \quad (9)$$

Where $D_{\$}$ is the total external debt of a country expressed in USD and $Y_{\$}$ is the domestic nominal debt expressed in USD. $Y_{\$}$ can be written in terms of real domestic GDP:

$$Y_{\$} = p_{LCU} Y_k e_{LCU\$} = p_{lcu} Y_k \frac{1}{e_{\$LCU}} \quad (10)$$

The nominal domestic GDP denominated in USD is equal to the real GDP Y_k multiplied by the domestic GDP deflator p_{lcu} and by the LCU to USD exchange rate $e_{LCU\$}$. We note also that the USD to LCU exchange rate is equal to the inverse of the USD to LCU exchange rate $e_{\$LCU}$. From the perspective of the domestic country, it is better to use this second form. Thus, now we can derive the rate of change of the debt ratio d as:

$$\hat{d} = \hat{D}_{\$} - \hat{Y}_{\$} = \hat{D}_{\$} - \hat{p}_{LCU} + \hat{e}_{\$LCU} - \hat{Y}_k \quad (11)$$

The debt ratio dynamic is therefore the outcome of four evolving forces: the numerator is driven by the change in the USD external debt stock; the denominator depends on real growth, on the rate of change of the domestic currency deflator, and on the USD to LCU exchange rate movements. We see that an increment in the deflator makes the debt ratio decrease, while a nominal exchange rate depreciation ($\hat{e}_{\$LCU} > 0$) makes it increase.

The real growth rate of GDP $\hat{Y}_k$ is g and we call π the rate of change of the domestic GDP deflator $\hat{p}_{LCU}$. We need an aggregate measure of the exchange rate and of the deflator for the SSA region. In order to determine the aggregate contribution of the exchange rate and deflator to economic growth we use a simple method:²⁰ We calculate the difference between nominal GDP denominated in USD growth rate and real GDP growth rate:

$$\hat{Y}_{\$} - g = \pi - \hat{e}_{\$LCU} \quad (12)$$

²⁰ A more articulated method implies calculating the deflator inflation and exchange rate movements of each country and the finding the mean value weighted by each SSA countries' GDP.

The only drawback is that we will not be able to separate the two different contributions to nominal growth. However, for our purpose this is not necessary as we are interested in the overall impact of nominal growth on the nominal value of external debt. To complete the GDS equation, considering deflator and the exchange rate, we can multiply both sides of equation (12) by d^{21} :

$$\dot{d} = \frac{\dot{D}_{\$}}{Y_{\$}} - (\pi - \hat{e}_{\$LCU} + g)d \quad (13)$$

We know that $\dot{D}_{\$}$ is defined according to the equilibrium in the BoP:

$$\dot{D}_{\$} = -C_{\$} + iD_{\$} \quad (14)$$

Where C is the absolute value of the NICA denominated in USD. If we plug (14) into (13) we finally obtain:

$$\dot{d} = -c + (i - \pi + \hat{e}_{\$LCU} - g)d \quad (15)$$

In the next section we will build the analysis starting from the GDS relations of equation (15), which is basically equation (5) but that considers the domestic GDP deflator inflation and the exchange rate movement. Of course, with $\dot{d} = 0$ we obtain the boundary relation:

$$c = (i - \pi + \hat{e}_{\$LCU} - g)d \quad (16)$$

As already stressed, instead of isolating real growth from deflator inflation and exchange rate movements, we will directly use the growth rate of nominal GDP expressed in dollars.

3 Economic and human development sustainability in SSA

The challenges and trade-offs highlighted at the end of the previous section become clear when the GDS model is used to evaluate the debt path of Sub-Saharan Africa. We have selected Kenya for four main reasons: first, Kenya has a high value of the external debt-to-GDP ratio, 37 per cent of GDP in 2021 (IDS data); second, Kenya have been issuing bonds on international markets and has a significant share of bilateral PPG debt held by China; third, according to the IMF Debt

²¹ Remember that in continuous time, the rate of change of a variable is equal to its derivative with respect to time divided by the variable itself:

$$\bar{D} = \frac{dD}{dt} \frac{1}{D} = \frac{\dot{D}}{D}$$

Sustainability Analysis (DSA) (July 19, 2023),²² Kenya is classified as high risk of debt distress; fourth, it's a non-oil exporting country thus the external position is not particularly exposed to oil price volatility.²³ We also considered a fictional country, Ubuntu,²⁴ whose data is based on the GDP weighted data of all SSA countries excluding the high income ones. Ubuntu is a representative, composite country for low- and middle-income African countries; its position in the GDS diagram helps to examine the debt dynamics for the region as a whole.

3.1 Baseline Data

For Kenya we merged IDS data on external debt with World Bank data. Since IDS data provides external debt stocks until 2021, the relevant variables of equation (7) have been calculated as the 2015-2021 mean value. For Ubuntu we instead used the aggregated data of SSA provided by the World Economic Outlook Database (2023). In this case we have the entire data range until June 2023, thus Ubuntu GDS variables are based on the 2015-2023 mean.

While g and c are derived from the time series, d and i need some explanation. Debt, d , is the total external debt ratio: the sum of public and publicly guaranteed debt (PPG), private non-guaranteed debt (PNG) and short term public external debt (ST) normalized by the GDP in current USD.²⁵ We take the average debt ratios to determine the countries' position in the GDS schemes together with the average NICA to GDP ratio c .

For the nominal interest rate i we take the value of the interest payments that the countries have actually disbursed in each year between 2015 and 2023 and divide them by the debt stock of the previous year; we call it 'effective interest rate'. We take the 'effective interest rate' which has been paid in the past as it is more in line with the empirical analysis based on magnitudes derived from the recent past. Moreover, it avoids the problem of the fluctuations of bond issuances and of other obligations over the years.²⁶ Of course this is a very cautious way to

²² IMF constantly updates the DSA List here: <https://www.imf.org/external/pubs/ft/dsa/dsalist.pdf>

²³ In Kenya there is a lively debate on foreign debt management, see the speech of President Ruto at the opening of the Africa Climate Summit in Nairobi last September, in The financial Times <https://www.ft.com/content/4e0ead2c-5a94-4274-8c67-2cea959cac20>. Zambia, Ghana and Ethiopia have recently defaulted on foreign debt repayment.

²⁴ No reference to the Linux open-source system; it is a word in Nguni language, part of the Bantu family of languages, and it has been widely associated with Nobel Prize winner Desmond Tutu. Ubuntu is pretty complex and difficult to translate; a possibility is fellow feeling (<https://www.wordreference.com/definition/Ubuntu>), a term used by Adam Smith. In general, it expresses a collectivistic way of living. Across all Southern Africa this word has different "cognate" names in other Bantu languages, i.e. with the same etymological derivation (Wa Mberia, 2015)

²⁵ Public debt is an external obligation of a public debtor, including the national government, a political subdivision (or an agency of either), or autonomous public bodies. Publicly guaranteed debt is an external obligation of a private debtor that is guaranteed for repayment by a public entity. Private Non-Guaranteed Debt is an obligation that has been contracted by private entities. Short Term Debt has an original maturity of one year or less. In the IDS database, data does not distinguish between public and private nonguaranteed short-term debt.

²⁶ In some years SSA countries had difficulties to service their external debt in full and there might be interest arrears, it would be correct to include these arrears within each year interests, which thus would include not only the interests actually paid, but

determine i in a period of increasing rates, but we prefer to be prudent, and this magnitude provides a good indication of the countries' actual capacity to pay.

3.2 Human Development Spending Data

As already stressed, our human development expenditures data focus on health and education. First, we assess reasonable targets for the two types of expenditures for each country, then we determine the additional spending required to achieve them.²⁷

The target on health spending is set at 5 per cent of GDP. In the Abuja Declaration of 2001, African countries pledged to increase their health spending to at least 15 per cent of the national budget and to 4-5 per cent of GDP. After twenty years few countries in SSA have achieved this goal as the average government health spending was estimated to be only around 7.2 per cent of the annual budget (Asante et al. 2020). Also, the World Health Organisation estimated an average 1.9 per cent of GDP on health expenditures in SSA in 2017, against the global mean of 3.3 per cent (Xu et al. 2019). In its 2010 report, the World Health Organization observed that on average countries with universal health care systems have a mandatory figure of 5-6 per cent of GDP for health coverage (WHO 2010, p. xv), hence this could be a decent medium-term target for low- and middle-income countries.²⁸ Neither of the two “countries” we consider is spending more than 2 per cent of GDP on health (see Table 3.1).

Furthermore, the target on educational spending is set at 6 per cent of GDP. We considered the 2015 Third International Conference on Financing for Development in Addis Ababa that set some benchmarks for educational spending, which have been also adopted by the UNESCO 2030 education agenda: at least 4 per cent to 6 per cent of GDP. On average African countries spend around 5 per cent of GDP on education, while the per student expenditure is the lowest at global level (AfDB 2020, pp. 101 to 133). In a sample of 42 African countries only 20 countries meet both UNESCO spending targets, 7 countries meet only one of the criteria and 15 countries met neither (ibid., p. 103). However, if we consider only the SSA composite country Ubuntu, the overall spending is even lower at 3.7 per cent of GDP according to World Bank data. Finally, Kenya, by spending on average 4.7 per cent of GDP on education, seems very close to satisfy this

also those due and not paid. However, data about arrears are available only for the PPG debt, where arrears are extremely small compared to the overall interest payments, thus we left them out. This assumes that also for the Public Non-Guaranteed Debt the proportion of interest arrears is irrelevant.

²⁷ The targets are expressed as ratios to GDP. We do not examine the composition of health and education expenditures. In the long run both types of expenditures might have a positive impact on the growth rate of the economy, but here we just focus on their short run impact on the balance of payments.

²⁸ Similar spending targets for universal health coverage, at least 5 per cent of GDP, emerge from other studies (Mcintyre et al. 2017, p. 135).

(lower bound) educational target. We call ‘Human Development Factor’ the additional spending required to achieve the two targets. It is determined by subtracting the five-year averages of expenditures on health and education from the targets (see Table 3.1).

Table 3.1 Health and Education Public Expenditures 2015-23 averages and required additional spending, % GDP.

Country	Expenditure Type	Avg. Gov. Spending 2015-2022	Targets	Additional spending to meet targets, G(h)
Kenya	Health	1,91	5,00	3,09
	Education	4,70	6,00	1,30
	Total	6,61	11,00	4,39
Ubuntu	Health	1,89	5,00	3,11
	Education	3,66	6,00	2,34
	Total	5,55	11,00	5,45

Source: WB data 2022

Notice that 5 and 6 per cent of GDP for health and education respectively are very prudent and modest targets. The 2020 Sustainable Development Report classifies as stagnating the progress of SSA towards the SDGs #3 and #4 which refer to health and education respectively (Sachs et al. 2020, pp. 500-501). According to the IMF, human development spending includes *five* SDG areas: health, education, water sanitation, infrastructures, and electricity -- not just health and education. A recent IMF study of 155 countries (including 49 low income developing countries, 72 emerging market economies, and 34 advanced economies) shows that having significant progress in these five areas should require an increase in their annual development expenditures by 20 per cent of their GDP (Gaspar et al. 2019). This is a much more ambitious target than those we have set for health and education, which however absorb almost half of the 20 per cent increase (Prady and Sy 2019).

Finally, we note the other big development financing issue for Africa: climate change. In September 2023, the African Union leaders asked for financial support to fight climate change, including debt relief and fresh funds for African development (see African Union 2023). However, our exercise does not include the possible expenditures related to adaptation and mitigation due to climate change.

3.3 Graphical Representation

Figures 3.1 and 3.2 portray the situations of Kenya and Ubuntu. Below each graph there is a table for the relevant magnitudes: Tables 3.2 and 3.3. c is the NICA, i the Effective Interest, d is the total external debt-to-GDP ratio, g_n is the nominal growth rate of GDP expressed in USD, d^* and d_h^* are the stable debt-to-GDP ratios in the baseline scenario and in the human development scenario.²⁹ G_h is the bold value in Table 3.2 and represents the additional spending. The two bottom rows of Table 3.2 and 3.3 show two variables that are implicitly included in the value of the nominal GDP growth g_n in USD: the real growth rate g_r and $g_n - g_r$. The latter is the difference between nominal and real growth and captures the contribution to the dollar nominal growth of GDP deflator and exchange rate movements.

In 3.1 and 3.2, the continuous lines of the baseline scenario describe the economic sustainability. The dashed lines correspond to the human development sustainability, which includes the additional spending. The circle and the square are the levels of NICA, c , before and after additional spending, respectively.

Figure 3.1 Kenya GDS

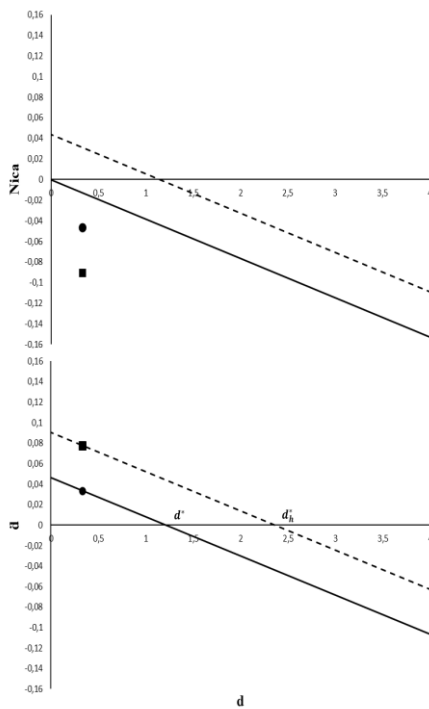
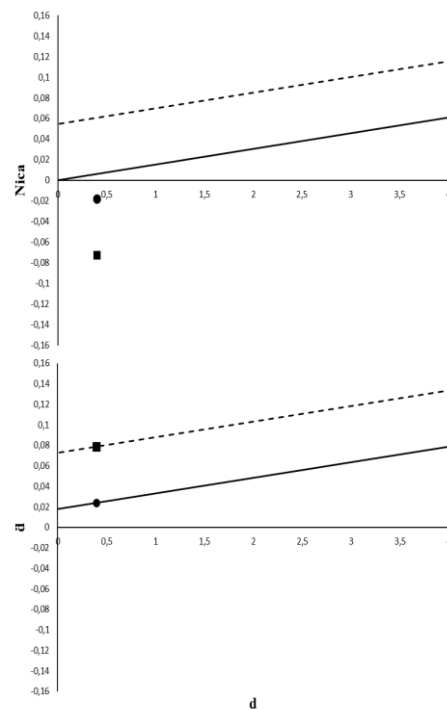


Figure 3.2 Ubuntu GDS



²⁹ In the case of the health and education expenditures time series are sometimes incomplete.

Table 3.2

c	-4,65
i	3,25
g_n	7,08
$i - g_n$	-3,82
d	33,33
d^*	121,63
G_h	4,39
d_h^*	236,41
g_r	4,44
$g_n - g_r$	2,63

Table 3.3

c	-1,81
i	2,62
g_n	1,10
$i - g_n$	1,52
d	39,74
d^*	-118,67
G_h	5,45
d_h^*	-476,95
g_r	2,73
$g_n - g_r$	-1,63

Kenya (Table 3.2) on average in the last years had a good nominal (7.08 per cent) and real growth (4.44 per cent) performance. The overall contribution of the GDP deflator and exchange rate movements is thus positive (2.63 per cent), meaning that the GDP deflator forces have prevailed over the exchange rate depreciation of the Kenyan shilling with respect to the US dollar. The effective interest is 3.25 per cent thus the difference with the nominal GDP growth in dollar is negative (-3.82 per cent) hence the slope of the boundary line is negative and the condition for the long-run convergence of the debt ratio to a stable value is met. Furthermore, the level of the debt ratio is moderate (33.33 per cent), below the 55 per cent threshold indicated by the IMF Debt Sustainability Analysis as a limit after which distress is more likely in a country. The problem is the high NICA deficit of 4.65 per cent of GDP, which set the country well outside the economic sustainability area. However, since $(i - g_n) < 0$ the slope of the line) is negative, in the baseline scenario the economy of Kenya admits a stable long-run debt ratio of 121 per cent (Figure 3.1, lower panel, the circle). When additional spending for imports on health and education is brought into the model, the stable debt ratio d_h^* increases to an extremely high level, 236 per cent of GDP (Figure 3.1, the square).

Ubuntu has a higher initial debt ratio (39 per cent) but the difference between the interest rate and the nominal growth rate, $(i - g_n)$ is positive: the average real effective interest (2,62 per cent) is higher than the average nominal growth of GDP in dollars (1,1 per cent). Therefore, as long as the Current Account is in deficit (1.81per cent in this case), the Ubuntu economy will see its debt ratio explode because of the Current Account deficit and the burden of the debt service. Combined, they will overcome the slow nominal growth, and d will not convergence to any stable debt ratio (see lower panel of Figure 3.2). g_n is so low because the average

contribution of GDP deflator and exchange rate to nominal growth of the last years have been negative (-1.63 per cent); the depreciation of the SSA currencies prevailed over the domestic GDP deflator inflation. Of course, adding the additional spending on human development makes the process of exploding debt much worse (the square in both panels of Figure 3.2).

This very simple analysis signals that debt dynamics in the Sub-Sahara African region is on an unsustainable debt trajectory. Either partial or total defaults are looming, or some major relief measures will have to be taken (such as cancellations, swaps, etc.)³⁰. Inflation, as in the recent years, could help to reduce the burden of the external debt, but on the other hand it would result in a loss of international competitiveness and worsen the Current Account deficit.

4 Discussion: Covid-19, structural change, and development finance

Between 2000 and 2008 SSA countries had relatively high performances in terms of real GDP growth rate, which was hovering around 6 per cent. Since 2008 the average growth rate has been slowly declining. Between 2010 and 2014 in particular, the average growth was around 4.5 per cent – though still a great pace for African countries. This average growth rate has led to an improvement in some human development indicators. Some examples: according to the World Bank data, primary school enrolment now is close to 80 per cent, infant mortality rates have diminished from 100 to 50 per 1000 live births. However, this progress is quite irrelevant compared to the significant steps toward development that still must be made: the extreme poverty in the SSA region remains the highest in the world, and the region is far from achieving many of the Sustainable Development Goals. Indeed, the GDS shows that before 2020 it was already very difficult to reconcile regular debt service and additional human development expenditures in SSA.³¹ Then the Covid-19 pandemic pushed between 70 and 100 million more people below the extreme poverty line in 2020 (see Valensisi 2020). The pandemic has had a negative impact on SSA health systems, because SSA countries have a very limited fiscal space as the overall fiscal balance has been negative since 2009 (see Figure 3). Sub Saharan African countries had a very small fiscal space, if any at all, to counter the social and economic effects of Covid-19.³² Some countries have tried some fiscal and social policies such as public work

³⁰ The 20 per cent of GDP target for social expenditures (Gaspar et al. 2019) would push the external debt to extremely high and even more unrealistic values.

³¹ This is also clear in the IMF Debt Sustainability Analysis of 2019 before the Covid-19 pandemic; 7 SSA countries were in debt distress, 9 countries were at high risk and the numbers had doubled since 2014 (IMF 2019b, p. 8).

³² On the lack of fiscal space see also Botta et al. 2023.

schemes or conditional cash transfers (Ethiopia, Guinea), tax exemptions/deferrals (Angola, Burkina Faso, Zambia)³³; these impacts still need to be assessed.

Furthermore, Covid-19 had negative effects on the educational system, namely the disruption in school attendance, worsened by a situation where a lot of children were already out of school and where it was very difficult to guarantee distance learning. Educational losses, in terms of missed days of instructions in 2020, reached almost 70 per cent in low-income countries (see IMF 2021, see also UN 2020 and UNICEF 2020).

4.1 Foreign constraints

The GDS focuses on the Non-Interest Current Account (NICA), that is to say, on the possibility of a country to generate the currency needed to repay its foreign debt. This capacity depends on the structure of foreign trade and the composition of imports and exports.³⁴ Figure 1.7 in Paragraph 1 has already shown that in SSA the Current Account has been negative since 2009. Figure 4.1 takes a much longer perspective and shows both the NICA and the Current Account have been negative for almost 50 years, with very few years of surplus, mainly linked to a positive cycle of commodity prices between 2004 and 2007. Sustained improvements in the growth rate and in export capacity require structural changes in the composition of exports and imports. These changes should modify the income and price elasticities of exports and imports and thus improve the trade balance.³⁵

4.2 Finance and development

We have assumed $i < g$ as a typical feature of most SSA countries. However, recent changes in the debt composition, with a larger share of private creditors and raising interest rates in Europe, the United States, and in international financial markets, imply that the cost of debt, i , is rising.³⁶ As we show in the case of Ubuntu's GDS, if $i > g$, the slope of the boundary line in the upper panel of Figure 4 turns positive, greatly reducing the sustainability area; compounded with structural NICA deficits this situation defies any possibility of solvency.³⁷ If a country is positioned outside the sustainability area a *NICA surplus becomes a necessary but not sufficient*

³³ Africa is a net importer of medical equipment. Since the global financial crisis many Emerging Markets and Developing Economies, EMDEs, have experienced major contractions in their fiscal space (see Kose et. al. 2017).

³⁴ In many SSA countries, economic growth is still linked to the cycles of primary commodity prices; a high price volatility is destabilizing as it can lead to imprudent borrowing.

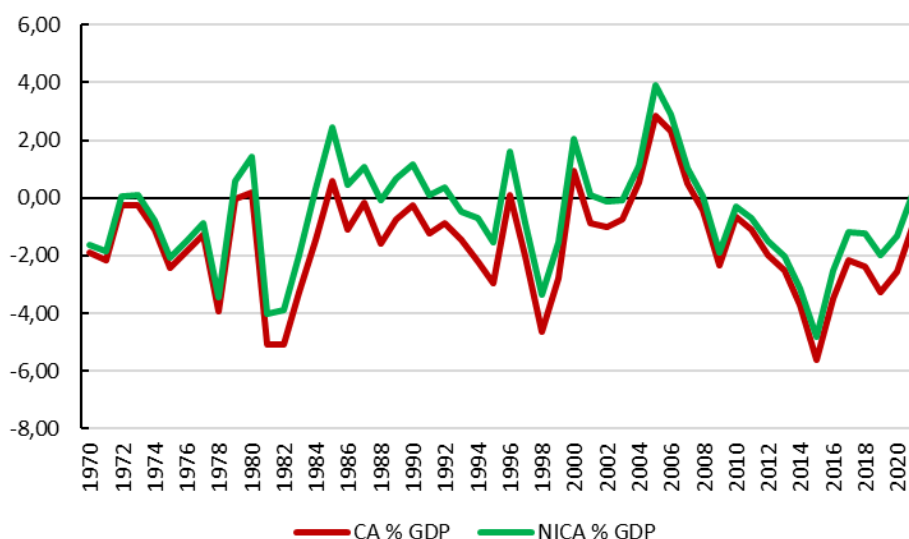
³⁵ See Fitzgerald 2005, Bhaduri 1987, Thirlwall 2011. This is in line with the strand of economic literature based on the three gaps which could constrain economic growth: fiscal, savings, and foreign exchange (see Bacha 1990 and Taylor 1994).

³⁶ Recall the *taper tantrum* of 2013, when interest rates increased because of the fear that the Federal Reserve could stop buying Treasury bills.

³⁷ This is already a problem for many middle-income countries, whose foreign debt is contracted at much higher interest rates than those of LICs.

condition for debt sustainability.³⁸ In the lower panel the state equation shows that the debt ratio will grow whatever its initial dimension; there will be no convergence to any stable value. The debt ratio will ‘explode’.³⁹

Figure 4.1 SSA Current Account and NICA as % of GDP 1970-2019 (excluding high income)



Source: WEO 2023

4.3 Conclusions

The reason for the difficulties in reconciling an appropriate debt service with human development improvements in low-income countries is an inherent timing mismatch. LICs need funds *now* to improve their economic growth and export performance, but this is a long-term process and, meanwhile, debts have to be repaid and refinanced. Many low and lower-middle income countries want to graduate from their dependence on foreign aid so to access international markets and blended finance opportunities. However, international financial markets are typically characterised by short-termism; transactions are fast and involve complicated hedging instruments (see Vaggi 2018). Above all, there are growing power imbalances between a few big investors managing trillions of dollars and many developing countries; litigations have become a normal part of the landscape.

Pasinetti's 1981 book focuses on the relationship between productivity changes in the various sectors of an economy and the modification in the composition of aggregate demand but does

³⁸ Mauro and Zhou warn about taking the condition $(i - g) < 0$ as an indication of a sustainable debt path (Mauro and Zhou 2020).

³⁹ 'Even debt cancellation may not be a sufficient condition to avoid a new external debt crisis' (Vaggi and Prizzon 2014, p. 1156).

not directly discuss the condition of developing countries. However, the last chapter of the book is dedicated to international economic relations and some of the main messages of the book have important implications for low-income countries. Pending an initial situation characterised by a Current Account deficit, a process of structural transformation is absolutely essential to avoid permanent difficulties in borrowing. Without such a change it is very complicated to simultaneously achieve the goals of a regular debt service and of significant improvements in human development.

Three simple conclusions can be drawn.

First, even a modest increase in human development expenditures would lead to extremely high debt ratios, at least in the short run, as it could take time to foster structural change. Second, the Debt Service Suspension Initiative and the *Common Framework* are most welcome plans but by themselves cannot lead to any reasonable situation of sustainability. The risk is ‘too little too late’. As the debt crisis of the eighties should have taught, more drastic and timely solutions are needed; substantial restructuring cum cancellation cannot wait ten or more years. Third, supporting the process towards the SDGs is the task of development finance.

A modest attempt to orientate development finance towards the need of low-income countries could include:

- An appropriate debt restructuring mechanism, first proposed by Anne Krueger more than twenty years ago (Krueger 2002)
- Specific markets for development bonds and types of financing, whose service is linked to the performances of the borrowing country, such as GDP indexed bonds (see Vaggi 2018 137-ff.)
- More dedicated financial instruments, in particular through Multilateral Development Banks, which have concessional lending criteria, both in terms of interest rates and maturities.⁴⁰

⁴⁰ Of course, MDBs should have appropriate funding for the new extra lending. Many authors advocate a major role for MDBs in lending to developing countries and in particular to low and lower-middle income countries’ ones., see for instance Zupi 2023.

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2 External debt stability and open economy dynamics in neo-Kaleckian models, a survey

Abstract: This chapter provides a comprehensive survey on external debt stability and open economy dynamics within neo-Kaleckian models. It explores how external constraints affect economic growth in developing countries and highlights the limitations of orthodox views on debt management, which often emphasize fiscal consolidation as a means to stabilize economies. This survey advocates for a post-Keynesian perspective, emphasizing the role of external factors and demand-driven policies in addressing debt sustainability issues. Key models are reviewed to illustrate the effects of capital account liberalization, interest rate policies, exchange rate dynamics, and distributional conflicts on foreign debt. The chapter underscores the complexity of debt stability, showing that financial openness, capital flows, and external shocks can lead to cyclical instability in economies reliant on foreign capital. Through a detailed analysis of various neo-Kaleckian approaches, this chapter highlights the potential of alternative economic frameworks to inform sustainable debt strategies in open economies.

1 Introduction: Diagnosis and Cures

In order to delineate what could ensure foreign debt sustainability, we need to understand the causes of it. As pointed out by Fischer and Storm (2023) there are two distinct points of view on the triggers of external debt instability in LICs. The mainstream one: external debt instability is mainly due to “proximate factors” related to bad budget management and spending for political consensus and corruption. The causality runs from internal (fiscal) to external balance (Abell 1990, Volcker 1984). Thus, fiscal consolidation (mainly by cutting expenditure) is a necessary policy. On the other hand, there is a less orthodox perspective: unstable debt accumulation, in developing countries, is due to external factors that limit aggregate demand and growth. These external constraints were developed according to core-periphery relations (whose roots can be found in the colonial history of each country) within the international financial markets. External unbalances, contrary to the mainstream view, could cause fiscal unbalances (Taylor 1994, Lavoie 2022) and thus fiscal consolidation could only aggravate the situation⁴¹. Therefore, according to post-Keynesian theory, unstable debt accumulation is the symptom and not the cause of an economy that can’t find the right path to development.

1.1 External constraints

The focus on the external limits to growth actually is a relatively old perspective that dates back to the structuralists theories elaborated in particular by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) school of economic thought (Porcile et al. 2021), starting from the Argentinian economist Raul Prebisch. Indeed, before the post-Keynesian theories of the balance of payments constraint to growth, (Thirlwall 1979, Thirlwall and Hussain 1982), Prebisch (1949, 1959) developed a theory that relates the growth rate of developing countries (the periphery) to the advanced countries (the core) according to the international trade specialization. While the periphery exports commodities to the core, the core produces technology-intensive manufacturing goods with a higher degree of income elasticity. Therefore, as incomes rise in both core and periphery, the demand for manufactured goods increases more rapidly than the demand for primary products overall. Assuming Kaldorian dynamics of aggregate demand, The North takes the lead in innovation while the South struggles behind (Cimoli and Porcile 2014). Since technical change is also closely associated with structural change and the emergence of new sectors, goods and skills, the

⁴¹ Lavoie (2022, p.283) on the Austerity programs imposed by IMF: “by restraining government expenditures and imposing austerity programmes, both the government deficit and the external deficit will be solved at once, thus killing two birds with one stone (and the economy as well, post-Keynesians would say!)”

productive structure of the core diversifies, going through major transformations with few spillovers toward the Southern production structure. As a result, the South remains highly specialized in a few less technology-intensive sectors but still needs to import goods from the north. This mismatch between imports and exports gives rise to balance of payment problems, problems that could be exacerbated when relative prices are considered.

Indeed, differences in productivity are reflected in differences in terms of relative wages and thus also in terms of relative prices. The term of trade worsens as the price of the commodities produced by the periphery relatively diminishes. Hence if, for hypothesis, the two rates of growth are equal in the initial stationary state, the same growth rates and the equilibrium in the balance of payments can be maintained as long as the terms of trade decreases period after period. However, for the sake of the economy, the term of trade can't be left to deteriorate forever (a relative reduction of a commodity price won't lead to higher demand forever). Thus, two possibilities: first, the periphery grows at a lower rate (divergence) to maintain the BoP equilibrium⁴² and avoid the Current Account deficit. Second, convergence and the Current Account Deficit in the periphery could be maintained as long as the external deficit is financed by capital flows from the core in form of FDIs or loans. However, as shown by Dutt (2002), foreign capital flows fuel the convergence as long as they promote structural change, meaning that the periphery uses this capital to shift its production toward a higher level of income elasticity. Otherwise, capital flows would just produce indebtedness, foraging the divergence from the core.

1.2 Here we go again: same old remedies?

Of course, both internal and external causes of debt instability are relevant for studying the issue of foreign debt stability. Going back to the legal lexicon adopted by Fischer and Storm, while internal causes are "proximate", the external causes are "remote". Bad domestic policy decisions (or a pandemic shock) could become the trigger of a debt crisis for an economy that was brought to the edge by years of structural external dependency. Indeed, what could have been a manageable mistake with some monetary and credibility losses, becomes a serious

⁴² This is basically Thirlwall (1979) where the growth rates of developing economies are constrained by the BoP equilibrium. Here Thirlwall don't consider any constraint on the amount of exports that an economy can produce to satisfy its increasing demand (infinite supply price elasticity). However, as well explained by Razmi (2016), in small developing countries exports can be constrained by the amount of productive capital in the export sector. Also, these economies are price-takers on the export side too. This entail three crucial implications: first, in the long run the level of the autonomous investment matters also on the foreign exchange constraint; second, if the foreign price of export is given, domestic price adjustments must be always followed by nominal depreciations; third, the real exchange rate level matters to the extent it influences the rate of capital accumulation. This model of Razmi better conciliate BOP vonstrained growth models for small countries with structuralist literature.

crisis because the actual configuration of the economy is severely limited by external constraints. The problem with the orthodox approach to external debt instability lies not only in the partial diagnosis of the problem, but also on the “cure” adopted, especially when the cure could be considered among the main drivers of these external constraints. On this last argument, an enormous literature elaborated criticisms on the package of IMF and WB policies that led developing countries to many socio-economic losses in the ‘80s (Nayyar 2008, Thompson et al. 2017, Kentikelenis 2017, Forster et al. 2020).

Despite the rhetoric of having reformed its previous structural adjustment practices, the IMF’s methods have changed very little in the last 40 years. Indeed, it seems that if on one side IMF and WB have acknowledged and reported the new built-up of external debt, on the other they are partly responsible for it because of the same old market-oriented remedies. This is what is argued in a recently published book by Kentikelenis and Stubbs (2023) where a database of IMF loans agreements and their relative conditionalities ranging from 1980 to 2019 has been analyzed. The authors conclude that although the “textual” IMF mandate has changed considerably over time, the organization continues to place a high burden of austerity reforms on countries in crisis. These reforms then decrease the availability of important social services and contribute to rises in income inequality and decline in population health.

This became particularly evident after the pandemic: as shown by Tamale (2021) in 2021, 85 percent of the 107 COVID-19 loans negotiated between the IMF and various governments provided plans to undertake austerity after 2024. In addition to this, the IMF has leveraged its negotiating power, significantly enhanced by the COVID-19 crisis and the increase in global interest rates, to insist on spending cuts, such as eliminating food, fuel, and agricultural subsidies, deemed as inefficient market distortions contributing to budget deficits, or else liberalizing exchange rates and capital accounts, and privatizing whatever is left of state-owned assets.

1.3 Or new bad paradigms?

According to the international organizations, public money should be spent to encourage private investment: the Addis Abeba UN conference on finance for development in 2015 ended with a joint statement from the IMF and many multilateral banks⁴³ where a new era of public-

⁴³ The document can be read here
<https://thedocs.worldbank.org/en/doc/622841485963735448-0270022017/original/DC20150002EFinancingforDevelopment.pdf>

private partnership and blended finance was invoked. The optimistic motto “from Billions to Trillions” in the title of that document suggested the need to move from billions in public and official funding to trillions by leveraging private sector investment.

An articulated critique to this recent finance for development paradigm has been elaborated by Daniela Gabor (2021). Gabor defines it as the “Wall Street Consensus”, replacing the old “Washington Consensus”: international organizations promote public-private partnerships in particular by shaping a state whose role is to de-risk private investment projects for SDGs and decarbonization. Private investors (generally private funds run by asset managers) argue that many infrastructure projects in emerging countries are not investible because their risk architecture does not create their preferred cash flow characteristics. Thus, it is the state that, rather than spending on public projects and industrialization, has the duty to ensure cash flow (with subsidies and guarantees) to private agents investing in infrastructures. Furthermore, in this context, international institutions encouraged the issuance of sovereign private bonds as a way to finance green projects. What could actually happen is that the liquidity provided by the bonds is used to de-risk the same infrastructural projects. In a certain sense the whole de-risking chain would be controlled by private investors, from the financing to the infrastructures, while transferring the risks onto the balance sheet of the state. Certainly, it is difficult to foresee whether these de-risked investments will provide actual structural change and green transition other than cash flows. The irony is that those who should be the promoters for long-run growth and investment (at least according to the de-risking *modus operandi*) are the first to ask for austerity measures when the first signs of fiscal stress emerge.

On this argument, Sylla and Doyle (2020) call this revival of severe fiscal austerity combined with financial-market oriented reforms a “debtor’s prison”: IMF demands that debt distressed countries run large primary budget surpluses in the medium term. This means that government revenue should exceed non-interest government spending. The surplus so generated is then used to meet interest payments and to pay down debt, at the expense of public spending and investment. Under the terms of typical IMF agreements, countries are required to commit to flipping from moderate fiscal deficits to these large primary surpluses within one to two years. If we add to this the poorly delivered programs for debt alleviation we mentioned previously (DSSI and Common Framework), low-income countries have very limited instruments to counter the crisis and foster development and structural change.

Ten years later it seems that nothing has changed. In July 2025 the UN financing for development was held in Sevilla. The final draft of the outcome document⁴⁴ seems to be once again prisoner of the billions to trillions paradigm despite it recognizes that the blended finance and adoption of sustainable business and finance legislation failed to reach expectations in the past years. Daniela Gabor was there in Seville; we reported her pessimistic view:

“The fourth UN Financing for Development conference, which concluded in Seville earlier this month, was a high-stakes meeting. The climate crisis is accelerating while climate commitments are weakening; official development assistance is shrinking while debt service is eviscerating poor countries’ education and health budgets. The negotiated outcome from the conference, known as the “Seville Compromiso,” is a mixed bag. The very forces behind the climate-debt crisis—capital’s twin wings, Big Finance and Big Tech—have strengthened their grip on the ambitions for “transformative development.” Around 6,000 corporate lobbyists (nearly half the total attendees) swarmed Seville’s plenary halls, peddling “blended finance,” “capital mobilization” and “AI for SDGs,” while Southern delegates pleaded for debt relief and climate finance. On the other hand, the Compromiso endorsed (on paper) a UN intergovernmental debt architecture process (with opt-outs from rich countries), tax justice, and social protection. In reality, it recycled the magic Billions to Trillions thinking that had become dogma at the Addis Ababa conference a decade ago—that is, development will only happen if it is investible, if it can mobilize private capital. The Compromiso added a notable qualification: investors should pay closer attention to development outcomes. BlackRock, we learnt in Seville, should ensure that its “investible” hospital in India, partly subsidized by concessional funding and partly by local health spending, ticks an SDG box. But the real battle raged elsewhere. While debt campaigners debated principles, the “derisking complex”—lobbyists, finance ministries, and multilateral banks—was laser-focused on one goal: how to turbocharge private capital into development assets.” From “After Seville” by Daniela Gabor on PhenomenalWorld.com⁴⁵.

Therefore, the Seville conference reflected a broader tension: while poorer nations sought a reimagined financial architecture that prioritizes long-term structural transformation and accommodates the temporal and contextual realities of their development needs, advanced economies, alongside the “derisking complex” of lobbyists, finance ministries, and multilateral development banks, doubled down on ensuring lucrative opportunities for Big Finance and Big Tech. The Seville Compromiso’s tepid acknowledgment that investors should align with

⁴⁴ Can be read here <https://docs.un.org/en/A/CONF.227/2025/L.1>

⁴⁵ <https://www.phenomenalworld.org/analysis/after-seville/>

development outcomes falls short of addressing the systemic inequities perpetuated by a private-driven model. Ultimately, Seville 2025, much like its predecessor in Addis Ababa a decade earlier, risks entrenching a development paradigm where the urgent needs of the Global South are eclipsed by the relentless pursuit of profit by global financial giants, leaving the promise of a just and sustainable financial system frustratingly out of reach.

2 The need for a post-Keynesian perspective on foreign debt

One of the reasons why the recent discussions on financing for development always ends up with private sector-led policies for growth is that mainstream economic theory (on which policymakers are usually trained) is generally irreconcilable with long run investment policies publicly driven. Investment can be financed only through current savings. If LICs governments have unbalanced budgets, the state should be able to attract private savings, but this would crowd out private investment. Furthermore, if the needs of the governments must be purchased abroad it means that, in case of a current account deficit and narrow foreign reserves, foreign savings must be attracted.

When talking about foreign debt, policymakers, economic agents, and markets are interested in debt ratios⁴⁶. In the context of LICs, focusing on fiscal consolidation means focusing on reducing the numerator of the ratio and hoping that fiscal discipline may have some positive spillovers on private economic activity (a signal to the markets?) and private SDGs targeting, while decreasing social spending. Conversely, focusing on public SDGs spending could help to reduce or stabilize the debt ratio as long as the impact on economic growth is larger than the increased budget deficit (the denominator Y , GDP, increases more than the numerator D , foreign debt). At the same time, in developing countries public expenditures are the main driver that could lead the economy toward the achievement of the Agenda2030 targets by increasing social security and climate-related interventions, also given the scarce incentives of the private sector (Gaspar et al. 2019) that requires investment to be de-risked (Gabor 2021). This, of course, requires firmly trusting the ability of the public sector in addressing SDGs and fostering economic growth (assuming away the topics on corruption and accountability that clearly are extremely country specific and that can't be easily implemented within the simple analytics of a Keynesian

⁴⁶ Commonly, the main debt indicator is debt to GDP ratio, D/Y . Most post-Keynesian models instead look at the debt to capital ratio D/K , as these dynamic models look at the convergence value of variables normalized by the productive capital. When the focus is on foreign debt however a better indicator for solvency could be the foreign debt to exports ratio D/X (Behring et al. 2019). Indeed, one of the main debt indicator of IMF's DSA is foreign debt to exports.

macro-model). On this latter topic, post-Keynesian theory suggests that expansionary fiscal policies, and more in general demand policies, are more effective in stabilizing the economy, even in the open economy. This is due to many assumptions that are drastically different from neoclassical and neo-Keynesian hypothesis. In this paragraph we will succinctly present some of them, the ones that better justify a demand side view on the stabilisation of foreign debt. The relevance of the supply side and structural change, though, must be not forget thanks to the lessons of Kalecki.

Inverted causality of Say's Law

In post-Keynesian economics, the causality in the savings-investment ($S=I$) identity is inverted compared to classical and neoclassical frameworks, fundamentally rejecting Say's Law in both the short and long run. Unlike Say's Law, which assumes that supply (savings) creates its own demand, post-Keynesian theory posits that investment drives savings. The $S=I$ identity holds as an accounting equality, but investment is autonomous, determined by entrepreneurs' expectations, animal spirits, and effective demand, rather than being constrained by prior savings. This inversion arises from the post-Keynesian view of money as endogenous, created by the banking system in response to investment demand. Firms finance investment through retained earnings, existing liquidity, or new credit extended by banks, which expands the money supply. As Lavoie (2022) emphasizes, this endogenous money creation undermines the neutrality of money assumed in neoclassical models, positioning effective demand as the primary driver of economic activity across both short and long runs. The inverted causality has profound implications, particularly for economic policy. In neoclassical models, automatic mechanisms—such as flexible wages and prices—are assumed to guide the economy toward a full employment equilibrium, rendering demand policies unnecessary or inflationary. However, post-Keynesian theory rejects the existence of such mechanisms, arguing that economies can persist in states of underemployment due to insufficient effective demand. In this context, demand-side policies—such as public investment or credit expansion—are not only viable but necessary to stimulate growth and reduce unemployment.

The rejection of automatic full employment mechanisms further challenges austerity policies that prioritize higher savings to boost investment. As Keynes (1936) highlighted in the "paradox of thrift," increased public or private savings reduce consumption and aggregate demand, leading to lower income and, counterintuitively, reduced savings. This paradox illustrates the fallacy of composition: what may be rational for an individual (saving more) becomes detrimental at the macroeconomic level, as aggregate demand contracts. Demand policies, by

contrast, counteract this contraction by stimulating investment and consumption, thereby generating income and savings endogenously.

Ricardian Equivalence doesn't hold

Post-Keynesian authors believe that among the demand policies, government expenditure is very effective in stabilizing the economy as they do not support the Ricardian Equivalence principle. The Ricardian Equivalence principle has been theorized by Barro (1974), inspired by a (partial) reading of Ricardo⁴⁷ (1820) and became matter of an intense scientific debate between economists. Briefly, the assumption is that there is no difference between debt financed expenditures and tax financed expenditures as the impact on consumption is the same and nihil (here is the “equivalence”). This happens because in this orthodox view agents are forward looking and consequently internalize the government's budget constraint when making their consumption decisions: taxpayers will anticipate that they will have to pay higher taxes in future. As a result, they will save, rather than spend, the extra disposable income from the initial increment in government expenditures, leaving demand and output unchanged. This is similar to the effect of an increment in taxes to finance additional spending as taxes reduce consumption but allow to increase government spending by an equal amount. These theoretical mechanisms therefore imply that debt financing is neutral to the level of aggregate demand.

On the opposite, within post-Keynesian theory debt-financed expenditures do not necessarily impact consumption behavior: agents are not forward looking and generally do not optimize intertemporal consumption as, at macro level, consumption is not just the sum of individual behavior. Rather, the household, at aggregate level, consumes according to an autonomous component, a component that depends on current disposable income and sometimes also a component that depends on the accumulated wealth (this latter component is a specific feature especially of Stock-flow Consistent Post-Keynesian models (see Godley and Lavoie 2007).

Fundamental Uncertainty

The reason why economic agents seem to be “blind” within post-Keynesian modelling can be explained with a more general argument on the role of time and the lack of intertemporal optimization in post-Keynesian theory. Whenever we are talking about debt, we are referring

⁴⁷ According to O'Driscoll (1977) Ricardo in his same works always denied the equivalence:

“Ricardo perceived taxation and debt issuance as nonequivalent in fact that he was of the opinion that preference should be given to the first” [Italic added]

The main reason is that, according to Ricardo, individuals have the illusion that the interest payment makes them richer, underestimating the future liabilities.

to an intertemporal problem as issuing debt today implies consequences in the future and, by definition, a debt is something that needs time to be paid back and guarantees to increase current private or public expenditures. As long as rational agents à la Lucas (1972) are assumed, mainstream models can incorporate theories like the Ricardian Equivalence and define the behavior of the agents according to a rational rule that maximizes intertemporal utility given some predictable rational actions of other economic agents like government or central banks. Therefore, time in mainstream models is just an artificial construction, where decisions are taken at time zero since agents know the complete socio-economic system and act according to a known distribution of events that could occur. It follows that agents achieve immediately stable and optimal economic equilibria as mainstream models follows an “intertemporal” dynamic.

Differently, in a post-Keynesian world, agents have bounded rationality, and they are not able to predict the future looking at the frequencies of events generated in the past. Rationality is limited to a bounded version because post-Keynesian theory assumes “fundamental uncertainty” (Lavoie 2022), rejecting the possibility of maximizing intertemporal utility thanks to known probabilities of events. Indeed, the time series generated by history and the socio-economic events are non-ergodic (Ferrari-Filho and Conceição 2005), meaning that the time and space averages may not coincide, and entailing that individuals cannot rely on current or past averages to discover what ought to happen in the future. A consequence is that expectations usually are “myopic” and based on the previous period. Post-Keynesian models, therefore, follows a “recursive” dynamic: each short run equilibrium is determined according to the equilibrium of the previous period. In short run the flows that make increase stock variables (generally changes in stock are referred to as Flows of Funds) are determined. And since short run solutions depend on the stock variables of the previous period, this process goes on until the flows become stable (the long run stability), if the system admits stability.

Going back to the intertemporal perspective on debt, agents, as well explained by Keynes (1936), act according to some rational conventions and instincts (“animal spirits”), in order to obtain a satisfying amount of utility but not the maximum amount of it, as persistent uncertainty prevents it. For the same reasons agents are not able to predict how much and when government will increase future taxes, but rather they react with rationality bounded to the current time, and consequently they increase consumption because public spending has currently increased the disposable income.

The non-neutrality of money

In this context of fundamental uncertainty, we can better understand also why the non-neutral role of the money is necessary to advocate for the irrelevance of Say's law: the $S = I$ causality is inverted because agents have liquidity preferences and therefore current savings are not completely spent in the economy. In an endogenous money world where money is also reserve of value and not just a veil, commercial banks are not intermediaries. Liquidity preferences arise not necessarily because agents are irrational or lack financial knowledge, but simply because in an uncertain and monetized world, liquidity in the form of cash or overnight deposits can help to deal with unexpected events (getting fired? Firm failure?). Money balances indeed act as a buffer against mistakes in expectations. Any mistake regarding expected disposable income is entirely absorbed by an equivalent unexpected change in money balances. The more uncertainty is perceived, the higher the preference for more liquid assets will be.

Effective demand and productive structure

We need not to forget the relevance of the supply side. Generally post-Keynesian models do not consider supply side because of two major reasons. First, they focus on technologically advanced countries where real production bottlenecks are absent; assuming away full employment and full capacity, effective demand in long run has always an impact on the real economy. Inflation rather than an excess demand phenomenon is a matter of conflicting claims between social classes. Second, post-Keynesian models are mainly concerned with monetary phenomenon and financialization, in response to the monetarism and the limited approach to the financial sector of orthodox models.

The principle of the effective demand can be always applied both in advanced and developing countries. However, as we have previously seen with Prebisch, it is true that in developing countries the supply side could be rigid and constrained by structural factors. Thus, in case of supply bottlenecks, an expansion of aggregate demand would be absorbed by a rise in prices, likely generating an inflationary spiral. This was the main argument proposed by the Structuralist theory of inflation (Noyola 1956, Sunkel 1958), inspired by the work of Kalecki (1954). Kalecki in particular stressed how, in under-developed countries with limited supplies of food and other essential and perishable consumer goods, severe inflationary pressures may be generated even in the absence of budget deficits and with relatively low rates of investment.

If on one side the argument of Kalecki can be seen as a limitation to the stabilizing role of public spending and intervention, on the other it reinforces it: only the transformation of the

production structure can lead to higher growth rates, but for this, specific industrial and development policies are necessary. The market must be guided, and investments oriented towards sectors with the highest value added and the greatest growth potential. Thus, modern structuralism must be merged with post-Keynesian tradition in order to better shape effective state-led macro policies for development. External debt stabilization would be a consequence of structural change.

Concluding, rather than orthodoxy, post-Keynesian economics could be more appropriate for analyzing the issue of the trade-off between foreign debt servicing and development spending, with an eye on the ability of public spending to foster structural change and development. So far, what are the main contributions of the post-Keynesian theory on this issue? In the following chapters we will show the main works and the different constellations of cases that emerge when foreign debt sustainability is assessed within a complex system of conflicting forces. Moreover, we will see that the post-Keynesian literature on foreign debt sustainability leaves room for further research. In particular we focused on neo-Kaleckian models, which are extremely useful for analyzing matters of income distribution. We will observe, indeed, that external debt could have a prominent role in the determination of the income share.

3 neo-Kaleckian Models

Kaleckian models of growth and distribution were developed in the early 1980s starting from the theories on income distribution of Kalecki (1954, 1971). Their purpose was to account for an alternative view regarding the relation between income distribution and economic growth. Contrary to the arguments prevalent in the mainstream, and even within post-Keynesian authors such as Joan Robinson and Nicholas Kaldor (in their works in the 1950s and early 1960s), early Kaleckian authors argued that higher real wages were associated with higher, not lower, rates of economic activity and capital accumulation (Rowthorn 1981, Dutt 1984, Amadeo 1986). Later work tended to further develop this corollary, by emphasizing the double role of wages, both as a source of consumption demand and as a cost to producers, affecting in contradictory ways their profitability. This argument was reinforced by the impact of rising wages on international competitiveness (Bhaduri and Marglin 1990). Together with Bhaduri and Marglin's work, Blecker (1989) developed a rich literature that extended Kaleckian models with open economy features as he discussed the impact of distributive changes (in mark-ups, wages, and income policies) on the balance of trade performance and its implications for the

possibility of coexistence of rising real wages and higher economic growth. Notwithstanding the extensive literature on open-economy Kaleckian models, up until recently all the analyses concerned solely the balance of trade and tended to ignore international financial flows and the impact of the accumulation of external financial assets and liabilities (Bortz, 2021). Today a very narrow literature shows how external debt, and more in general foreign assets, could be integrated in a Kaleckian model of growth and distribution with relevant leakages on the stability of the system.

3.1 Survey Criteria

We found in total nine works that develop a foreign debt dynamic within a Kaleckian framework. We decided to group these works according to the relevant economic phenomenon on which the model centers its analysis. Indeed, we proceed as follows. First, we give a look at the analysis of Rocha and Oreiro (2013) on the consequences capital account liberalization and the relation between external debt and growth. They confirm the non-linear relation between debt and capital accumulation, suggesting that excessive indebtedness is very likely to be harmful for growth. Second, further developing the critique of the “Financial Globalization”, Porcile et al. (2011) and Birkan (2012) proposed two different models to analyze the impact of interest rate policies on the stability of an indebted economy. While Porcile et al. study two different interest rate policies (inflation and RER targeting) and their impact on long run stabilization, Birkan focuses more on the short run implication of a rise in the interest rate. In both cases an aggressive monetary policy could lead to instability. Third, Kohler (2017, 2019) studies the destabilizing role of the exchange rate as he gives relevance to the balance sheet effects of exchange rate movements and its procyclical relations with economics cycles. In particular the work of Kohler confirms that external indebtedness likely weakens the already questionable expansionary effects of nominal depreciations. Also, foreign indebtedness could create volatility and cyclicity by affecting capital accumulations behavior. Fourth, the models of La Marca (2010) and Bortz et al. (2022) show similarities to the works of Kohler, but they focus their analysis on the formalization of conflicting income distribution due to exchange rate movements. In particular foreign indebtedness could severely impact on income distribution by influencing the dynamics of the real exchange rate. Fifth, the models of Charles and Marie (2016) and Missaglia (2021) could represent two different moments in the economic history of a small, dollarized economy that is indebted to the rest of the world. Charles and Marie modelled the rise of hyperinflation due to distributive conflict and its interaction with foreign debt, a phenomenon that could induce a country to reduce volatility by adopting a foreign currency as

a national currency (dollarization). Missaglia however shows, in an endogenous money world, that a successful dollarization could still lead the economy toward a debt trap and slow economic growth, because of the mechanism arising from liquidity preferences.

4 Capital account liberalization and economic activity

Greater access to capital markets and free convertibility gave developing countries the possibility of attracting capital inflows. In models a la Solow-Swann, external savings generally let an economy increase investment and foster economic growth. Therefore, capital mobility has a prominent role among mainstream economics' recipes for development. However, the need for external savings inflows implies that the economy is running a current account deficit. What happens when the financial inflows are entirely in the form of foreign loans? Is it harmful to growth? Economic theory found many reasons why too much external debt could depress economic activity. Of particular relevance was the "Debt Overhang Hypothesis" (Krugman 1988) applied to developing countries⁴⁸, and further empirically verified by Pattillo et al. (2002) and Clemens et al. (2003). Briefly, debt and growth have a nonlinear relationship as after a certain level of debt to GDP new borrowings would be needed more and more not for capital accumulation but rather for service an exploding outstanding debt. Sachs (1989), in order to express a similar concept, named this relation the as "Debt Laffer curve". In this paragraph we present the model of Rocha and Oreiro (2013) who attempted to portray the Debt Overhang Hypothesis under a Kaleckian framework.

4.1 Rocha & Oreiro 2013

Rocha and Oreiro (2013) developed a theoretical Kaleckian model to replicate a nonlinear relation between the capitalist's rate of profit and the debt ratio. In the second part of their work, they test whether this relation is significative through an econometric procedure. In this survey, however, we are just interested in the theoretical part.

⁴⁸ Krugman took the idea by Myers (1977) who utilized the concept of Debt Overhang for explaining the burden of debt on corporate investment.

The Model

Four institutional sectors are considered: workers, capitalists, firms, and the rest of the world (RoW). Two kinds of assets: firms accumulate productive capital and borrowing from abroad, accruing foreign debt. The accumulation of foreign debt is driven by the current account deficit as there is an infinitely elastic supply of foreign loans.

In the tradition of Kaleckian theory, prices are a fixed mark-up τ over variable costs due to imperfect competition:

$$p = (1 + \tau)(wb + e_r p_f a_0) \quad (4.1)$$

Variable costs are divided into unit wage wb and the unit cost of intermediate imports, where e_r is the nominal exchange rate, p_f is the foreign price (supposed to be fixed) and $a_0 = IM/Y$ is the coefficient share of import on total output (in this model all the imports are considered intermediate imports for production). From (4.1) we can also derive the income distribution of the domestic economy⁴⁹:

$$pY = \tau(wb + e_r p_f a_0)Y + wbY + e_r p_f a_0 Y = R + W + INT \quad (4.2)$$

According to equation (4.2) the income produced by domestic firms (GDP) is distributed in form of profits to capitalists $R = \tau(wb + e_r p_f a_0)Y$, in form of wage bills $W = wbY$ to workers, and foreign income due to intermediate imports $INT = e_r p_f a_0 Y$. The rate of profits $r = \frac{R}{K}$ thus can be defined as a share π of capacity utilization⁵⁰ $u = \frac{Y}{K}$. Indeed:

$$r = \frac{\tau(wb + e_r p_f a_0)}{(1 + \tau)(wb + e_r p_f a_0)} \frac{Y}{K} = \pi u \quad (4.3)$$

⁴⁹ We note that this model lacks stock-flow consistency. Indeed, it is not clear who is paying interest on external debt. Since external debt is financing capital accumulation, firms should pay the debt service to the foreign sector, thus profits should be net of interests.

⁵⁰ Capacity utilization u is defined as the ratio between actual output and potential output $u = \frac{Y}{Y_p}$. Potential output is the maximum amount of output that can be produced given the stock of productive capital K and its productivity $v = \frac{Y_p}{K}$. In this model the authors implicitly assume $v = 1$. Therefore $Y_p = K$ and $\frac{Y}{K} = u$. If $u < 1$ it means that capital is underutilized, production is not at its full capacity.

Where $\pi = \frac{\tau}{1+t}$ is the profit share on GDP. Since the authors in this model are not interested in capacity utilization but rather in the rate of profits, given the relation of equation (4.3), they express utilization as a function of r :

$$u = \frac{r}{\pi} \quad (4.4)$$

The equation defining the equilibrium in the goods market is the following:

$$\sigma = g + b - qa_0 \frac{r}{\pi} \quad (4.5)$$

Where $q = \frac{p_f e_r}{p}$ is the fixed real exchange rate. According to equation (4.5), the rate of savings σ must be equal to the rate of capital accumulation g plus the current account to capital ratio $b - qa_0 u$, where b is the net export to capital ratio and $qa_0 u$ is the intermediate imports to capital ratio.

Workers do not save while capitalists save a fraction s of their profit income. Thus, the rate of savings is simply defined as follows:

$$\sigma = sr \quad (4.6)$$

Furthermore, g , as defined in equation (4.7), is the endogenous accumulation rate of firms and it is assumed to be a function of animal spirits and the difference between the profit rate and the interest rate. Also, g depends positively in a nonlinear way on the foreign debt to capital ratio ($z = D/pK$), meaning that the higher the level of indebtment, the less capital accumulation will increase:

$$g = \alpha_0 + \alpha_1(r - i) + \alpha_1 z^\psi \quad 0 < \psi < 1 \quad (4.7)$$

The term $\alpha_1 z^\psi$ therefore represents another external constraint to the economy. More specifically, it is assumed that an increase in external indebtedness as a share of capital stock will generate a less than proportional increase in the investment rate. This feature is justified by the authors through the idea that capital flows are not fully devoted to financing fixed capital investment, but are also used, for instance, to finance government debt or real estate. Moreover, Rocha and Oreiro, assuming a fixed exchange rate and UIP, define the nominal interest rate as follows:

$$i = i^* + \rho_0 + \rho_1 z \quad (4.8)$$

The nominal domestic interest rate is assumed to be equal to the foreign interest rate i^* plus a country risk premium composed of an exogenous component ρ_0 and an endogenous component depending on external indebtedness $\rho_1 z$. The last element of equation (4.5) that must be defined is the net exports to capital ratio b , or trade balance. b depends positively on an exogenous component ε_0 and negatively on aggregate demand $u = \frac{r}{\pi}$:

$$b = \varepsilon_0 - \varepsilon_1 \frac{r}{\pi} \quad (4.9)$$

Finally, we can rewrite the equilibrium in the system by inserting (4.6), (4.7) and (4.9) into (4.5):

$$\alpha_0 + \alpha_1(r - i^* - \rho_0 - \rho_1 z) + \alpha_2 z^\psi + \varepsilon_0 - \varepsilon_1 \frac{r}{\pi} - sr - qa_0 \frac{r}{\pi} = 0 \quad (4.10)$$

Long Run

The short run equilibrium value⁵¹ of r is also the $\dot{r} = 0$ isocline in the space r, z :

$$r^* = r|_{\dot{r}=0} = \frac{\alpha_0 + \varepsilon_0 - \alpha_1(i^* + \rho_0 + \rho_1 z) + \alpha_2 z^\psi}{s + qa_0 \frac{1}{\pi} + \frac{\varepsilon_1}{\pi} - \alpha_1} \quad (4.11)$$

Equation (4.11) defines r as a nonlinear function of z . In fact, the derivative of r^* with respect to z depends on the size of the debt ratio z : initially we have that $\frac{\partial r^*}{\partial z} > 0$, however after a certain threshold, its sign would turn negative.

Furthermore, Rocha and Oreiro write the differential equation of the debt to capital ratio z as:

$$\dot{z} = -b + (i - g)z \quad (4.12)$$

The accumulation of foreign debt is driven by the current account deficit as there is an infinitely elastic supply of foreign loans. The foreign debt to capital ratio $z = \frac{D}{K}$ increases with the current account deficit to capital ratio $(-b + iz)$ and decreases with capital accumulation g .

⁵¹ Short run stability of the equilibrium requires that: $s + qa_0 \frac{1}{\pi} + \frac{\varepsilon_1}{\pi} > \alpha_1$. It implies also that the denominator of (3.11) is always positive. This condition is always assumed to hold, and it is called Keynesian Stability condition (Lavoie 2014). In the next paragraphs we will show a better explanation of this condition, as in this model is less intuitive than others.

After plugging equations (4.7)-(4.9) into (4.12), we can obtain the locus $\dot{z} = 0$. Once again, the relation is nonlinear, as the sign of the derivative $\frac{\partial r^*}{\partial z}$, given the locus $\dot{z} = 0$, depends on the size of z . According to Rocha and Oreiro, one possible configuration⁵² of the two loci in the space r, z is the one represented in Figure 4.1:

Figure 4.1 Long Run Multiple Equilibrium in Rocha and Oreiro Model

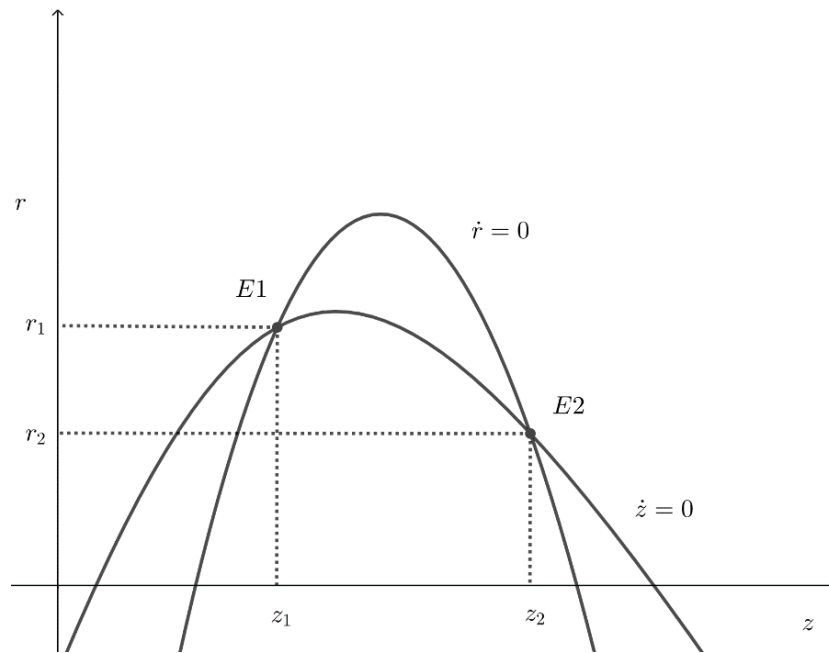


Figure 4.1 shows the existence of two long-run equilibrium positions. The first one, E1, is characterized by the existence of high profitability and a low level of external indebtedness. The second equilibrium E2, is characterized by a situation of low profitability and a high level of external indebtedness. These results are interesting, however Rocha and Oreiro do not analyze the stability of the equilibria as they do not present any Jacobian matrix of the differential equation system. It follows that they can't assess whether E1 and E2 are locally stable or instable equilibria (even if we could suppose that authors consider both equilibria stable) Rocha and Oreiro therefore in line with the Debt Overhang Hypothesis, conclude that capital inflows may cause an excessive level of external indebtedness with a negative effect on profit rates and thus on the growth rate of capital accumulation. The lack of analytical proof of the stability of the equilibria is a relevant weakness of the model, as it is not clear what are the conditions to achieve long run stability what is the path the economy follow to achieve stability.

⁵² The authors don't analyze what are the analytical conditions to obtain this precise isocline configuration. As long as we don't know these conditions, we cannot reject the possibility of a scenario where the low debt equilibrium implies a lower return on capital than the high debt one.

Also, these results are mainly obtained through one particular ad hoc element of the investment function ($\alpha_1 z^\psi$), that by default imposes non-linearity between debt and growth.

5 Interest rate Policies and foreign debt stability

In this paragraph we present the models of Porcile et al. (2011) and Birkan (2012). Both the models deal with the impact of interest policies on the stability of an open economy. Several studies of post-Keynesian persuasion have pointed out that widespread financial openness and capital mobility (the so-called Financial Globalization) have tended to make the world economy more and not less unstable (Arestis and Singh 2010). New financial globalized dynamics have reduced the maneuvering space of the already flawed monetary policy recipes of orthodox economics. Indeed, interest rate changes could give rise to perverse dynamics. Porcile et al. (2011) focus on the role of the exchange rate and capital flows, while Birkan (2012) is more interested in the short run relation of the exchange rate with debt, distribution and profits. In both cases interest hikes could push external debt toward instability.

5.1 Porcile et al. 2011

Porcile, de Souza and Viana (2011) proposed a Kaleckian model⁵³ whose aim is to describe how an interest rate operation procedure (IROP), that is an interest rate rule to counter economic instability, could lead a small open economy integrated into the international financial market to a (private) external debt crisis. Two IROP are investigated: an inflation targeting rule and a real exchange rate targeting rule.

The Model

In this model the government does not levies taxes and does not spend, its role is confined to choosing the level of the interest rate to fight inflation or the level of exchange rate to maintain international competitiveness. There are four relevant institutional sectors: workers, capitalists, firms, and RoW. Two assets: foreign debt for financing firms' investment and productive capital. Profits are completely distributed to capitalist that saves a fraction s , while workers perceive wages and consume it all.

⁵³ Despite the formal structure follows the tradition of the Kaleckian models, relevant elements of the Kaleckian analysis are not explicitly considered: first, prices and income distribution are not modelled as there is no pricing formula. Second, neither the endogenous capacity utilization is explicit as the behavioral functions don't depend on aggregate demand. The main reason is that Porcile et al. wanted to focus on IROP causes of instability without complications from the income distribution perspective, at least in the short run.

Porcile et al. define the following short run equilibrium condition:

$$\sigma = g + b \quad (5.1)$$

Where sigma is the ratio of private savings to capital $\sigma = sr$, $g = \frac{I}{K}$ is the capital accumulation rate and $b = \frac{NX}{K}$ is the net exports to capital ratio. The firm's decision to accumulate capital is defined by the following Kaleckian function:

$$g = g_0 + h(r_e - i_r) \quad (5.2)$$

Investment is a function that depends on "animal spirits" g_0 and on the difference between the expected profit rate r_e and the real interest rate i_r . The real interest rate is defined according to the traditional Fisher equation (Fisher, 1930) as the difference between nominal interest rate and inflation:

$$g = g_0 + h(r_e - i_r) \quad (5.3)$$

Instead, the net exports to capital ratio is a function of real exchange rate $q = \frac{p_f e_r}{p}$ and propensity to import m :

$$b = aq - m \quad (5.4)$$

Short Run

By combining equations (4.1)-(4.4)⁵⁴ they derive the short-run equilibrium variables⁵⁵:

$$r^* = \frac{g_0 - h(i_n - \pi) + aq - m}{s - h} \quad (5.5)$$

$$g^* = \frac{\{g_0 s + h[aq - m - s(i_n - \pi)]\}}{s - h} \quad (5.6)$$

We can observe that, according to this model, in short run foreign indebtedness is not relevant for determining equilibrium values as the debt-ratio variable is not present in the equations

⁵⁴ Capital accumulation is a function of expected profits r_e . The authors don't formalize the expectations' structure, but they just assume that short run equilibrium is achieved when $r_e = r$.

⁵⁵ Here the Keynesian stability condition is simply $s > h$

(5.5) and (5.6). This is due to the fact that, when Porcile et al. define the distribution of the national income, they do not consider the interest rate on external debt that firms must pay. We will see that, within the formalization of the long-run dynamic of the debt ratio, the authors include the interest on external debt, thus not respecting flow consistency as the inflow to the rest of the world is not related with an outflow from the domestic economy.

The lack of stock flow consistency entails that, as long as the model ends with equations (5.5) and (5.6) with no further complications, the two short run solutions are stable also in the long run independently from the stability of the debt ratio. Being capital accumulation g a function of the nominal interest rate i_n , long run instability arises when IROP are introduced in the model, as the interest rate rule must react to the value of the debt ratio.

Long Run

In the long run they assume that the external debt is issued in the international markets in units of the foreign currency at the nominal international interest rate i^* . There is an infinite capital supply at the interest rate i^* . Therefore, Porcile et al. define the BoP equilibrium:

$$-NX + i^* e_r p^* D + \hat{e}_r Dp = \dot{D}p \quad (5.7)$$

Equation (5.7) says that the accumulation of foreign debt denominated in domestic currency $\dot{D}p$ is driven by the current account deficit (as in Rocha and Oreiro 2013), expressed as the sum of trade balance deficit (NX), the interest paid on the foreign currency denominated debt $i^* e_r p^* D$ and the increment of debt due to movement of the nominal exchange rate $\hat{e}_r Dp$. After some manipulation the authors obtain the differential equation of the external debt to capital ratio:

$$\dot{\delta} = m - aq + \delta(i^* q + \hat{e}_r - \pi - g) \quad (5.8)$$

At this point Porcile et al. assumes that both Uncovered Interest Parity (UIP)⁵⁶ and Power Purchase Parity (PPP)⁵⁷ must hold in the long run. The equilibrium values of inflation π and real exchange rate q that let these two conditions to hold are the following:

$$\pi = z - j i_n \quad (5.9)$$

⁵⁶ UIP: $i_n = i^* + \hat{e}_r^e$ where $\hat{e}_r^e = (-\frac{1}{j})\hat{e}_r$ are backward-looking expectations. Therefore $\hat{e}_r = j(i^* - i_n)$: as long as the foreign nominal interest rate is higher than the domestic nominal interest rate, the exchange rate will depreciate with velocity $j > 0$

⁵⁷ PPP: $\hat{q} = \pi^* + \hat{e}_r - \pi = 0$, in the long run the real exchange rate must be stable.

$$q = \frac{z - (j - v)i_n}{\mu} \quad (5.10)$$

Where $z = \pi^* - j i^*$ is a parameter that depends exogenously on the foreign inflation and interest rates. $j > 0$ is the velocity of the exchange rate expectations adjustment, $v > 0$ is the parameters that define the efficiency of the interest rate in regulating economic activity, $\mu > 0$ is the intensity of the pass-through effect from the real exchange rate to inflation (distributional conflict). A higher nominal interest rate reduces both inflation and the real exchange rate as the authors assume $j > v$. After defining the main equations, Porcile et al. show two possible IROP policy and their implications for the stability of the model: inflation targeting and real exchange rate targeting.

a) Price and external stability under inflation target $\bar{\pi}$

The authors define a simple Taylor rule that the government follows to set the interest rate to counter inflation. Indeed, inflation target combined with a fluctuating exchange rate regime has been increasingly adopted in many Latin American countries since the nineties. Nominal interest rate is set according to the following IROP equation:

$$i_n = \alpha(\pi - \bar{\pi}) \quad (5.11)$$

Taking into account (5.5) and (5.6), equation (5.11) creates a system of differential equations with (5.8). This system admits one fixed point whose stability must be studied. The authors obtain the following stability condition from the Jacobian matrix of the system⁵⁸:

$$SC = i^*q + \hat{e}_r - \pi - g < 0 \quad (5.12)$$

According to (5.12) a negative SC produces stability, while a positive SC implies a negative determinant and consequently a saddle point equilibrium where stability can be achieved only by a fluke. More precisely, local stability is obtained when capital accumulation and inflation prevail over cost of the debt (interest rate) and nominal depreciation. But how does the inflation target impact on stability? Porcile et al. show that:

$$\frac{\partial SC}{\partial \bar{\pi}} = \frac{j - v}{(\mu j)} \left(i^* - \frac{ha}{s - h} \right) - \frac{hs}{s - h} \left(\frac{1}{j} + 1 \right) \quad (5.13)$$

⁵⁸A fixed point is locally stable when the 2x2 Jacobian matrix shows negative trace and positive determinant. If both the trace and the determinant are positive, thus the fixed point is a saddle point.

Equation (5.13) will be negative if the response of investment to a lower interest rate and a higher real exchange rate are higher than the international interest rates $\frac{ha}{s-h} > i^*$. This should be the case in normal times – and hence a higher inflation target tends to reduce SC and increase the stability of the system. Conversely, if a conservative Central Bank independently pursues too low a rate of inflation, this may give rise to a sharp appreciation of the real exchange rate and to an explosive situation on the external front. In other words, in the specific conditions defined by a close integration into world markets, the Central Bank must keep an eye on the real exchange rate when it defines its inflation target. Otherwise, the result would be growing instability and an ensuing debt crisis.

Moreover, the authors analyze what are the implications of inflation targeting economic agents have perfect foresight in the formation of exchange rate expectations⁵⁹. It results that when perfect foresight is included in this model, inflation targeting become always ineffective as there will be two types of countries: some of them are in a virtuous path of growth with an increasingly lower debt to capital ratio, while others move towards explosive deficits in the external front. At equilibrium they obtain real interest parity $i^* - \pi^* = i_n - \pi$, so that if there is a fall in the international real interest rate, the government should either accept a higher domestic inflation rate or a lower interest rate. Any attempt at a counter-cyclical policy based on raising the interest rate would have an impact on the exchange rate shifting inflation away from the target.

b) Real Exchange Rate Target $\bar{q}$

In the last part of the paper, Porcile et al. define instead a real exchange rate target policy rule whose purpose is to avoid any loss in terms of international competitiveness. Germany, South Korea and Brazil in the sixties and early seventies, and more recently China and Argentina are examples of countries which in different periods embraced policies that sought to keep the exchange rate competitive. Assuming real interest parity ($i^* - \pi^* = i_n - \pi$) and fixing the real exchange rate $q = \bar{q}$ from (5.10), helps to define the nominal interest rate target that maintains fixed the real exchange rate:

⁵⁹ This means that the expected rise of the exchange rate is always equal to the actual change. This requires $j = -1$:

$$\widehat{e}_r^e = \left(-\frac{1}{j}\right) \widehat{e}_r = \widehat{e}_r$$

Hence, from the UIP condition:

$$\widehat{e}_r = i^* - i_n$$

$$\bar{i}_n = \frac{\mu \bar{q} + i^* - \pi^*}{1 + v} \quad (5.14)$$

The IROP policy rule hence is the following:

$$\dot{i}_n = \varepsilon(\bar{i}_n - i_n) \quad (5.15)$$

Equation (5.15) shows how the interest rate must react to maintain a target real exchange rate. For example, if $q > \bar{q}$, nominal interest rate is $i_n > \bar{i}_n$. Hence the government will have to reduce the interest rate in order to achieve the desired real exchange rate.

Equation (5.15) and (5.8) form the system of differential equation whose Jacobian matrix admits the following stability condition:

$$SC = i^* \bar{q} + j(i^* - i_n) - \pi - g < 0 \quad (5.16)$$

Where π and g are at their equilibrium value. If (5.16) is verified, the system achieves local stability, otherwise if $SC > 0$ there is a saddle point. The exchange rate target impacts on the stability of the system are shown by the following derivative:

$$\frac{\partial SC}{\partial \bar{q}} = i^* - \frac{\mu(1+j)}{1+v} - \frac{h}{s-h}a \quad (5.17)$$

A higher real exchange rate target has two effects on the stability of the system: it increases the real debt burden ($i^* - \frac{\mu(1+j)}{1+v}$) but also it produces improvements in the net exports through international competitiveness ($-\frac{h}{s-h}a$). If the second effect prevails, a higher real exchange rate target would improve the stability of the system. Furthermore Porcile et al. find another interesting implication: if condition (5.17) holds, it is implied that $\bar{q}$ must be higher than a critical value, since g , π , and i_n are function of $\bar{q}$. The critical level q^* is defined as follows:

$$q^* = \frac{\left[\frac{h}{s-h}m + \frac{hs}{s-h}(i^* - \pi^*) - g_0 \frac{s}{s-h} \right] (1+v) + (v-j)(i^* - \pi^*)}{\left(\frac{s}{s-h}a - i^* \right) (1+v) + \mu(1+j)} \quad (5.18)$$

If the government fails to target at least this threshold level, the whole system will become unstable. Therefore, any exogenous shocks impacting on this critical value (ex. foreign nominal interest rate increases) could push the economy into severe instability as it would increase q^* .

To maintain a stable equilibrium, the government should adopt a new target that would lead to a further real depreciation according to the IROP. However, responding through the IROP could make rise inflation through distributional conflict as workers try to defend a certain level of real wage. The government instead should follow other policies to respond to external shocks. For example, improving the structure of imports (lower propensity to imports m) or higher autonomous spending g_0 could counter the rise in the foreign interest rate and maintain stable the target q^* with no need for exchange rate movement.

More in general, Porcile et al. conclude that, while IROPs promote mainly price competitiveness and a consequent distributive conflict, small open economies should have strong policies in favor of learning and structural change since they are much more vulnerable to changes in the international conditions. The vulnerability indeed is mainly due to foreign indebtedness.

5.2 Birkan 2012

Birkan (2012) built a Kaleckian model that, similarly to Porcile, shows the detrimental impact of inflation targeting on the long run stability of an open economy, and in particular on the foreign debt to capital ratio. Birkan develops a more sophisticated short run analysis than Porcile, while long run dynamics follows just the total debt dynamic. Also, while Porcile defined a precise rule for inflation targeting, Birkan analyses the impact of a change of domestic interest rate on equilibrium variables.

The Model

The model is made of five institutional sectors: the domestic economy is divided into workers, rentiers, and firms, while the foreign sector is divided between firms and rentiers. The income of rentiers, both domestic and foreign, is limited to the interests perceived from the indebted firms. Two assets: productive capital and loans to domestic firms. The credit to domestic firms is owned both by domestic and foreign rentiers but there isn't any distinction between foreign and domestic debt. Also, compared to the models previously presented, the BoP is capital account driven as the capital account is determined by the choice of foreign investors to bring more resources into the domestic economy. Another difference with Porcile et al. is the formalization of the price and the distributive shares. Prices are formed as a markup on variable unit costs:

$$p = (1 + \tau)(a_1 w + a_2 er) \quad (5.19)$$

τ is the mark-up; a_1 is the inverse of labor productivity; a_2 is the technical input-output coefficient for intermediate imports; er is the nominal exchange rate. Therefore, the profits to capital ratio, or rate of profits, can be determined as a share π of capacity utilization:

$$r = \frac{\tau}{1 + \tau} u = \pi u \quad (5.20)$$

Where $u = \frac{Y}{K}$ is the capacity utilization. To acknowledge the fact that firms are subject to international competition and that they need to protect their international market share, the markup rate τ and consequently the profit share π is assumed to be sensitive to changes in the exchange rate, er . Also, firms try to pass part of the increasing costs of debt to consumers, therefore whenever the interest rate increases so does the profit share. In both cases, however, firms are not able to fully pass the cost increment to consumers. In fact, Birkan defines:

$$0 \leq \frac{\partial \pi}{\partial er} \leq 1 \quad 0 \leq \frac{\partial \pi}{\partial i} \leq 1$$

Now, the condition for the equilibrium in the goods market is the following⁶⁰:

$$\sigma = g \quad (5.21)$$

Simply, the rate of savings of the economy (comprehensive of the foreign savings) must be equal to the rate of capital accumulation. σ is defined as:

$$\sigma = \frac{S}{K} = r + s(1 - \rho)i\delta + i\rho\delta \quad (5.22)$$

Total savings, normalized by the nominal capital stock, are the sum of three components: first, the profits are fully reinvested by firms to finance capital accumulation. Second, while workers fully consume their wage income, domestic rentiers consume part of their normalized interest income and save a proportion s . The normalized interest income is calculated on a share $(1 - \rho)$ of the debt to capital ratio $\delta = \frac{D}{K}$. Third, foreign rentiers save completely their normalized

⁶⁰ In this model there are no net exports. The difference with a closed economy equilibrium is that excess investment is financed by foreign loans. Also, the intermediate imports component is not accounted in this equilibrium, thus the model lack of stock-flow consistency, since intermediate imports are accounted in the pricing equation but not in when defining income distribution.

interest income calculated as a share ρ of the debt to capital ratio. We can see that Birkan assumes that ρ is fixed: a really strong assumption that however let avoid more complexity.

On the right side of the equilibrium equation (5.21) there is capital accumulation $g = \frac{I}{K}$. The rate of capital accumulation is of course endogenous, as firms decide to invest according to the following function:

$$g = \alpha_0 + \alpha_1 \pi + \alpha_2 u - \alpha_3 i\delta \quad (5.23)$$

Firms decide how much to invest according to animal spirits α_0 , the profit share π and aggregate demand u . The investment decision also reacts negatively to interest payments $i\delta$. In short run however δ is fixed as it depends on two stock variables, D and K .

Short Run

Equations (5.21), (5.22) and (5.23) form a system of three equations with three endogenous variables, r, u and g . By solving the system Birkan obtains the following short-run equilibrium values⁶¹:

$$r^* = \frac{(\alpha_0 + \alpha_1 \pi)\pi + \pi[(1-s)(1-\rho) - \alpha_3]i\delta}{\pi - \alpha_2} \quad (5.24)$$

$$u^* = \frac{(\alpha_0 + \alpha_1 \pi) + [(1-s)(1-\rho) - \alpha_3]i\delta}{\pi - \alpha_2} \quad (5.25)$$

$$g^* = \frac{(\alpha_0 + \alpha_1 \pi) + [\alpha_2(1-s)(1-\rho) - \pi\alpha_3]i\delta}{\pi - \alpha_2} \quad (5.26)$$

We can note that the debt to capital ratio is one of the elements that determines exogenously the short run equilibrium values as it enters in equation (5.24), (5.25) and (5.26) through the debt service element $i\delta$. Therefore, in the long run debt instability implies instability in the whole economic system. Whether its impact on the short run equilibria is positive or negative depends on the sign of the element $(1-s)(1-\rho) - \alpha_3$. The element $(1-s)(1-\rho)$ represents the share of interest income that is consumed domestically, becoming part of aggregate demand. α_3 is the coefficient through which debt service discourages capital accumulation g . Therefore,

⁶¹ The Keynesian stability in this case requires that: $\frac{\partial \sigma}{\partial u} > \frac{\partial g}{\partial u} \Leftrightarrow \pi > \alpha_2$

the higher the share debt that is owed to foreign creditors (coefficient ρ) and the higher foreign debt service deters investment, the more likely the overall effect of a rise of debt service $i\delta$ on the short run equilibrium values will be negative. This could be the case of many indebted developing countries.

Effects of inflation targeting on short run equilibria

Birkan does not explain analytically inflation targeting as there is not a well-defined interest policy rule as in Porcile et al. (2011). She just assumes that UIP is holding and therefore any increment of the interest rates to fight back inflation will also cause nominal appreciation to the extent that it indicates higher relative expected rates of return on domestic financial assets. For this reason, the analysis of the impact of inflation targeting on the stability of the system just relies on calculating the derivative of the equilibria with respect to the interest rate first and with respect to the exchange rate second. The overall effect of inflation targeting will be given by the aggregate effect of the two different derivatives.

First, the impact of a change of the nominal domestic interest rate on short run equilibria is:

$$\frac{\partial r^*}{\partial i} = \frac{(\pi\alpha_1 - \alpha_2 u)}{(\pi - \alpha_2)} \frac{\partial \pi}{\partial i} + \frac{[(1-s)(1-\rho) - \alpha_3]\pi\delta}{(\pi - \alpha_2)} \quad (5.27)$$

$$\frac{\partial u^*}{\partial i} = \frac{(\alpha_1 - u)}{(\pi - \alpha_2)} \frac{\partial \pi}{\partial i} + \frac{[(1-s)(1-\rho) - \alpha_3]\delta}{(\pi - \alpha_2)} \quad (5.28)$$

$$\frac{\partial g^*}{\partial i} = \frac{(\pi\alpha_1 - \alpha_2 u)}{(\pi - \alpha_2)} \frac{\partial \pi}{\partial i} + \frac{\alpha_2[(1-s)(1-\rho) - \alpha_3]\delta}{(\pi - \alpha_2)} \quad (5.29)$$

The normal case of a developing country should be when inflation targeting is contractionary (as in Porcile et al.). This happens with high debt service elasticity of investment α_3 , small share of domestic rentiers in total finance $1 - \rho$ and/or low marginal propensity to consume out of domestic rentiers income $1 - s$, higher magnitude of the capacity utilization argument in the desired investment function relative to the profitability argument $\pi\alpha_1 < \alpha_2 u$. Also, the higher is the share of foreign investors ρ and the higher is the debt ratio δ , the more likely inflation targeting will have a negative impact on short run equilibria.

Second, Birkan describes the impact of exchange rate movement:

$$\frac{\partial r^*}{\partial er} = \frac{(\pi\alpha_1 - \alpha_2 u)}{(\pi - \alpha_2)} \frac{\partial \pi}{\partial er} \quad (5.30)$$

$$\frac{\partial u^*}{\partial er} = \frac{(\alpha_1 - u)}{(\pi - \alpha_2)} \frac{\partial \pi}{\partial er} \quad (5.31)$$

$$\frac{\partial g^*}{\partial er} = \frac{(\pi\alpha_1 - \alpha_2 u)}{(\pi - \alpha_2)} \frac{\partial \pi}{\partial er} \quad (5.32)$$

With a positive exchange rate sensitivity of the markup rate, depreciations may be contractionary or expansionary depending on the relative magnitudes of the profitability and capacity utilization arguments in the investment function. Thus, appreciation of the domestic currency because of the high-interest rate policy in the context of inflation targeting may reinforce the effects of the interest rate policy or counter them depending on the structural characteristics of the economy as (5.30), (5.31) and (5.32) could be positive or negative. The relative magnitudes of the exchange rate sensitivity and the interest rate sensitivity of the mark-up play an important role in defining the overall result of the targeting policy mix, too.

Birkan put together the two short run impacts and defines different scenarios. Once again, the case where an interest rate hike would have contractionary effects on short run equilibria is the more likely, as it would prevail over the exchange rate appreciation effect. This scenario is defined by the following features: high level of indebtment δ , most of which is owed to foreign investors ρ ; investment is very sensitive to the cost of debt service (high α_1), and low-capacity utilization u . Also, Birkan admits that inflation targeting won't even pursue its duty of contrasting inflation as exchange rate movements are likely to provoke a distributive conflict (not developed in the model) between social classes and consequent inflationary process.

Long Run

Before presenting the long run analysis of the model, we must make a premise. As previously said, this model lacks stock-flow consistency because of the missing foreign income due to intermediate imports when dealing with functional distribution. The debt accumulation dynamic is also particularly problematic. Indeed, when debt accumulation is partly driven by the desire of foreign investors, there should be a mechanism that balances the debt inflows from abroad with the foreign currency needs of the domestic economy. As we will see in Kohler (2019), this mechanism could rely on a flexible exchange rate that adapts gradually or instantaneously to ensure the BoP equilibrium. Birkan doesn't define such a mechanism as the

exchange rate seems to be a quasi-exogenously determined variable which is sensible to the level of the domestic interest rate. No variable is modelled such that capital inflows are accommodated respecting BoP equilibrium and no mentions about the role of the exchange rate in determining the investment desire of the foreign rentiers. In general, no current account or financial account dynamics are mentioned, and nothing ensures that these two terms sum to zero respecting the open economy macro constraint. Yet, despite the lack of national accounting coherence, the long-run analysis presents interesting suggestions.

In the long run Birkan defines the dynamic of the accumulation of debt. Whenever the debt ratio δ will achieve a stable convergence, the whole economy will achieve stability also in the long run. We note that Birkan looks at the overall level of indebtment, without differentiating between foreign and domestic debt. Birkan imposes that the accumulation of debt evolves according to the savings of the domestic rentiers plus the whole interest income reinvested by the foreigners plus new funds brought by foreign rentiers, driven by their current income ($i\rho D$). Thus:

$$\dot{D} = s(1 - \rho)iD + i\rho D + \varphi i\rho D \quad (5.33)$$

$\varphi > 0$ is the propensity to bring additional funds into the domestic economy by foreign investors. Presumably this coefficient could be a function of real interest rate, however Birkan maintains it exogenous to avoid further complications. After some manipulation and assuming away long run inflation, the dynamic of the debt to capital ratio δ is the following :

$$\hat{\delta} = \hat{D} - g = [s(1 - \rho) + \rho(1 + \varphi)]i - \frac{(\alpha_0 + \alpha_1 \pi) + [\alpha_2(1 - s)(1 - \rho) - \pi\alpha_3]i\delta}{\pi - \alpha_2} \quad (5.34)$$

Assuming verified the Keynesian stability $\pi - \alpha_2 > 0$, the condition for long run stability therefore is $\frac{\partial \hat{\delta}}{\partial \delta} < 0$, which means:

$$SC = \alpha_2((1 - s)(1 - \rho) - \alpha_3)i > 0 \quad (5.35)$$

We can see that the higher is the sensitivity of investment to interest payments α_3 and the higher is the ratio of foreign loans ρ , the less likely is to achieve the stability condition. Moreover, we note that the interest rate does not impact on SC except when $i < 0$.

Effects of inflation targeting on long run debt ratio convergence value

Birkan also defines the long run convergence value of the debt to capital ratio:

$$\delta^* = \frac{[s(1 - \rho) + \rho(1 + \varphi)]i(\pi - \alpha_2) + (\alpha_0 + \alpha_1 \pi)}{\alpha_2[(1 - s)(1 - \rho) - \alpha_3]i} \quad (5.36)$$

We have seen that, in the long run, inflation targeting has no impact on the stability of the economy, meaning that, if the system is already stable, any movement of the interest rate and, consequently, of the exchange rate, won't destabilize the system (unlike Porcile et al.). However, both the interest rate and the exchange rate could change the long run level of convergence of the debt ratio. Indeed, Birkan obtains:

$$\frac{\partial \delta^*}{\partial i} = \frac{(\alpha_0 + \alpha_1 \pi)}{\alpha_2[(1 - s)(1 - \rho) - \alpha_3]i^2} + \frac{[s(1 - \rho) + \rho(1 + \varphi)]i - (\alpha_0 + 2\alpha_1 \pi)}{\alpha_2[(1 - s)(1 - \rho) - \alpha_3]i} \frac{\partial \pi}{\partial i} \quad (5.37)$$

$$\frac{\partial \delta^*}{\partial er} = \frac{[s(1 - \rho) + \rho(1 + \varphi)]i - (\alpha_0 + 2\alpha_1 \pi)}{\alpha_2[(1 - s)(1 - \rho) - \alpha_3]i} \frac{\partial \pi}{\partial er} \quad (5.38)$$

Birkan finds three possibilities for the impact of inflation on the debt ratio convergence value: first, both (5.37) and (5.38) are positive; second, both (5.37) and (5.38) are negative; third, (5.37) is positive and (5.38) is negative. Since an increase of the interest implies a decrease of the exchange rate (UIP is always valid), for the first and the second state, the overall effect of inflation targeting policy mix on the debt-capital ratio is ambiguous; for the third, inflation targeting leads to an increase in the debt-capital ratio. In particular, the higher is the element $(\alpha_0 + 2\alpha_1 \pi)$, the lower will be the impact of inflation targeting on the debt ratio, with the possibility of turning negative the two derivatives. This means that the higher components of investment demand that does not depend on capacity utilization, α_0 and α_1 , the more effective inflation targeting would be in reducing the long run debt ratio level of convergence. Also, of particular interest is the role of the novel parameters of the model, namely the share of foreigners in total debt ρ and the sensitivity of capital inflows to the return on the existing portfolio φ , as both could increase the likelihood of a positive relation between interest rate and the convergence debt ratio.

6 Exchange rate movements, debt balance sheet effects and instability

According to the classic Mundell-Flaming model a real exchange devaluation would improve the external position of a country as long as the Marshall-Lerner (M-L) condition holds. Of course, this view has been challenged: for example, Alexander (1952), Diaz-Alejandro (1963), and Krugman and Taylor (1978) pointed out that devaluations can be contractionary for several reasons. The main argument: M-L condition could not hold because of a limited structure of exports, i.e. the price elasticity of the exported goods is very small. Also, real devaluations are likely to redistribute income from workers to profit earners, who normally have a lower propensity to consume, and thereby depress consumption demand. To these dynamics, Kohler (2017) adds the balance sheet effect that affects foreign currency denominated loans and thus investment decision of firms. Therefore, exchange rate movements become relevant for external debt stability. In a second work, Kohler (2019) starts from this assumption to develop a Kaleckian-Minsky model where business cycles are determined by the flexible exchange rate environment.

6.1 Kohler 2017

Kohler (2017) developed a kaleckian model of a small open economy that manages a fixed exchange rate and is able to attract foreign loans. In particular he analyzes how currency devaluations affect aggregate demand and capital accumulation, focusing on two main effects: the balance sheet effect on firm's foreign liabilities and the "pass-through" implications on income distribution. Contractionary devaluation may arise despite the Marshall-Lerner condition holds. Moreover, Kohler discusses how the economy may end up in a vicious cycle of foreign-currency indebtedness and derives the conditions under which indebtedness becomes stable or unstable in the long run.

The Model

Four institutional sectors: workers, firms, banks, and the foreign sector. Four types of assets: productive capital accumulated by domestic firms, foreign currency denominated foreign loans to firms, domestic currency denominated domestic loans to firms and domestic currency denominated deposits of foreigners in the domestic banks. Workers neither hold assets nor liabilities as they don't save. Firms' liabilities consist of foreign credit denominated in foreign currency and loans denominated in domestic currency. Banks are pure intermediaries with no

net worth that provide loans in domestic currency to domestic firms and take deposits only from abroad because workers do not save, and firms retain their net profits. The external sector holds bonds that have been issued by domestic firms in foreign currency and holds deposits at domestic banks in domestic currency. Of course, firms operate in an imperfect market as they are able to charge a mark-up τ over unit cost to calculate prices:

$$p = (1 + \tau)wb \quad (6.1)$$

Thus, the rate of profits can be expressed as a function of capacity utilization u , the profit share of nominal output $\pi = \tau/(1 + \tau)$ and the inverse of capital productivity v :

$$r = \frac{\pi}{v}u \quad (6.2)$$

The mark-up is sensible to movements the real exchange rate $q = er/p$ with $p_f = 1$. Indeed, τ depends on two conflicting forces and on the real exchange rate:

$$\tau = f(q, \delta, \eta) ; \frac{\partial \tau}{\partial \delta} > 0; \frac{\partial \tau}{\partial \eta} < 0; \frac{\partial \tau}{\partial q} \gtrless 0 \quad (6.3)$$

Starting from a situation of fixed exchange rate, a depreciation pushes two conflicting forces represented by the bargaining power of firms δ and workers η . Firms try to absorb it by increasing the mark-up, $\frac{\partial \tau}{\partial \delta} > 0$, while workers want to reduce it, $\frac{\partial \tau}{\partial \eta} < 0$. The final impact of the depreciation on the mark-up depends on what force prevails. Since generally depreciation pushes prices up (Blecker 2011), Kohler assumes $\delta > \eta$ and $\frac{\partial \tau}{\partial q} > 0$. This entails also that real depreciations make increase the profit share, $\frac{\partial \pi}{\partial q} > 0$.

The equilibrium condition in the goods market is:

$$\sigma + i_f q \lambda + i f = g + b \quad (6.4)$$

The rate of savings σ is equal to the retained profit rate, i.e. firms' profit, net of the interest payment on domestic and foreign loans⁶², normalized by productive capital:

⁶² We note that in this case flow consistency is respected as interest payment are relevant also in short period, an outflow for firms and an inflow for the foreign sector.

$$\sigma = r - i_f q \lambda - i \tau \quad (6.5)$$

Where i_f and i are respectively the interest on foreign and domestic denominated debt; λ is the foreign debt to capital ratio; τ is the domestic debt to capital ratio. Furthermore, Kohler defines the endogenous rate of capital accumulation as:

$$g = g_0 + g_1 u + g_2 \pi - g_3 q \lambda \quad (6.6)$$

Firms' decision to invest depends on animal spirits g_0 , on capacity utilization u and on the share of profits π . Also, firms look at the balance sheet effect on foreign debt ($-g_3 q \lambda$): a devaluation ($q \uparrow$) increases the cost of debt service in foreign currency; thus, firms react by decreasing capital accumulation.

Kohler then defines the net exports to capital ratio b as follows:

$$b = b_0 u_f + b_1 q - b_2 u \quad (6.7)$$

The normalized net exports depend positively on the foreign aggregate demand whose proxy is the endogenous foreign capital accumulation u_f . The real exchange rate impacts positively on the net exports, meaning that Kohler is assuming the Marshall Lerner condition to hold ($b_1 > 0$), while a higher level of capacity utilization implies higher demand for imports, as the trade balance worsens.

Short Run

By solving the system formed by equations (6.2), (6.4)-(6.7), Kohler derives the following short run values:

$$u^* = \frac{g_0 + g_2 \pi - g_3 q \lambda + b_0 u_f + b_1 q}{\frac{\pi}{v} - g_1 + b_2} \quad (6.8)$$

$$r^* = \frac{\frac{\pi}{v} (g_0 + g_2 \pi - g_3 q \lambda + b_0 u_f + b_1 q)}{\frac{\pi}{v} - g_1 + b_2} \quad (6.9)$$

$$g^* = \frac{(g_0 + g_2\pi - g_3q\lambda)\left(\frac{\pi}{v} + b_2\right) + g_1(b_0u_f + b_1q)}{\frac{\pi}{v} - g_1 + b_2} \quad (6.10)$$

The short run Keynesian stability condition requires that $b_2 + \frac{\pi}{v} > g_1$. We note that in this case the debt ratio impacts on these equilibrium values through the balance sheet effect on capital accumulation. Indeed, Kohler finds that the short run impact of a devaluation ($q \uparrow$) on the system is ambiguous as depends mainly on three elements: the distributional conflict, the profit-led or wage led nature of the economy and the balance sheet effect.⁶³ For example, assuming a wage-led economy where also the Marshall Lerner condition is holding, it is likely that a devaluation overall would have a detrimental impact on aggregate demand as the balance sheet effect on foreign indebtment would be stronger than the improvement in export competition, the higher is the foreign debt ratio.

Long Run

In the long run financial assets are endogenous as new debt and deposits are accumulated. Kohler assumes the following dynamic of the foreign debt accumulation⁶⁴:

$$er\dot{B}_f = \phi pI \quad (6.11)$$

Equation (6.11) states that firms are borrowing from abroad to finance a share ϕ of the nominal investment. The share ϕ is a function of the domestic-foreign interest rate differential:

$$\phi = \phi(i - i_f) \quad (6.12)$$

Kohler assumes that interest rates are endogenous too:

⁶³ Let's take the derivative of u^* with respect to q :

$$\frac{\partial u^*}{\partial q} = \frac{\frac{\partial \pi}{\partial q}\left(g_2 - \frac{u}{v}\right) - g_3\lambda + b_1}{\frac{\pi}{v} - g_1 + b_2}$$

Its sign depends on the numerator. Even assuming that Marshall-Lerner condition holds ($b_1 > 1$), the numerator could be still negative if $g_3\lambda - \frac{\partial \pi}{\partial q}\left(g_2 - \frac{u}{v}\right) > b_1$. $g_3\lambda$ is the balance sheet effect on the rate of capital accumulation while the term $\frac{\partial \pi}{\partial q}\left(g_2 - \frac{u}{v}\right)$ represents the overall impact of a devaluation on income distribution. While by assumption a devaluation redistributes income toward profits, $\frac{\partial \pi}{\partial q} > 0$, the term within the brackets determines whether capital accumulation is profit-led or wage-led. If wage-led ($g_2 < u/v$), $\frac{\partial \pi}{\partial q}\left(g_2 - \frac{u}{v}\right) < 0$ and thus is very likely that, overall, the denominator would be negative, meaning that a devaluation would reduce capacity utilization and thus aggregate demand. A similar analysis can be done on $\frac{\partial r^*}{\partial q}$ and $\frac{\partial g^*}{\partial q}$.

⁶⁴ This implicitly means that foreign debt is current account driven but limited to the desired share that firms want to finance with foreign loans.

$$i = i_f^b + \rho_0 + \rho_1 q\lambda \quad (6.13)$$

$$i_f = i_f^b + \rho_1^f q\lambda \quad (6.14)$$

The domestic economy promises a premium to make foreign investors indifferent between foreign and domestic returns. In particular in (6.13) we see that the domestic interest rate is determined according to the base foreign interest rate i_f^b (a sort of UIP condition) plus an illiquidity premium ρ_0 , and plus the premium that depends on the risk of default on foreign currency denominated debt, $\rho_1 q\lambda$. In equation (6.14) instead, we observe that the foreign interest the domestic economy pays on foreign loans depends solely on the default risk premium.

After putting together (6.11)-(6.14), Kohler obtains the following foreign debt accumulation dynamic⁶⁵:

$$er\dot{B}_f = (\phi_0 + \phi_1 q\lambda)pI \quad (6.15)$$

Consequently, the differential equation of the foreign debt to capital ratio is:

$$\dot{q}\lambda = g^*[\phi_0 + q\lambda(\phi_1 - 1)] \quad (6.16)$$

Where g^* is the short run equilibrium value of capital accumulation, as defined in equation (5.10). The other differential equation shows the dynamic of the domestic debt to capital ratio⁶⁶ η :

$$\dot{\eta} = \eta(i_f^b + \rho_0 + \rho_1 q\lambda - g^*) + g^*(1 - \phi_0 - \phi_1 q\lambda) + (i_f^b + \rho_1^f q\lambda)q\lambda - r^* \quad (6.17)$$

Stability

Equations (6.16) and (6.17) form a differential equation system whose stability must be studied. From (6.16) Kohler calculates the long run foreign debt ratio value:

⁶⁵ Kohler derives what follows: $\phi = \phi(i - i_f)$, $\phi = \phi[\rho_0 + (\rho_1 - \rho_1^f)q\lambda]$. If $\rho_1 > \rho_1^f$ then devaluation or rising foreign debt would increase the preference for foreign debt ϕ financing. If $\rho_1 < \rho_1^f$, firms would use less foreign debt and more domestic debt. Kohler normally assumes $\rho_1 > \rho_1^f$. If we linearize everything, we obtain the final form $\phi = (\phi_0 + \phi_1 q\lambda)$, with $\phi_0 = \phi\rho_0 > 0$ and $\phi_1 = \phi(\rho_1 - \rho_1^f) > 0$.

⁶⁶In this case the accumulation of the domestic debt stock is equal to the share $(1 - \phi)$ net of retained profits: $\dot{B} = (1 - \phi)pI - R_{net} = (1 - \phi_0 + \phi_1 q\lambda)pI - R + i_f er\lambda - i\eta$. Equation (6.17) is normalize this equation by K such that $\eta = B/K$

$$q\lambda^*|_{q\lambda=0} = \frac{\phi_0}{1 - \phi_1} \quad (6.18)$$

The long run convergence value of foreign debt ratio depends solely on the propensity to finance capital accumulation through foreign debt. If the illiquidity premia increase (lower trust on the domestic currency), the numerator improves and so the value of $q\lambda^*$. If instead the risk premia on foreign debt improves, $q\lambda^*$ would decrease. Devaluation in this case has no impact.

Further, from (6.17) Kohler derives the steady state of the domestic debt ratio:

$$\eta^*|_{\dot{\eta}=0} = \frac{g^*(1 - \phi_0 - \phi_1 q\lambda) + (i_f^b + \rho_1^f q\lambda)q\lambda - r^*}{(g^* - i_f^b - \rho_0 - \rho_1 q\lambda)} \quad (6.19)$$

η^* can be positive or negative. Assuming the denominator to be positive⁶⁷, η^* is positive too as long as the share of foreign debt plus the interest payment are higher than the return rate on capital. If instead the numerator is negative, also η^* would be negative, meaning that firms save more money than their spend, thus hold deposits in commercial banks.

The stability of the system formed by equation (6.16) and (6.17) depends on the signs of the element of the Jacobian matrix evaluated at the steady state. In particular local stability is achieved as long as both the diagonal elements are negative⁶⁸:

$$J11 = g^{**}(\phi_1 - 1) < 0 \quad (6.20)$$

$$J22 = i_f^b + \rho_0 + \rho_1 q \frac{\phi_0}{1 - \phi_1} - g^{**} > 0 \quad (6.21)$$

Where g^{**} is obtained by inserting the long run foreign debt ratio $q\lambda^*$ into the short run equilibrium value of capital accumulation g^* . Observing (6.20), $J11$ is negative as long as g^{**} is positive and the propensity to finance investment with foreign currency debt is less than one, $\phi_1 < 1$. Instability arises in recession when $g^{**} < 0$, because animal spirits turn negative g_0 or because the detrimental impact of balance sheet effect on investment g_3 is very high. If there is no recession, distrust on the domestic currency could push the system into instability, as the risk premium on domestic currency brings the propensity to finance out of

⁶⁷ The condition for partial stability is $\frac{\partial \dot{\eta}}{\partial \eta} > 0, (g^* - i_f^b - \rho_0 - \rho_1 q\lambda) > 0$

⁶⁸ Local stability in a fixed point is obtained when the Jacobian matrix exhibits a negative trace and a positive determinant.

foreign debt to a level higher than one, $\phi_1 > 1$, and pushes firms toward an exceptional accumulation of foreign debt.

Furthermore, (6.21) shows that a second condition for local stability is that the capital accumulation rate, evaluated at the steady state, must be higher than the domestic interest rate. This is the traditional condition $g > i$ for debt stability. In this case, however the domestic interest rate depends on many external factors that can't be controlled as the higher the illiquidity and risk premia, the harder will be to achieve the condition (6.21). More in general, a loss of confidence of domestic banks on the stability of the foreign debt ratio (higher ρ_1) would push the system toward instability.

Finally, Kohler derives what is the impact of a devaluation on the stability condition in steady state. He shows that devaluation could improve stability ($\frac{\partial J_{11}}{\partial q} < 0$; $\frac{\partial J_{22}}{\partial q} < 0$), as long as the boost of capital accumulation and exports competition prevails over the balance sheet effect. The balance sheet effect could be mitigated if the economy is profit driven, as capitalists are the likely winners after a devaluation. To conclude, the stronger the balance sheet effect is and the higher the foreign debt accumulation is, the more difficult it is to manage instability. Once again, structural parameters as g_0 and b_1 help to protect economy from debt instability.

5.2 Kohler 2019

Kohler enhanced his work on debt balance sheet effect (2017) into a Kaleckian-Minsky model⁶⁹. In particular the author is interested in modelling endogenous boom-bust cycles in emerging market economies, to explain the empirically observed procyclicality of exchange rates and the countercyclicality of the trade balance. The focus is on the interaction of the flexible exchange rate dynamic with the balance sheets' effect of debt ratios on investment. This pattern points to predator-prey dynamics where economic activity takes on the role of the prey that is being squeezed by a rising exchange rate (i.e., depreciation), while the currency behaves like a predator that grows together with the prey. Stockhammer et al. (2019) argue that such an endogenous real-financial interaction mechanism lies at the heart of theories of financial-real cycles such as Hyman Minsky's Financial Instability (Minsky 1975). Indeed, a key aspect of the Minskyan approach is the claim that financial fragility increases during economic booms to the point where it spills over to the real economy and turns them into busts.

⁶⁹ See Nikolaidi and Stockhammer (2017) for a survey of Minsky models that builds on the distinction between Kaleckian Minsky models with stable and Kaldorian Minsky models with unstable goods market.

The Model

Four institutional sectors: workers that fully consume their income, firms that use their retained profits to finance investment, monetary authority that accumulates foreign reserves and that lend to domestic firms, and the foreign sector. Four types of assets: productive capital, foreign loans into domestic firms, domestic loans to domestic firms and foreign reserves. Despite being a kaleckian model, the income distribution is not formalized since it is not central in the analysis of the author. For this reason, domestic prices are simply fixed and equal to one.

The traditional national accounting identity of GDP is:

$$Y = C + I + X - sM \quad (6.21)$$

Where s is the spot exchange rate. Since $p = p_f = 1$, s is also the real exchange rate. The Balance of Payments (BoP) instead is defined as follows:

$$(X - sM - si^f D^f) + s\dot{D}^f = s\dot{Z} \quad (6.22)$$

Where the Current Account (CA) is $(X - sM - si^f D^f)$ and the Financial Account (FA) is the change in foreign debt $s\dot{D}^f$. If $CA + FA < 0$ then domestic central bank must deplete foreign currency reserves ($s\dot{Z} < 0$). Conversely, if $CA + FA > 0$, $s\dot{Z} > 0$. BoP is in equilibrium when $CA + FA = 0$.

All profits R are retained by firms, while the wage bills W are wholly spent by workers for consumption. The investment-savings equilibrium instead is:

$$I = R + s\dot{D}^f + s\dot{L} - i^f s\dot{D} \quad (6.23)$$

The investment decision of firms is financed through retained profits net of interest plus, foreign debt (bearing interests i^f). If there is excess investment compared to the financing sources, a monetary authority provides firms with interest-free domestic loans L denominated in foreign currency for achieving the equilibrium. Net retained profits $(R - i^f s\dot{D})$ ensure Stock-Flow consistency. Putting together (6.21)-(6.23) we can find:

$$s\dot{Z} = -s\dot{L} \quad (6.24)$$

This means that the monetary authority uses foreign reserves to lend in foreign currency. To simplify the dynamics, Kohler assumes that the changes in foreign reserves are always negligible with no need to verify whether the stock of foreign reserves has been depleted.

The equilibrium in the goods market, normalized by productive capital K , can be written as:

$$r = g + b \quad (6.25)$$

Where, r are the normalized profits or the rate of profits and can be expressed as a function of profit share π and utilization $u = \frac{Y}{K}$:

$$r = \pi u \quad (6.26)$$

$g = \frac{I}{K}$ is the capital accumulation rate. In this model is assumed to be fixed in short run. Firms, however, calculate their short run desired accumulation rate g^d :

$$g^d = g_0 + g_r r - g_\lambda \lambda \quad (6.27)$$

It depends positively on an autonomous component g_0 , and on the profit rate r . Moreover, like in the previous work (Kohler 2017), the level of the foreign currency debt to capital ratio $s\lambda = sD^f/K$ is detrimental to the desired investment (balance sheet effect). Finally, the trade balance to capital ratio b is defined as follows:

$$b = b_u u^f - b_u u + b_s s \quad (6.28)$$

It increases exogenously with the foreign aggregate demand u^f (export demand) , while it decreases with domestic demand u (import demand). Finally, if s depreciate, b rises as $b_s > 0$, meaning that the Marshall-Lerner condition is assumed to hold.

When we solve the system formed by equations (6.25), (6.26) and (6.28), we can derive the short run equilibrium value of utilization:

$$u^* = \frac{g + b_u u^f + b_s s}{\pi + b_u} \quad (6.29)$$

Long-Run

Given the simple nature of the short run equilibrium, the long-run analysis is the most important part of the work of Kohler. In long run three variables must be endogenized: capital accumulation g , the exchange rate s and the foreign debt to capital ratio λ .

First, g adjusts in long run according to the firms' desired capital accumulation rate g_d as defined in (6.27). Indeed:

$$\dot{g} = \gamma(g_d - g) \quad (6.30)$$

As long as the desired capital accumulation is higher than the actual capital accumulation, firms will increase g . Of course, equation (6.30) must respect the Keynesian stability condition:

$$\frac{\partial \dot{g}}{\partial g} < 0 \Leftrightarrow \pi g < \pi + b_u \Leftrightarrow \frac{\partial g_d}{\partial u} < \frac{\partial r}{\partial u} - \frac{\partial b}{\partial u} \quad (6.31)$$

Second, the spot rate s adjusts to equilibrate the normalized BoP equation:

$$\dot{s} = \mu \left(\frac{-X - s\dot{D}^f + sM + si^f D^f}{K} \right) = \mu \left(-b_{uf}u^f + b_u u - b_s s + si^f \lambda - \frac{s\dot{D}^f}{K} \right) \quad (6.32)$$

In this case Kohler assumes that the exchange rate moves sluggishly to equilibrate demand (imports, debt service) and supply (exports, capital inflows) of foreign reserves. During the gradual adjustment, foreign reserves interventions guarantee to achieve the equilibrium in the BoP. This could be considered a “Managed Floating” regime (Ghosh et al. 2015), where adjustment parameter μ could be considered as the degree of deregulation of the domestic financial market. The author assumes however that the domestic country owns sufficient foreign reserves for this purpose, as changes in the stock of reserves have negligible effects on the economy.

Note that the higher μ , the faster the exchange rate would adjust toward the equilibrium exchange rate and the lower the change in foreign reserves will be. For very high levels of μ the adjustment would be instantaneous, such that this macro closure becomes very similar to the solution of Carnevali (2022), where the exchange rate always instantaneously adjusts to ensure the equilibrium in the BoP in absence of changes of foreign reserves (which aren't even included in Carnevali's framework). Conversely if $\mu = 0$, Kohler's closure would collapse obviously to a fixed exchange rate closure.

Third, the stock of foreign debt is externally driven: foreign investors decide to lend money to the domestic economy according to a foreign debt to capital target λ_t . While an infinitely accommodating foreign demand for domestic assets (bonds issued in foreign currency) could simplify the stability analysis by avoiding the need of an equilibrating mechanism, capital account-driven debt accumulation is more realistic and figures better the “push” and “pull” factors that induces investors to finance the current account of a developing country. The formalization of a flexible exchange rate regime ensures that, despite a possible mismatch between the domestic needs of capital inflows and the foreign investors’ desire for domestic asset, the BoP equilibrium is always ensured (with the help of foreign reserves transactions).

Contrary to the vast Minskyan literature where endogenous targets are based on economic fundamentals, λ_t for simplicity is exogenous. Hence:

$$\frac{\dot{D}}{K} = \delta(\lambda_t - \lambda) \quad (6.33)$$

Consequently, the dynamic of the foreign debt to capital ratio is:

$$\dot{\lambda} = \delta(\lambda_t - \lambda) - g\lambda \quad (6.34)$$

Equation (6.34) shows that even if the target is achieved, debt ratio could still change as long as the rate of growth of the economy is different from zero. Under normal circumstances, the target is thus never met, and the actual debt ratio will stabilize only once capital accumulation reaches its long-run equilibrium⁷⁰ too.

Equations (6.30), (6.32) and (6.34), while considering capacity utilization at its short run value defined by (6.29), forms a system of three differential equations. Kohler presents two cases: first, he assumes that the debt ratio λ is constant such that the system is reduced to a simplified two-dimensional version. Second, he simulates the whole three-dimensional system, interested in particular on the conditions that could entail economic cycles.

⁷⁰ It's easy to show that the long-run convergence value of λ is always smaller than the actual target λ_t as long as capital accumulation g is positive. The condition for debt-ratio stability is:

$$\frac{\partial \dot{\lambda}}{\partial \lambda} = -\delta - g$$

This means that the economic system will always be attracted toward a stable debt ratio as long as $g > 0$. The long-run attractor point of debt to capital ratio can be derived from (6.34) by setting $\dot{\lambda} = 0$:

$$\lambda^* = \frac{\delta \lambda_t}{g + \delta}$$

We note that if $g > 0$, thus $\frac{\delta}{g + \delta} < 1$ and $\lambda^* < \lambda_t$.

Cyclical dynamics with constant debt ratio

Looking at equations (6.33) and (6.34), a constant debt ratio $\dot{\lambda} = 0$ requires that the exogenous debt inflows must change proportionally to the rate of investment⁷¹:

$$\frac{\dot{D}}{K} = \lambda g \quad (6.35)$$

The Jacobian matrix resulting from the 2-d system formed by $\dot{g}$ and $\dot{s}$ admits at most two fixed points, one with both positive coordinates and one with both negative coordinates. The local stability of the positive fixed point (the only economic meaningful) requires the Jacobian matrix evaluated in that point to have a negative trace and a positive determinant. Therefore, the condition for local stability is⁷²:

$$\begin{cases} i_f < g^* + \frac{\theta b_s}{\lambda} + \varepsilon_0 \\ i_f < g^* + \frac{\theta b_s}{\lambda} + \varepsilon_1 \end{cases} \quad (6.36)$$

If $\varepsilon_0 > \varepsilon_1$, the first equality is binding and vice versa. The author hence finds that the system could achieve convergence value as long as the global interest rate is lower than a certain threshold that depends on structural parameters. Furthermore, Kohler shows that the system admits oscillations in the adjustment process. Oscillations arise when the Jacobian matrix exhibits complex eigenvalues. The author shows that complex eigenvalues are very likely when the propensity to import is large ($b_s \gg 0$) and the balance sheet effect is very impactful on capital accumulation ($g_s \gg 0$), two typical elements of developing countries. Specifically, the cyclical adjustment process could function as follows: starting from an undervalued position, the exchange rate would appreciate. The currency appreciation feeds into investment demand via expansionary balance sheet effects, kicking off an investment boom. The resulting increase in the capital stock will trigger capital inflows, so that the debt ratio remains constant. The exchange rate keeps appreciating for a while, as the initial appreciation eases the burden of interest payments on foreign debt, which temporarily reduces demand for foreign currency. The investment boom boosts aggregate demand, which leads to a worsening of the trade balance. As the trade deficit grows faster than the incoming capital flows, excess demand for currency puts pressure on the domestic exchange rate. There is a short period in which investment keeps

⁷¹ Since $\lambda = \frac{D}{K}$, we can write: $g = \frac{\dot{D}}{K} \frac{K}{D} = \hat{D}$. Thus, we obtain: $\hat{\lambda} = \hat{D} - g = 0$

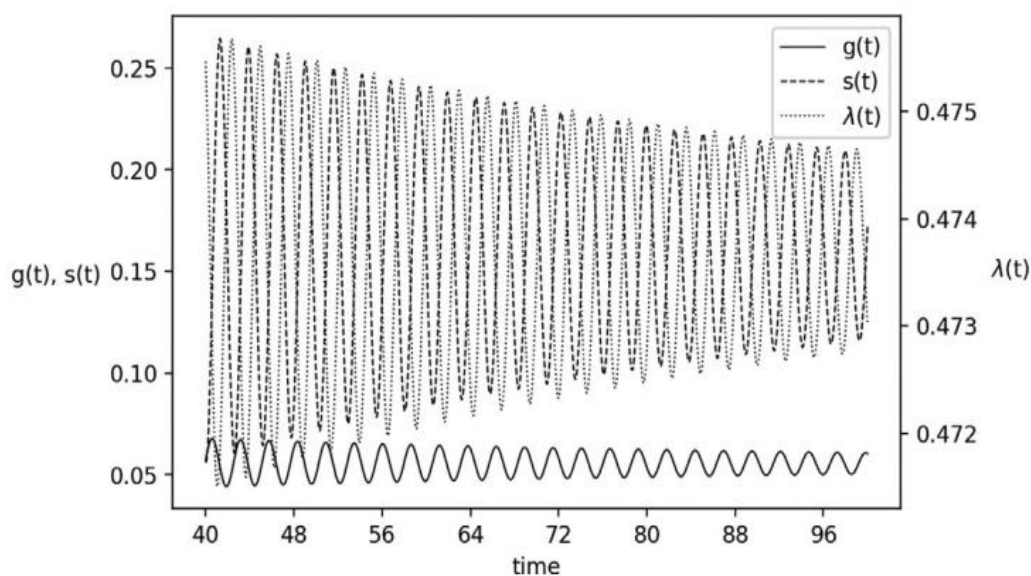
⁷² $\theta = \frac{\pi}{\pi + b_s}$, $\varepsilon_0 = \frac{\gamma(1-\theta g_r)}{\mu \lambda}$, $\varepsilon_1 = \frac{(\frac{\theta}{\pi} b_u - s^*)(\theta b_s g_r - g_s \lambda)}{(\theta g_r - 1)\lambda}$

accelerating while the currency already depreciates, but this phase is quickly displaced by a sustained contractionary depreciation phase due to balance sheet effects. As a result, the downward trajectory of the trade balance eventually reverses until the pressure on the exchange rate is removed, and capital accumulation picks up again. Overall, the author obtains a clockwise procyclical adjustment of the nominal exchange rate similar to the ones empirically observed in emerging countries.

Cyclical Dynamics of the complete dynamic system

In the last part of the paper, Kohler analyzes the dynamic of the system when all state variable g, s and λ can evolve in time, respectively equations (6.30), (6.32) and (6.34), given equations (6.27) and (6.29). The Jacobian matrix now is a 3-d matrix that admits at most two fixed points. As in the previous case only the point where both state variables are positive is economically meaningful. In particular the author is interested in what kind of oscillations are generated around this fixed point⁷³. He shows that there are two kinds of oscillatory behavior, both analytically and by computer simulations: first, starting from a close neighborhood, the system would converge toward a stable fixed point after a series of damped oscillations around that point (Figure 6.1).

Figure 6.1 Oscillation toward a convergence point



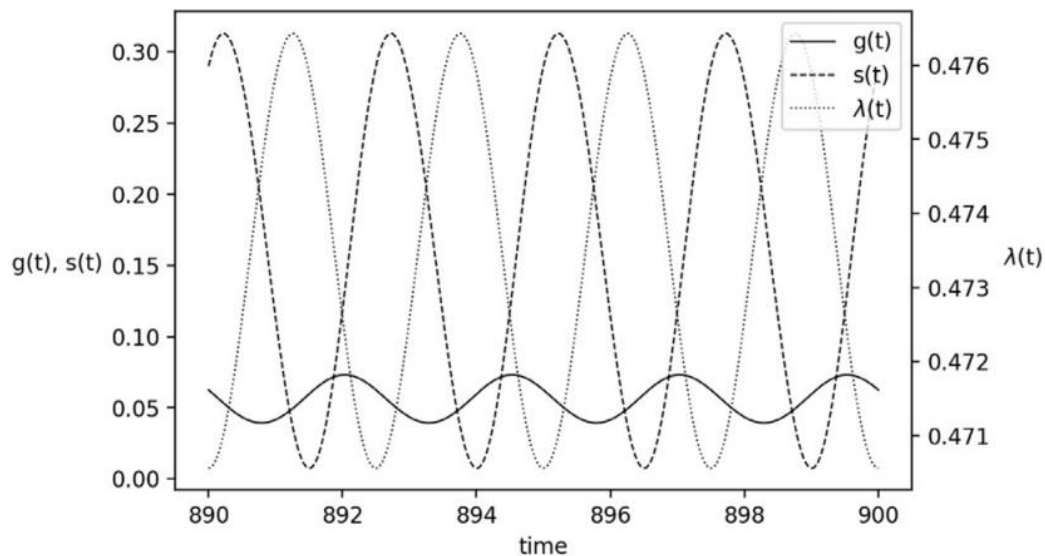
Source: Kohler (2019)

Second, the system, given a specific set of parameters (Kohler in particular calculated a threshold level of the exchange rate speed of adjustment μ), could give rise to stable limit cycle. A limit cycle is a closed orbit of the variables of a dynamic system around a locally unstable fixed

⁷³ The conditions for the oscillatory movement of the variable are similar to the previous case where debt ratio was fixed.

point. In the immediate neighborhood of the fixed point, the system is unstable and gets pushed away from it. However, rather than exhibiting explosive behavior, the system reaches a periodic cycle, as it is bounded due to its inherent nonlinearity. While in the previous case (Figure 6.1) the state variables oscillations are progressively smoothed until convergence, now the oscillations are persistent as convergence will never be achieved (Figure 6.2).

Figure 6.2 Stable limit cycle oscillations



Source: Kohler (2019)

Given these two oscillatory behavior Kohler concludes that the model admits a “Hopf bifurcation” in the positive fixed point. Indeed, Hopf bifurcation are found in fixed points where, as a parameter changes, the system's stability switches, and a periodic solution (stable limit cycle) arises. In this case the critical parameter could be the real exchange rate's speed of adjustment parameter μ , a parameter that could represent the degree of financial deregulation in the economy. Higher “deregulation” could lead to higher instability.

Concluding, the author derives some condition for oscillations: foreign exchange market must not be excessively self-destabilizing (i.e. the foreign interest rate must not be too high); the cyclical interaction mechanism between the exchange rate and investment must be strong (i.e. strong balance sheet effects coupled with a large propensity to import); the system must converge toward a moderate steady state external debt ratio, otherwise debt service could lead to exploding debt; the adjustment speed of the exchange rate must exceed a critical value ($\mu_0 > \mu$) (i.e. the financial account must be sufficiently open). Finally, Kohler highlights three areas of intervention: first, since capital inflows could fuel the boom, capital controls could reduce macro fluctuations; second, an active exchange rate policy could reduce the pro-cyclical effects;

third, in these country most capital inflows are foreign currency loans, there is the need to encourage domestic lending through a more developed domestic banking sector.

7 Distributional conflict, growth, and foreign indebtedness

The main feature of post-Kaleckian models is the focus on income distribution. In the next two models, income distribution becomes a medium-long run phenomenon due to conflicting distributional claims. In both cases the endogenous income share interacts with the long-run dynamics of capacity utilization and foreign debt. La Marca (2010) is more interested in the causes of long run oscillation, as these variables could give rise to dampened oscillations following Godwin-type cycles. Bortz et al. (2022) instead show how external debt plays a differential role according to its impact on the exchange rate and on debt-service. In particular, the short-term appreciatory impact on the exchange rate, which reduces inflationary pressures and reduces the cost of external borrowing for firms, would be overcome in a normal regime by the weight of external indebtedness and debt-servicing payments, leading to increases in income inequality and stagnated aggregate demand.

7.1 La Marca 2010

According to Bortz (2021) the first Kaleckian model that tried to incorporate external indebtedness has been developed by La Marca (2005, 2010). Since the latter is an enhancement of the former, we will discuss the 2010 work. The author focuses on both the long-run configuration and short-run dynamics of the real exchange rate, the profit and wage shares, output growth, capacity utilization, and net foreign asset accumulation in a stock-flow consistent framework.

The Model

La Marca considers an open economy divided into four institutional sectors: households, firms, government, and the rest of the world. Three kinds of assets: equities, productive capital, and net foreign liabilities/assets. In this model the government levies taxes on wages and dividends and spends the exact quantity for buying consumption goods, therefore the budget is always balanced as $G = T$ and no public debt is accumulated.

Of course, it is assumed imperfect competition in the goods market as prices p are a mark-up over variable costs, unit wage and imported inputs unit cost:

$$p = (1 + m)(wl + e_r a_0 p_f) \quad (7.1)$$

m is the mark-up; wl is the unit wage where w is the nominal wage and $l = \frac{N}{Y}$ is the employment to output ratio but also the inverse of the labor productivity; $e_r a_0 p_f$ is the unit cost of imported inputs, where e_r is the fixed nominal exchange rate, a_0 is the exogenous coefficient for the imported inputs share of output and p_f is the foreign currency price of imported inputs.

Then La Marca assumes that the mark-up m is endogenous as the wage share adjusts according to a Phillips curve:

$$\dot{\varphi} = \tau(\varphi^* - \varphi) \quad (7.2)$$

Where φ^* is the wage share target of workers that evolves with capacity utilization and employment:

$$\varphi^* = l \exp(1 + ulk) \quad (7.3)$$

u is the capacity utilization, l is the inverse of labor productivity and k is the labor supply ratio. The profit share and the real exchange rate are negatively related to the wage share. In fact, rising wage costs are passed partially to prices (and therefore to the real exchange rate as $\varepsilon = \frac{p_f e_r}{p}$) and partially into lower profits (via mark-up reduction), according to the price-elasticity of exports. Therefore, given the profit share $\pi = m/(1 + m)$, La Marca assumes:

$$\frac{\partial \varepsilon}{\partial \varphi} < 0 \quad \frac{\partial \pi}{\partial \varphi} < 0$$

We understand that in this economy labor institutions have enough bargaining power to prevail over capitalists. The limits of the capitalist's ability to raise the mark-up are also given by the need to preserve international competitiveness (market shares).

Furthermore, capacity utilization adjusts with a certain speed λ to fill the discrepancies between investment to capital ratio $g = \frac{I}{K}$, private savings ratio $\sigma = \frac{S}{pK}$, and foreign savings ratio $z = \frac{NX}{pK}$.

Indeed, La Marca defines:

$$\dot{u} = \lambda(g + z - \sigma) \quad (7.4)$$

We can note that, while in other Kaleckian models' utilization adjusts immediately in the short run, in this case utilization is fixed in short run and adapt with speed λ in the long run, as firms need time to adjust their production to changing aggregate demand.

The element g is the endogenous rate of capital accumulation and is expressed as:

$$g = \gamma + \alpha r \quad (7.5)$$

This is the traditional Kaleckian function of firms' investment decision that depends on the actual rate of profits r and on autonomous demand γ , also referred as "animal spirits". The rate of profit is a function of profit share and capital accumulation:

$$r = \pi u$$

Furthermore, savings are composed of different items. Households save out of wage income, out of dividend payments, and out of capital gains (their equity holdings). Firms have retained earnings, a proportion of their profitability and interest revenues/payments. If we put together retained earnings plus the saved portion of dividends plus the saved portion of capital gains, we obtain the following equation for the rate of private saving, $\sigma = \frac{S}{pK}$:

$$\sigma = s_p(\pi u + j\epsilon b) + s_h \varphi u \quad (7.6)$$

Where s_p is an aggregate saving rate of the rentiers and capitalists, that also incorporates the tax rate on profits; j is the interest rate on the net foreign assets/liabilities; ϵ is the real interest rate; b is the net foreign asset/liabilities per capital ratio; s_h is the saving rate of workers comprehensive of the tax rate on wages.

Then La Marca calls z is the sum of the components of the current account that depend on the real exchange rate, divided by k :

$$\sigma = s_p(\pi u + j\epsilon b) + s_h \varphi u \quad (7.7)$$

n is the sensitivity of exports to real exchange rate, $x = NX/pK$, a_0 is the technological fixed share of intermediate imports on production.

By putting (7.5), (7.6) and (7.7) in (7.4), La Marca obtains⁷⁴:

$$\dot{u} = \lambda \{[(\alpha - s_p)\pi - s_h\psi - \xi a_0]u + \gamma + \xi \eta x + (1 - s_p)j\xi b\} \quad (7.8)$$

From (7.8) we can already draw some interesting implications of the impact of net foreign asset/liabilities on aggregated demand. First, whether the economy is wage-led or profit-led, it depends also on the creditor-debtor position with the rest of the world. Indeed, we have:

$$\frac{\partial \dot{u}}{\partial \varphi} = \lambda \left[\frac{\partial \varepsilon}{\partial \varphi} (n\varepsilon^{n-1} x - a_0 u) - (s_p - \alpha) \frac{\partial \pi}{\partial \varphi} u + \frac{\partial \varepsilon}{\partial \varphi} (1 - s_p)jb - s_h u \right] \quad (7.9)$$

Since the real exchange rate ε adapts to the wage share ($\frac{\partial \varepsilon}{\partial \varphi} < 0$), a shift of wage share impacts on u also through foreign assets/liabilities. Given $s_p < 1$, if the economy is a net-creditor, then a real appreciation (greater wage-share) reduces the stream of income denominated in domestic currency from interest revenues, and a depreciation (falling wage-share) increases that same flow. That means, if b is positive, the economy is more likely to be profit-led, and vice versa.

Now if we look at the direct impact of net foreign assets/liabilities on capacity, we have that:

$$\frac{\partial \dot{u}}{\partial b} = \lambda(1 - s_p)j\varepsilon \quad (7.10)$$

It is easy to see that, if s_p is smaller than one, then $\frac{\partial \dot{u}}{\partial b}$ is positive. This means that if the economy is a net creditor ($b > 0$), capacity utilization will increase, and vice versa if the country is a net debtor, i.e., in this open-economy setting the model only allows for a debt-burdened regime.

La Marca defines the dynamic of net foreign assets/liabilities to capital as follows:

$$\dot{b} = \frac{\sigma - g}{\varepsilon} - gb \quad (7.11)$$

Then if we plug (7.5) and (7.6) into (7.11) we obtain:

⁷⁴ Long run stability requires that capacity utilization must be self-stabilizing: $\frac{\partial \dot{u}}{\partial u} < 0$. This implies that the following condition must hold: $s_p\pi + s_h\psi + \xi a_0 > \alpha\pi$ or $\frac{\partial \sigma}{\partial u} - \frac{\partial b}{\partial u} > \frac{\partial g}{\partial u}$. Hence, if aggregate demand increases, savings and imports must react stronger than capital accumulation. This condition, known as the Keynesian Stability Condition (Lavoie 2014) can be derived in every post-Keynesian model and it is always assumed to hold.

$$\dot{b} = \frac{(s_p - \alpha)\pi u + s_h \psi u - \gamma}{\varepsilon} - (g - s_p j)b \quad (7.12)$$

Equation (7.12) shows that net foreign assets/liabilities accumulation is a function of the imbalance between domestic savings, investment, net exports, and interest revenues/payments. We see that if savings react stronger than investment to capital utilization ($s_p > \alpha$), the overall impact on debt would be positive, therefore $\frac{\partial \dot{b}}{\partial u} > 0$. Also we can deduct the stability condition for the debt dynamic: $\frac{\partial \dot{b}}{\partial b} < 0$ if $g > s_p j$. La Marca therefore obtains a condition similar to the traditional debt stability condition that has been known since Domar (1944).

These are the more interesting implications on foreign indebtedness shown by La Marca (2010). In the last part of his work La Marca, assuming a net debtor country, briefly shows the stability conditions of the system made by the three differential equations (7.2), (7.8) and (7.12) and the short run equation (7.5), (7.6) and (7.7). A net debtor country can reach an equilibrium with large u , y , b and g , an appreciated ε and low π (we have seen that when b is a liability the system is more likely wage-led). Moreover, the condition for debt stability is the one previously shown ($g > s_p j$). Then, assuming $s_p = 1$ and $s_h = 0$ (traditional assumption of not saving workers and not consuming rentiers), the system is simplified to a two for two Jacobian matrix, as the debt ratio no more affects the long run dynamics of utilization and income distribution. The author shows that long run stability could admit dampened oscillations of the state variables as in Kohler (2019), as long as the matrix exhibits complex eigenvalues. This system, indeed, with the aim of computer simulations, can reproduce Goodwin-type cycles, with interactions between capacity utilization and the wage-share, which further impact on the real exchange rate and net external asset accumulation.

7.2 Bortz et al. 2022

The complexity of the model is given by two novelties. First, foreign debt accumulation is driven by the choice of heterogeneous foreign investors, chartists or fundamentalists; second, capital inflows make the exchange rate appreciate. Long run stability will depend on a constellation of cases resulting from how social groups react to foreign indebtedness.

The Model

Five institutional sectors: households (workers), firms (capitalists), government, the central bank, and the rest of the world. Four types of assets/liabilities. Workers consume a part of their taxed income and save what remains in the form of domestic cash. Firms accumulate productive capital. Capital accumulation is financed through fully retained profits and foreign debt. Whenever foreign debt and profits are not enough to cover investment, firms use their domestic cash. Otherwise, the excess foreign reserve from capital inflows is converted into domestic cash. Same story for the government, as it accumulates debt, and the excess is converted into domestic cash. Overall, we see that the central bank has liabilities in the form of cash, tied by assets in the form of foreign reserves.

Bortz et al. start by defining the two analytical novelties. First, the nominal exchange rate appreciates with capital account inflows⁷⁵. Since in this model capital inflows are limited to foreign debt accumulation, the growth rate of the exchange rate negatively follows the rate of growth of the debt to capital ratio, with velocity ω :

$$\hat{E} = -\omega \hat{d} \quad (7.13)$$

Foreign debt to capital ratio is the sum of the public and the private foreign debt ratio. Bortz et al. assumes that the two components are a fixed proportion d_1 and $(1 - d_1)$ of the total debt ratio. Therefore:

$$d = d_f + d_g = d_1 d + (1 - d_1) d \quad (7.14)$$

The second novelty relies on the capital ratio dynamics, as, similarly to Kohler (2019), foreign indebtedness is determined according to foreign investors' desire of domestic assets. The balancing mechanism in this case is the flexible exchange rate⁷⁶. Indeed Bortz et al. define the following debt ratio dynamics:

$$\hat{d} = d_u u + \mu(i - i^*) + (1 - \mu)(d^f - d) \quad (7.15)$$

The foreign debt ratio evolves according to three components. First, Investors look at the level of aggregate demand represented by capacity utilization u . Second, a set of investors are

⁷⁵ There is a vast heterodox literature on this relation, see De Paula 2008; Jongwanich 2010; Bhattarai, Chatterjee, and Park 2015; Kaltenbrunner 2015; Cimoli, Lima, and Porcile 2016a; Cimoli, Ocampo, and Porcile 2016b.

⁷⁶ The authors don't formalize reserves movements as a balancing item in the BoP since the focus is on the gross flows of capital account.

“chartists” traders, agents that decide to invest according to the past economic trends, here proxied by interest rate differential. Third, a second set of investors is made of “fundamentalists” that look at some economic fundamentals, here proxied by the discrepancy of the debt ratio from a “fundamental” target.

Now we can define income distribution. The income received by firms must be distributed between profits, wage bills, interest payments on foreign debt and the cost of intermediate imports. Profit share depends on the mark-up τ applied on intermediate costs when monopolistic firms set the price. Therefore, profit share of total output is:

$$\pi = \frac{\tau}{1 + \tau} = 1 - \psi - \Xi - \frac{e}{j} \quad (7.16)$$

Where ψ is the wages share, Ξ is the share of debt service and $\frac{e}{j}$ represents the share of intermediate imported inputs, keeping in mind that j represents the unit requirement of imports for production and e represents the real exchange rate. The mark-up τ (and therefore income shares) is endogenously determined, as real wages and prices are the result of conflicting forces. Workers increase nominal wages pursuing an endogenous wage share target ψ_w :

$$\hat{w} = \phi_w(\psi_w - \psi) \quad (7.17)$$

Where ϕ_w is the coefficient expressing the bargaining power of workers. Firms instead set prices according to an endogenously determined wage share target ψ_f , implicitly defending a desired profit share:

$$\hat{p} = \zeta(\psi - \psi_f) \quad (7.18)$$

Where ζ is the bargaining power of firms. ψ_f instead, is defined as follows:

$$\psi_f = -d_f(\delta - \omega) \quad (7.19)$$

We know from (7.16) that the profits share is affected by wages, debt service and the exchange rate shares. Since the exchange rate depends on the debt ratio too, we understand that foreign indebtedness impacts on distribution according two channels: on one side rising debt increases interest payments (effect δ), on the other it makes appreciate the exchange rate, thus it reduces the cost of intermediate imports (effect ω). In order to maintain the desired profit share firms

increases (decreases) prices when the effect δ (ω) prevails. Putting together equations (7.17)-(7.19), Bortz et al. obtain the following wages share dynamic⁷⁷:

$$\hat{\psi} = \psi(-\phi_w - \zeta) - \zeta d_1 d (\delta - \omega) + \phi_w \psi_w - \widehat{a_0} \quad (7.20)$$

The third differential equation of the model is the endogenous dynamic of capacity utilization u , that, following La Marca (2010), adapts in the medium long run with velocity λ , in order to achieve the savings-investment equilibrium⁷⁸:

$$\hat{u} = \lambda(g + ca - \sigma_p - \sigma_g) \quad (7.21)$$

The authors define capital accumulation g as follows:

$$g = g_0 + g_u u + g_\pi \pi - g_i d_1 d (\delta - \omega) \quad (7.22)$$

Capital accumulation depends positively on an autonomous component g_0 , on capacity utilization u and on the level of profits share π . Also, there is a component that captures the negative impact of the burden of debt service, mitigated by the appreciation due to debt inflows. Indeed if $\delta < \omega$, investment could be debt driven. The current account to capital ratio ca instead is formulated as:

$$ca = b_f u_f - b_u u - b_e d - d(\delta - \omega) \quad (7.23)$$

The current account ratio improves with rising foreign aggregate demand u_f and worsens with domestic aggregate demand u . The component $-b_e d$ with $b_e > 0$, instead considers the positive effect of real exchange rate depreciation on current account (Marshall-Lerner condition), as exchange rate movements negatively follow debt accumulation. The last term $-d(\delta - \omega)$ represents once again the ambiguous impact of a higher debt ratio on the current account.

⁷⁷ The wage share is equal to the nominal wage divided by domestic price and the labor productivity $\psi = \frac{w}{pa_0}$. Thus, the growth rate of the wage share can be written as follows: $\hat{\psi} = \widehat{w} - \hat{p} - \widehat{a_0}$

⁷⁸ Goods market equilibrium requires that Investment plus the current account must be equal to the sum of private savings plus public savings: $I + CA = S_p + T - G = S_p + S_g$. Normalizing by pK we have: $g + ca = \sigma_p + \sigma_g$.

Furthermore, given the propensity to save out of wages s_w and out of profits s_f , the private savings ratio σ_p can be written as a function of capacity utilization u divided by capital productivity v ⁷⁹:

$$\sigma_p = (\pi s_f + \psi s_w)uv(1 - t) \quad (7.24)$$

Private saving ratio indeed is the sum of the savings out of normalized wages and out of normalized profits⁸⁰, after paying taxes.

Finally, the public rate of savings σ_g is defined as follows:

$$\sigma_g = uvt(\pi + \psi) - \gamma - (1 - d_1)d(\delta - \omega) \quad (7.25)$$

According to (7.25), the rate of savings of government is equal to the taxes ratio minus public expenditures to capital ratio⁸¹ $\gamma = G/K$ and the public debt service $(1 - d_1)d(\delta - \omega)$ that depends on the two opposite forces we already described.

Long Run

Equations (7.15), (7.20) and (7.21) form a system of three differential equations. Since the whole stability analysis is pretty complex, we limit to report here the main features that could lead to local stability. First, of course it is required Keynesian stability, meaning that in long run changes of capacity utilization must diminish until steady state ($\frac{\partial \hat{u}}{\partial u} < 0$). This condition is satisfied if savings react more than capital accumulation to a rise in aggregate demand:

$$g_u < b_u + [\pi s_f + s_w \psi] \frac{1}{v} (1 - \tau) + \tau \frac{1}{v} (\pi + \psi) \quad (7.26)$$

Second, the demand-regime of the economy depends on the sign of $\frac{\partial \hat{u}}{\partial \psi}$. If $\frac{\partial \hat{u}}{\partial \psi}$ is positive (negative), the economy is wage-led (profit-led). Furthermore, the impact of rising debt on the wage share depends on whether the rising burden of debt service (δ) prevails on the cheapening of foreign debt due to appreciation (ω). Indeed:

⁷⁹ As we have seen previously, $u = \frac{Y}{Y_p}$ when $v = \frac{K}{Y_p} \neq 1$.

⁸⁰ It is not clear, but we think that, even if firms retain all profits, they save a fraction s_f in form of domestic cash. What remains is used to finance capital accumulation.

⁸¹ Public spending is exogenous as it increases in time according to a fixed growth rate as: $G = G_0 e^{\alpha t}$.

$$\frac{\partial \hat{\psi}}{\partial d} = -\zeta d_1 (\delta - \omega) \quad (7.27)$$

If $\delta > \omega$ then (6.27) is negative and wage share reduces when the foreign indebtedness increases. Bortz et al. call this case “debt-service driven” regime. Conversely, when $\delta < \omega$ we are in a scenario of “exchange-rate driven” economy. Same story when we look at the relation between utilization and foreign debt:

$$\frac{\partial \hat{u}}{\partial d} = (-d_1 - g_i d_1)(\delta - \omega) - b_e \quad (7.28)$$

When $\frac{\partial \hat{u}}{\partial d}$ is positive (negative) the economy features a “debt burdened” (debt-led) regime.

Putting together these results, the authors find three alternative stable regimes that could be both wage-led or profit led:

Table 7.1 Combinations of regimes that lead to long run stability.

Scenario	$\frac{\partial \hat{\psi}}{\partial d}$	$\frac{\partial \hat{u}}{\partial d}$	Impact of income distribution on u^*
NORMAL	-	-	Wage-led: Higher Profit-Led: Lower
PUZZLING	+	+	Wage-led: Higher Profit-Led: Lower
CONCILIATING DEBT	+	-	Wage-led: Higher Profit-Led: Lower

We can observe from Table 7.1 that in every scenario a wage-led regime ($\frac{\partial \hat{u}}{\partial \psi} > 0$) implies a higher level of capacity utilization at steady state. The Normal scenario is the more likely and reflects literature findings: debt inflows lower both wage share and aggregate demand as the rise in debt service prevails over appreciation. The higher the bargaining power of the firms, the lower wages will be as they must absorb most of the debt shock.

The opposite happens in the “puzzling” scenario. This second case is the most unlikely, but it could explain the case of the very early phase after stabilization programs in South America in the ‘90s, when opening to trade liberalization brought many inflows of foreign currency capitals that temporarily made appreciate the exchange rate and rise aggregate demand. Finally, the last scenario, “Conciliating Debt”, shows that overall aggregate demand would decrease because the

depression of net exports due to appreciation (Marshall-Lerner condition) would prevail over the positive effect on wage share.

8 Before and after dollarization: implications on foreign indebtedness

In this last chapter we discuss the models of Charles and Marie (2016) and Missaglia (2021). A country could opt for the adoption of a foreign currency as legal tender (Dollarization “Strictu Sensu”, Fields and Vernengo 2012) for mainly three reasons: to maintain inflation low and to stimulate domestic savings and investment; to eliminate the exchange rate risk and boost capital inflows; to reduce the interest rate and cut the weight of public debt service. In short, domestic (private and public) savings would be stimulated by dollarization, and foreigners would bring more money into the dollarized economy as the uncertainty due to currency risk and country risk would be apparently reduced. Charles and Marie, by modelling hyperinflation and its interaction with debt stability, suggest why dollarization could be desirable. Missaglia, however, shows that the endogenous nature of money represents another threat to economic growth that must be added to the orthodox drawbacks of dollarization. We will see that foreign debt is once again the main de-stabilizing variable.

8.1 Charles and Marie 2016

Charles and Marie modelled a small open economy with fixed exchange rate and full capacity utilization. They propose an alternative theory on the emergence of hyperinflation and its long-term interaction with foreign indebtedness. Indeed, mainstreams always analyze hyperinflation as a phenomenon due to lax monetary and/or lax fiscal policies and agents’ expectations on government actions, within a framework of exogenous money. Post-Keynesian theory instead focuses more on distributive conflict, indexation, expectations, and self-fulfilling behavior, refusing the quantity theory of money. In particular, unsustainable foreign indebtedness in the long run becomes a relevant phenomenon for the price instability of the economy because of the interest premium and exchange rate expectations. Dollarization could be seen as a solution to bring back stability and trust in the currency.

The Model

Four institutional sectors: workers, rentiers, firms, and the rest of the world. Two kinds of assets: productive capital and net loans to foreign, the sign of which implies whether the

economy is a net creditor or debtor. Workers consume all their wage income, while rentiers consume part of their profit and save what remains.

The nominal output pY is equal to the distribution of income:

$$pY = wN + rpK + ep^*IM^{NC} \quad (8.1)$$

Where e is the fixed nominal exchange rate, p^* is the fixed foreign price of imports and IM^{NC} are the real non-competitive imports that are necessary for domestic production according to a fixed coefficient $a_0 = \frac{Y}{IM^{NC}}$. From equation (8.1) we have the mark-up pricing:

$$p = (1 + \tau)(wb + ep^*a_0) \quad (8.2)$$

Prices are formed according to a mark-up τ on unit costs composed of wage costs wb and non-competitive imports costs ep^*a_0 . The profit share can be written as follows:

$$\pi = \frac{\tau}{1 + \tau} = 1 - \frac{w}{p}b - qa_0 \quad (8.3)$$

According to equation (7.3), firms' profit share is equal to one minus the wage share $\frac{w}{p}b$ and the share of foreign income qa_0 , where $q = \frac{ep^*}{p}$ is the nominal exchange rate. Therefore, the rate of profits of the firms r can be determined as a function of capacity utilization u :

$$r = \left(1 - \frac{w}{p}b - qa_0\right)u \quad (8.4)$$

The equilibrium in the goods market requires:

$$\sigma = g + tb = g + b - qa_0u \quad (8.5)$$

The rate of savings $\sigma = sr$, must be equal to the capital accumulation rate g plus the normalized trade balance tb . The trade balance rate tb is equal to the net exports ratio minus the non-competitive imports as a share of utilization. Furthermore, the authors, similarly to Porcile et al. (2011), define the function of the desired capital accumulation rate as:

$$g^d = \alpha_0 + \alpha_1 r - \alpha_2(i - \hat{p}) \quad (8.6)$$

First, firms in pure Kaleckian fashion decide to accumulate capital according to the rate of profits. Second, capital accumulation is also due to “animal spirits” α_0 . In this case animal spirits have a negative endogenous component driven by inflation in the economy, such as:

$$\alpha_0 = g_0 - \beta \hat{p} \quad (8.7)$$

The parameter β could represent firm’s uncertainty due to inflation. Lastly, inflation reduces the real interest rate ($i_r = i - \hat{p}$), negatively impacting on investment through α_2 . Overall, the impact of inflation on the decision to invest depends on whether uncertainty prevails over real interest rate erosion:

$$\frac{\partial g^d}{\partial \hat{p}} = -\beta + \alpha_2 < or > 0 \quad (8.8)$$

Charles and Marie formalize also an endogenous domestic nominal interest rate:

$$i = i^* + \rho \lambda \quad (8.9)$$

The nominal interest rate is equal to the exogenous foreign nominal interest rate i^* , plus a risk premium that depends on the level of external debt to capital ratio $\lambda = D/K$. Thus, the level of indebtedness impacts negatively on capital accumulation by increasing the interest rate and discouraging firms to invest:

$$\frac{\partial g^d}{\partial \lambda} = -\alpha_2 \rho < 0 \quad (8.10)$$

Finally, the authors define the net exports to capital ratio, or trade balance tb as:

$$b = \varepsilon_0 + \varepsilon_1 q \quad (8.11)$$

Charles and Marie assume $\varepsilon_0 < 0$ as net exports tend to be negative in the event of a very unfavorable real exchange rate. In the previous models we have seen that usually in the expression of b there is a component that depends on capacity utilization u . In this case the imports component that depends on aggregate demand is present in the non-competitive imports that enter in the equilibrium equation (8.5) from the incomes side.

Short Run

Charles and Marie, differently from the previous works we mentioned, assume that full capacity utilization is achieved, hence the equilibrium value for u can be expressed as:

$$u^* = u_k \quad (8.12)$$

Where u_k is the fixed value of full capacity. Therefore, the equilibrium values for the endogenous r and g can be expressed as follows:

$$r^* = \left(1 - \frac{w}{p}b - qa_0\right)u_k \quad (8.13)$$

$$g^* = g^d = s \left(1 - \frac{w}{p}b - qa_0\right)u_k + tb \quad (8.14)$$

Where $tb = qa_0u_k - b$ is the trade balance deficit to capital ratio. In the short run prices, nominal exchange rate and thus real exchange rate are fixed: this can be due to price controls and exchange rate policies. Also λ is exogenous as in short run there is no debt accumulation. The authors assume that short run equilibrium $g^* = g^d$ is always achieved through quantity adjustment driven by government interventions (by adapting public expenditures to the desired level of aggregate demand). They don't formalize this mechanism as there is no government sector in the model since it would complicate the long run dynamics without changing the relevant implications on inflation and foreign debt.

Long Run

In the long run, in developing countries, price controls and stabilization policies cannot succeed indefinitely (due to constraint on financing and government credibility) therefore inflation would destabilize the system. Also, debt would accumulate as long as there is a current account deficit. We know from (8.8) and (8.10) that the external debt to capital ratio λ impacts on the desired accumulation rate g^d through the interest premium. Overall, Charles and Marie assume that equilibrium in the domestic goods market may be affected by variations in internal prices and the stock of foreign debt, hence they study the stability of the system and how hyperinflation could be generated.

The authors define an inflation equation adapted from Dutt (1992):

$$\hat{p} = \theta_1(\omega - \omega_f) + \theta_2(g^d - g) + \theta_3 e^a \quad (8.15)$$

There are three terms inducing inflation: distributional conflict, excess demand, and exchange rate expectations. First, firms increase prices when the actual wage share ω is above firms' target wage share ω_f that is defined as:

$$\omega_f = \sigma_0 - \sigma_1 i \quad (8.16)$$

Firms adapt their desired wage share (and hence prices) to absorb the rising cost of foreign debt.

Second, prices rise whenever the desired rate of capital accumulation g^d is above its actual level g . This means that whenever there is excess demand at full capacity, the economy would adjust through a price increment. These first two elements of the inflation equation entail an ambiguous relation between the nominal interest rate and the inflation rate: from (8.16) indeed we have a distribution effect that make increase prices, while in the second term interest rate through (8.8) is reducing the desired level of investment with a consequent negative price adjustment.

The last element of equation (8.15) links exchange rate movement expectations with inflation. When firms suspect that monetary authorities will be unable to maintain the exchange rate at its actual parity, because of a huge trade deficit and a corresponding increase in foreign debt, they postulate that companies start incorporating the effect of devaluation into the price function in order to reduce losses. In fact, the expectations on the nominal exchange rate are defined as a function of foreign debt to capital ratio:

$$e^a = \psi \lambda \quad (8.17)$$

$\psi > 0$ is the elasticity of exchange rate expectations with respect to the foreign debt ratio. The higher the debt ratio, the higher expectations will be on a devaluation (the end of the fixed regime) and therefore firms will anticipate the incoming losses due to rising intermediate imports cost by raising prices. Also, equation (8.17) incorporates the hyperinflation generating mechanism where agents start to reject domestic currency and make transactions in foreign currency.

As already said, debt accumulation is driven by the current account deficit. There is no constraint on financing as foreign sector is supplying all the loans needed by domestic firms. The authors indeed obtain the common differential equation of the debt to capital ratio λ :

$$\dot{\lambda} = -tb + (i - g)\lambda \quad (8.18)$$

In order to derive the complete form of both equations (8.15) and (8.18) the components that depends on λ and p must be made explicit. Indeed, the complete system of long run differential equations is the following⁸²:

$$\begin{cases} \hat{p} = \Omega \left(-\frac{\Phi_A}{p} + \Phi_B + \Phi_C \lambda \right) \\ \dot{\lambda} = \rho \lambda^2 + A\lambda + B - \left(\frac{(\varepsilon_1 - a_0 u_k) - \Lambda \lambda}{p} \right) ep^* \end{cases} \quad (8.19)$$

To study the stability of the system Charles and Marie define the two loci $\hat{p} = 0$ and $\dot{\lambda} = 0$:

$$p|_{\hat{p}=0} = \frac{\Phi_A}{\Phi_B + \Phi_C \lambda} \quad (8.20)$$

$$p|_{\dot{\lambda}=0} = \frac{[(\varepsilon_1 - a_0 u_k) - \Lambda \lambda]e}{p\lambda^2 + A\lambda + B\lambda} \quad (8.21)$$

Equations (8.20) and (8.21) can be represented in the plane λ, p of the phase diagram as shown in Figure 8.1. Figure 8.1 shows one of the possible configurations of the system, a configuration that admits two equilibria, $E1$ and $E2$. $E1$ is a stable equilibrium that implies a negative debt to capital ratio λ and a low level of prices p . Economies that find themselves to the right of $E1$ would converge to $E1$. Firms are net creditors as they are lending money to the foreign sector, accumulating foreign assets D . In $E1$ firms will reach a fixed proportion λ between foreign assets D and the productive capital stock K . The stability of the foreign asset accumulation entails that firms can achieve their desired level of capital accumulation $g = g_d$ and therefore capacity utilization can be fully maintained. In the convergence path to $E1$, a decreasing debt

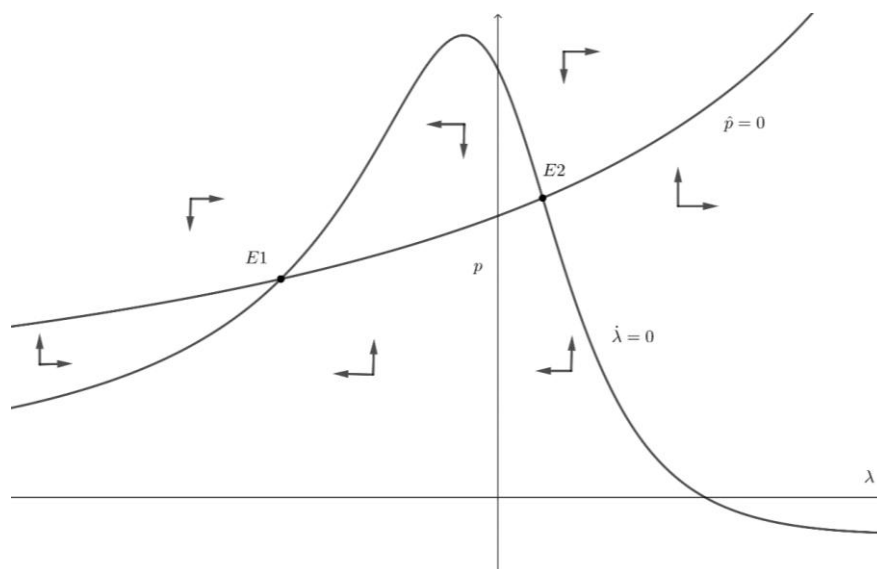
⁸² Where:

$$\begin{aligned} \Phi_A &= \theta_2 [a_0 u_k (1 + \alpha_1 - s) - \varepsilon_1] ep^* < 0 \\ \Phi_B &= \theta_1 \left(\frac{w}{p} b - \sigma_0 + \sigma_1 i \right) + \theta_2 \left[(g_0 + \varepsilon_0 - \alpha_2 i) + (\alpha_1 - s) \left(1 - \frac{w}{p} b \right) u_k \right] < 0 \\ \Phi_C &= \rho (\theta_1 \sigma_1 - \theta_2 \alpha_2) + \theta_3 \psi > 0 \\ \Omega &= \frac{1}{[1 - \theta_2 (\alpha_2 - \beta)]} > 0 \\ A &= i + \varepsilon_0 - s \left(1 - \frac{w}{p} b \right) u_k < 0 \\ B &= -\varepsilon_0 > 0 \\ \Lambda &= \varepsilon_1 - a_0 u_k (1 - s) > 0 \end{aligned}$$

ratio reduces the risk premium of the interest, hence firms can decrease prices to gain international competitiveness. Also, a decreasing λ pushes the exchange rate expectations down through equation (8.17), once again with a favorable effect on international price competitiveness. Overall, decreasing debt ratio and prices would create a vicious circle of assets accumulation and rising international competitiveness.

Conversely $E2$ is a very fragile equilibrium as a small positive shock on foreign debt and/or on domestic prices will send the economy into a hyperinflationary process, meaning that prices will rise indefinitely faster and faster. The liquidity preference of agents and expectations on the exchange rate in the context of increasing uncertainty would lead them to get rid of the domestic currency, boosting hyperinflation. Debt accumulation would explode too as rising prices deteriorate the trade balance. Obviously, when hyperinflation sets in, the economy must abandon its full capacity situation, and the previously fixed exchange rate regime explodes because the monetary authorities do not have sufficient reserves to maintain the exchange rate parity. Also, this accelerating dynamic would be enhanced by the interest rate premium that would explode too.

Figure 8.1 Phase diagram, the foreign debt curve



7.2 Missaglia 2021

Missaglia (2021) developed a Kaleckian model of a dollarized economy in a world of endogenous money. In this case indebtedness is due not only to current account deficit but it is also boosted by the cash preferences of households. Indeed, as long as the national currency is a strong foreign currency (ex. dollars), the more cash is withdrawn (because of distrust of the banking system) the more banknotes must be borrowed by the domestic banks from the foreign central bank. The simple economy so defined shows the fragilities a developing economy could be exposed to, even after a successful dollarization process that reduces volatility of prices and exchange rate⁸³.

The Model

Four institutional sectors: households with no class distinction, firms, domestic commercial banks, and rest of the world. There are five types of assets: households save part of their income in form of deposits at banks or hold cash; firms are financing investment entirely with loans from banks as profits are completely distributed to households⁸⁴; banks hold deposits and lend money to firms, however, whenever households withdraw dollar cash, they need to borrow banknotes from rest of the world, therefore they accumulate foreign debt. It results that banks have deposits and foreign loans as liabilities and loans to domestic firms as their counterpart assets.

The nominal wealth of the household can be defined as the sum of deposits D and dollar cash H . Since the net worth of banks is nihil, deposits are equal to the difference between loans to firms L and borrowing from abroad L_f . Therefore:

$$V = D + H = H + L - L_f = pK + H - L_f \quad (8.22)$$

Note that $H - L_f$ is the Net Foreign Asset position (NFA). Normalizing by nominal capital pK , equation (8.22) becomes:

$$v = 1 + h - l_f \quad (8.23)$$

⁸³ Missaglia assumes that the process of dollarization has succeeded in stabilizing prices and exchange. Indeed, in this model both prices and real exchange rate are fixed.

⁸⁴ This means that the stock of nominal capital must be equal to the stock of domestic loans, $pK = L$

Households hold cash in a fixed proportion α (the “preference for cash” parameter) of their wealth V . Hence, assuming v as given in the short run, (8.23) can be rearranged as follows:

$$l_f = 1 - v(1 - \alpha) \quad (7.24)$$

According to equation (7.24), in short run, if the preference for cash increases because of uncertainty, banks must borrow banknotes from abroad, therefore the foreign debt to capital ratio l_f increases. The normalized equilibrium in the domestic goods market is the following:

$$u = c + g + b \quad (8.25)$$

Capacity utilization $u = Y/pK$ must be equal to the sum of consumption rate $c = C/pK$ plus the rate of accumulation $g = I/pK$ and the trade balance to capital ratio $b = TB/pK$. Consumption is a function of household disposable income and wealth⁸⁵. Disposable income in this model is equal to the Gross National Income (GNI), that is the sum of domestic incomes minus incomes paid to foreign, meaning interests paid on foreign debt⁸⁶. Therefore, the consumption to capital ratio can be defined as:

$$c = c_1(u - i^*l_f) + c_2v \quad (8.26)$$

Where c_1 and c_2 are respectively the propensity to consume out of disposable income and out of wealth. i^* is the foreign interest rate that must be paid on foreign debt. We see that foreign indebtedness in this case has a direct impact on the economy in short run as it reduces the disposable income and thus consumption. Capital accumulation instead is modelled as a function of expected profits rate r^e plus an autonomous component g_0 that represents animal spirits:

$$g = g_0 + g_1r^e \quad (8.27)$$

Finally, Missaglia defines the simplest form of the trade balance to capital ratio:

$$b = b_0 - b_2u \quad (8.28)$$

⁸⁵ This is the typical consumption function form of Stock Flow Consistent Post-Keynesian Modeling, see Godley and Lavoie (2007)

⁸⁶ As long as there is no class distinction, households perceive every income generated in form of wages or profits, also bank's profits. Since banks are indebted with foreign, interest on foreign debt reduces their profits that are then perceived by households.

The autonomous element b_0 is comprehensive of the component that depends on real exchange rate q movement, as $q = 1/p$ is assumed to be fixed.

Short Run

Assuming v , l_f and r^e to be fixed, equations (8.23), (8.25)-(8.28) form a system that can be solved to find u^* , b^* and c^* . Missaglia obtains the following short run value of capacity utilization:

$$u^* = \frac{g_0 + b_0 + g_1 r^e + v[c_1 i^*(1 - \alpha) + c_2] - c_1 i^*}{1 - c_1 + b_2} \quad (8.29)$$

u^* is stable as long as the Keynesian stability condition $1 - c_1 + b_2 > 0$ holds. We note from equation (8.23)⁸⁷ that higher foreign loans mean lower wealth, and therefore lower capacity utilization, as $\frac{\partial u^*}{\partial l_f} < 0$. Also, cash preference has a detrimental impact on u^* , $\frac{\partial u^*}{\partial \alpha} < 0$. Moreover, Missaglia shows that changes in the world interest impacts on capacity utilization according to the net asset position of the economy: interest rate hikes reduce capacity as long as the country is a net debtor ($l_f > 0$). In general, in this model foreign indebtedness impacts on the short run equilibria through the consumption channel. First, it reduces GNI through rising debt service; second, it reduces wealth. This detrimental impact is boosted by higher preference for cash and interest rate. Therefore, whether dollarization brings foreign stability in long run, it would depend particularly on these two parameters.

Long Run

In long run Missaglia endogenizes r^e and v (and therefore l_f). Firms' expectations of the profit rate evolve according to the following equation:

$$\dot{r}^e = \varphi[r^* - r^e] \quad (8.30)$$

Where r^* is the short run equilibrium value of the profit rate, or the realized profit rate:

$$r^* = (1 - \psi)u^* - i^* \frac{L}{K} = (1 - \psi)u^* - i^* \quad (8.31)$$

Equation (8.31) shows that r^* is a function of capacity utilization u^* at his short run equilibrium as described in (8.29), multiplied by the profit share $(1 - \psi)$, minus interest paid on domestic

⁸⁷ The wealth can be defined also as follows: $v = \frac{1-l_f}{1-\alpha}$. The derivative of u^* with respect to l_f is: $\frac{\partial u^*}{\partial l_f} = -\frac{c_1 i^* + c_2 \frac{1}{1-\alpha}}{1-c_1+b_2} < 0$. The higher is preference for cash α and/or the world interest i^* , the stronger is the impact of indebtedness on capacity.

debt i^* ⁸⁸. ψ is the wage share on domestic output. We note therefore that the realized profit rate is net of the interest rate, as required by flow consistency. Equation (8.30) shows that firms have adaptive behavior as they revise up expectations with velocity $\varphi > 0$ as long as the realized profit rate is higher than expected. Being r^* a function of u^* , it means that profit rate expectations depend also on the wealth to capital ratio, as shown by (8.29).

Missaglia defines the long run dynamic of v as follows:

$$\dot{v} = ca^* + (1 - v)g^* \quad (8.32)$$

The wealth to capital ratio increases (decreases) when the current account to capital ratio, at his short run equilibrium, is positive, as foreign assets (liabilities) are accumulated. The impact of capital accumulation instead depends on the value of v itself: when $v < 1$ it means from (8.23) that $NFA < 0$, therefore growth g has a negative impact on v as the denominator K grows more than the numerator V . Conversely, when $v > 1$, $NFA > 0$, thus g impacts positively.

Stability Analysis

Equation (8.30) and (8.32) form a system of differential equations that Missaglia carefully discuss graphically in a phase diagram described by the plane v, r^e . From (8.30), assuming the locus $\dot{r}^e = 0$, the relative isocline shows a linear relation between r^e and v :

$$r^e|_{\dot{r}^e=0} = \frac{(1 - \psi)(g_0 + b_0) - (1 + b_2 - \psi c_1)i^* + (1 - \psi)[c_1 i^*(1 - \alpha) + c_2]v}{1 - c_1 + b_2 - (1 - \psi)g_1} \quad (8.33)$$

Equation (8.33) is a straight line in the plane v, r^e , as we can observe in Figure 8.2 and Figure 8.3. The intercept could be positive or negative, while the slope is always positive and depends in particular on the income distribution parameter $(1 - \psi)$. The isocline $r^e|_{\dot{r}^e=0}$ is an attractor element: indeed $\dot{r}^e > 0$ when $r^e|_{\dot{r}^e=0} < 0$, so in all the points in the plane v, r^e above (8.33) r^e is decreasing ($\downarrow$), while under (8.33) r^e is increasing ($\uparrow$).

The locus $\dot{v} = 0$ instead is more complex to derive as its isocline in the plane v, r^e is nonlinear. In fact, $r^e|_{\dot{v}=0}$ can be represented as an equilateral hyperbole⁸⁹:

⁸⁸Missaglia assumes that the domestic interest rate is equal to the foreign one, $i = i^*$. Also, we know that capital accumulation is completely financed with loans. Then $i^* \frac{L}{pK} = i^*$

⁸⁹ $A = \{i^*(1 - \alpha)(1 - c_1)(1 + b_2) - b_2 c_1 - g_0(1 - c_1 + b_2)\}$

$B = [(1 - c_1)g_1]$

$C = [(1 - c_1 + b_2)g_1]$

$D = (1 - c_1)[i^*(1 + b_2) - b_0 - g_0]$

$$r^e|_{\dot{v}=0} = \frac{D - Av}{B - Cv} \quad (8.34)$$

Out of the steady state we have that $\dot{v} > 0$ when $Av + Br^e - Cvr^e - D < 0$, thus the only attractor branch of the hyperbole is the one above the horizontal asymptote, as we can see from Figure 8.2 and Figure 8.3. We note that $B > 0$ and $C > 0$ while the sign of D and A could be positive or negative. For this reason, the model of Missaglia admits a constellation of cases, cases that the author studies according to how the two relevant parameters α and i^* modify the shape of the two isoclines. While there are many ranges of the world interest i^* that imply different long run dynamics, there are two regimes of preference for cash, given the threshold α_T . When $\alpha < \alpha_T$ the economy finds itself in a weak preference for cash regime, while when $\alpha > \alpha_T$ there is strong preference for cash. In terms of the shape of the two isoclines, the two regimes imply that given the same range level of the interest rate range, stability is more difficult to achieve. Of course, α_T and the ranges of i^* are analytical results of Missaglia we don't have to fully formalize. We limit to present two relevant graphical cases in Figure 8.2 and Figure 8.3.

Figure 8.2 High World Interest and Weak Preference for Cash

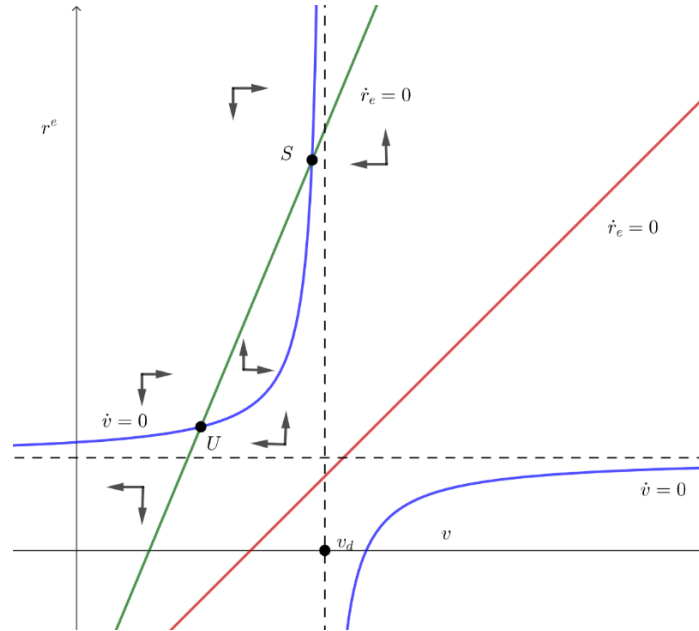


Figure 8.2 shows the scenario of a very high world interest rate and weak preference for cash regime. When the world interest is very high the hyperbole of the $\dot{v} = 0$ locus locates its attractor branch in the northwest section of the diagram formed by the two asymptotes. Also, every point on the attractor branch entails an economy indebted with foreign investors⁹⁰: even

⁹⁰Given (7.24), when $l_f = 0$, $v = \frac{1}{1-\alpha} > 1$. The vertical asymptote is $v_d = \frac{(1-c_1)}{(1-c_1+b_2)} < 1$. Since the stable branch is always behind v_d , we have that $v < v_d < 1 < \frac{1}{1-\alpha}$, so we can say that $l_f > 0$ in every point.

when preference for cash is low, the interest rate is high enough to fuel foreign debt accumulation. The straight line of the $\dot{r}^e = 0$ locus instead has a negative intercept, but we can't say a priori whether the positive slope is enough to intersect the hyperbole. If there is no intersection between the two isoclines, as in the case of the red line, the economy would converge toward it until $\dot{r}^e = 0$, then an explosive dynamic will reduce the wealth ratio v toward minus infinity since foreign indebtedness is accelerating. The only way to achieve stability is to repress wages, forcing a redistribution toward profits. This will reduce the wage share ψ ⁹¹, increasing the slope of the $\dot{r}^e = 0$ isocline (green line), while the hyperbole does not move. In this scenario there are two possible equilibria, S and U . U is a saddle point, thus unstable as the economy would be on a stable trajectory only for a fluke. S is locally stable, thus it could be achieved only from a "sufficiently small" neighborhood. This close neighborhood requires an extremely unequal society, where income distribution is skewed toward capitalists. Indeed, the rate of profits⁹² would be so high that it would stimulate an accumulation rate high enough to stabilize the foreign debt ratio. Even if this scenario is analytically possible, it is unlikely: the social damage of a repressed working class would lead to wage resistance or something even worse, bringing back the economy to the case of the red line. In sum, Missaglia finds that in a scenario of high world interest, a dollarized economy with even just a weak preference for cash has few, painful options: debt stability with an extremely unequal society (therefore "social" instability), or financial instability.

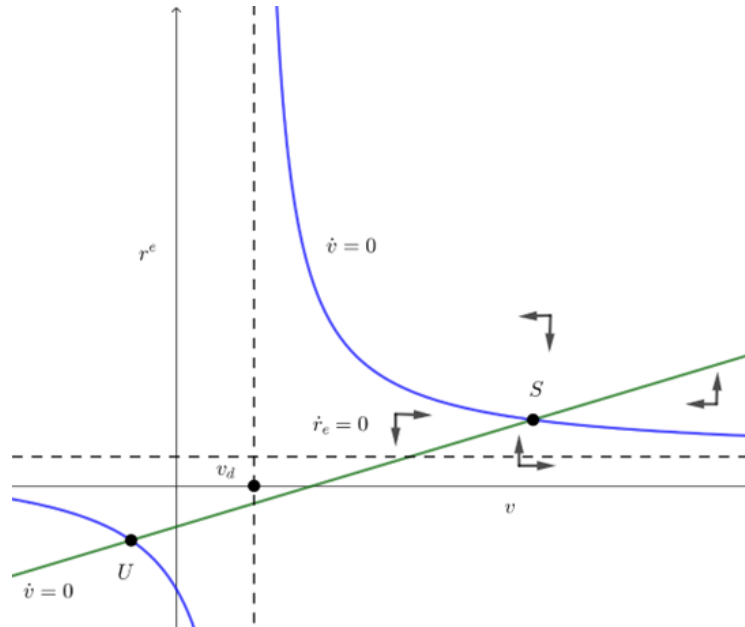
Figure 8.3 instead shows the dynamics of a dollarized economy with weak preference for cash when the world interest is low. We know that the world interest changes the shape and the position of the two isoclines. Within a certain range, a low i^* would modify the hyperbole so that the attracting branch would be located in the north-east section of the diagram formed by the two asymptotes. Also, the straight line of the locus $(\dot{r}^e) = 0$ becomes flatter and its intercept increases, but we can't know whether it is positive or negative. However, in this scenario there is no ambiguity over the existence of a stable equilibrium, as in any case the two isoclines would intersect. U is still a saddle point, thus less interesting. Point S is the locally stable equilibrium where the economy would converge. In S the economy features a positive rate of profits r and a positive wealth ratio v , but we can't say whether the country is a net creditor or debtor. While in the previous case convergence to S required the economy to be in a close neighborhood with repressed wages, this scenario is more optimistic: for every distributional configuration,

⁹¹ From (15) we see that a lower ψ impacts positively on the numerator and negatively on the denominator of the slope.

⁹² Note that in steady state $r = r^e$

stability will always be achieved as long as the economy finds itself above the unstable branch of the hyperbole. Therefore, a low world interest creates favorable conditions for stability, despite preference for cash is pushing the accumulation of foreign debt.

Figure 8.3 Low world interest and weak preference for cash



So far, we have shown two of the many cases presented by Missaglia, assuming a weak regime of preference for cash. In the last part of his work the author performs the same graphical analysis but in a regime of strong preference for cash. Without the need for a graphical discussion, we can understand that when $\alpha > \alpha_t$, the domestic banking system must borrow even more banknotes from abroad to satisfy households' preferences. Of course, this would make stability harder to achieve, given the same level of the world interest. A high world interest scenario like the one shown in Figure 8.2 would require an even more unequal income distribution to reach S . Instead, a scenario like in Figure 8.3, with the lower world interest would feature a different steady state, as Missaglia shows that, given the same low interest rate, when $\alpha > \alpha_t$ the hyperbole's branches shift back to the configuration where the stable branch is in the north-west section of the asymptotes diagram (as in Figure 8.3). Also, the horizontal asymptote would become negative. The new steady state, if achieved, would imply lower wealth, higher foreign indebtedness ($v < v_d$) and lower profit rate, thus a lower growth rate⁹³ than in the case of weak preference for cash.

Overall, we observe that a stronger preference for cash decelerates the steady-state growth of the system since the lower world interest rate does not help to avoid the risky trade-off between

⁹³ Given (7) and $r = r^e$ in steady state we know that if the rate of profit is lower so will g .

social and financial instability. Therefore, Missaglia concludes that a dollarized economy would worsen in terms of stability and growth as long as households decide to hold a part of their wealth in form of cash because of distrust in the domestic banking system.

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3 Stability in a SFC post-Keynesian Growth Model: considerations of a closed economy

Abstract: This chapter advances the post-Keynesian growth literature by developing a stock-flow consistent (SFC) model within a closed economy framework, laying the foundation for subsequent open economy extensions. Building on Kaleckian insights, we construct a discrete-time model to rigorously integrate real and financial stocks and flows, addressing a gap in traditional Kaleckian frameworks that often overlook such coherence. Starting with a simple demand-driven model, we progressively incorporate a profit-dependent investment function and retained profits to explore the dynamics of growth, income distribution, and financial stability. Through analytical derivations and numerical simulations, we examine the multiplicity of equilibria and their stability properties, revealing how interest rates and retained profits shape short and long-run outcomes. The basic model exhibits a stable equilibrium where households' normalized wealth equals the capital stock, with stability conditions aligning with the typical Keynesian stability. Introducing profit-driven investment makes stability sensitive to interest rates, while retained profits enhance short-run stability but introduce long-run vulnerabilities, including potential non-existence of equilibria under high interest rates. These findings highlight the critical interplay between financial dynamics and growth, setting the stage for analysing external debt and trade in an open economy context.

Introduction

In the previous chapter of this thesis, we explored a variety of open economy Kaleckian models, emphasizing their differences and the insights they offer into the dynamics of economic growth and external debt stability. These models, rooted in the post-Keynesian tradition, have provided a rich framework for understanding how demand-driven growth interacts with income distribution and external debt accumulation in an open economy setting. Building on this foundation, the present chapter aims to contribute to this literature by developing a fully stock-flow consistent (SFC) model. Our objective is to enhance the analytical rigor of Kaleckian growth models by ensuring that all stocks and flows—real and financial—are coherently integrated, a feature sometime overlooked in the traditional Kaleckian literature we reviewed.

Before extending our analysis to the complexities of an open economy, it is imperative to first establish a solid understanding of the model's dynamics in a closed economy framework. This step is crucial given the potential multiplicity of equilibria and the associated stability conditions that arise in SFC models. Unlike many Kaleckian models that rely on continuous-time formulations, we adopt a discrete-time approach in this chapter. This shift allows us to simulate the dynamic behaviour of the SFC framework more effectively, capturing the evolution of key variables over time and facilitating a detailed examination of stability properties through numerical exercises. By doing so, we not only address the pedagogical need to clarify the mechanics of growth in a closed economy but also lay the groundwork for extending the model to an open economy in subsequent analyses of multiple equilibria.

The chapter proceeds as follows. We begin with a simple closed economy model, introducing the basic structure and equations, and then progressively increase its complexity by incorporating alternative investment functions and retained profits. Throughout, we analyze the multiplicity of equilibria and their stability, employing both analytical derivations and computer simulations to illustrate the model's behavior under various parameter configurations. This dual approach not only clarifies the conditions under which the economy converges to a steady state but also highlights the limitations of overly simplified frameworks when addressing real-world economic phenomena. By establishing these dynamics in a closed economy, we set the stage for the open economy extension, where external trade and capital flows will further enrich the analysis.

1 A simple closed economy

Compared to the basic (C + I) model, say model BMW of Chapter 7 in Godley and Lavoie (2007), there are some important new elements to be stressed. Look at the balance sheet of our economy in Table 1:

- Firms may finance capital accumulation not only through bank loans, but also by issuing corporate bonds (here consols with a market price⁹⁴ $pb = 1/i_b$). For the time being, we will assume their profits to be fully distributed to households. This implies that in absence of capital gains/losses, firms' wealth is equal to zero ($V_f = 0$). For the sake of simplicity, we will also assume capital depreciation away (gross and net investments are the same).
- Instead of being exclusively held in the form of bank deposits, households' wealth is subdivided between bank deposits and corporate bonds. In this preliminary version of the model, expectations are static (expected capital gains are assumed to be zero and the rate of return on consols coincides with their yield to maturity. i.e., with the rate i_B).
- Banks are now assumed to earn positive profits (the interest rate on loans is higher than the interest rate on deposits, the latter being assumed to be zero). These profits are also fully distributed to households. This, together with the fact that there are no capital gains/losses for banks, implies their wealth to be always zero.

Table 1.1 Balance Sheet

	Hous	Firms	Banks	Tot
Deposits	M		$-M$	0
Loans		$-L$	$+L$	0
Bonds	pbB	$-pbB$		0
Capital		K		K
Net Worth	V_h	0	0	$V_h = K$

The flows and flows-of-funds of the economy are illustrated in Table 2. For the sake of completeness, in the table the yield on corporate bonds and the interest rate on bank loans are given two different names, i_B and i_L , respectively. In the model, however, we will impose the equality between the two rates, under the (strong) assumption that non-financial firms

⁹⁴ This is the real price of bonds (units of GDP needed to buy one bond). The price of GDP here is 1 and remains fixed.

consider the two modalities of financing capital accumulation as perfect substitutes and under the (weak) assumption that corner solutions are to be ruled out.

Table 1.2 Transaction Flow Matrix

	Hous	Firms		Banks		Tot
		c/a	k/a	c/a	k/a	
Flows						
Consumption	$-C$	C				0
Investment		I	$-I$			0
[memo: GDP]	$GDP = Y = C + I = i_{L-1}L_{-1} + B_{-1} + WB + \Pi$					
Interest on Loans		$-i_{L-1}L_{-1}$		$i_{L-1}L_{-1}$		0
Bonds Inter.	B_{-1}	$-B_{-1}$				0
Wages	WB	$-WB$				0
Firms Profits	Π	$-\Pi$				0
Banks Profits	$i_{L-1}L_{-1}$			$-i_{L-1}L_{-1}$		0
FoFs						
Money	$-\Delta M$				ΔM	0
Bonds	$-pb\Delta B$		$pb\Delta B$			0
Loans			ΔL		$-\Delta L$	0
TOT	0	0	0	0	0	0
[memo: capital gains]	ΔpbB_{-1}	0	$-\Delta pbB_{-1}$	0	0	0

A couple of words on how investments are determined. In general, they depend on the expected net profit rate accruing to the investing firms. This, in turn, depends on expected demand and on income distribution, i.e. on how the fruits of the investment will have to be shared among non-financial firms (“productive” capitalists), workers and bankers (“financial” capitalists). So, a relatively complete investment function should be written as $I = I(\pi, r, Y)$. Here, however, for the sake of simplicity and given the pedagogical purpose of these notes, we will exclusively concentrate on the accelerator term of the investment function. To some extent, this is justified by the fact that in this simple framework we are not giving income distribution between labour and capital any significant role, and we are treating the interest rate as given (in an endogenous money setting, this is decided by the banking system). We just want to concentrate on the mechanics of growth.

1.1 The Equations of the Model

$$Y = C + I \quad (1.1)$$

$$C = \alpha_1 Y + \alpha_2 V_{h-1} \quad (1.2)$$

$$I = \gamma K_{-1} + \delta Y \quad (1.3)$$

Observe that these initial three equations already constitute a squared and autonomous system. This is not the end of the story, however.

$$V_h = V_{h-1} + CG + Y - C \quad (1.4)$$

$$CG = (1/i_B - 1/i_{B-1})B_{-1} \quad (1.5)$$

$$B = (\lambda_0 + \lambda_1 i_B) i_B V_h - \lambda_2 i_B V_h \quad (1.6)$$

$$M_d = V_h - B/i_B \quad (1.7)$$

$$K = K_{-1} + I \quad (1.8)$$

$$L_d = V_h - B/i_B \quad (1.9)$$

$$L_s = L_d \quad (1.10)$$

$$i_L = i^* \quad (1.11)$$

$$i_B = i_L \quad (1.12)$$

Some comments may help the reader. Equation (1.4) defines the end-of-period households' wealth, and this must include realized capital gains, CG , as defined in equation (1.5). Equations (1.6) and (1.7) split households' wealth between corporate bonds and money (deposits), and this is done according to the standard Tobinesque principle (and under the assumption that expected capital gains are zero). Equation (1.8) describes the evolution of the capital stock under the assumption of no depreciation. Equation (1.9) calculates firms' debt towards banks, and makes it clear that, *ceteris paribus*, the higher households' holding of bonds, the lower the stock of firms' debt towards banks. Note that (1.9) is obtained putting together two accounting identities, i.e.:

$$V_F = K - L_d - B/i_B$$

$$V_F = K - V_h$$

Equations (1.10) and (1.11) make it clear that the banking system decides the interest rate on loans and lends whatever amount is demanded by firms to achieve the target interest rate. The interest rate on bank loans coincides with the yield of corporate bonds, as stated by (12), because the two forms of financing capital accumulation are assumed to be perfect substitutes from the perspective of investing firms.

The system (1.1)-(1.12) constitutes a complete description of the economy, of its real ((1.1)-(1.3)) and financial ((1.4)-(1.12)) sides. Yet one could also be interested in measuring money supply. To do this, use banks' balance sheet:

$$M_s = L_s \quad (1.13)$$

It is worth noting that we do not have variables for bonds' supply (B_s) and bonds' demand (B_d), but just a generic variable for bonds (B). The reason is that in our model firms are indifferent between bonds and bank loans: whatever amount of their investments' plans is not funded by households will be demanded to (and obtained from) banks.

1.2 Solving the Model

Before making some calculations, observe that the way the investment function (1.3) is written implies that K and Y cannot be stationary in the steady state. If they were at some positive level, I would be positive too, meaning that K is not stationary! What is stationary in the steady state of this economy is the output-capital ratio (degree of capacity utilization): in a steady state, output and the capital stock grow at the same, constant rate⁹⁵.

⁹⁵ Observe, also, that the level of output appearing in the investment function should be the expected output. In (1.3), then, we implicitly assumed that expectations are rational ($Y^e = Y$). In a stochastic framework, rational expectations should be written as $Y^e = Y + \varepsilon$, where ε represents a zero-mean random variable.

Let us normalize the system. Use the definitions in Table 1.3:

Table 1.3

Variable	Definition	Description
Flows		
u	Y/K_{-1}	Degree of capacity utilization
c	C/K_{-1}	Normalized consumption
g	I/K_{-1}	Accumulation rate
cg	CG/K_{-1}	Normalized capital gains
Stocks		
v_h	V_h/K	Share of households in national wealth
l	L/K	Share of bank loans in investment finance
b	B/K	Normalized bonds
m_d	M_d/K	Normalized money demand
m_s	M_s/K	Normalized money supply

The equations of the normalized model are (using $L_s = L_d = L$):

$$u = c + g \quad (1.1n)$$

$$c = \alpha_1 u + \alpha_2 v_{h-1} \quad (1.2n)$$

$$g = \gamma + \delta u \quad (1.3n)$$

$$v_h = \frac{v_{h-1}}{1+g} + \frac{cg + u - c}{1+g} \quad (1.4n)$$

$$cg = (1/i_B - 1/i_{B-1})b_{-1} \quad (1.5n)$$

$$b = \{\lambda_0 + \lambda_1 i_B - \lambda_2 u/[v_h(1+g)]\}i_B v_h \quad (1.6n)$$

$$m_d = v_h - b/i_B \quad (1.7n)$$

$$l = v_h - b/i_B \quad (1.8n)$$

$$i_L = i^* \quad (1.9n)$$

$$i_B = i_L \quad (1.10n)$$

$$m_s = l \quad (1.11n)$$

At the first level of the structure of causality, the system (1.1n)-(1.3n) determines u , c and g , whereas (1.9n) determines i_L . Then, at the second level, (1.10n) determines i_B . At the third level, (1.5n) determines cg and then, at the fourth, (1.4n) gives v_h . At the fifth level of the logical structure, (1.6n) tells us the value of b . The other endogenous variables follow.

As usual, the most rigorous way to find the steady state of the model is to follow step-by-step its structure of causality and identify the relevant difference equations. Doing this, one gets the following short-run solutions for u and g :

$$u^s = \frac{\gamma + \alpha_2 v_{h-1}}{1 - \delta - \alpha_1}$$

$$g^s = \frac{\gamma(1 - \alpha_1) + \delta \alpha_2 v_{h-1}}{1 - \delta - \alpha_1}$$

Plugging these solutions into (4n), after some manipulation, one gets the following expression:

$$v_h = \frac{[1 - \alpha_1 - \delta(1 - \alpha_2)]v_{h-1} + \gamma(1 - \alpha_1) + (1 - \delta - \alpha_1)(1/i_b - 1/i_{B-1})b_{-1}}{\delta \alpha_2 v_{h-1} + (1 - \alpha_1)(1 + \gamma) - \delta} \quad (1.14)$$

Finally, plug the short-run solutions v_h^s , u^s and g^s into (1.6n) to get the solution for the (normalized) quantity of bonds households want to hold in every period:

$$b = i^* \left\{ \frac{\{(\lambda_0 + \lambda_1 i^*)[1 - \alpha_1 - \delta(1 - \alpha_2)] - \lambda_2 \alpha_2\}v_{h-1} + \gamma[(\lambda_0 + \lambda_1 i^*)(1 - \alpha_1) - \lambda_2] + (\lambda_0 + \lambda_1 i^*)(1 - \delta - \alpha_1)(1/i_b - 1/i_{B-1})b_{-1}}{\delta \alpha_2 v_{h-1} + (1 - \alpha_1)(1 + \gamma) - \delta} \right\} \quad (1.15)$$

Equation (1.14) and (1.15) constitute a system of nonlinear, first-order difference equations. A steady-state for such a system is one in which $1/i_b = 1/i_{b-1}$ (there are no capital gains along

the steady-growth path), $v_h = v_{h-1} = v_h^{ss}$ and $b^s = b_{-1} = b^{ss}$. So, the steady-state solutions must be calculated imposing:

$$v_h^{ss} = \frac{[1 - \alpha_1 - \delta(1 - \alpha_2)]v_h^{ss} + \gamma(1 - \alpha_1)}{\delta\alpha_2 v_h^{ss} + (1 - \alpha_1)(1 + \gamma) - \delta} \quad (1.16)$$

$$b^{ss} = i^* \left\{ \frac{\{(\lambda_0 + \lambda_1 i^*)[1 - \alpha_1 - \delta(1 - \alpha_2)] - \lambda_2 \alpha_2\}v_h^{ss} + \gamma[(\lambda_0 + \lambda_1 i^*)(1 - \alpha_1) - \lambda_2]}{\delta\alpha_2 v_h^{ss} + (1 - \alpha_1)(1 + \gamma) - \delta} \right\} \quad (1.17)$$

An inspection of (1.16) is reassuring. In the framework of this model, there must be only one meaningful steady state, that in which $v_h^{ss} = 1$. In the transition to the steady-state it could be, due to capital gains/losses, that $v_h^s \neq 1$ (and, correspondingly, $v_F^s = 1 - v_h^s \neq 0$) but, along the steady-growth path, with no capital gains/losses around, it must be necessarily true that $v_h^{ss} = 1$ and $v_F^s = 0$. Well, if you impose $v_h^{ss} = 1$ on the RHS of (1.16), you get the same on the LHS. The model works⁹⁶. Yet it remains to be studied under which parametric conditions such a steady state is stable. On top of this, the nonlinear nature of (1.16) suggests that other steady states might exist and, for the reasons just explained, we do not want them to be stable. Let us check.

1.3 Stability

When dealing with nonlinear systems such as (1.14)-(1.15), which might have multiple equilibrium, we have to consider the following steps:

- 1) Find the equilibrium solution v_h^{ss} whose neighborhood you want to study
- 2) Compute the Jacobian⁹⁷ matrix of the system, i.e.

$$J = \begin{bmatrix} \frac{\partial v_h^s}{\partial v_{h-1}} & \frac{\partial v_h^s}{\partial b_{-1}} \\ \frac{\partial b}{\partial v_{h-1}} & \frac{\partial b}{\partial b_{-1}} \end{bmatrix}$$

- 3) Substitute v_h^{ss} into Jacobian and analyze the resulting matrix. For the steady state under inquiry to be stable, both eigenvalues of the Jacobian must be inside the unit circle (they must be less than one in absolute value).

⁹⁶ Of course, things would be different in a framework where firms and/or banks should decide to retain some profits. In this case, it must be $v_h^{ss} < 1$.

⁹⁷ Nonlinear systems can be studied as linear systems assuming linearity in a close neighbourhood of the steady state. Linearity indeed results through a Taylor expansion of a perturbation of the steady state.

First step: find the possible steady state points. In this case it is extremely simple to derive the steady state value for v_h . Look at the balance sheet, Table 1.1. We know that in absence of capital gains ($cg = 0$) household wealth is equal to the stock of capital, $V_h = K - V_f = K$. If we normalize this identity by K , we obtain: $v_h = 1$. If $v_{ss} = 1$, thus we can define also b_{ss} :

$$b^{ss} = i^* \left\{ \lambda_0 + \lambda_1 i^* - \lambda_2 \frac{\gamma + \alpha_2}{\delta \alpha_2 + (1 - \alpha_1)(1 + \gamma) - \delta} \right\}$$

The second and third steps are about calculating the derivatives making part of the Jacobian using (1.14) and (1.15) and evaluating them in steady state. Some simple algebra (and the fact that in a steady state the price of consols is constant) shows that:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}^s} \right|_{v_h^s=v_h^{ss}, b^s=b^{ss}} = \frac{(1 - \delta - \alpha_1)}{(1 - \delta - \alpha_1) + \gamma(1 - \alpha_1) + \delta \alpha_2}$$

$$\left. \frac{\partial v_h^s}{\partial b_{-1}} \right|_{v_h^s=v_h^{ss}, b^s=b^{ss}} = 0$$

$$\left. \frac{\partial b^s}{\partial b_{-1}} \right|_{v_h^s=v_h^{ss}, b^s=b^{ss}} = 0$$

In a case like this ($n = 2$), the condition that all eigenvalues are less than one in absolute value amounts to:

$$1 + tr(J) + det(J) > 0$$

$$1 - tr(J) + det(J) > 0$$

$$1 - det(J) > 0$$

The derivatives we calculated are already enough to see that in our case:

$$tr(J) = \left. \frac{\partial v_h^s}{\partial v_{h-1}^s} \right|_{v_h^s=v_h^{ss}, b^s=b^{ss}}$$

$$det(J) = 0$$

We can conclude also that the 2x2 dynamic system can be reduced to a 1x1 system(the difference equation of vh) as b does not matter for the stability of our model. Indeed, in this very simple and basic growth model all we need for stability is the condition $|tr(J)| < 1$:

$$\left| \frac{(1 - \delta - \alpha_1)}{(1 - \delta - \alpha_1) + \gamma(1 - \alpha_1) + \delta\alpha_2} \right| < 1 \quad (1.18)$$

Condition (1.18) is always true provided that $(1 - \delta - \alpha_1) > 0$. Therefore here (and only here, in such a basic growth model), short-run (or Keynesian) and dynamic stability are one and the same thing. Moreover, the system converges monotonically (with no fluctuations) to the steady state, since the derivative of wealth with respect to its past value is positive. As an example, we simulate the model according to a stable configuration of parameters (Keynesian stability holds). Look at what happens when the interest rate increases:

Figure 1.1 Wealth and higher interest Rate

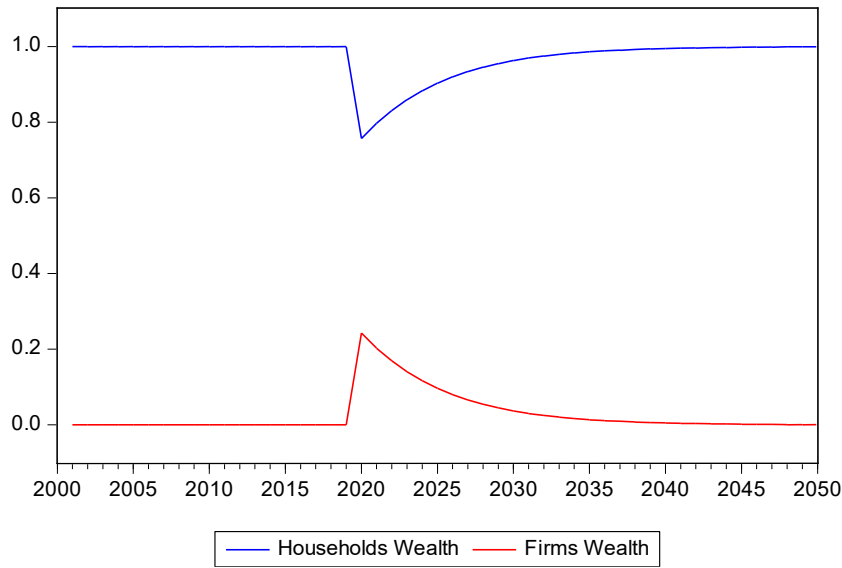


Figure 1.1 demonstrates that an increase in the interest rate temporarily shifts households' normalized wealth away from its steady-state level of $v_h^{ss} = 1$. This shift occurs due to the capital loss on perpetuities held by households. As a result, we also observe a temporary rise in the normalized wealth of firms—the households' debtors—which turns positive, since a higher interest rate lowers the real value of their debt burden issued as perpetuities. After a few periods, both variables revert to their initial steady-state values: $v_h = 1$ and $v_f = 0$. Indeed, in this simple model, the interest rate does not influence the long-run equilibrium. To explore this further, let's examine the long-run equilibrium values of g and u . By substituting $v_h^{ss} = 1$ into the short-run solutions, we obtain:

$$u^{ss} = \frac{\gamma + \alpha_2}{1 - \delta - \alpha_1}$$

$$g^{ss} = \frac{\gamma(1 - \alpha_1) + \delta\alpha_2}{1 - \delta - \alpha_1}$$

We see that in both cases the steady state solution does not include the interest rate. In the long run, income distribution and finance are irrelevant. Things like “liquidity preference”, “rentiers’ euthanasia”, “financialization”, etc. cannot be investigated within such a simplified framework. On top of this, like any other purely demand-driven Keynesian model, this is a model where supply constraints and bottlenecks are simply ignored, which makes this kind of model particularly unfit to study developing economies’ issues.

2 A different investment function

Of course, there are several ways of complicating the picture and building a more interesting SFC, Keynesian growth model. The most immediate is related to the investment function. The kind of investment function we put in the model (equation (3n)) is somehow inevitably associated to the fact that here “households” receive all kind of incomes: wages, profits and interests. Income distribution is irrelevant because all incomes go to the same subject (and the propensity to consume out of any kind of income is the same). If the interest rate goes up, firms’ net profits go down, banks’ net profits go up, and households’ income is unchanged. Households go on receiving the same with a different name: less profits, more interests. That’s why, in taking their investment decisions, firms’ owners (households) do not care about the interest rate, and the investment function is written as we did.

2.1 Updating the normalized equations

Things would be different if we should introduce a more realistic element and recognize that in most cases those who receive interest incomes (banks’ dividends) are not the same subjects who receive profits (firms’ dividends), even if for analytical purposes we group them in a single, generic, “households” aggregate. In this case, the desired investment spending would depend on the expected profit rate, and not just on the rate of capacity utilization. Assuming again static expectations, we define a new capital accumulation function:

$$g = \gamma + \delta r \quad (2.3n)$$

In turn, the profit rate turns out to be (ω is the wage rate, a is labor productivity; we will take both of them as given):

$$r = u(1 - \omega/a) - b_{-1} - i_{L-1}l_{-1} = hu - b_{-1} - i_{L-1}l_{-1} \quad (2.12n)$$

Where $h = (1 - \omega/a)$ as the share of capital incomes (profits and interest) in total GDP. Of course, $1 - h$ is the wage share. The rest of the model is unchanged.

As usual, before studying steady-states and analyzing the dynamics of the model, have a look at the structure of causality.

$$u = c + g \quad (2.1n)$$

$$c = \alpha_1 u + \alpha_2 v h_{-1} \quad (2.2n)$$

$$g = \gamma + \delta r \quad (2.3n)$$

$$v_h = \frac{v_{h-1}}{1 + g} + \frac{cg + u - c}{1 + g} \quad (2.4n)$$

$$cg = (1/i_B - 1/i_{B-1})b_{-1} \quad (2.5n)$$

$$b = \{\lambda_0 + \lambda_1 i_B - \lambda_2 u/[v_h(1 + g)]\}i_B v_h \quad (2.6n)$$

$$m_d = v_h - b/i_B \quad (2.7n)$$

$$l = v_h - b/i_B \quad (2.8n)$$

$$i_L = i^* \quad (2.9n)$$

$$i_B = i_L \quad (2.10n)$$

$$m_s = l \quad (2.11n)$$

$$r = hu - i_{L-1}l_{-1} - b_{-1} \quad (2.12n)$$

At the first level of the structure of causality, (2.9n) determines i_L . Then, at the second level, (2.10n) determines i_B and the sub-system (2.1n)-(2.3n), (2.12n) determines u, c, r and g . At the third level, (2.5n) determines cg and then, at the fourth, (2.4n) gives v_h . At the fifth level of the logical structure, (2.6n) tells us the value of b . The other endogenous variables follow. The short-run solutions for u, g and r are:

$$u^s = \frac{\gamma + (\alpha_2 - \delta i_{-1}^*)v_{h-1}}{1 - \alpha_1 - \delta h}$$

$$g^s = \frac{\gamma(1 - \alpha_1) + \delta[\alpha_2 h - (1 - \alpha_1)i_{-1}^*]v_{h-1}}{1 - \alpha_1 - \delta h}$$

$$r^s = \frac{\gamma h + [\alpha_2 h - (1 - \alpha_1)i_{-1}^*]v_{h-1}}{1 - \alpha_1 - \delta h}$$

It is immediately clear the recessionary impact of higher interest rates. Also, the level of activity can't be "wage-led" because there are no differences in the propensity to consume of the different social classes. On the contrary, higher wages are here contractionary because they slow the pace of accumulation (the Keynesian multiplier is a negative function of the wage share). Clearly, short-run growth is negatively affected by both a higher interest rate (income distribution shifts in favor of financial actors, for any given h) and a higher wage share (for any given interest rate, i.e., for any intra-capitalistic distribution). No, surprise at all. Again: activity and growth in the short run cannot be waged in this simple model where consumption patterns are not differentiated by class. If we plug these solutions into (2.4n) and rearrange, we obtain the dynamic of v_h :

$$v_h^s = \frac{[(1 - \alpha_1)(1 - \delta i_{-1}^*) - \delta h(1 - \alpha_2)]v_{h-1} + \gamma(1 - \alpha_1) + (1 - \alpha_1 - \delta h)(1/i_b - 1/i_{b-1})b_{-1}}{\delta[\alpha_2 h - (1 - \alpha_1)i_{-1}^*]v_{h-1} + (1 - \alpha_1)(1 + \gamma) - \delta h} \quad (2.1)$$

Observe that putting $h = 1$ and dropping the interest rate effect on growth (the term $\delta(1 - \alpha_1)i_{-1}^*$), you get exactly equation (1.14), as it must be.

Finally, plug the short-run solutions v_h^s , u^s and g^s into (2.6n) to get the solution for the (normalized) quantity of bonds households want to hold in every period:

$$b^s = i^* \frac{\{(\lambda_0 + \lambda_1 i^*)[(1 - \alpha_1)(1 - \delta i_{-1}^*) - \delta h(1 - \alpha_2)] - \lambda_2(\alpha_2 - \delta i_{-1}^*)\}v_{h-1} + \gamma[(\lambda_0 + \lambda_1 i^*)(1 - \alpha_1) - \lambda_2] + (\lambda_0 + \lambda_1 i^*)(1 - \alpha_1 - \delta h)(p_b^* - p_{b-1}^*)b_{-1}}{\delta[\alpha_2 h - (1 - \alpha_1)i_{-1}^*]v_{h-1} + (1 - \alpha_1)(1 + \gamma) - \delta h} \quad (2.2)$$

Observe, again, that imposing $h = 1$ and dropping the interest rate effect on growth and activity, you get exactly (1.15), as it must be. Equations (2.1) and (2.2) constitute a system of nonlinear, first-order difference equations. By imposing stationarity, they become:

$$v_h^{ss} = \frac{[(1 - \alpha_1)(1 - \delta i^*) - \delta h(1 - \alpha_2)]v_h^{ss} + \gamma(1 - \alpha_1)}{\delta[\alpha_2 h - (1 - \alpha_1)i^*]v_h^{ss} + (1 - \alpha_1)(1 + \gamma) - \delta h} \quad (2.3)$$

$$b^{ss} = i^* \frac{\{(\lambda_0 + \lambda_1 i^*)[(1 - \alpha_1)(1 - \delta i^*) - \delta h(1 - \alpha_2)] - \lambda_2(\alpha_2 - \delta i^*)\}v_h^{ss} + \gamma[(\lambda_0 + \lambda_1 i^*)(1 - \alpha_1) - \lambda_2]}{\delta[\alpha_2 h - (1 - \alpha_1)i^*]v_h^{ss} + (1 - \alpha_1)(1 + \gamma) - \delta h} \quad (2.4)$$

We are still in a framework (with no retained profits) where the only meaningful steady state is $v_h^{ss} = 1$. And again, luckily enough, (2.3) holds with $v_h^{ss} = 1$. Correspondingly, using (2.4):

$$b^{ss} = i^* \left\{ \lambda_0 + \lambda_1 i^* - \lambda_2 \frac{\gamma + \alpha_2 - \delta i^*}{\delta[\alpha_2 h - (1 - \alpha_1)i^*] + (1 - \alpha_1)(1 + \gamma) - \delta h} \right\} \quad (2.5)$$

2.2 Stability

Once again, to study stability, the only derivative we have to check is the following:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right|_{v_h^s=v_h^{ss}, b^s=b^{ss}, i_{-1}^*=i^*} = \frac{(1 - \alpha_1 - \delta h)}{(1 - \alpha_1 - \delta h) + (1 - \alpha_1)(\gamma - \delta i^*) + \delta \alpha_2 h}$$

Therefore, dynamic stability requires:

$$\left| \frac{(1 - \alpha_1 - \delta h)}{(1 - \alpha_1 - \delta h) + (1 - \alpha_1)(\gamma - \delta i^*) + \delta \alpha_2 h} \right| < 1 \quad (2.6)$$

It is not surprising that dropping the interest rate effect and putting $h = 1$, (2.6) reduces exactly to (1.18).

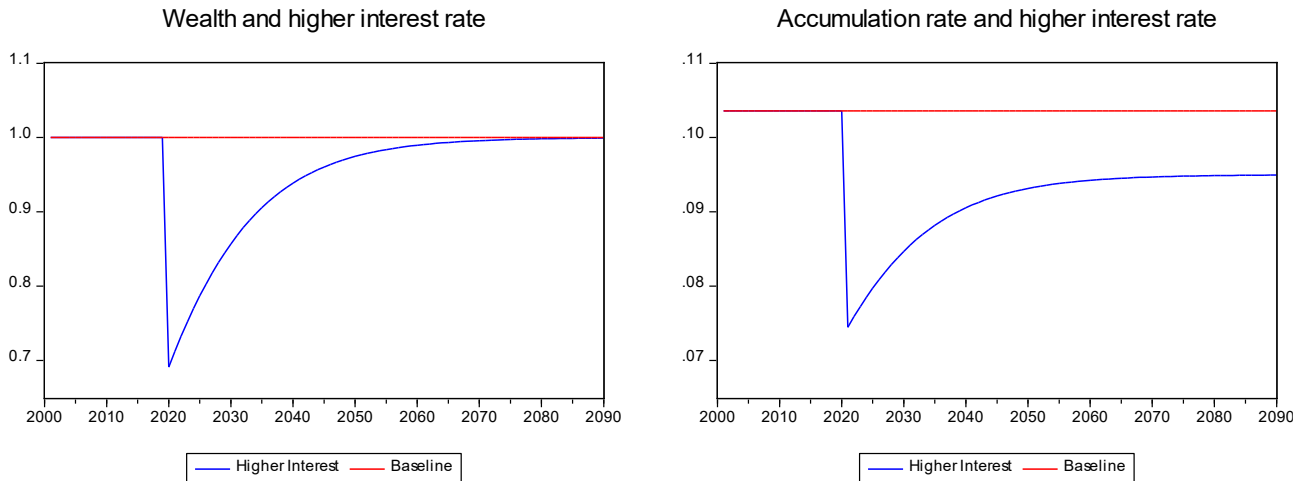
The discourse on dynamic stability is now a bit more complicated (and interesting) than it was in the original model. This time, the short-run stability condition $(1 - \alpha_1 - \delta h > 0)^{98}$ is not enough to guarantee dynamic stability. The crux of the matter is of course the term $(1 - \alpha_1)(\gamma - \delta i^*) + \delta \alpha_2 h$ appearing in the denominator of (2.6). Should this term be negative, condition (2.6) would be violated, and the system won't converge at the steady state $v_h^{ss} = 1$. In conclusion, in this slightly more interesting model, the condition $1 - \alpha_1 - \delta h > 0$ is not enough for dynamic stability; we must add another condition:

$$i^* < \frac{\alpha_2 h}{(1 - \alpha_1)} + \frac{\gamma}{\delta} \quad (2.7)$$

When both conditions hold, the system converges monotonically to the steady state.

To have a feeling of what's going on with dynamic stability, let us try a couple of exercises with computer simulations. First, increase the interest rate from the baseline value (2.5%) to a higher 4.5%. Look at Figure 2.1. The economy will converge to a new equilibrium where $v_h^{ss} = 1$ (as it *must* be) and the growth rate goes down to a new steady state value (this latter effect was absent in the model where accumulation was assumed to depend only on capacity utilization).

Figure 2.1 Impact of higher interest rate on wealth and growth

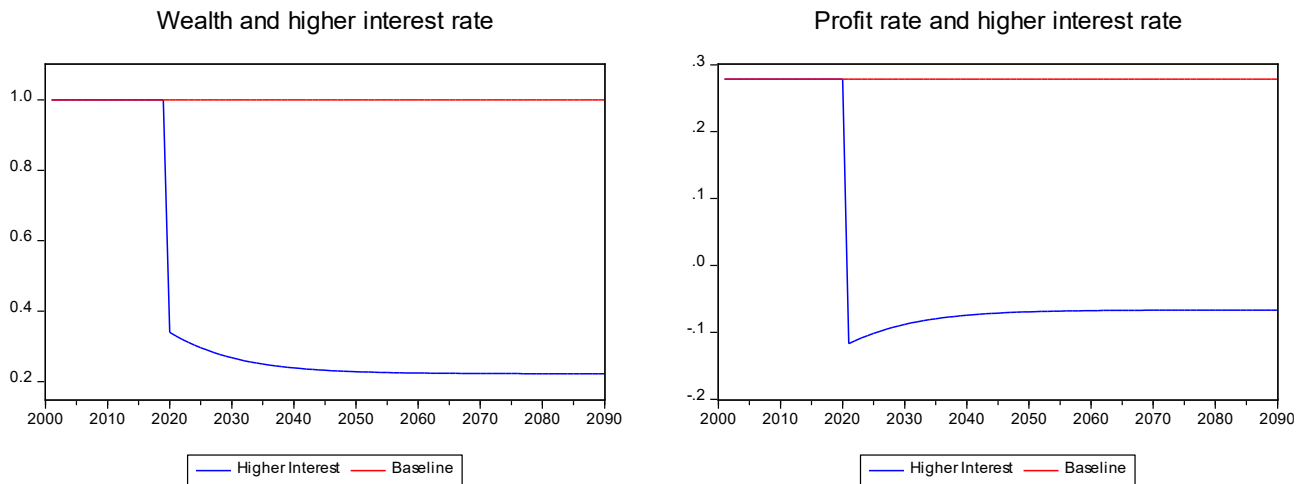


Second exercise, increase the interest rate from 2.5% to 50%, in such a way that condition (2.7) is violated. As expected, we note in Figure 2.2 that the economy won't converge back to the

⁹⁸ Remember this is not only (and not mainly) a stability condition. It is a condition for the model to make sense in the first place!

economically feasible steady state $v_h^{ss} = 1$ (the related dominant eigenvalue lies outside the unit circle).

Figure 2.2 Impact of a much higher interest on wealth and profit rate



3 More complexity: retained profits

Previously we assumed that all profits were distributed to the households. In this section we add retained profits, used by firms to finance investment. Given total net profits Π (net of interest payments), a share $\theta\Pi$ will be retained while a share $(1 - \theta)\Pi$ will be distributed to households. Of course, if we set $\theta = 0$ we'll obtain the previous model dynamics with no retained profits. The main result is that firms may have positive net worth due to the internal funds used for financing capital accumulation. Still, if desired investment is higher than the retained profits, the difference will be financed through perpetuities or, residually, through bank loans. Table 3.1 shows a small change in the balance sheet of the model:

Table 3.1 Balance Sheet

	Hous	Firms	Banks	Tot
Deposits	M		$-M$	0
Loans		$-L$	$+L$	0
Bonds	pbB	$-pbB$		0
Capital		K		K
Net Worth	V_h	V_f	0	$V_h + V_f = K$

We see that total wealth in the economy now is:

$$V_h + V_f = K \quad (3.1)$$

Where $V_f > 0$ is a positive net worth of firms. In normalized terms:

$$v_h + v_f = 1 \quad (3.2)$$

Hence, the steady state of the economy would imply $v_h \neq 1$ as long as firms have a non-negative net worth. Long run dynamics have become indeed slightly more complicated.

Let's give a look at the new Transaction Flow Matrix. One small change: total profits Π are partly distributed to households ($\Pi_h = (1 - \theta)\Pi$) and partly reinvested ($\Pi_f = (1 - \theta)\Pi$).

Table 3.2 Transaction Flow Matrix

	Hous	Firms		Banks		Tot
		c/a	k/a	c/a	k/a	
Flows						
Consumption	$-C$	C				0
Investment		I	$-I$			0
[memo: GDP]	$GDP = Y = C + I = i_{L-1}L_{-1} + B_{-1} + WB + \Pi$					
Interest on Loans		$-i_{L-1}L_{-1}$		$i_{L-1}L_{-1}$		0
Bonds Inter.	B_{-1}	$-B_{-1}$				0
Wages	WB	$-WB$				0
Firms Profits	Π_h	$-\Pi$	Π_f			0
Banks Profits	$i_{L-1}L_{-1}$			$-i_{L-1}L_{-1}$		0
FoFs						
Money	$-\Delta M$				ΔM	0
Bonds	$-pb\Delta B$		$pb\Delta B$			0
Loans			ΔL		$-\Delta L$	0
TOT	0	0	0	0	0	0
[memo: capital gains]	ΔpbB_{-1}	0	$-\Delta pbB_{-1}$	0	0	0

3.1 The equations of the model

While looking at the transaction flow matrix, we can define the equations of this new model.

$$Y = C + I \quad (3.3)$$

$$C = \alpha_1 Y_h + \alpha_2 V_{h-1} \quad (3.4)$$

$$Y_h = (1 - h)Y + (1 - \theta)\Pi + i_{L-1}L_{d-1} + B_{-1} \quad (3.5)$$

$$\Pi = hY - i_{L-1}L_{d-1} - B_{-1} \quad (3.6)$$

$$I = \gamma K_{-1} + \delta \Pi \quad (3.7)$$

$$V_h = V_{h-1} + CG + Y_h - C \quad (3.8)$$

$$CG = \left(\frac{1}{i_B} - \frac{1}{i_{B-1}} \right) B_{-1} \quad (3.9)$$

$$B = (\lambda_0 + \lambda_1 i_B) i_B V_h - \lambda_2 i_B Y_h \quad (3.10)$$

$$M_d = V_h - B/i_B \quad (3.11)$$

$$K = K_{-1} + I \quad (3.12)$$

$$L_d = V_h - B/i_B \quad (3.13)$$

$$L_s = L_d \quad (3.14)$$

$$M_s = L_s \quad (3.15)$$

$$i_L = i^* \quad (3.16)$$

$$i_B = i_L \quad (3.17)$$

Few comments. Compared to the model shown in Section 1, we kept the investment function presented in Section 2, as investment depends on profits Π and thus capital accumulation depends on the profit rate $\frac{\Pi}{K_{-1}} = r$, equation (3.7). Furthermore, the existence of retained profits entails that now households' income is different from total income. Thus, we had to include a variable for household income that we called Y_h . Household income Y_h , as shown in equation (3.5) is equal to the wage bills, $(1 - h)Y$ plus the distributed net profits $(1 - \theta)\Pi$ plus the interest income $i_{L-1}L_{d-1} + B_{-1}$. Households' wealth accumulation and demand for perpetuities now depend on Y_h instead of Y , equations (3.8) and (3.10). In equation (3.4), consumption depends on Y_h too. Once again, we are not differentiating between propensity to consume out of wages and out of profit: the model remains profit led.

3.2 Solving the model

Keeping in mind Table 1.3 and defining $y_h = Y_h/K_{-1}$, we can normalize the equations of the model as follows:

$$u = c + g \quad (3.1n)$$

$$c = \alpha_1 y_h + \alpha_2 v_{h-1} \quad (3.2n)$$

$$y_h = (1 - h)u + (1 - \theta)r + i_{L-1}l_{-1} + b_{-1} \quad (3.3n)$$

$$r = hu - i_{L-1}l_{-1} - b_{-1} \quad (3.4n)$$

$$g = \gamma + \delta r \quad (3.5n)$$

$$v_h = \frac{v_{h-1}}{1 + g} + \frac{cg + y_h - c}{1 + g} \quad (3.6n)$$

$$cg = \left(\frac{1}{i_B} - \frac{1}{i_{B-1}} \right) b_{-1} \quad (3.7n)$$

$$b = (\lambda_0 + \lambda_1 i_B) i_B v_h - \lambda_2 i_B \frac{y_h}{1 + g} \quad (3.8n)$$

$$m_d = v_h - b/i_B \quad (3.9n)$$

$$l = v_h - b/i_B \quad (3.10n)$$

$$m_s = l \quad (3.11n)$$

$$i_L = i^* \quad (3.12n)$$

$$i_B = i_L \quad (3.13)$$

At the first level of the structure of causality, (3.12n) determines i_L . Then, at the second level, (3.12n) determines i_B and the sub-system (3.1n)-(3.5n) determines u , c , r and g . At the third level, (2.7n) determines cg and then, at the fourth, (3.6n) gives v_h . At the fifth level of the logical

structure, (3.8n) tells us the value of b . The other endogenous variables follow. The short-run solutions for u , g and r are:

$$u^s = \frac{\gamma + [(\alpha_1\theta - \delta)i_{-1}^* + \alpha_2]v_{h-1}}{1 - \alpha_1 + (\alpha_1\theta - \delta)h}$$

$$r^s = \frac{h\gamma + [h\alpha_2 - i_{-1}^*(1 - \alpha_1)]v_{h-1}}{1 - \alpha_1 + (\alpha_1\theta - \delta)h}$$

$$g^s = \frac{\gamma[1 - \alpha_1(1 - \theta h)] + \delta[h\alpha_2 - i_{-1}^*(1 - \alpha_1)]v_{h-1}}{1 - \alpha_1 + (\alpha_1\theta - \delta)h}$$

Short run stability now requires: $1 - \alpha_1 + (\alpha_1\theta - \delta)h > 0$. Moreover, the higher is θ the higher the denominator will be, and thus short run stability would improve. This can be explained by the fact that the higher retained profits the faster total savings react to aggregate demand with respect to investment. In turn the Keynesian multiplier would decrease. Furthermore, we note that now utilization u has an ambiguous relation with the interest rate, as it depends on the sign of $\alpha_1\theta - \delta$. The first term, $\alpha_1\theta$ represents the positive impact of debt service on consumption out of profits, while δ is the impact of debt service on investment⁹⁹. If $\alpha_1\theta > \delta$, a higher interest rate could lead the economy to a new steady state with a higher level of capacity utilization (we know that generally a positive shock of the interest rate makes increase firms' liabilities and consequently households' assets and interest income). Finally, if we assume no retained profits, ($\theta = 0$) we would obtain the same short-run solutions derived in Section 2, as we should expect.

In order to study the long-run stability of the model, we acknowledged in the previous section that the relevant dynamic is households' wealth accumulation function. We know from equation (3.2) that household's normalized wealth can be considered as households' share of the total wealth in the economy, equal to K . Thus, households' share is equal to one minus the share of the other sector with positive wealth, firms: $v_h = 1 - v_f$. Let's derive first the dynamics of firms' wealth. Firms accumulate wealth through retained profits and capital gains (that in this simple model are equal to perpetuities' devaluation, or households' capital losses). So, in normalized terms, we can write:

⁹⁹ Firms pay first interest income to households, then divide net profits between the distributed and retained shares. Given that the same households perceive the distributed profits, a higher interest makes increase the share of gross profits distributed to households. If this effect is stronger than the negative impact of debt service on firms' decision to invest, consumption would increase more than the reduction in investment, resulting in, overall, a higher degree of capacity utilisation.

$$v_f = \frac{v_{f-1}}{1+g} + \frac{\theta r - cg}{1+g}$$

We substitute $v_f = 1 - v_h$ to obtain a preliminary households' wealth dynamic:

$$v_h = \frac{v_{h-1}}{1+g} + \frac{g - \theta r + cg}{1+g}$$

If we plug in the short run solutions, after some manipulation we finally obtain:

$$v_h^s = \frac{\gamma(1-\alpha_1)(1-\theta h) + \{(1-\alpha_1)[1-(\delta-\theta)i_{-1}^*] + h[\theta(\alpha_1-\alpha_2) + \delta(\alpha_2-1)]\}v_{h-1} + cg[1-\alpha_1 + (\alpha_1\theta - \delta)h]}{-\delta h + (1+\gamma)[1-\alpha_1(1-\theta h)] + \delta[h\alpha_2 - i_{-1}^*(1-\alpha_1)]v_{h-1}} \quad (3.18)$$

Equation (3.18) represents the state equation of household wealth. This nonlinear equation may allow for multiple equilibria. In previous sections, the dynamics exhibited a similar pattern, yet there was a stable steady-state solution, $v_h^{ss} = 1$ which could be derived using theoretical insights and accounting matrices without requiring detailed calculations. In that case, it was not necessary to demonstrate the existence of other potential equilibria. Here, however, greater analytical uncertainty surrounds the possible equilibria, necessitating a more precise approach, within the bounds of economic reasoning.

3.3 Stability

In equation (3.18) we can assume $cg = 0$ as in this model the interest rate (and the price of perpetuities) is always fixed unless exogenous shocks. After this simplification, we highlight the nonlinear nature of equation (3.18). Define:

$$A = (1-\alpha_1)[1-(\delta-\theta)i_{-1}^*] + h[\theta(\alpha_1-\alpha_2) + \delta(\alpha_2-1)]$$

$$B = \gamma(1-\alpha_1)(1-\theta h)$$

$$C = \delta[h\alpha_2 - i_{-1}^*(1-\alpha_1)]$$

$$D = -\delta h + (1+\gamma)[1-\alpha_1(1-\theta h)]$$

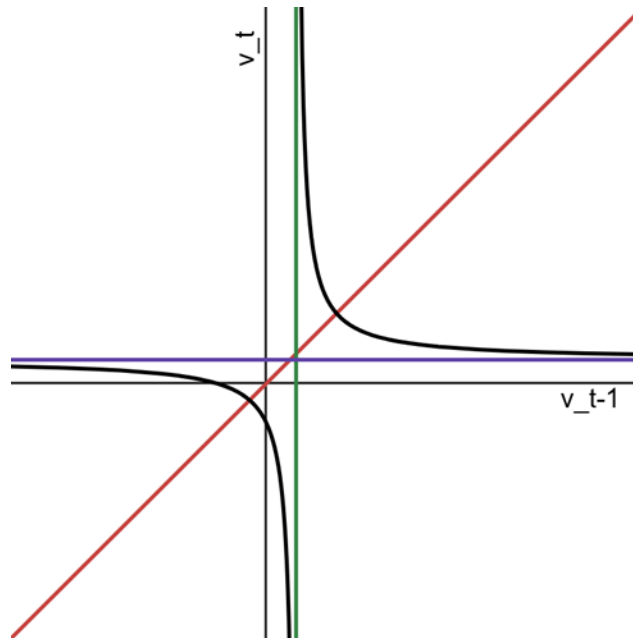
These are the elements that shape an equilateral hyperbole in the plane v_h^s, v_{h-1} :

$$v_h^s = \frac{Av_{h-1} + B}{Cv_{h-1} + D} \quad (3.19)$$

Because of the presence of numerous parameters, it's difficult to estimate the size or the sign of every parameter. For now, with the help of the assumptions, we could just say that $A > 0$ $B > 0$, while for C and D we can't know a priori the exact sign. Equation (3.19) can be represented in the plane v_h, v_{h-1} as an equilateral hyperbole whose center of symmetry has coordinates $(-d/c, a/c)$ and with a vertical asymptote $v_{h-1} = -d/c$ and a horizontal asymptote $v_h = a/c$.

Figure 3.1 shows one possible configuration:

Figure 3.1 A possible shape of the hyperbole



In Figure (3.1), within the v_h, v_{h-1} plane, we can identify the branches of the equilateral hyperbola (black line), the vertical axis (green line), the horizontal axis (blue line), and the 45-degree line (red line). The 45-degree line is crucial for identifying equilibrium points, as the wealth dynamics reach a steady state whenever $v_h = v_{h-1}$. Thus, any intersection between the 45-degree line and the hyperbola represents an equilibrium point, whose stability must be analysed. However, it is possible that the parameter configuration results in no intersections between the 45-degree line and the hyperbola. Therefore, a necessary condition for the existence of an equilibrium is the presence of such an intersection. Let's take equation (3.19) and substitute $v_h = v_{h-1}$. This yields an equation that determines the two possible equilibrium points:

$$Cv_h^{s^2} + (D - A)v_h - B = 0$$

With basic algebra we can define the two steady states:

$$v_{h_{1,2}}^{ss} = \frac{(A - D) \pm \sqrt{\Delta}}{2C} \quad (3.20)$$

The existence condition of such points requires Δ to be nonnegative:

$$\Delta = (D - A)^2 + 4BC \geq 0 \quad (3.21)$$

If $\Delta < 0$ there are no intersections between the hyperbole and the 45-degree line. If $\Delta = 0$ the 45-degree line is tangent to the hyperbole and thus we obtain a single equilibrium. If $\Delta > 0$ there are two intersections and thus two possible equilibria¹⁰⁰.

The next step requires studying local stability in each equilibrium. We know from the previous sections that the stability of a system of difference equations requires the eigenvalues of the characteristic equation of the system to be less than unity in absolute terms. In the case of a single state equation, this condition is simplified to check whether the absolute value of the derivative $\frac{\partial v_h^s}{\partial v_{h-1}}$, evaluated in the steady state, is less than unity. Thus, from the state equation (3.19) we can derive what follows:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right|_{v_h=v_{h-1}=v_{h_{1,2}}^{ss}} = \left| \frac{AD - BC}{(Cv_h^{ss} + D)^2} \right| < 1 \quad (3.22)$$

This is indeed the condition that ensures an equilibrium point is locally stable, allowing the model to reach a steady state.

Given the large number of parameters to consider, in the next paragraphs we present several parameter configurations for which we conduct computer simulations. We will verify each condition accordingly.

¹⁰⁰ The model with no retained profits, $\theta = 0$, presented in Section 2, is just a particular case where $v_h^{ss} = 1$ is the stable equilibrium out of two possible equilibria. Take A, B, C, D and substitute $\theta = 0$. It would result that $A - D = C - B$. Equation 3.20 becomes: $v_{h_{1,2}}^{ss} = \frac{(C-B) \pm \sqrt{(B-C)^2 + 4BC}}{2C}$. This yields two equilibria: $v_{h_1}^{ss} = 1, v_{h_1}^{ss} = -\frac{B}{C}$. See Appendix A for more calculations.

3.4 Simulating the model

a) First configuration

We assume low non-wage share h , low reinvested profits share θ , and low interest rate i^* . Parameters are such that Keynesian stability holds.

$$\alpha_1 = 0.55 \quad \alpha_2 = 0.05 \quad \theta = 0.2 \quad h = 0.2 \quad \lambda_0 = 0.6$$

$$\lambda_1 = 1.5 \quad \lambda_2 = -0.05 \quad i^* = 0.02 \quad \gamma = 0.05 \quad \delta = 0.8$$

According to this configuration we obtain the following values for the elements of the hyperbole:

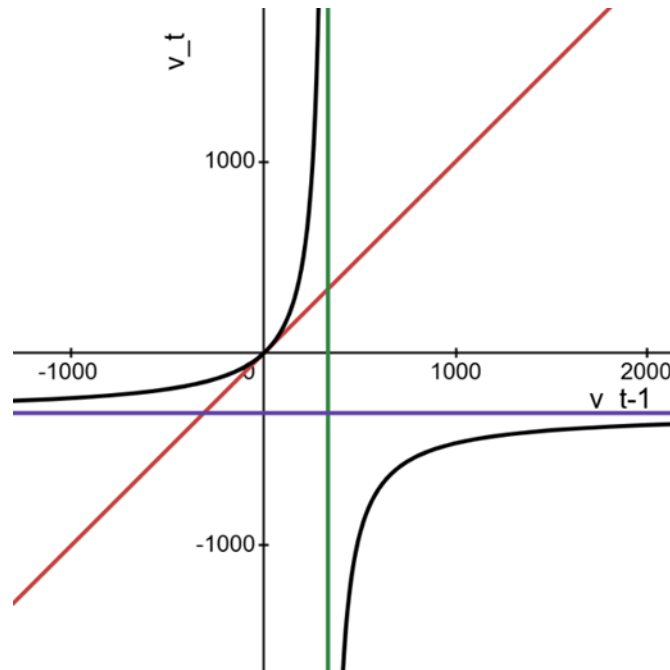
$$A = 0.31125 \quad B = 0.0216 \quad C = -0.01 \quad D = 0.3356$$

From which we can immediately derive the asymptotes values:

$$v_{h-1} = -\frac{D}{C} = 335.6 \quad v_h = \frac{A}{C} = -311.25$$

We could represent the dynamic equation of v_h as shown in Figure 3.2.

Figure 3.2

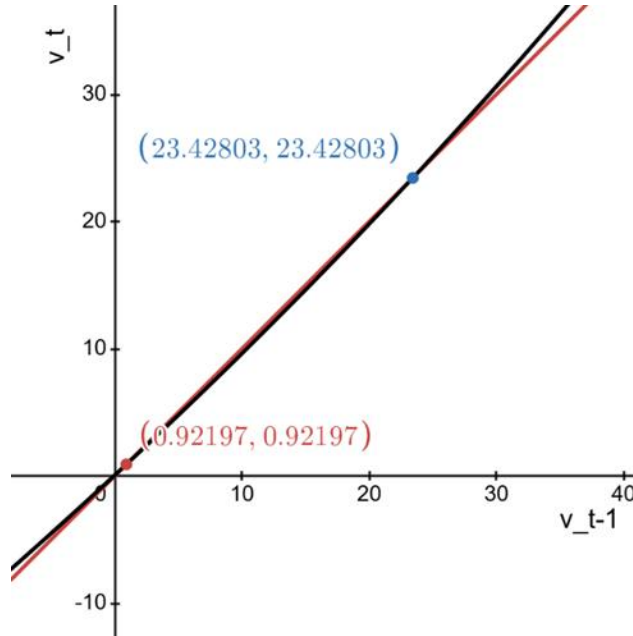


From this perspective it is not clear whether the 45-degree line intersects the hyperbole. Let's calculate Δ :

$$\Delta = (D - A)^2 + 4BC = 0.0005065 > 0$$

There are two equilibrium points. Indeed, if we “zoom in” Figure 3.2 we can observe the two intersections:

Figure 3.3



Two equilibria:

$$v_{h_1}^{ss} = 0.922 \quad v_{h_2}^{ss} = 23.43$$

If we check the stability of each point, we obtain:

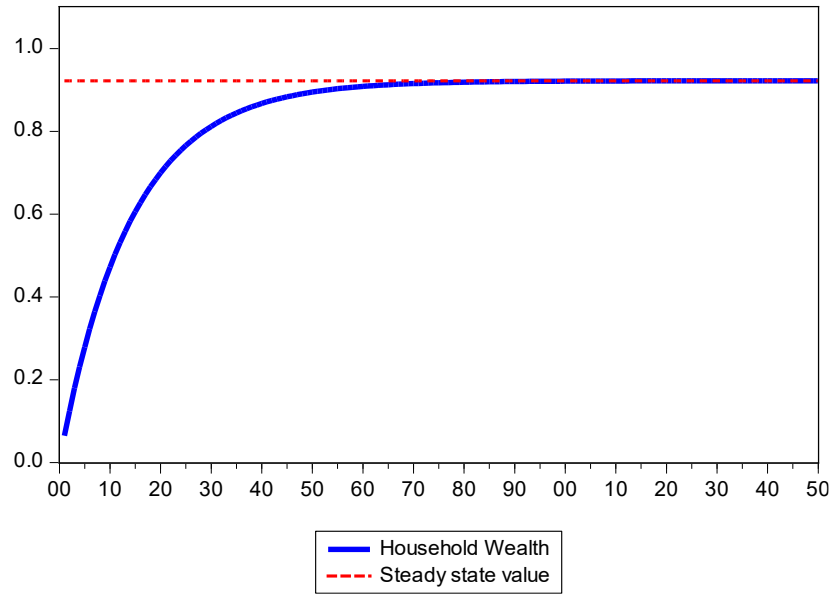
$$\left. \frac{\partial v_h}{\partial v_{h-1}} \right|_{v_{h_1}^{ss}} = |0.933| < 1 \quad \left. \frac{\partial v_h}{\partial v_{h-1}} \right|_{v_{h_2}^{ss}} = |1.072| > 1$$

Hence $v_{h_1}^{ss} = 0.922$ is a locally stable equilibrium point, while $v_{h_2}^{ss} = 23.43$ is an unstable point.

We can observe the behavior of each equilibrium through simulations. First, we run the model from a neighborhood of $v_{h_1}^{ss} = 0.922, v_h = 0$:¹⁰¹

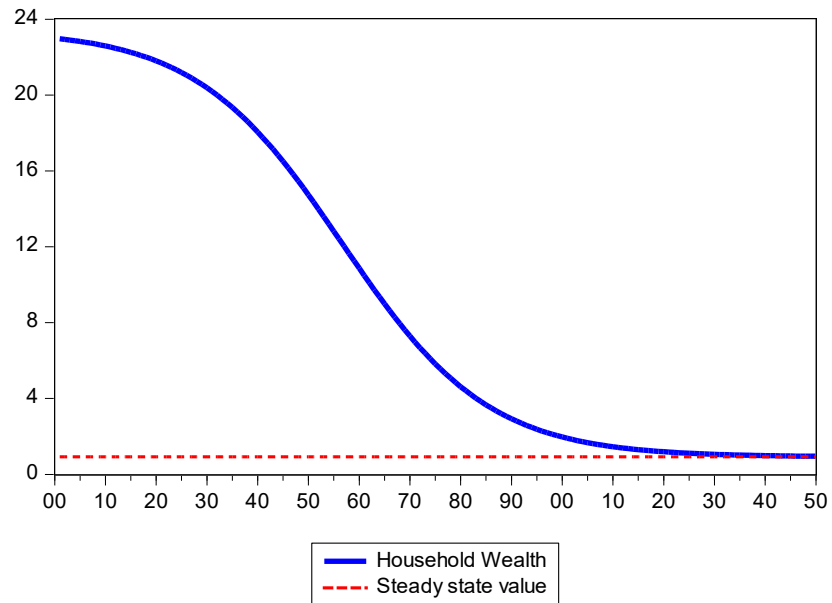
¹⁰¹ Starting the model out the equilibrium from $v_h = 0$ means that firms have an initial positive stock of pre-existing capital but no liabilities, such that $v_f = 1$.

Figure 3.4 Convergence from $v_h = 0$



Households' wealth converges to $v_{h_1}^{ss} = 0.922$. Now let's do the same but by starting from a left neighborhood of $v_{h_2}^{ss}$, $v_h = 23$.¹⁰²

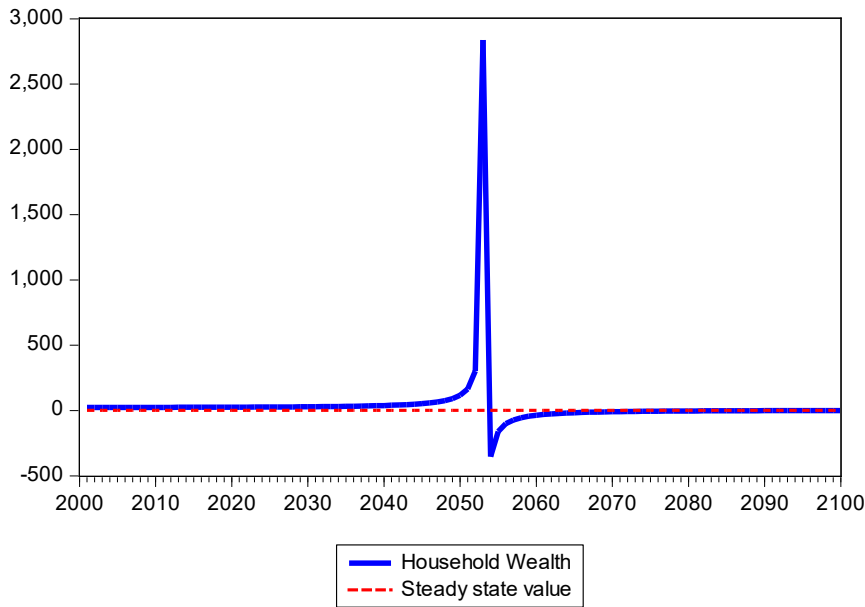
Figure 3.5 Convergence from $v_h = 23$



The system converges to $v_{h_1}^{ss} = 0.922$. To confirm the instability of this equilibrium, we run the model from a right neighborhood of $v_{h_2}^{ss}$, $v_h = 24$.

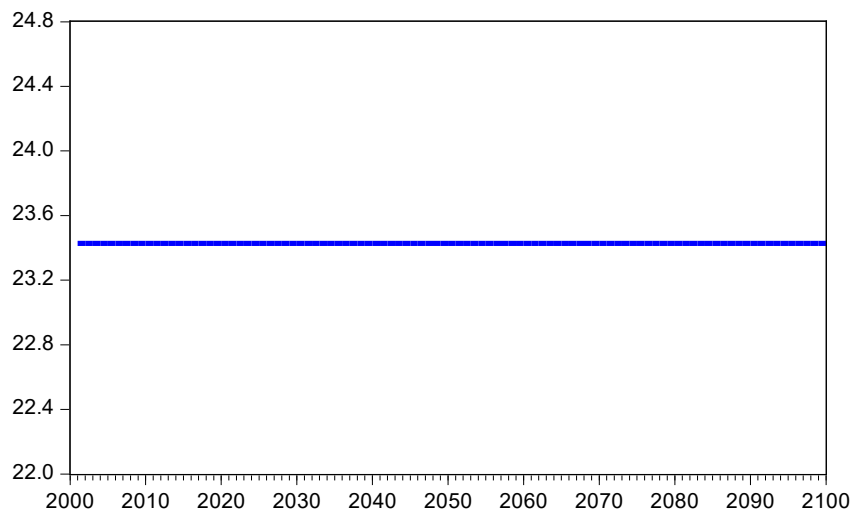
¹⁰² Such a high initial households' wealth to capital ratio isn't properly justified in such a model, still we run it for observational purpose.

Figure 3.5 Explosive path from $v_h = 24$



This time, the dynamics are a bit more intriguing. We confirm that the point $v_{h_2}^{ss} = 23.43$ acts as a repulsor: starting from its right neighbourhood, household wealth continues to grow, not due to capital accumulation (which, given such a high debt ratio, would turn negative), but rather due to debt service itself. The greater the debt service, the newer debt accumulates, following an explosive trajectory. However, this dynamic feature a vertical asymptote, a point where the derivative $\frac{\partial v_h^s}{\partial v_{h-1}}$ becomes infinite. In discrete time, wealth accumulation overshoots this asymptote (we know the vertical asymptote occurs at $v_h = 335.6$, yet the model reaches $v_h = 2838$), unrealistically shifting back to a stable dynamic that converges to $v_{h_1}^{ss} = 0.922$.

Figure 3.5 Stability of $v_{h_2}^{ss} = 23.43$



Finally, in Figure 3.5 we show that, despite being an unstable equilibrium, $v_{h_2}^{ss} = 23.43$ is a steady-state point. Indeed, if by some fluke the model lands exactly at $v_{h_2}^{ss} = 23.43$, the system stays there in equilibrium.

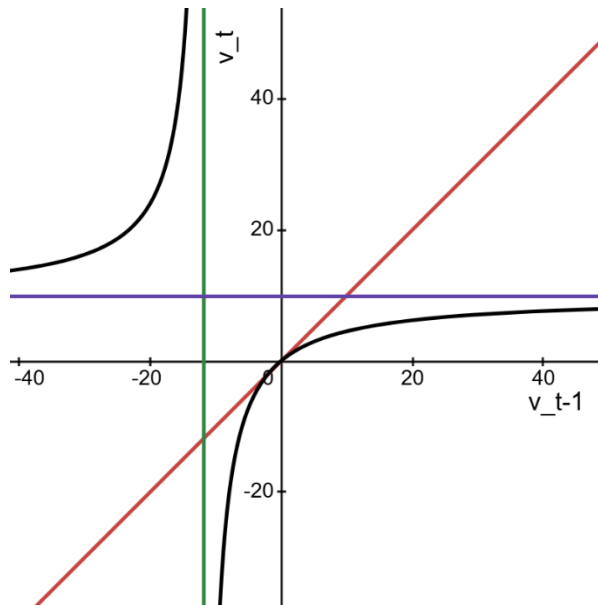
b) Second configuration

With this second configuration we assume high non-wage share h , high reinvested profits share θ , and low interest rate i^* . Parameters are such that Keynesian stability holds.

$$\alpha_1 = 0.55 \quad \alpha_2 = 0.05 \quad \theta = 0.8 \quad h = 0.71 \quad \lambda_0 = 0.6$$

$$\lambda_1 = 1.5 \quad \lambda_2 = -0.05 \quad i^* = 0.025 \quad \gamma = 0.05 \quad \delta = 0.8$$

Figure 3.6



The hyperbole is shaped by the following elements:

$$A = 0.1929 \quad B = 0.0096 \quad C = 0.0196 \quad D = 0.2311$$

And the asymptotes:

$$v_{h_{-1}} = -\frac{D}{C} = -11.807 \quad v_h = \frac{A}{C} = 9.854$$

In figure 3.6 we note that now the south-east branch of the hyperbole intersects the 45-degree line. Two intersections, indeed Δ is once again positive:

$$\Delta = (D - A)^2 + 4BC = 0.002215 > 0$$

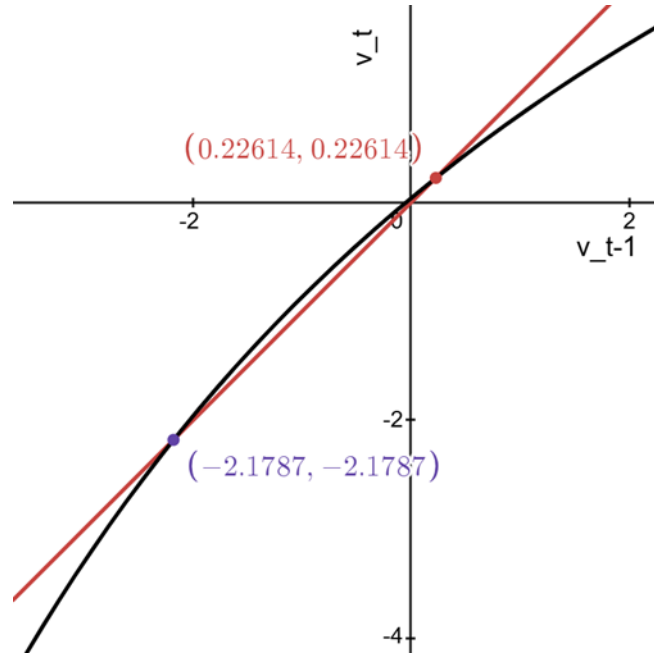
The two equilibrium points are:

$$v_{h_1}^{**} = 0.226 \quad v_{h_2}^{**} = -2.179$$

Where:

$$\left. \frac{\partial v_h}{\partial v_{h-1}} \right|_{v_{h_1}^{**}} = |0.800| < 1 \quad \left. \frac{\partial v_h}{\partial v_{h-1}} \right|_{v_{h_2}^{**}} = |1.249| > 1$$

Figure 3.7



The steady state of households' wealth now is much lower than in the first configuration: firms retain much more profits such that they need less to issue perpetuities or to contract loans with banks to finance investment. Moreover, the unstable equilibrium point is negative meaning that whatever is the initial level of firms' indebtedness, the system will always converge to the stable steady state.

Briefly, in Figure 3.8 and 3.9 we show the dynamic of v_h when we run the model from a left neighborhood of $v_{h_1}^{ss}$ and $v_{h_2}^{ss}$ respectively.

Figure 3.8 Convergence from $v_h = 0$

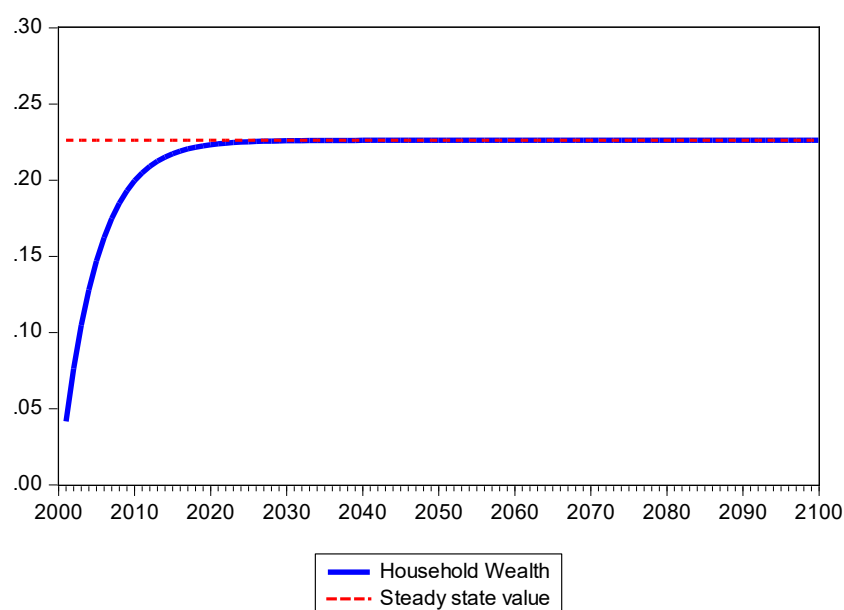
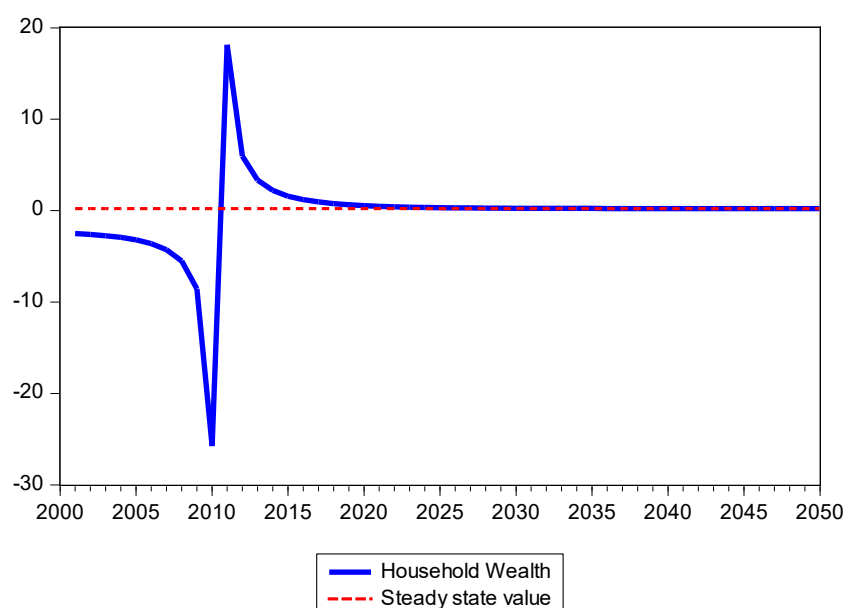


Figure 3.9 Unstable path from $v_h = -2.5$



In Figure 3.8 nothing new: households wealth converges to the stable equilibrium $v_{h1}^{ss} = 0.226$. In Figure 3.9 instead we observe an implosive dynamic of household wealth, where, households are becoming indebted more and more with firms. Again, the unstable dynamic stops once the vertical asymptote is breached.

c) Third configuration

The model without retained profits, developed in Section 2, is always capable of achieving a steady state (see Appendix A) as the wealth dynamic, shaped as a hyperbole, always intersects the 45-degree line at least in one point. When retained profits are added, the existence of equilibria is not granted. In this configuration we show that, even if Keynesian stability holds, the interest rate is too high to ensure a locally stable equilibrium, but neither an unstable one: there are no steady states.

Assume low non-wage share h , low reinvested profits share θ but high interest rate i^* . Parameters are such that Keynesian stability holds.

$$\alpha_1 = 0.55 \quad \alpha_2 = 0.05 \quad \theta = 0.2 \quad h = 0.2 \quad \lambda_0 = 0.6$$

$$\lambda_1 = 1.5 \quad \lambda_2 = -0.05 \quad i^* = 0.1 \quad \gamma = 0.05 \quad \delta = 0.8$$

We obtain the following values for the elements of the hyperbole:

$$A = 0.291 \quad B = 0.0216 \quad C = -0.028 \quad D = 0.3356$$

Compared to the first configuration, only A and C assume different values as the interest rate impacts just on these two elements of the hyperbole. This makes shift the position of the asymptotes:

$$v_{h-1} = -\frac{D}{C} = 11.99 \quad v_h = \frac{A}{C} = -10.39$$

In Figure 3.10, it seems that the 45-degree line intersects the hyperbole, however if we check the existence condition we obtain:

$$\Delta = (D - A)^2 + 4BC = -0.00043 < 0$$

Indeed, if we zoom-in, as shown in Figure 3.11, we will note that the hyperbole never touches the 45-degree line.

Figure 3.10

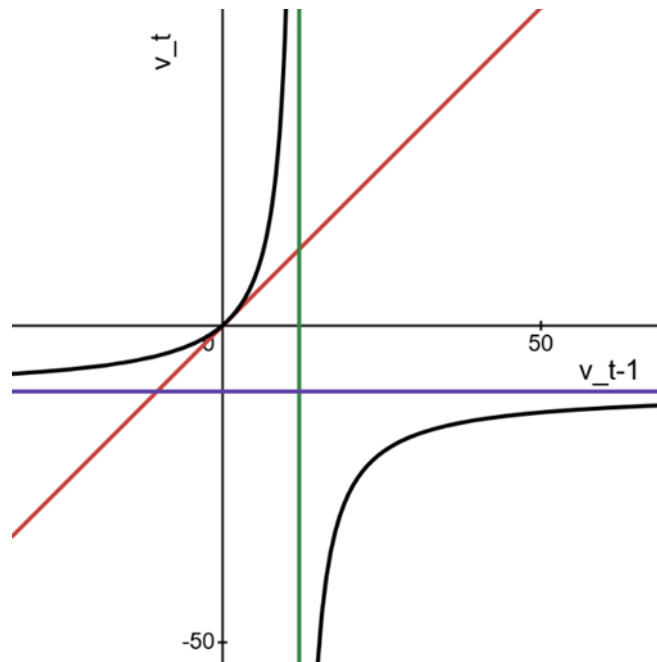
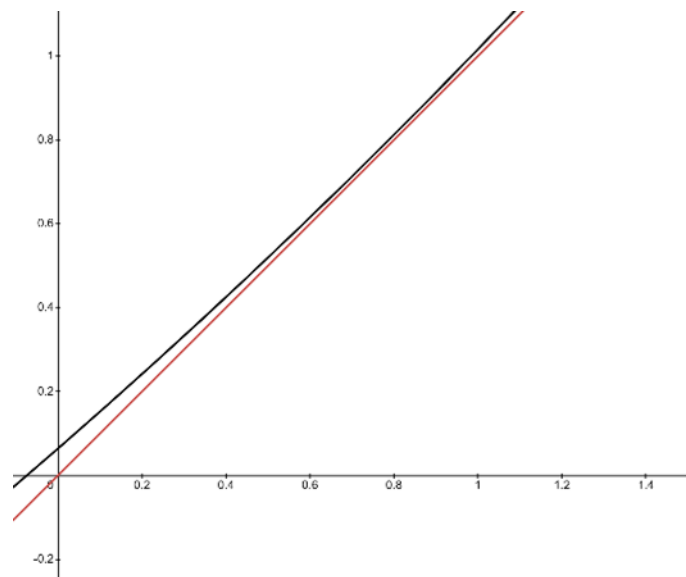
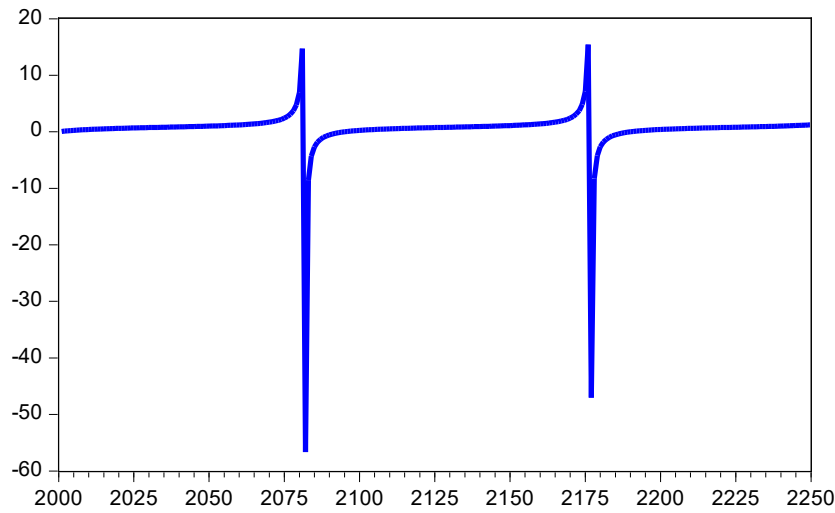


Figure 3.11



If we look at the dynamic indeed, we observe an ever-exploding household wealth, switching from one explosive dynamic to another every time the asymptote is breached. Figure 3.12 shows this dynamic when starting from $v_h = 0$

Figure 3.12 Wealth in an unstable configuration



3.5 Some exercises

To conclude with this model, we illustrate some exercises where we shock the baseline scenario with an exogenous change of a parameter. The baseline scenario in this case is calibrated in steady state by setting the parameters as in the first configuration:

$$\alpha_1 = 0.55 \quad \alpha_2 = 0.05 \quad \theta = 0.2 \quad h = 0.2 \quad \lambda_0 = 0.6$$

$$\lambda_1 = 1.5 \quad \lambda_2 = -0.05 \quad i^* = 0.025 \quad \gamma = 0.05 \quad \delta = 0.8$$

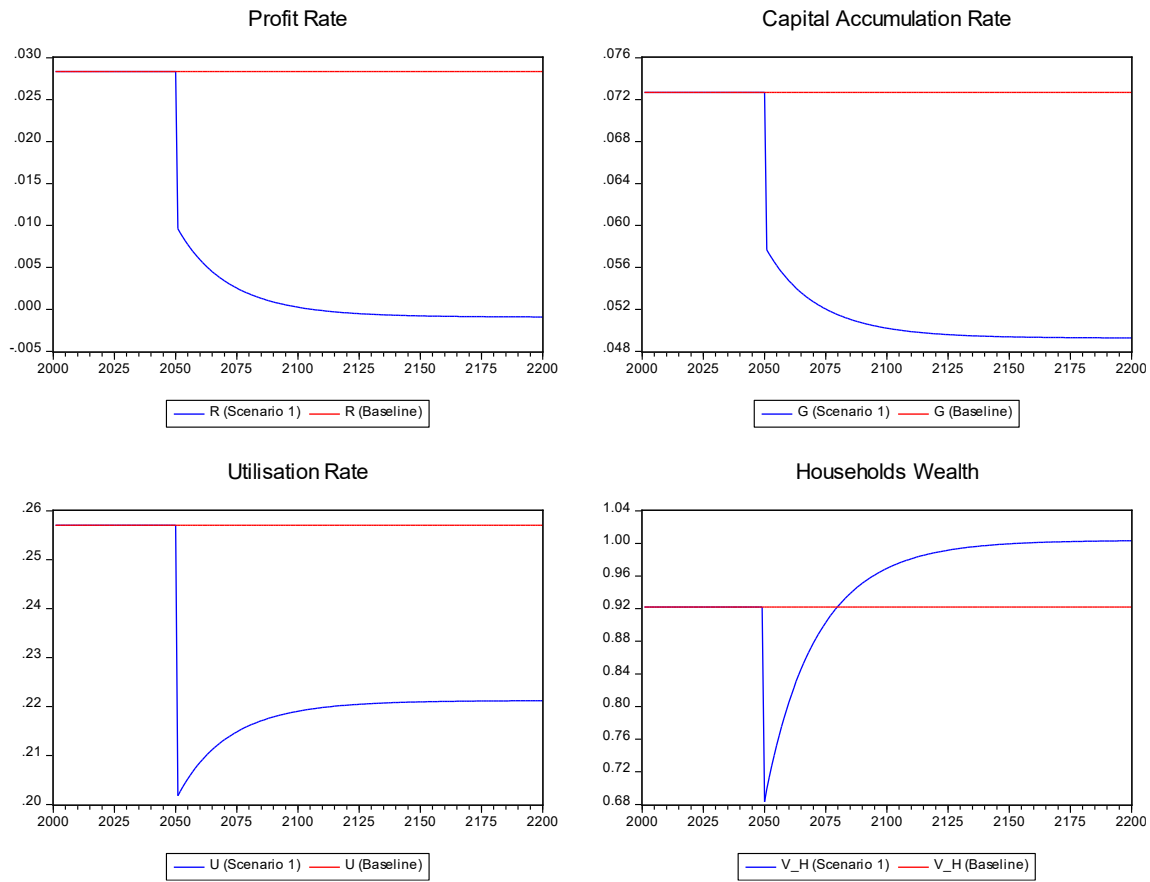
In paragraph 3.2 we have shown that the relation between the interest rate and capacity utilisation depends on the sign of $\alpha_1\theta - \delta$. By default, we assume $\alpha_1\theta < \delta$, such that the interest rate has a negative impact on utilization.

a) Higher Interest rate

Figure 3.13 illustrates the effects of an interest rate increase from 0.025 to 0.045. Despite this increment, the new interest rate level remains sufficiently low to maintain stability within the model. This change effectively shifts the system toward a new steady state. Initially, a higher interest rate increases debt servicing costs, which in turn reduces the profit rate, eventually driving it into negative territory in this scenario. In our model, the profit rate and the capital accumulation rate are closely linked through the Kaleckian accumulation function: as capitalists' expected profit rate declines, they opt to reduce investment. This decrease in investment lowers aggregate demand, reflected in reduced capacity utilization. However, the decline in capacity utilization is partly offset by a positive interest income effect on households, whose asset returns increase. Following an initial sharp drop—triggered by capital losses due

to the higher interest rate, normalized household wealth begins to rise, eventually stabilizing at a new, higher steady-state value, slightly above 1 in this case. This new steady state exceeds the baseline because, in this simplified model, the interest rate redistributes wealth toward asset holders, enhancing their overall wealth share. The household wealth share exceeds one because the negative profit rate leads to negative retained profits, resulting in a negative normalized net worth for firms.

Figure 3.13 Impact of a higher interest, negative impact on utilization



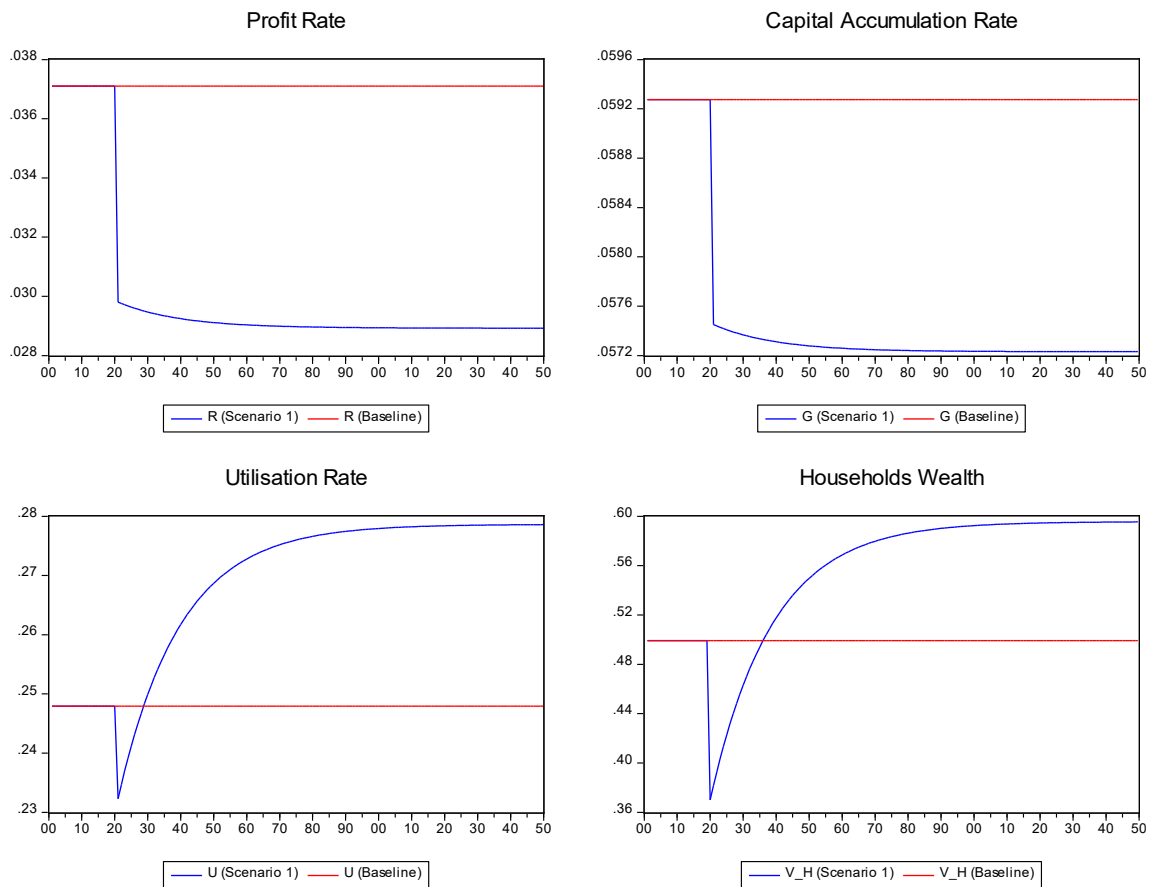
Now change configuration such that $\alpha_1 \theta > \delta$. We assume a higher retained profit share θ and a lower propensity to invest out of profits δ .

$$\alpha_1 = 0.55 \quad \alpha_2 = 0.05 \quad \theta = 0.8 \quad h = 0.2 \quad \lambda_0 = 0.6$$

$$\lambda_1 = 1.5 \quad \lambda_2 = -0.05 \quad i^* = 0.025 \quad \gamma = 0.05 \quad \delta = 0.25$$

We apply the same shock on the interest, from 0.025 to 0.045. Let's see what happens, Figure 3.14.

Figure 3.14 Impact of a higher interest, positive impact on utilization

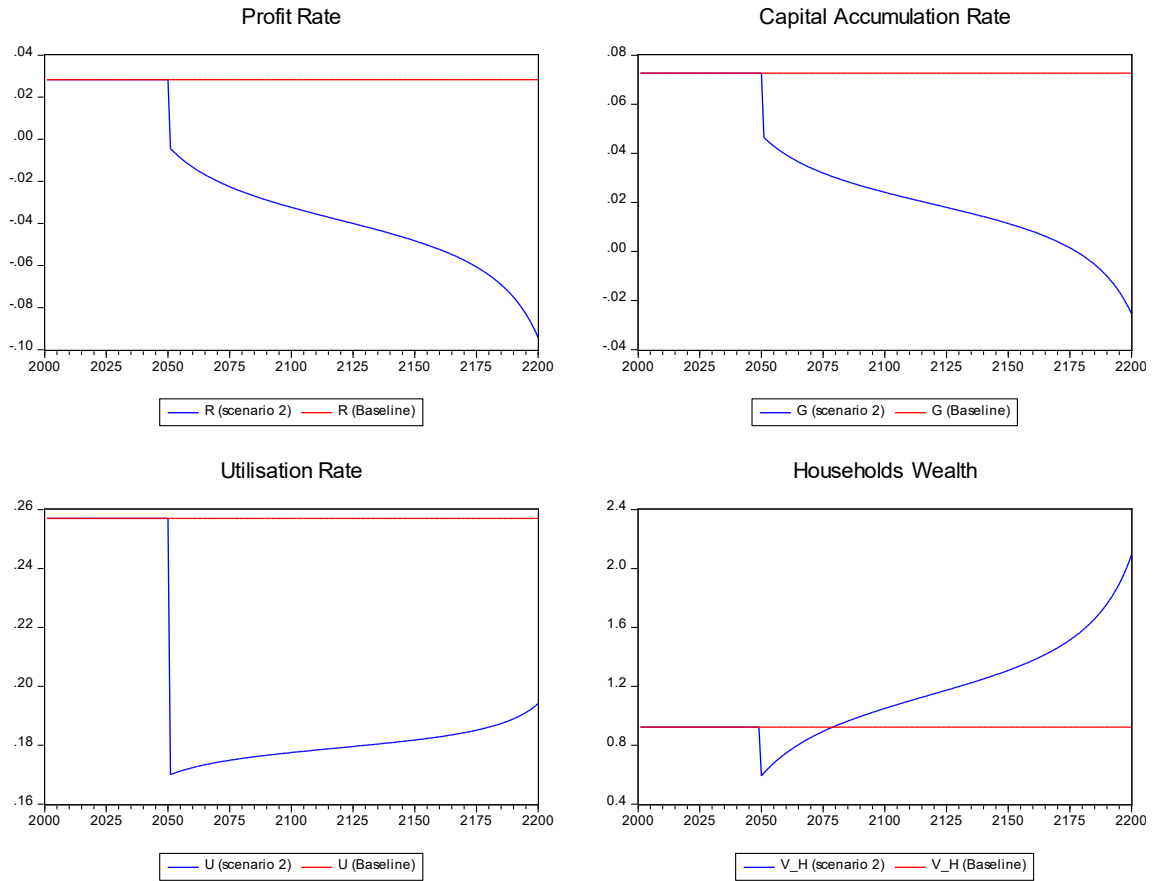


Compared to the previous case, the dynamics are quite the same except for utilization. Within this configuration, the positive interest income effect on consumption overcomes the negative effect on capital accumulation. Firms initially disburse interest payments to households before distributing net profits between retained earnings and payouts. Since households are the recipients of these distributed profits, an elevated interest rate boosts the fraction of gross profits they receive. The higher is the retained profit share, the more effective is the interest rate increment in diverting gross profits to households. If this boost surpasses the adverse effect of debt servicing costs on firms' investment choices, household spending would grow more than investment declines, ultimately resulting in greater capacity utilization overall.

b) Much higher Interest rate

The interest rate increase could drive the economic system into instability when the new level is excessively high. We shock the economy by setting the interest rate from 0.025 to 0.1, four times higher. Figure 3.15 illustrates this case.

Figure 3.15 Impact of a much higher interest rate



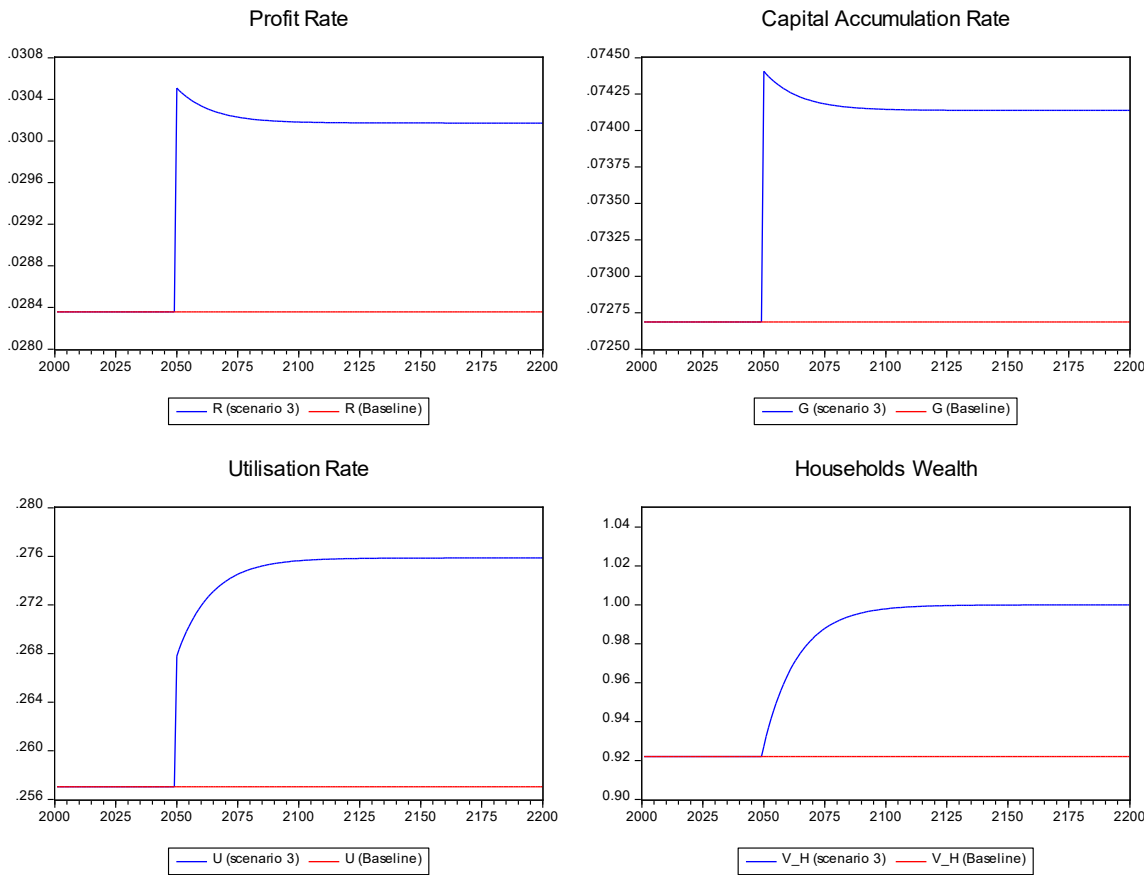
The shock on the interest rate pushes the economy into a vicious circle of rising debt service and diminishing profit rate and capital accumulation. Indeed, the cost of debt is so high that the profit rate turns negative rapidly. Consequently, the desired investment of the capitalists turns negative too, as the firms start to disinvest the productive capital in order to mitigate the new debt emission. However, debt is following an unsustainable path and new debt must be issued not to finance investment (that turned negative) but to pay back the enormous debt service. The higher the debt service the more negative the profit rate and the accumulation rate will be, and the faster debt will be issued. On the other side of the balance sheet, household income would explode too, driven by the interest income perceived on their assets, resulting in growing households' wealth. Parameters are such that $\alpha_1 \theta < \delta$, indeed we see that after an initial drop utilization remains lower than the baseline scenario. Still, we could guess that utilization at a

certain point would turn positive¹⁰³, driven by the explosive dynamic of interest income that drives households' consumption. In the simulation this process will go on until the model crashes or until the wealth dynamic violates its asymptote. In this last case we would observe a dynamic similar to Figure 14. More realistically, at a certain point of this “Ponzi” dynamic, firms will default, leaving no mor space for analytical speculations.

c) No retained profits

What happens if, after some periods, firms decide to redistribute all their profits to households? In this simulation we impose $\theta = 0$ after 50 periods.

Figure 3.16 No more retained profits



Look immediately at Households' wealth, in Figure 3.16: it converges back to $v_h^{ss} = 1$. All the other variables achieve a higher steady state equilibrium. This of course is an expected result as the model in section 2 is just one case of the model here presented.

To conclude, we have seen that overall things do not change that much when adding retained profits. On the one side short run stability improves as, being this model profit-led by

¹⁰³ If $\alpha_1 \theta > \delta$ we would observe that after the initial drop caused by capital losses on wealth accumulation and consumption, utilization will soon turn positive following a much faster dynamic.

construction, retained profits ensure that savings react more than investment after a rise in utilization. On the other side long run stability deteriorates as the model is more exposed to the level of interest rate whose impact could be ambiguous especially on capacity utilization.

3.6 Some final considerations

This chapter has advanced the development of a stock-flow consistent (SFC) post-Keynesian growth model within a closed economy framework, serving as a critical step toward its eventual extension to an open economy context. Beginning with a simple demand-driven model in Section 1, we progressively enriched the framework by incorporating a profit-dependent investment function in Section 2 and retained profits in Section 3. Through this progression, we have employed a discrete-time approach to analyse the multiplicity of equilibria and their stability properties, performing both analytical derivations and numerical simulations.

A key finding across all three sections is the presence of multiple equilibria, a feature inherent to the nonlinear dynamics of the Kaleckian growth framework when developed with stock flow consistency criteria. In Section 1, the basic model with an accelerator-driven investment function exhibits one meaningful steady state at $v_h^{ss} = 1$. The conditions for long-run stability overlap with the condition for short-run (Keynesian) stability, $1 - \delta - \alpha_1$. The long run solutions function however lacked a direct impact of the main financial variable, the interest rate, on the model. Section 2 introduces a more realistic investment function dependent on the profit rate. This time the interest rate matters. Indeed, the stable equilibrium at $v_h^{ss} = 1$ requires both the Keynesian stability condition and an additional constraint on the interest rate. In Appendix A we show that the level of the interest rate could lead to multiple outcomes and dynamics according to multiple thresholds. Still, the only meaningful steady state is $v_h^{ss} = 1$. Therefore, we assume instability when high interest rates lead to different steady states (e.g., Figure 2.2). Section 3 further complicates the picture by adding retained profits: we explicit the nonlinear dynamic of households' wealth, yielding two potential equilibria, equation (3.20), whose existence depends on the eventual intersection between its hyperbolic state equation, and the 45-degree line. Unlike Sections 1 and 2, the existence of equilibria is not guaranteed, and high interest rates can eliminate steady states entirely (e.g., Figure 3.11), leading to explosive dynamics (Figure 3.12).

Comparing the models reveals how simple financial assumptions shape stability outcomes despite the consistent presence of multiple equilibria. In Section 1, the simplicity of the investment function and the absence of retained profits or interest rate effects result in a

robustly stable primary equilibrium, with the second equilibrium typically irrelevant due to its instability or implausibility. Section 2 introduces more complexity via the profit rate, making stability more sensitive to interest rates; while the stable equilibrium persists under moderate conditions, excessive interest rate shocks can destabilize the system. Section 3's inclusion of retained profits enhances short-run stability by reducing the Keynesian multiplier (as savings respond more strongly to demand), but it compromises long-run stability: the stable equilibrium shifts below $v_h = 1$ due to firms' positive net worth, and the system becomes vulnerable to parameter configurations that preclude equilibria or trigger unsustainable debt paths (e.g., Figure 3.15). Simulations across all sections underscore this pattern: multiple equilibria exist, but their stability and economic relevance vary with the model's financial structure.

Concluding, the consistent emergence of multiple equilibria reflects the realism of capturing stock-flow interactions, yet it also underscores the challenge of ensuring stable, economically meaningful outcomes. Section 1 offers simplicity and predictability, Section 2 balances realism with tractability, and Section 3 provides a richer but less certain framework. This progression not only contributes to the Kaleckian growth literature by integrating financial dynamics in a discrete time setting but also sets the stage for an open economy extension. The stability issues identified—particularly the sensitivity to interest rates and the role of retained profits—will be critical as we introduce external debt, trade balances, and exchange rate dynamics, where global interactions may amplify or mitigate these effects.

Appendix A: completing Section 2 stability analysis

In Section 2 we analyzed the stability of the equilibrium $v_h^{ss} = 1$. In Section 3 we added further instruments for the stability analysis of the hyperbolic shape of wealth state equation. In this appendix we can complete the analysis of the model without retained profits, by showing the existence and the condition for stability of the other possible equilibrium.

First, recall the equation through which we could determine the steady state value of wealth:

$$v_h^s = \frac{Av_{h-1} + B}{Cv_{h-1} + D}$$

In absence of retained profits ($\theta = 0$), the elements of the hyperbole become:

$$A = (1 - \alpha_1)(1 - \delta i_{-1}^*) + h\delta(\alpha_2 - 1)$$

$$B = \gamma(1 - \alpha_1)$$

$$C = \delta[h\alpha_2 - i_{-1}^*(1 - \alpha_1)]$$

$$D = -\delta h + (1 + \gamma)(1 - \alpha_1)$$

Note the following properties:

$$A - D = C - B = \delta[h\alpha_2 - i_{-1}^*(1 - \alpha_1)] - \gamma(1 - \alpha_1) \quad (1A)$$

$$A - C = D - B = 1 - \alpha_1 - \delta h \quad (2A)$$

$$A + B = (1 - \alpha_1 - h\delta) + (1 - \alpha_1)(\gamma - \delta i_{-1}^*) + h\delta\alpha_2 \quad (3A)$$

We can now derive the two equilibria. We recall equation (3.20):

$$v_{h1,2}^{ss} = \frac{(A - D) \pm \sqrt{(D - A)^2 + 4BC}}{2C} \quad (3.20)$$

Use the property (1A). We obtain:

$$v_{h_{1,2}}^{ss} = \frac{(C - B) \pm \sqrt{(B - C)^2 + 4BC}}{2C} = \frac{(C - B) \pm \sqrt{(C + B)^2}}{2C}$$

From which we can define the two equilibrium points:

$$v_{h_1}^{ss} = \frac{(C - B) + C + B}{2C} = 1 \quad (4A)$$

$$v_{h_2}^{ss} = \frac{(C - B) - C - B}{2C} = -\frac{B}{C} \quad (5A)$$

Note that in this case, when $\theta = 0$, we are always certain that at least one equilibrium point exists. Indeed:

$$\Delta = (D - A)^2 + 4BC = (C - B)^2 + 4BC = (C + B)^2 \geq 0$$

The hyperbole always intersects the 45-degree line at least in one point. Still, we must understand what the stability conditions of these equilibriums are. While from the main text we already know the stability conditions for (4A), here we study the stability of (5A).

We recall the following stability conditions:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right|_{v_h=v_{h-1}=v_{h_{1,2}}^{ss}} = \left| \frac{A}{Cv_h^{ss} + D} - \frac{CAv_h^{ss} + CB}{(Cv_h^{ss} + D)^2} \right| < 1$$

We substitute $v_h^{ss} = -B/C$:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right|_{v_h=v_{h-1}=v_{h_{1,2}}^{ss}} = \left| \frac{A}{D - B} - \frac{B(C - A)}{(D - B)^2} \right| < 1$$

By using the property $C - A = -(D - B)$ we can simplify it to:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right|_{v_h=v_{h-1}=v_{h_{1,2}}^{ss}} = \left| \frac{A + B}{D - B} \right| < 1$$

Finally, if we substitute properties (3A) and (2A) we obtain:

$$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right|_{v_h=v_{h-1}=v_{h,2}^{ss}} = \left| 1 + \frac{(1-\alpha_1)(\gamma - \delta i_{-1}^*) + h\delta\alpha_2}{(1-\alpha_1-h\delta)} \right| < 1 \quad (5A)$$

We can derive once again an interest rate rule for stability:

$$i^* > \frac{h\alpha_2}{1-\alpha_1} + \frac{\gamma}{\delta} \quad (6A)$$

This is the specular rule to the condition (2.7), the condition that ensures stability of $v_h^{ss} = 1$, as it must be. Note however that, assuming a positive interest rate, (6a) is not sufficient for $v_h^{ss} = -B/C$ to be a stable equilibrium. In Table 1A we show all the cases assuming a positive interest rate. Note that the only economically meaningful equilibrium is the first case where $0 < i^* < \frac{h\delta\alpha_2}{1-\alpha_1} + \frac{\gamma}{\delta}$ and $v_h^{ss} = 1$. For completeness we present the other cases.

Table 1A: Interest rate thresholds for local stability

Level of the Interest Rate	Stable equilibrium and type of convergence path	Value of derivative in $v_h^{ss} = 1$	Value of derivative in $v_h^{ss} = -B/C$
$i^* < \frac{h\alpha_2}{1-\alpha_1} + \frac{\gamma}{\delta}$	$v_h^{ss} = 1$ monotonic convergence	$0 < \left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=1} < 1$	$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=-\frac{B}{C}} > 1$
$\frac{h\alpha_2}{1-\alpha_1} + \frac{\gamma}{\delta} < i^*$ $< \frac{(1-\alpha_1-\delta h) + \delta\alpha_2 h}{\delta(1-\alpha_1)} + \frac{\gamma}{\delta}$	$v_h^{ss} = -\frac{B}{C}$ monotonic convergence	$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=1} > 1$	$0 < \left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=-\frac{B}{C}} < 1$
$\frac{(1-\alpha_1-\delta h) + \delta\alpha_2 h}{\delta(1-\alpha_1)} + \frac{\gamma}{\delta} < i^*$ $< \frac{2(1-\alpha_1-\delta h) + \delta\alpha_2 h}{\delta(1-\alpha_1)} + \frac{\gamma}{\delta}$	$v_h^{ss} = -\frac{B}{C}$ damped oscillations	$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=1} < -1$	$-1 < \left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=-\frac{B}{C}} < 0$
$i^* > \frac{2(1-\alpha_1-\delta h) + \delta\alpha_2 h}{\delta(1-\alpha_1)} + \frac{\gamma}{\delta}$	$v_h^{ss} = 1$ damped oscillations	$-1 < \left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=1} < 0$	$\left. \frac{\partial v_h^s}{\partial v_{h-1}} \right _{v_h^{ss}=-\frac{B}{C}} < -1$

4 Salient features of post-Keynesian open economy theory and a model of a BoP crisis

Abstract: this final chapter is divided into two distinct sections. In the first part we present and survey the main features that characterize the post-Keynesian theory of the open economy and how they differ from the mainstream approach. In particular we are interested in the macroeconomic closures for each exchange rate regime. First, we discuss how the compensation thesis operates under a fixed exchange rate regime. Second, we present some PK theories of exchange rate determinations, opposed to the orthodox workhorse models. Third, we illustrate the critique of Taylor (2004) on the impossibility of the determination of the exchange rate through the BoP equation and how it can be conciliated with the closure of the OPENFLEX model developed by Godley and Lavoie (2007). The first part is necessary to better understand some modelling choices taken in the second part of this chapter, where we develop, starting from the closed economy model of Chapter 3, an open economy variant. Our open economy model, despite the simple framework, let us simulate balance of payments crises arising from extreme capital flights or foreign interest rate hikes. The primary source of instability lies in foreign currency-denominated debt, which is vulnerable to balance sheet effects from exchange rate depreciation and an interest rate that incorporates a risk premium over the international currency's foreign interest rate. These dynamics underscore the fragility of small, indebted economies and provide a robust theoretical basis for analysing external debt sustainability within a post-Keynesian stock-flow consistent framework.

1 Salient features of PK open economy Theory

The post-Keynesian perspective of an open economy remains elusive, with no unified definition due to the diverse phenomena and perspectives it encompasses, and, especially, because of the absence of a proper workhorse model as the Mundell-Fleming for the mainstreams. Despite this lack of general consensus, post-Keynesian theory provides a distinctive framework that fundamentally diverges from mainstream economic approaches, particularly in its analysis of balance of payments (BoP) flows through the lenses of endogenous money theory.

1.1 Price specie Flow vs Compensation

A central tenet of PK theory is the rejection of automatic stabilizers for trade unbalances; a concept deeply embedded in mainstream economics. Mainstream frameworks under fixed exchange rate regimes assume that trade imbalances are self-correcting through specific mechanisms. In the period of the Gold Standard the main stabilizer mechanism was the so called “price-specie flow”, as theorized by Hume in the 18th century: a trade deficit would lead to a loss of gold reserves, triggering price deflation. Lower prices would enhance trade competitiveness, increasing demand for exports. This process would continue until exports are sufficiently high to restore the trade balance.

Similar is the mechanism in the Mundell-Fleming model in case of a fixed exchange rate: a trade deficit and a loss of foreign reserve imply a reduction in the monetary base (that is the liability counterpart of reserves within the balance sheet of a central bank). Lower monetary base entails a higher interest rate that would slow down the economy reducing also demand for imports, until the trade balance is restored.

In PK theory there isn't such a theory: external deficits can persist as there aren't automatic stabilizers. In particular, within a fixed exchange rate regime, money supply is of a different kind of endogeneity compared to mainstream views.

According to Lavoie (2022) in the mainstream view of open economy money has a “supply side” explanation for its endogeneity as money supply depends on foreign reserves accumulation due to trade surpluses. In the post-Keynesian view, money has always a “demand side” endogeneity. The central bank controls the interest rate by acting as lender of last resort: money supply is always equal to the money demanded by economic agents for the various reasons agents wish

to hold money described by Keynes in the General Theory. This is guaranteed also in the open economy by the so-called Compensation principle.

According to the Compensation principle (Lavoie 2022), forex reserve flows are sterilized or automatically compensated by an equivalent change in asset-liability structure of the central bank, without the need to change the interest rate or the money supply, that remain respectively exogenous and endogenous. This happens not necessarily through a deliberate action of the CB (active or endogenous sterilization) but rather, as already noted by Nurske (1944) back in the WWII days, through the behavior of economic agents to which the central bank passively reacts,.

To better understand this mechanism let's give a look at the balance sheet of a hypothetical central bank. Usually, mainstream open economy monetary models present a balance sheet structure as the one in Table 1.1.

Table 1.1 Basic balance sheet of a central bank

Assets	Liabilities
Foreign Reserves/foreign government bonds	Domestic currency in circulation
Domestic government bonds	Banks Reserves

Table 1.1 shows the central bank's balance sheet of an "asset based" financial system where commercial banks obtain banks reserves at the central bank in exchange of government securities. Even if to some extent this could be the case of the Anglo-Saxon monetary systems (Lavoie 2022), this scheme is still far from being a realistic depiction, as there is a one-to-one relation between the assets of the central bank and the monetary base (currency in circulation + banks reserves)

In the context of Table 1.1, and assuming a fixed exchange rate regime, any trade deficit would deplete the foreign reserves stocks. According to the mainstream models, any change in the stock of foreign reserves must be matched by a change in the monetary base¹⁰⁴ in order to

¹⁰⁴ Assume a stylized model where the banking system (commercial+ central bank) is consolidated. Agents need foreign currency cash, say to pay a net trade balance deficit (excessive imports). They exchange domestic currency for foreign currency at the central bank. On one side the domestic currency in circulation, once retired by the CB, gets "destroyed". On the other side, the central bank depletes its foreign reserve stock.

preserve the one-to-one relations between assets and liabilities. This of course would trigger the automatic stabilizers we previously described. An alternative, described by mainstreams too as it is a possible closure of the Mundell-Fleming model, is that the central bank engages in an active “sterilization” by purchasing domestic government such that the monetary base remains unchanged. However, orthodoxy usually argues that sterilization cannot be pursued for very long or is ineffective because various assumptions. Among the various arguments, the main one is related to perfect asset substitutability (Obstfeld and Rogoff 1995). Indeed, perfect asset substitutability would prevent any sterilization activity from working as capital flows would keep on going until asset returns are equalized (according to interest parity), thus the central bank won’t be able to maintain its desired policy rate fixed and the money supply unchanged.

On the contrary, post-Keynesian believes in imperfect asset substitutability and in the irrelevance of the interest parity relationships (as we will see in the next chapter). Thus, in the case of imperfect asset substitutability, sterilized interventions are possible and will have some effect in maintaining fixed the money supply. Also, monetary policy will remain independent from the exchange rate determination. Not only do post-Keynesian believe in the efficacy of sterilization but also assume it’s an automatic mechanism rather than a discretionary action of the central bank. While mainstream considers sterilization as “exogenous” or discretionary, post-Keynesian theorized an endogenous mechanism based on the interest targeting behavior of the central bank. To further elaborate this argument, following Lavoie (2022), we illustrate a more realistic central bank balance sheet that is less stylized than the one presented in Table 1.1.

Table 1.2 A more realistic Central Bank’s balance sheet

Assets	Liabilities
Foreign Reserves/foreign government bonds	Domestic currency in circulation
Domestic government bonds	Banks Reserves
Claims on domestic banks	Government Deposits
	Central Bank Bonds
	Equity Capital

Table 1.2 shows a more realistic balance sheet where multiple assets and liabilities open up to various ways to conduct a sterilization intervention, compared to the limited case of Table 1.1 (the main used in mainstream models) where sterilization is just a matter of changes in domestic government bonds held by the central bank¹⁰⁵. But first we must explain the new components.

On the asset side, loans to domestic private banks are the key addition. In most monetary frameworks, central banks extend credit to private banks. These commercial banks are inherently indebted to the central bank and will seek to reduce this debt whenever possible, such as during foreign currency inflows. These monetary systems are 'overdraft' systems, allowing private banks to access a form of overdraft by drawing on a credit line at the central bank, provided they present suitable collateral. On the liability side of the central bank's balance sheet, three additional components are included. Beyond the central bank's equity capital, there are central bank bonds and government deposits. A central bank can freely shift government deposits between its own account and those held by government entities at various private banks. Additionally, in several (developing) countries, central banks issue their own securities, known as central bank bills or bonds, as domestic financial markets often view these securities as less risky than government securities.

An increase in foreign reserves can thus be compensated– in three additional ways: by reducing loans to domestic banks or claims on the central government; or by increasing government deposits at the central bank and the outstanding volume of central bank-issued securities. These extra entries in the central bank's balance sheet complicate the direct link between the central bank's asset size and the monetary base. The core idea of the compensation approach is that, in an external surplus scenario, when commercial banks gain extra reserves after selling newly acquired foreign currency to the central bank, they will strive to eliminate these surplus reserves. Since banks do not rely on additional reserves to issue new loans to creditworthy borrowers, they have already extended all possible loans to such borrowers when foreign currency accumulates in their accounts. Thus, banks will typically act to shed these excess

¹⁰⁵ The bias toward government bonds as the main asset instrument for sterilization, led mainstream economists to develop arguments against the efficacy of sterilization based also on the Ricardian Equivalence or in general on agents' behavior with respect to government deficit (Calvo 1991; Obstfeld and Rogoff 1995). On this topic we share the perplexity of Dominguez and Frenkel (1990): *"It is not clear that the creation of a Money Market Deposit Account - which is part of M2- but is the liability of a privately-owned financial institution rather than of the government - should have a fully proportionate effect on the exchange rate, while the issue of a Treasury Bill has no effect."*

reserves, either by paying down loans from the central bank or by investing in low-risk assets, such as government securities or central bank bonds, due to the opportunity cost of holding reserves at zero or low interest rates. This reflects a deliberate choice by banks, with central banks passively observing a decrease in their claims on domestic banks.

Note that the same “passivity” of the central bank could be observed in the case of sterilisation through government bonds. Nurske (1944) reported that in the case of an inflow of gold and foreign exchange, foreign investors would purchase new government securities independently from any central bank initiative. This would allow the government to reduce its debt to the central bank, as would be the case in an open- market operation. Alternatively, Nurske pointed out that gold inflows could also be neutralized by an increase in government deposits held at the central bank, as the Bank of Canada does nowadays (BoC 2004).

To conclude, through the compensation principle, balance- of- payments disequilibria have no effect on the overall monetary base or money supply. Money aggregates are still determined by demand- led factors. The only difference is that these foreign-induced disequilibria will change the composition of the balance sheet of the central bank. This mechanism is confirmed by studies on the gold standard period, between 1880–1913 and 1922–38. Bloomfield (1959) shows that when looking at year to-year changes in the period before the First World War– the heyday of the gold standard– the foreign assets and the domestic assets of central banks moved in opposite directions 60% of the time. Foreign assets and domestic assets moved in the same directions only 34% of the time for the eleven central banks under consideration. Almost identical results were obtained in the case of the 1922–38 period. Nurkse (1944) shows that the foreign assets and the domestic assets of twenty-six central banks moved in opposite direction in 60% of the years under consideration, and that they moved in the same directions only 32% of the time.

1.2 Interest rate parity

A consequence of the compensation theory is that central banks are able to maintain exogenous their desired interest rate level even within fixed exchange rate regimes (so breaking the famous trilemma by Obstfeld et al, 2005). One of the mainstream objections is that if interest parity conditions should hold, central banks, in order to defend the fixed exchange rate, should set the interest rate such that any capital outflows would be prevented, thus losing control over their main instrument. Two main conditions: uncovered interest parity (UIP) and covered interest parity (CIP). Uncovered interest parity involves investors seeking arbitrage in forex markets,

betting on expected exchange rate changes, while covered interest parity involves agents hedging against currency risk using forward contracts to lock in the exchange rates that will be considered in the final transactions.

We could derive the UIP with the following reasoning. Assume we buy foreign assets whose value in foreign currency is F , bearing an interest i^* , while our expectations about the future exchange rate (or future spot rate) is E_e . Our expected return is:

$$r_f^e = \frac{i^* F E_e + F(E_e - E)}{F E}$$

$$r_f^e = \frac{(1 + i^*) F E_e}{F E} - 1 = (1 + i^*) \frac{E_e}{E} - 1$$

To ensure no arbitrage (and avoid capital flows toward the most profitable asset) the domestic interest rate i must be set such that:

$$i = (1 + i^*) \frac{E_e}{E} - 1$$

Within mainstream models, UIP is always ensured as arbitrage opportunities and market expectations drive the exchange rate toward its equilibrium value. Investors, seeking higher returns, move capitals to currencies with higher interest rates, increasing demand for that currency and appreciating its spot exchange rate. Over time, rational expectations align expected future exchange rates with interest rate differentials, as any Investors adjust their portfolios based on expected returns, incorporating interest rate differences and anticipated exchange rate changes. If UIP doesn't hold, arbitrageurs exploit misalignments, buying the higher-yielding currency and selling the lower-yielding one, driving exchange rates toward the equilibrium where expected returns equalize across currencies, assuming no risk premiums or frictions. Persistent deviations are corrected as expectations converge to actual outcomes in efficient markets over the long run.

Now think about the forward market, where hedgers stipulate contracts. To cover the exchange risk, one could sign a forward contract with a bank. According to the “cambist” view the banks set their forward rate to cover from eventual losses when doing the opposite transaction to let

the customer purchase foreign currency. Indeed, the forward exchange rate is set by banks with the following formula:

$$f = e + i - i^*$$

Where f and e are respectively the forward and the spot exchange rate in logarithmic terms. This is the Covered Interest Parity and, according to the cambist view (Coulbois and Prissert 1974, 1976; Lavoie 2022) this relation has empirical foundation as the CIP condition arises from hedging behavior of banks, and not from arbitrage of arbitrageurs. If $f = e_e$ is true, the unbiased efficiency hypothesis (UEH) holds and the UIP and CIP are equivalent. However, the forward rate, as demonstrated in numerous empirical tests (Moosa 2004), hardly ever predicts the future spot rate. UEH could be true only by admitting a risk premium:

$$E_{t+1} = F + \sigma$$

If this identity is true, then UIP would differ from CIP due to the risk premium. In general, there are various arguments on why the UIP does not hold in the real financial markets. First, CIP, as already mentioned, holds not as a relation to which the economy automatically converges but rather as a rule that helps banks to hedge against the currency risk in the forward market. The forward exchange rate is not an expectational variable; it is instead the result of a simple arithmetical operation. Except when they themselves speculate by carrying open- exchange positions, banks do not make money on any intrinsic interest differential; rather they make a profit by setting a small profit margin between the selling and the buying price, which they quote to their customers on the forward exchange market.

Second, the failure of UIP may result from risk premia. We know however that perfect capital mobility differs from perfect asset substitutability. Indeed, in its open-economy version, the Tobin-Godley approach to portfolio choice creates rates-of-return differentials, even among no-risk Treasury bills of various countries, because asset-holders avoid concentrating all investments in one place. As Lavoie (2022) says, “*holders will not want to put all their eggs in the same basket*”. An interest differential won’t cause infinite, unending capital flows. Portfolios adjust, then remain stable, leaving interest gaps unchanged. Moreover, unlike closed economies, open economies include an extra factor affecting expected asset returns—expectations of future exchange rates. The proportions of assets held shift accordingly, but this occurs without altering

interest rates controlled by monetary authorities, provided they are committed to maintaining current rates. Thus, with imperfect asset substitutability, UIP doesn't hold. In other words, the uncovered interest parity theorem holds only in a world with perfect asset substitutability, free of currency risk, credit risk, or fundamental uncertainty. Uncovered interest parity fails because uncovered positions involve currency risk. Arbitrageurs exploiting divergent expected returns on safe assets can do so only by accepting exchange risks. As pointed out by Lavoie (2022), this conclusion is inescapable.

Uncovered interest parity rose to prominence via economists promoting models with a single interest-earning asset (the monetary approach to balance of payments). But how is uncovered interest parity interpreted in a world with multiple income-earning assets, like equities? Low real interest rates can drive high growth; thus, high equity returns. Bibow (2002) suggests the European Central Bank's (ECB) 1999–2000 rate hikes, aimed at halting euro depreciation against the dollar, produced opposite effects. The euro fell with each rate increase because, according to Bibow, markets prioritized growth prospects over inflation-adjusted money market rates. Presumably, global financial operators were drawn to fast-growing economies offering potential for high equity returns. Rising rates weakened growth outlooks. During that period, if uncovered interest parity held any validity, it related to equity returns rather than short-term asset yields. This suggests the covered interest parity theorem and uncovered interest parity theorem address different assets and returns. They aren't comparable.

Through the compensation principle, balance-of-payments disequilibria don't impact the overall monetary base or money supply, even under fixed exchange rates. Money aggregates remain driven by demand-led factors. The only change is that foreign-induced disequilibria alter the central bank's balance sheet composition. Additionally, in an open economy, the central bank can choose domestic interest rates aligned with its assigned economic goals, one being the foreign exchange rate. Just as there was no need for the bank rate to match the natural rate in a closed economy, there's no requirement for domestic interest rates to align with rates elsewhere globally. This stems from the uncovered interest parity theorem, unlike the covered interest parity relation, being unable to hold, either theoretically or practically.

1.3 Exchange rate determination in mainstream models and a PK alternative

According to the mainstream view, variations in interest rates, and hence portfolio decisions, will be the major determinant of exchange rates in the short term, while trade balances and

current account balances will determine exchange rates in the medium term. The relative purchasing power parity will be the main determinant in the (very) long term. There are thus different ‘fundamentals’, depending on the time period considered.

The PK author who wrote more extensively on this topic is JT Harvey (2007, 2019, 2025), whose work focused mainly on studying the role of financial flows and investors’ expectations on the determination of the exchange rate. In particular he wanted to delineate an alternative framework to the workhorse models of mainstream economics: the monetary model and the Dornbush model.

Monetary model or Neoclassical model

The monetary model is based on the Power Purchase Parity (PPP) condition and on the Quantity Theory of Money (QTM).

We already know that PPP requires that:

$$E = P/P^*$$

While the QTM:

$$MV = PY$$

Where the “velocity” of money is assumed to be fixed, $V = \bar{V}$. Also, GDP is exogenous $Y = \bar{Y}$ as it is determined, in the long run by exogenous factors affecting its natural level. If we consider Home and Foreign country, we can write:

$$E_h = \left(\frac{M_h V_h}{Y_h} \right) / \left(\frac{M_f V_f}{Y_f} \right)$$

Assume that the home country with balanced trade ($X = M$) implements an expansionary fiscal policy, financed through monetization (ΔM_h). In a neoclassical word, as shown by the QTM, this would induce a price adjustment due to full employment, such that $\Delta P_h = \Delta M_h$. In an open economy, higher prices mean that exports are more expensive, pushing the economy toward a trade deficit. Agents now are selling home currency to buy foreign currencies of countries whose goods are cheaper. The home currency depreciates preserving PPP and bringing back

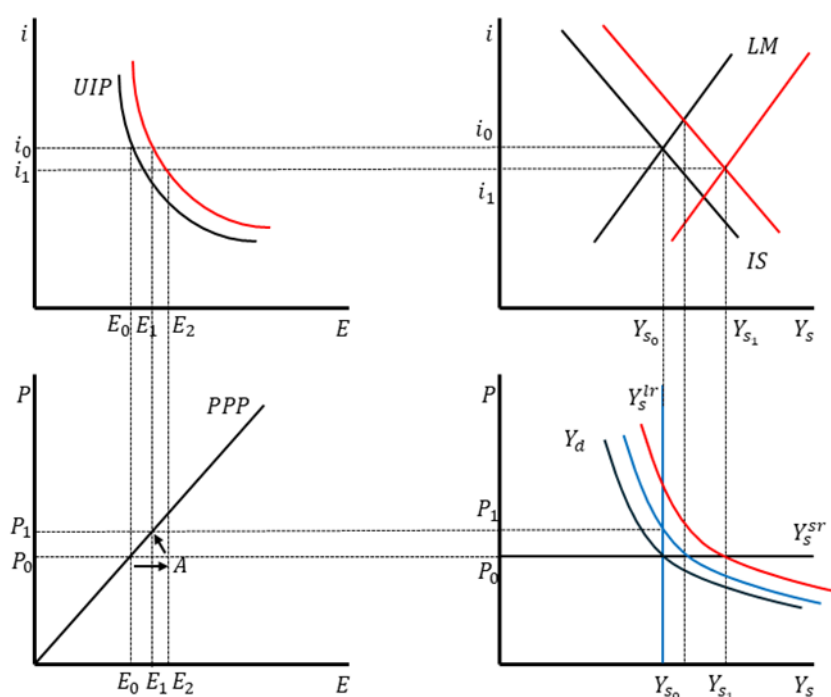
exports such that the trade is balanced again. The overall result of the fiscal policy is higher prices, a depreciated exchange rate and higher interest rates.

Dornbush Model

Dornbush (1976) attempted to modify the Monetary model by including two empirical facts: trade imbalances (in the short run) and currency volatility. The very innovation compared to the monetary model is currency volatility. The main mechanism relies on short run sticky prices, letting the interest rate and the financial markets adjust more quickly to money supply changes. Exchange rate volatility is caused by overshooting in the short run.

Dornbush model requires PPP, UIP, the IS-LM curves and aggregate supply and demand curves to explain the whole mechanism. We represent the whole system with the help of four quadrants in Figure 1.1, each representing one economic relation.

Figure 1.1 Higher money supply in the Dornbush Model



The financial sector behavior is dictated by the UIP relation that always holds, while PPP is a long run relation from which the economy can temporarily deviate. Price stickiness is represented by two different curves for aggregate supply. In short run there could be temporary deviations from the full-employment level and Y_s^{sr} is horizontal, assuming short run quantity

adjustments. In long run Y_s^{lr} becomes vertical as prices adjustments ensure that the system is maintained at its output potential.

Short Run: Imagine an increase in the nominal money supply. Investors immediately expect a nominal depreciation. Since the interest rate is determined in the IS-LM, that in this micro period is assumed to remain unchanged, the UIP relation is ensured by an immediate depreciation of the exchange rate. In the north-west quadrant indeed, we observe that the UIP relation shifts due to expectations, toward right (the new curves's position is always represented in red). Given the interest rate is temporarily unchanged, the new level of the exchange rate is E_1 .

At the end of the micro-period, we observe some shifts on the IS-LM quadrant: a rise in money supply and sticky prices imply a rise in real money supply M/P (LM shifts toward right). At the same time the depreciated currency improves the aggregate supply due to rising net exports (IS shifts toward right). Overall, in the short run it will be observed a higher level of aggregate supply at Y_{s1} . The impact on the interest rate is ambiguous as it depends on which curve moves further toward right. Assuming that the financial sector reacts faster, the LM moves further and thus the interest rate decreases to i_1 .

Here is the “overshooting”: the exchange rate has moved already due to expectations of the markets, but now it is moving again (a further depreciation) due to capital flights induced by an even lower interest rate. This would not have happened if the prices hadn't been sticky. Otherwise, the real money supply would have been unchanged, so would the real exchange rate.

In the PPP quadrant (south-west), given the price stickiness, there is a temporary deviation (point A) due to depreciation that led to a trade surplus (here is the temporary trade imbalances), responsible for the shift of the IS curve. To end the short run explanation, the short run real output in the IS-LM should be matched in the Y_s, Y_d apparatus. This is guaranteed by a shift of the Y_d curve (the red curve), whose movement can be explained by the fact that a trade surplus brings more liquidity to the economy, resulting in higher demand. Aggregate supply temporarily accommodates the increased demand.

Long Run: Over the long term, prices become fully flexible as wage stickiness diminishes (potentially due to increased worker bargaining power driving wage growth), leading to higher inflation. Consequently, Y_s reverts to its prior full-employment level, shifting the IS curve back to its original position. The real money supply (M/P) returns to its initial value, and within the

IS-LM framework, the interest rate is restored to its starting point as both IS and LM are restored to their initial level (the black curves).

On the UIP side, the higher interest rate induces capital inflows and thus provokes an appreciation that drives the exchange rate back to the value that was expected from the beginning by investors (thus still a higher level than the initial one at the baseline, but a lower level compared to the one obtained due to the overshooting), at E_1 . This appreciation happens along the new red UIP line. Moreover, as we can see in the south-west quadrant, this long-term level of the exchange rate guarantees that the PPP is verified (the system now finds itself at the P_1, E_1 coordinates), thus rebalancing the trade deficit.

Finally, in the Y_s, Y_d side, Y_s turns vertical, while Y_d reduces, shifting toward left, as the inflows of liquidity from the trade surplus are ended. The position of the long-run demand curve is now denoted by the blue line

Overall, the long-term equilibrium is characterized by higher prices, a higher exchange rate, but no impact on the real economy. This is the same outcome as the monetary model: what changes is the adjustment process that is much more complex, comprehensive of two empirical facts, exchange rate volatility and trade imbalances.

Note that investors have expectations, but while in PK theory their expectations can have an impact on foreign currency prices, in this case investors' beliefs have the duty of enforcing the main mechanism that ensures full employment and a balanced trade: the PPP. So, rather than having particular beliefs, agents and their expectations are instrumental to ensure the validity of a workhorse mechanism of neoclassical open economy models, with no real impact on the exchange rate.

A Keynesian model of Exchange rate determination.

Harvey (2007), similar to Dornbush, illustrates with the help of a four-quadrant scheme a simple model of exchange rate determination based on post-Keynesian theory. We represent it in Figure 1.2. It's immediate to note many differences between the two approaches.

Let's start with the PPP relation, in the south-north quadrant. In Dornbush PPP is assumed to be a binding long run outcome. In Harvey's model such a relation does not necessarily hold, neither in the short nor in the long run. Also, PPP is not an attractor equilibrium but just an eventuality. Thus, it is better to define the locus of the points on which domestic prices and the

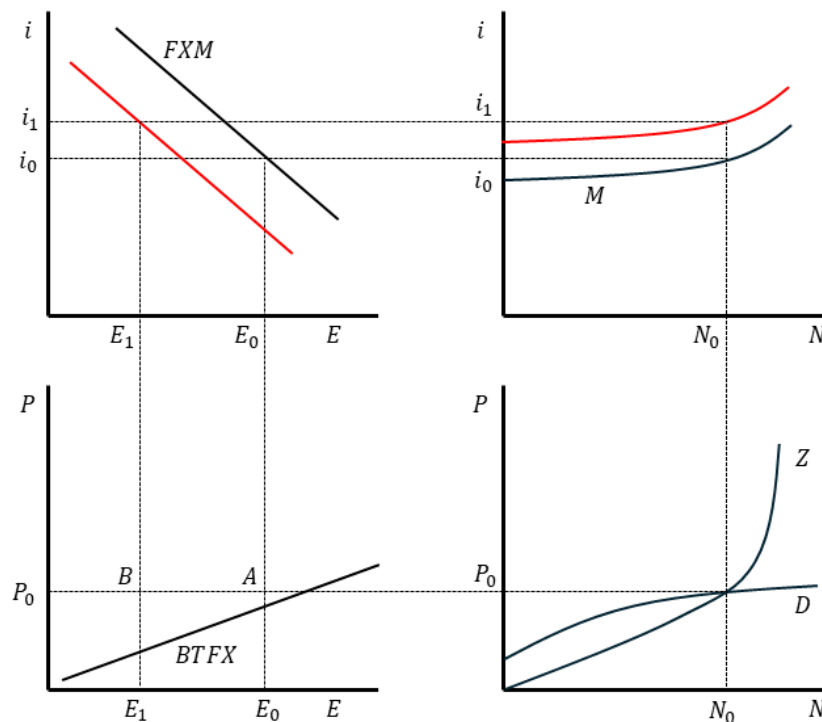
nominal exchange rate are such that they guarantee a real exchange rate that ensure balanced trade.

Assume that the net exports are a function of the exchange rate, and that we know that it exists a value of the real exchange rate Q^* such that net exports are zero (balanced trade). Therefore, we can define the locus of balanced trade (Harvey calls it BTFX) in the P, E quadrant:

$$P = \frac{P_f}{Q^*} E$$

In contrast to PPP, any deviation from this locus, say higher domestic prices, would result in a persistent unbalanced trade: there is no mechanism that guarantees that the economy converges back to PPP. For this reason, in the further example the economy will start from the equilibrium point A that entails a permanent trade deficit (as in the case of the US).

Figure 1.2 Harvey's model of exchange rate determination



Furthermore, as we have seen in the previous paragraph, there is no more space for UIP conditions. Yet Harvey introduces a very similar concept: the exchange rate is determined by portfolio capital flows and expectations about asset returns:

$$e = f(i, i^*, E^e)$$

As we'll better explain in the next paragraph, this does not mean that interest parity, as conceived by UIP, holds, it's a different mechanism that is based on investors' belief and expectations rather than on arbitrage conditions. The main difference is that incomplete confidence could favor one asset or another, independently of its actual risk.

A rise in the domestic interest rate (a discretionary choice of the central bank) induces capital inflows and thus the exchange rate appreciates ($\downarrow$). The opposite happens if the foreign interest depreciates ($\uparrow$), inducing capital outflows. Expected depreciations of the exchange rate make depreciate the currency as investors start to buy the currency they expect to appreciate. This relation is represented in the north-west quadrant by the curve FXM.

Finally, the remaining quadrants are the money market in the north-east quadrant, where money supply is endogenous and accommodates to money demand¹⁰⁶, and the typical Keynesian Z-D diagram (south-east quadrant) that determines the level of activity of the economy through aggregate demand. In both quadrants Harvey uses the level of employment N as a proxy for economic activity. Note that within this post-Keynesian framework, the economy does not automatically converge to full employment. Full employment is not an attractor equilibrium but rather a potential outcome achievable through targeted policies, such as appropriately designed expansionary fiscal measures. These policies can stimulate aggregate demand and increase employment, aligning the economy closer to its full potential.

Now, the basic open economy principle of this framework is that any expansionary policy will have a real impact and would push the trade balance out of the equilibrium, until other policies are implemented to restore balanced trade. In this framework indeed, automatic stabilizers are not working. The second main feature is that expectations about an eventual depreciation would result in the depreciation of the same currency (self-fulfilling prophecy), that would push the economy out of balanced trade with real side impacts.

Harvey uses this framework to explain the impact of the introduction of the Euro (1999-2001) on the American economy. He wants to capture one particular feature of that period: a 25% appreciation of the Dollar against the Euro. Harvey highlights two main causes: a rise of the

¹⁰⁶ Horizontalists believes that money supply is completely flat in the i, N plane as the CB acts as lender of last resorts to maintain its control on the interest rate. Harvey makes a less extreme assumption as for high level of activity the interest rate is increasing.

American interest rate, resulting in a positive differential with the European interest rate; the expectation that the United States would experience faster GDP growth than its European trading partners. The first cause can be represented by a vertical shift of the M curve, while the second cause is represented by a shift to the left of the FXM curve as high US growth expectations can be translated into Dollar appreciation expectations. What resulted was a strong appreciation of the dollar (from E_0 to E_1) that pushed its trade balance into a deeper deficit, from point A to B

The general conclusion of this model by Harvey is that, while mainstream models fall out of reality because of the constraints imposed by their same theories of full employment and rational expectations, the PK approach is more helpful for explaining actual investors behavior, persistent trade imbalances and exchange rate volatility in the light of a modern monetary theory based on endogenous money supply.

1.4 Capital Flows

We have shown that Harvey (2007) based his PK model on an exchange rate determination function that depends on interests and depreciation expectations. We further elaborate on why this theory is slightly different from interest parity's mechanics.

In a further paper Harvey (2019) elaborates a more complex explanation on how capital flows could impact on exchange rate determination. Following Kaltenbrunner (2015) and Andrade and Prates (2013), that both elaborated their theory along the lines of Keynes (1936), he considers the expected rate of returns on the assets of two different countries:

$$r_h = q_h - c_h + l_h$$

$$r_f = q_f - c_f + l_f + a_f$$

Where q is the output generated by holding the asset (generally the interest rate), c is the cost of holding the asset, l is the security of holding the asset¹⁰⁷, while a is the expected value change of one asset with respect to the other (in case of currencies, it's the expected depreciation/appreciation). Generally, these rates tend to equalize because of a variation in a .

¹⁰⁷ Also, this term can be considered the liquidity premium. Starting from this element it arises a vast PK literature on currency hierarchies see for example De Paula et al. 2017

Hence, we can expect most currency-price fluctuations—particularly in the developed world—to be the result of shifting sentiment and expectations, captured by a .

According to Harvey (2019), over the long term, the domestic interest rate r_h should converge toward the foreign interest rate r_f through a mechanism similar to Uncovered Interest Parity (UIP). Capital moves to the country offering higher returns, inducing currency depreciation. However, this convergence is merely a tendency, occurring in an environment of imperfect confidence. Consequently, the dynamic can operate in both directions, not solely toward the riskier currency as UIP suggests, where deviations are attributed mainly to risk. This is due to errors in forecasting precise returns. Empirically, higher interest rates are shown to generate greater returns. Still, unbalanced trade and equalized rate of returns can coexist. Indeed, according to Harvey, trade is mostly (90%) financed by endogenous money creation, i.e. capital flows that do not compete with speculative flows. In particular Harvey differentiates the capital flows between trade financing and speculative financing.

Imports (exports) are always matched by a financing inflow (outflow) (generally borrowing/lending in foreign/domestic currency). Assuming away interest payments and transfers, we can write:

$$X = K_{out}^t$$

$$M = K_{in}^t$$

Such that, in the absence of speculative flows, we have the following BoP equilibrium:

$$CA + KA^t = X - M + K_{in}^t - K_{out}^t = 0$$

Now, let's include also speculative flows, and assume that $CA < 0$.

$$CA + KA^{ts} = X - M + K_{in}^t - K_{out}^t + K_{in}^s - K_{out}^s = 0$$

If we follow Harvey and assume that all trade is financed endogenously, since $BoP=0$ must be always true, it must hold also the following identity:

$$K_{in}^s = K_{out}^s$$

While net trade financing flows can be positive (to finance a CA deficit), net speculative flows must always sum to zero. This happens due to the tendency of returns to equalize. One important caveat: because trade finance occurs via endogenous money creation, it does not directly affect the speculative capital market nor the exchange rate that is set there. This happens because it does not compete with the participants in that market. Hence, trade-financing capital flows do not push the speculative capital market into disequilibrium by putting pressure on the flexible exchange rate (that would make change the denominator of a). As we will see this view could be opposed to Lavoie's (2022).

Harvey, even if skeptical due to actual data (90% of the transactions in the forex markets are due to speculation and 90% of the trade financing flows are endogenous, only the remaining 10% compete in the forex markets), proposes a scenario where not all trade flows are financed endogenously. Assume that the domestic current account deficit does not receive enough endogenously created finances:

$$X - M + K_{in}^t - K_{out}^t = -(K_{in}^s - K_{out}^s)$$

$$X - M + K_{in}^t - K_{out}^t < 0, \quad K_{in}^s - K_{out}^s > 0$$

$$K_{in}^s > K_{out}^s$$

Briefly, if the net endogenous trade inflows are not enough to finance the trade flows, these would drive up the term a (depreciation), increasing the expected returns of the home country ($r_h > r_f$). This would induce positive net speculative capital inflows from the rest of the world ($K_{in}^s > K_{out}^s$).

If $r_h > r_f$, then why are net capital flows not pushing them back together by driving up the spot price of the dollar (at least up to the point that the difference no longer exceeds the estimated forecast error)? There is an excess demand for the domestic currency in the speculative capital market; however, it is directly offset by the excess demand for the foreign currency to underwrite the otherwise un-financed imports, demand that is competing for currency in that same market.

Those wishing to buy foreign currency in order to buy foreign goods and services are selling domestic currency (net excess of domestic currency) to the equivalent net excess of those who

want to domestic currency in order to purchase domestic speculative financial assets (net excess of foreign currency). *Ceteris Paribus*, this can take place indefinitely, with the excess demand in one market being offset by the excess in the other. It is important to note here that these are completely different actors. Those importing and exporting are in a very different business than those managing portfolios of assets. Still Harvey thinks that this is an unstable equilibrium. More in general Harvey prefers to believe that the exchange rate is formed in speculative forex markets, while trade flows would be adequate with no impact at all, as trade financing is mainly endogenous.

1.5 Trade flows and Exchange Rate determinations

Harvey (2019) highlighted the fundamental role of speculative capital flows and investors' expectations in currency price formation. Lavoie (2022), despite admitting capital flows have a role, believes that trade flows have a very relevant impact on exchange rate formation. While Harvey is always extremely careful in proposing theories supported by empirical facts extrapolated by data and survey, the argument of Lavoie derives from the (theoretical) stock-flow modelling of open economies, belonging to the Harrodian tradition of the import multiplier.

To our knowledge, most of the open economy SFC models with a flexible exchange rate closure are based on the OPENFLEX model of Godley and Lavoie (2007, Chapter 12), or on its most recent version developed by Carnevali (2022). These models incorporate stocks and flows of both the real and the financial sides of two economies connected by trade flows and financial relationships. These models thus incorporate trade relations that depend both on income and relative prices, as well as on portfolio decisions, which depend on income as well as on expectations about asset returns at home and abroad.

The closure of Godley and Lavoie (2007) assumes that the exchange rate continuously clears the market for internationally traded assets. This is consistent with the idea that central banks can maintain interest rates even in the face of capital flows (breaking the mainstream trilemma) and that, in contrast to the position maintained by Neoclassicals, even under flexible exchange rates, fiscal policy is more effective than monetary policy. Therefore, one could think that the approach of Godley and Lavoie, in line with Harvey, focuses solely on capital flows. This is where Carnevali's model comes in to provide clarity.

Carnevali (2022) noted that the closure of Godley and Lavoie was a sort of black box, where the theoretically relevant mechanisms could be disentangled with difficulty. In particular it is not clear what is the role of the central bank if the exchange rate clears the bonds market. Moreover, the foreign country households seem to actually behave as the lender of last resort instead of the domestic central bank.

For this reason, Carnevali proposes an alternative closure where the residual purchasing of the central bank is made explicit, while the exchange rate is determined by market forces acting in the forex market: both trade and financial flows. Assume a two-country model where just two interest bearing assets (one in domestic currency, D and one in foreign currency F) compete in the international markets. The current account expressed in domestic currency would be:

$$CA_h = X_h - IM_h + i_F F_h E - i_D D_f$$

The current account indeed is the sum of the trade balance plus net interest payments (net primary income). Incoming interest payment are related to foreign assets owned by the home country F_h . Since these payments are in foreign currency, their value must be changed in domestic currency through the exchange rate e . Outgoing interest payments are related to assets hold by foreign investors, D_f .

The financial account expressed in domestic currency, instead, is equal to the net capital inflows. The inflows are represented by the change in the stock of domestic asset hold by foreign investors, while the outflows are represented by the change in the stock of foreign assets hold by domestic investors converted in domestic currency.

$$FA_h = \dot{D}_f - \dot{F}_h E$$

We know that the equilibrium in the Balance of payments requires that the sum of CA and FA is always equal to zero:

$$CA + FA = 0$$

Alternatively, this is a market clearing equation of the foreign exchange market. Carnevali thus set the exchange rate as the market clearing variable. First, we can substitute to obtain:

$$X_h - IM_h + i_F F_h E - i_D D_f + \dot{D}_f - \dot{F}_h E = 0$$

If we isolate the exchange rate on the left side, we finally obtain the equation of e that ensures BoP=0:

$$E = \frac{-X_h + IM_h + i_D D_f - \dot{D}_f}{i_F F_h - \dot{F}_h}$$

We see that in this case the exchange rate is not determined solely by the financial market, but both by trade and financial flows. This closure is completely equivalent to the one developed by Godley and Lavoie, yet it lets the central bank behave explicitly as a lender of last resort.

The same Godley and Lavoie were aware of this:

"[...]might seem to imply that the exchange rate is determined in a unique market [...] the system is a fully interdependent one such that the solution of the model as a whole requires and ensures that every equation in which the exchange rate appears is satisfied at the same time. [...] the exchange rate [...] will be found to satisfy all the trade equations in which it appears and also to influence personal consumption through its effect on capital gains"

This feature guarantees that in both models there is a peculiar phenomenon: changes in trade parameters affect permanently the exchange rate, even if gradually, while changes in portfolio preferences have an immediate impact on the exchange rate, that in the long run will vanish or even revert.

Indeed, when a country sees a temporary boost in its financial account due to higher preference for its assets, it often faces higher debt-servicing costs. This happens because the initial surge in capital inflows strengthens the currency, which hurts the trade balance by making exports pricier and imports cheaper. To cover these extra costs, the exchange rate must eventually depreciate enough to create a trade surplus that offsets the increased interest payments on foreign debt. Essentially, short-term exchange rate expectations tend to amplify movements but over the medium to long term, these expectations shift toward stabilizing, pulling the rate back toward a level that balances the current account.

This dynamic plays out in a flexible exchange rate system, where expectations and portfolio choices can cause big short-term swings. However, as Wynne Godley pointed out, these effects

tend to self-correct over time due to trade feedback, though it can take a while to reach equilibrium. He put it well:

“Finally if we make the assumption that a change in expectations alters the relative demand for one country’s assets . . . the effect on the exchange rate, though it may be large and immediate, is essentially self-reversing because of the feedback from trade, though the re-achievement of ‘equilibrium’ may take a long time. Hence while hardly anything has been said about expectations in this paper, I incline to the view that their role (though very important) is somewhat exaggerated in much contemporary discussion of exchange theory. (Godley, 1999, p. 23)”

This view differs from Harvey’s, who emphasizes the disruptive power of expectations and capital flows. For Godley, while expectations and monetary policy can push exchange rates up or down in the short run, the long-term trend hinges on the current account—what a country earns versus what it spends on trade.

This idea seems to be initially backed by Lavoie and Daigle’s 2011, which weaves in the OPENFLEX model more complex exchange rate expectations from chartalist (trend-following) and fundamentalist (long-term value-focused) investors. When trend-followers are a small group, the exchange rate behaves much like it would without expectations, gravitating toward a value shaped by trade fundamentals. But the rate fundamentalists believe is “correct” does influence where the economy heads long-term. If they underestimate the stable exchange rate, the actual rate overshoots its trend; if they overestimate, it undershoots. Expectations generally slow the journey to that long-term value. However, if trend-followers dominate, their speculative bets create wild, non-converging cycles, breaking the link between trade and exchange rates. This suggests that capital flows driven by short-term speculation can indeed destabilize currencies, leaning closer to Harvey’s perspective.

In any case we can conclude that both the trade flows and the financial flows are relevant for the determination of the currency price: as pointed out by Carnevali (2022), in a pure floating regime at each moment of time, the exchange rate will have to be such that the equation of BoP equilibrium is realized ($BoP=0$), so that both trade flows and capital flows play a role, while recognizing that these variables are themselves endogenous. Therefore, the general idea is that the exchange rate is determined in the balance of payment equilibrium, such that:

$$BoP = f(E) = 0$$

In all these models (in SFC models but also in the Mundell-Fleming) a well-known dichotomy is always implied: in case of a fixed exchange rate the foreign reserves become endogenous, while in case of a floating exchange rate the reserves remain constant as an instantaneous adjustment of the nominal exchange rate guarantees that demand and supply of foreign currency are always equalized. Lance Taylor (2004) criticized this idea through a precise accounting analysis of a two-country stock flow consistent model. His lesson must be taken into consideration when modelling an open economy.

1.6 The Lance Taylor Critique

As we said, Lance Taylor (2004) criticized the endogenous reserves/fixed exchange rate vs constant reserves/flexible exchange rate dichotomy through a two country SFC model, yet his arguments are not based on particular mechanisms arising from the model dynamic behavior. Indeed, Taylor is not interested in behavioral equations (ironically the only behavioral equation he fully explicit is UIP), he just needs to highlight the accounting relationships of his model. Here we briefly describe the accounting critique to the portfolio balance model (Branson 1972, 1976)¹⁰⁸.

The idea of the portfolio balance model is to determine interest rates and the exchange rate simultaneously in a general equilibrium setting. Taylor assumed the interest rate to be endogenously determined, but its arguments are consistent within a post-Keynesian framework too, where central banks control the interest rate and money supply is endogenous.

Two countries: Home (H) and Foreign (F). In this whole economy there are four financial assets: money issued by H, M , money issued by F, M^* , government bonds issued by H, T and government bonds issued by F, T^* . The government bonds issued in each country are also demanded as foreign reserves by the other country, R and R^* . Therefore, there are four markets that must be cleared, and four markets clearing conditions:

$$M_s = M_d \quad (1.1)$$

$$M_s^* = M_d^* \quad (1.2)$$

$$T_s = T_b + T_{hp} + T_{fp} + R \quad (1.3)$$

¹⁰⁸ Branson (1972, 1976) proposed an open extension to the closed economy portfolio balance approach of Tobin (1969). The lesson of Tobin is one of the theoretical foundations of SFC modelling.

$$T_s^* = T_b^* + T_{hp}^* + T_{fp}^* + R^* \quad (1.4)$$

In the home country, the money supply M_s must satisfy the private sector demand for money, M_d (determined by liquidity preferences), while government bonds issuance T_s must satisfy the demand of the banking system, T_b , the demand of the home private sector, T_{hp} , demand of the foreign private sector T_{fp} and the demand for reserve accumulation of the foreign country, R . The same applies to the foreign country's supply of money and bonds. Note that foreign reserves are considered endogenous. This is an important implication on how and in what market the flexible exchange rate can be determined.

There are other important accounting identities that we can easily obtain with the help of the balance sheet in Table 1.3. Taylor's critique is based on a simplified accounting framework, one where banks' net worth is assumed to be zero and real capital is not taken into consideration. We focus on country H, but it would be the same for the accounting of F.

Table 1.3 Balance Sheet of Home country, Taylor (2004)

	Private Sector	Banking Syst.	Govt	RoW (F)	Tot
Money	M_d	$-M_s$			0
Bond H	T_{hp}	T_b	$-T_s$	$T_{fp} + R$	0
Bond F	ET_{hp}^*	ER^*		$-E(T_{hp}^* + R^*)$	0
Net Worth	$-\Omega$			N	$-\Omega + N$
Total	0	0	$-T_s$	0	$-T_s$

First, the net foreign assets of home country, N , are equal to the foreign assets purchased by the home country minus the liabilities with respect to the foreign country. If we look at the Rest of the World column (RoW), this identity results as:

$$N = E(T_{hp}^* + R^*) - (T_{fp} + R) \quad (1.5)$$

That means that the net foreign assets of the home country in this case are equal to the value of the total stock of foreign government bonds held by the home economy (and converted into domestic currency through the exchange rate E), minus the total stock of home government bonds held by the foreign country sectors.

Second, we have seen that the private sector allocates its wealth according to three assets: domestic money, domestic government bonds and foreign government bonds. If we define private wealth as Ω , it must be true that:

$$\Omega = M_d + T_{hp} + ET_{hp}^* \quad (1.6)$$

Third, if the open economy accounting is consistent, it must result that the wealth of a nation is equal to its net foreign assets. Indeed, as we can see in the last column of Tale 3, the sum of private wealth Ω plus public wealth $-T_s$ (government's wealth is equal to the public debt) should be equal N . Alternatively, we can write:

$$\Omega = T_s + N \quad (1.7)$$

Now we have all the accounting relations to proceed with Taylor's argument. Let's recall the market clearing conditions (1.1)-(1.4). Due to Walras' law (the sum of excess demands is always zero), only three equations are independent to each other and are thus to be considered. In this way, the three-equation system determines the three endogenous variables: the two interest rates, domestic and foreign, and the nominal exchange rate¹⁰⁹. Taylor however shows this argument is wrong, because the system above does not have three, but only two independent equations and thus cannot determine the triplet i, i^*, E , but just two of them. On top of Walras' law, indeed, there is another constraint our world financial market must respect, namely the macro constraint (1.5). Let us see how this works.

First, let's consider the system (1.1)-(1.3) while equation (1.4) is the Walras law equation. Take the macro financial constraint, equation (1.5):

$$N = E(T_{hp}^* + R^*) - (T_{fp} + R) \quad (1.5)$$

Alternatively, we can write:

$$R = E(T_{hp}^* + R^*) - T_{fp} - N \quad (1.5')$$

¹⁰⁹ Nothing relevant would change in a post-Keynesian framework where the interest rates would be set exogenously and money supplies M_s and M_s^* , would become endogenous.

Now consider the market clearing condition for the home government bonds, equation (3). If we plug (1.5'), it results:

$$T_s = T_b + T_{hp} + T_{fp} + E(T_{hp}^* + R^*) - T_{fp} - N$$

By simply bringing N to the left side we obtain:

$$T_s + N = T_b + T_{hp} + E(T_{hp}^* + R^*)$$

We know from equation (1.7) that the sum of the supply of bonds plus the foreign asset is equal to private wealth:

$$\Omega = T_b + T_{hp} + E(T_{hp}^* + R^*) \quad (1.7)$$

We know also from equation (1.6) that private wealth is allocated between money, domestic bonds and foreign bonds. Thus, it is true that:

$$M_d + T_{hp} + ET_{hp}^* = T_b + T_{hp} + E(T_{hp}^* + R^*)$$

After eliminating the terms that cancel each other, it results:

$$M_d = T_b + ER^* = M_s$$

The banking system's net worth is zero such as its assets are always equal to its liabilities. Thus, from the balance sheet in Table 1.3 (similarly to the "Asset based" banking system in Table 1) we observe that money supply, M_s (banks' liability), is equal to the sum of the stock of purchased bonds T_b plus the domestic currency value of the stock of foreign reserves, ER^* . Therefore, it results that equation (1.3) and equation (1.2) are equivalent. If the money market in H is in equilibrium, so does the world market for bonds H. A fully analogous proof can be used to show that the same happens in country F: if the money market in F is in equilibrium, so does the world market for bonds F. Thus, only two (and not three) of the four market-clearing conditions are independent. It must be concluded that this model cannot determine simultaneously, in a temporary equilibrium, the two interest rates (or money supplies) and the exchange rate. According to Taylor this means that the exchange rate must be determined elsewhere, for example It could evolve over time subject to rules based on expectations about its future values in the future as it could follow a UIP relation between the two interest rates. This, of course, is

a rather unsatisfactory conclusion, at least from a post-Keynesian perspective, as it revives a mainstream relationship that difficultly fits the data. On this matter, Harvey's approach on exchange rate determination could substitute UIP with a more realistic one.

Regardless of one's stance on the validity of UIP, it is clear that when foreign reserves are endogenous (and thus not fixed) and the exchange rate is determined elsewhere out of the BoP equilibrium equation, the traditional dichotomy of constant reserves with a flexible exchange rate versus endogenous reserves with a fixed exchange rate is fundamentally disrupted.

1.7 Taylor vs Godley and Lavoie

The critique of Taylor to models that determines endogenously the exchange rate through the BoP equilibrium equation is flawless and its conclusion unavoidable. Furthermore, the results help to explain why an enormous empirical literature finds that 'fundamentals-based' models of the exchange rate have negligible predictive power: if the theoretical models cannot determine the exchange rate, then econometric tests based upon them will almost certainly fail.

Yet why do almost all the existing SFC literature on flexible exchange rate open economies is built upon such an accounting inconsistency? And how do these models can be computer simulated respecting stock-flow consistency?

The reason lies in how foreign reserves are treated. Taylor in particular finds it unsatisfactory to treat foreign reserves as constant in the event of a flexible exchange rate regime. Two main reasons.

First, according to Taylor, the banking system has tools at its disposal to control both components of its total assets (T_b and ER^*) with no need for a floating rate. For example, Isard (1995) has shown that a central bank can counter such a shock to its portfolio holdings: it can offset the reserve increase by selling a quantity N of foreign bonds and using the proceeds to buy home bonds (perhaps with the help of the foreign central bank), and reverse the monetary expansion by selling a quantity N of home bonds in a domestic open market operation.

Second, to maintain fixed the stock of foreign reserves and endogenize the nominal exchange rate is possible as it would be consistent with the model accounting constraints. This is what Godley and Lavoie do with their model as we have previously seen. E in Taylor's model could be determined by the financial macro constraint represented by equation (1.5):

$$N = E(T_{hp}^* + R^*) - (T_{fp} + R) \quad (1.5)$$

However, this would mean unrealistically that net worth drives asset evaluation as it's rare to see wealth dictating the value of its components, particularly in the short term. Rather it's true the opposite: the nominal net worth of a household, company, country, or the global economy should be shaped by its real asset holdings and their respective market prices. For both individual and collective entities, asset valuations drive net worth, not the other way around. Moreover, this macro closure would imply another unrealistic feature (that Taylor calls “disturbing”): higher capital flows would make increase the exchange rate, contrary to the common knowledge according to which capital inflows are supposed to strengthen, not weaken, the local currency.

Is this the case with Godley and Lavoie and Carnevali? It is immediate to show that the closure of Carnevali (2022) is equivalent to making E endogenous through (1.5). Carnevali endogenize the exchange rate through the BoP equilibrium equation. Within the framework of Taylor, BoP equation would result as:

$$CA + FA = 0$$

$$CA + (\dot{T}_{fp} + \dot{R}) - E(\dot{T}_{hp}^* + \dot{R}^*) = 0 \quad (1.8)$$

Carnevali's closure is equivalent to Taylor's “disturbing” closure as the only difference is that Carnevali's one is in flow terms while Taylor is in stock terms. To prove this, let's make dynamic equation (1.5):

$$\dot{N} = \dot{E}(T_{hp}^* + R^*) + E(\dot{T}_{hp}^* + \dot{R}^*) - (\dot{T}_{fp} + \dot{R}) \quad (1.9)$$

The term $\dot{E}(T_{hp}^* + R^*)$ is related to Home country's capital gains on foreign asset due to exchange variations. We know that the net foreign assets of a country evolve according to the current account plus capital gains:

$$\dot{N} = CA + \dot{E}(T_{hp}^* + R^*) \quad (1.10)$$

Hence, if we plug (1.10) into (1.9) we can write:

$$\dot{N} = CA + \dot{E}(T_{hp}^* + R^*)$$

And finally:

$$CA - E(\dot{T}_{hp}^* + \dot{R}^*) + (\dot{T}_{fp} + \dot{R}) = 0 \quad (1.11)$$

Equation (1.9) (the financial macro constraint (1.5) in dynamic terms) and equation (1.11) are indeed equivalent.

Once we acknowledged this, two questions arise. First, is it actually true that, with such an endogenous exchange rate, the net worth drives asset evaluation? Or is it a matter of simultaneous equations where it *seems* that the net foreign asset position determines the exchange rate? Similarly, before the work of Carnevali made it clearer, it seemed erroneously that in OPENFLEX the foreign household sector was behaving like the actual lender of last resort. Second, in Godley and Lavoie and Carnevali's models, do capital inflows entail a counterintuitive appreciation? Actually yes, we have seen in the previous paragraphs that in both models the long run outcome of higher preferences for the home government bonds consisted in a depreciation after a temporary depreciation. This dynamic was described by Godley as self-reversing because of the feedback from trade and government debt issuance. What Taylor calls "disturbing" is considered by Godley and Lavoie the outcome of a complex system that dynamically respond changes of parameters. This makes us think that it is pretty difficult to find a satisfactory closure that makes everyone agree. We conclude with a quote of Godley and Lavoie from the end of Chapter 12:

"Our experience with various closures is that whatever the institutional background, some results are being systematically achieved when any particular closure is being adopted. The important thing to bring is that, there is not, in general, as Lance Taylor (2004) has forcefully argued, an equilibrium towards which economies and exchange rates are moving"

1.8 Final Considerations

The post-Keynesian open economy framework fundamentally diverges from mainstream models, offering a dynamic perspective anchored in endogenous money and a rejection of mainstream long-run stabilizers that assume convergence to predefined equilibria, such as full employment or balanced trade. Unlike mainstream approaches, where interest parities constrain monetary policy by forcing interest rate alignment with foreign rates or market

expectations, PK theory posits that central banks can set interest rates exogenously to achieve domestic goals like employment and growth, regardless of exchange rate regimes. In fixed regimes, the compensation principle—an mechanism resulting from central banks' role as lenders of last resort—automatically offsets balance-of-payments flows through adjustments in the central bank's balance sheet, such as treasury bill holdings or government deposit transfers. This challenges the mainstream "impossible trinity" and dismisses automatic stabilizers like price-specie flow or Mundell-Fleming's monetary base adjustments, which presume self-correcting trade imbalances.

The PK framework also engages a critical debate on exchange rate determination, highlighting diverse market dynamics. J.T. Harvey's work emphasizes speculative capital flows and investor expectations as primary drivers of currency prices in forex markets, where sentiment shapes volatility, diverging from UIP's mechanistic arbitrage. Conversely, the SFC analysis of Godley and Lavoie's OPENFLEX model, argues that exchange rates are determined by the interplay of trade and financial flows, as the balance of payments must clear in a floating regime. Trade flows exert a lasting influence over the medium to long term, while portfolio preferences drive immediate but often transitory effects. However, Lance Taylor's (2004) critique challenges these SFC models, arguing that their BoP-based exchange rate determination is flawed due to insufficient independent equations, rendering simultaneous determination of exchange rates and interest rates impossible. Taylor contends that assuming constant foreign reserves in flexible regimes is unrealistic, as central banks can adjust reserves without floating rates, and endogenizing the exchange rate via net worth is problematic, as asset valuations typically drive wealth, not vice versa. He also notes that such models counterintuitively predict currency weakening from capital inflows, clashing with empirical expectations.

This tension highlights the challenge of selecting a macro closure, as Godley and Lavoie acknowledge no universal equilibrium exists for exchange rates. The choice of closure—whether emphasizing speculative forex markets, trade dynamics, or policy mechanisms—depends on which aspect of reality the model seeks to depict most accurately. Despite these theoretical debates, PK's strength lies in its rejection of mainstream stabilizers and its policy-oriented paradigm, which empowers governments to address economic challenges effectively under both fixed and flexible regimes. By prioritizing endogenous money and capturing the complex interplay of speculative and trade-driven forces, PK offers a realistic account of exchange rate dynamics, aligning with empirical observations and providing a robust

framework for navigating open economy complexities, even as unresolved issues like Taylor's critique persist.

2 BoP crisis in a theoretical SFC Kaleckian growth model

In this final section we present the most original contribution of the PhD thesis by extending the Kaleckian growth model of Chapter 3 to an open economy framework, while preserving its established properties. This extension introduces new sources of instability, particularly those arising from foreign currency debt dynamics. As discussed in Chapter 1, a foreign currency debt poses a significant barrier to economic development in Low-Income Countries, which often face persistent current account deficits and limited capacity to accumulate foreign reserves. Such debt creates liabilities whose costs are largely beyond the control of small economies, driven by two key factors: the interest rate, which typically includes a premium over foreign rates to attract investors, and the exchange rate, whose fluctuations can significantly alter the debt accumulation path. High debt service costs reduce economic activity and hinder economic development, potentially leading to a debt overhang. This fragile equilibrium may escalate into a Balance of Payments (BoP) crisis, triggered by pressures on the exchange rate, both from trade and financial flows. Drawing on the lessons from the debt crises of the 1980s, our model represents a small, indebted open economy operating under a flexible exchange rate regime. It highlights how capital flights, increasing foreign interest rates, or persistent trade deficits can precipitate a BoP crisis, characterized by runaway debt accumulation and a severe recession driven by escalating debt service burdens that crowd out capital accumulation.

2.1 Matrixes and BoP accounting

Table 2.1 Balance Sheet Matrix

	Hous	Firms	Banks	RoW	Tot
Deposits	M		-M		0
Loans		-L	+L		0
Bonds	pb B	-pb B			0
For. Assets	crF			-crF	0
For. Curr. Bonds		-cr pbf B_f		+cr pbf B_f	0
Capital					K
Net Worth	V_h	V_f	0	-NFA	$V_h + V_f = K + NFA$

Table 2.2 Transaction flow Matrix

	Hous	Firms		Banks		RoW	TOT
		c/a	k/a	c/a	k/a		
Flows							
Consumption	-C	C					0
Investment		I	-I				0
Net Exports		NX				-NX	0
[memo: GDP]		$GDP = Y = C + I + NX = i_{L-1}L_{-1} + (B_{-1} + erB_{f-1}) + WB + \Pi$					
Bank Inter.		$-i_{L-1}L_{-1}$		$i_{L-1}L_{-1}$			0
Bonds Inter.	B_{-1}	$-B_{-1}$					0
For. Curr. Bonds Inter.		$-er B_{f-1}$				$er B_{f-1}$	0
Wages	WB	-WB					0
Firms Profits	Π_h	$-\Pi$	Π_f				0
Banks Profits	$i_{L-1}L_{-1}$			$-i_{L-1}L_{-1}$			0
For. Assets Interests	$i_{F-1}F_{-1}er$					$-i_{F-1}F_{-1}er$	0
FoFs							
Money	$-\Delta M$				ΔM		0
Bonds	$-pb \Delta B$		$pb \Delta B$				0
Loans			ΔL		$-\Delta L$		0
For. Curr. Bonds			$er pb \Delta B_f$			$-er pb \Delta B_f$	0
For. Assets	$-er \Delta F$					$er \Delta F$	0
TOT	0	0	0	0	0	0	0
[memo: capital gains]	$\Delta pb B_{-1} + \Delta er F_{-1}$	0	$-\Delta pb B_{-1} + \Delta er pb \Delta B_{f-1}$	0	0	$-\Delta er F_{-1} - \Delta er pb \Delta B_{f-1}$	0

Table 2.1 and 2.2 represent respectively the Balance Sheet Matrix and the Transaction Flow Matrix of our model. The open economy features enter the model through one single column, named Rest of the World (RoW). This approach is typical of open economy post-Keynesian models as the one discussed in Chapter 2, but if we look at post Keynesian open economy Stock flow consistent models a la Godley and Lavoie (2007), it's much more common to find two countries models, where both home and foreign countries are modelled. Our choice is justified by the fact that a small economy is incapable of affecting the rest of the world. Indeed, we assume a quite passive RoW sector to avoid unrealistic external feedback to the behaviour of our small developing economy. Just one equation is under the domain of foreign economic agents: the demand for domestic bonds, reflecting the behaviour of international investors with regard to the issuance of foreign currency bonds by LICs countries. Furthermore, we must remember that, as we did in the closed economy model, all the variables are expressed in real terms as units of domestic GDP. We assume away prices and inflation, as income distribution is exogenous. Therefore, the real exchange rate and the nominal exchange rate will coincide.

As we can see from the Balance Sheet Matrix of Table 2.1, we added two more assets: first, domestic households can now allocate part of their savings in form of foreign assets F ; second, domestic firms partly finance their investment by issuing foreign currency bonds B_f , bonds that will be purchased by foreign investors. On the real side, and now we are looking at the Transaction Flow Matrix in Table 2.2, trade flows are represented by a simple item related to “net exports”, NX . This item aggregates the import-export flows into one simple behavioural

equation on the line of the open economy models we have seen in Chapter 2. Furthermore, the income generation process now must integrate the interest generated by the international assets: households perceive an interest income from the foreign assets they purchased, while firms must pay back the interest on the foreign currency bonds purchased by foreign investors. Note also that, once again, we assume away any government activity. If on one side this choice let us reduce the complexity of the model, on the other it stresses the fact that BoP crisis and excessive foreign indebtedness are a matter of productive structure and financing costs rather than of unbalanced government budget balance. As we better argued in the second chapter, external debt sustainability must be an outcome of structural transformation rather than the result of aggressive policies against investment and expenditures.

We have briefly described the new flows and stocks that have been added to our closed economy model to create an open economy. As noted, all these elements appear in the column Rest of the World column of the Transaction Flow Matrix. This column is extremely helpful, as the sum of the vertical elements results in the Balance of Payments equation. First, we can define the Current Account, comprehensive of trade in goods and services plus the net primary income, in which is accounted the net interest income with respect to the Rest of the World:

$$CA = NX + er \, i_{F-1} F_1 - er \, B_{f-1}$$

Note that both interest payments, since they are related to a foreign currency denominated asset, must be converted into domestic currency through the exchange rate er .

Second, the change in the stock of foreign assets, namely the capital inflows and outflows, can be accounted within the Financial Account equation:

$$FA = er \, p_{bf} \Delta B_f - er \Delta F$$

The Balance of Payments equilibrium condition thus requires that the sum of FA and CA must sum to zero:

$$BoP = CA + FA = NX + er \, i_{F-1} F_1 - er \, B_{f-1} + er \Delta F - er \, p_{bf} \Delta B_f = 0$$

As we will see, this equation, along the lines of Godley and Lavoie (2007) and Carnevali (2022), is fundamental to determine the flexible exchange rate. Moreover, from the equation of the Financial Account we can derive another important macro constraint, the Net Foreign Asset

Position of the economy. Coherently with the RoW column of the balance sheet matrix, the NFA is the sum of asset and liabilities with respect to the foreign sector:

$$NFA = erF - er p_{bf}B_f$$

NFA is equal to the total stock of foreign assets held by domestic households, minus the stock of foreign currency bonds held by foreign investors. With the help of the Financial Account, we can define also its dynamic equation:

$$\Delta NFA = -FA + \Delta er F_{-1} - \Delta(er p_{bf})B_{f-1}$$

The change of the net asset position must be equal to the (negative) Financial Account plus the net capital gains generated by the two assets. Note that an indebted country generally has a negative NFA .

2.2 The Equations of the model

In this section we present the whole system of equations that compose our model. Since most of the equations have been already discussed in the previous chapter, here we will focus more on the new ones and on the main changes.

The Trade Balance

The GDP of our small economy now is comprehensive of the “net export” element:

$$Y = C + I + NX \quad (2.1)$$

NX is a term related to the total net trade flows in goods and services. Alternatively, we can call it “trade balance”. To maintain coherence with the assumption of a small open economy and a quite passive Rest of the World, the behavioural equation of NX should simulate the aggregate result of exports and imports with respect to the foreign sector. In particular NX can be modelled as follows:

$$NX = (b_0 + b_1 er^{b_3} - b_2 Y/K_{-1})K_{-1} \quad (2.2)$$

Equation (2.2) defines the normalized trade balance NX/K_{-1} as a function of three main elements. First, NX/K_{-1} depends positively on an exogenous parameter b_0 that captures the autonomous demand for exports from the rest of the world. Second, NX/K_{-1} is a positive

function of the real exchange rate er , yet there is a caveat: the higher the level of the exchange rate, the lower is the marginal increment in the trade balance. Indeed, we included a nonlinear specification $b_1 er^{b_3}$ with $0 < b_3 < 1$ such that the marginal increment of NX is decreasing with higher er . In this way we weaken the positive impact of a depreciation on the trade balance. In small developing countries, exports are often primary commodities or low-value-added goods with inelastic global demand. Depreciation makes exports cheaper, but demand may not rise significantly if foreign buyers are insensitive to price changes or if substitutes are abundant. Third, net exports depend negatively on the rate of capacity utilisation, $u = \frac{Y}{K_{-1}}$. The higher is the degree of economic activity, the higher will be the imports demand, thus the overall trade balance would deteriorate. This is particularly true for small developing countries, as these countries have huge reliance on imported inputs and limited domestic substitutes.

Households' consumption and savings

Like in the closed economy model, we consider an aggregate class of households comprehensive of wage earners, profit earners and financial rentiers. The disposable income of households is composed by three sources of income: wages, distributed profits and interest incomes.

$$Y_h = (1 - h)Y + (1 - \theta)\Pi + i_{L-1}L_{-1} + B_{h-1} + er i_{F-1}F_{-1} \quad (2.3)$$

Wage bills once again are a share $(1 - h)$ of total output, where h is the capital income share that we set exogenously, say due to institutional factors. We maintain the assumption that firm's profits are partially distributed to households: a share θ of total net profits Π is devoted to finance capital accumulation. Remember that also banks' profits (interest payments on loans) are distributed to households (banks' owners are considered within the aggregate household's class). Finally, households perceive an interest income on the two interest bearing assets of their portfolio: corporate bills denominated in domestic currency, B_h and foreign assets F .

Households consume units of domestic GDP according to the traditional consumption function:

$$C = \alpha_1 Y_h + \alpha_2 V_{h-1} \quad (2.4)$$

And accumulate wealth according to the following dynamic:

$$V_h = V_{h-1} + Y_h - C + CG \quad (2.5)$$

Note that now capital gains must be modified to include capital gains of foreign assets due to variations in the exchange rate:

$$CG = (er - er_{-1})F_{-1} + (p_b - p_{b-1})B_{f-1} \quad (2.6)$$

Wealth is allocated according to three assets: non remunerated banks deposits, M_d , domestic currency corporate bonds, $p_b B_h$ and foreign assets erF :

$$B_h = (\lambda_{10} + \lambda_{11}r_b + \lambda_{12}r_f) \frac{V_h}{p_b} + \lambda_{13} \frac{Y_h}{p_b} \quad (2.7)$$

$$F = (\lambda_{20} + \lambda_{21}r_b + \lambda_{22}r_f) \frac{V_h}{er} + \lambda_{23} \frac{Y_h}{er} \quad (2.8)$$

$$M_d = V_h - p_b B_h - erF \quad (2.9)$$

For simplicity we assume away more complex forms of expected returns by setting $r_b = i_B$ and $r_f = i_F$. The domestic interest i_B is set exogenously by the firms' sector that issues all the corporate bonds demanded by households at that level of the interest rate. Of course, the price of the corporate bonds is equal to the inverse of the domestic interest rate. Firms have no need to issue a specific level of domestic currency bonds as the banking sector will act as lender of last resort, lending money to firms at $i_L = i_B = i^*$. Firms indeed set the interest rate at the interest level chosen by the banking sector, such that bonds and loans are perfect substitutes. The foreign interest instead is simply set exogenously by foreign monetary authorities, $i_F = i^*$.

$$r_b = i_B \quad (2.10)$$

$$r_f = i_F \quad (2.11)$$

$$i_B = i^* \quad (2.12)$$

$$i_F = i_f^* \quad (2.13)$$

$$p_b = 1/i_b \quad (2.14)$$

Firms and debt accumulation

The capital accumulation decision of the firms remains the same: firms accumulate capital according to a basic Kaleckian investment function, g , that depends on the profit rate r .

$$I = gK_{-1} \quad (2.15)$$

$$K = K_{-1} + I \quad (2.16)$$

$$g = \gamma + \delta r \quad (2.17)$$

Where r is the profit rate:

$$r = \frac{\Pi}{K_{-1}} \quad (2.18)$$

Profits are equal to the non-wage share of output minus the debt service:

$$\Pi = hY - B_{-1} - i_{L-1}L_{-1} - erB_{f-1} \quad (2.19)$$

Firms pay interests on the total stock of issued domestic currency bonds, $p_b B$, on the Loans from the banks, and on the stock of foreign currency bonds purchased by the foreign investors, $er p_{bf} B_f$. Note that a depreciation, *ceteris paribus*, make increase the debt service quota of the foreign currency bonds, thus reducing profits and the profit rate. It would be much different if foreign investors would simply purchase domestic currency corporate bonds.

The total domestic currency bonds of course are supplied according to households' demand:

$$B = B_h \quad (2.20)$$

While similarly foreign currency bonds are issued by accommodating the demand of foreign investors. International investors demand foreign currency bonds according to the following function:

$$B_f = \frac{1}{p_{bf}} \eta_0 \left(\frac{Y}{K_{-1}} \right) K \quad (2.21)$$

Equation (2.21) is defined such that, when normalized by K , demand for foreign currency bonds is a linear function of capacity utilisation, $u = \frac{Y}{K_{-1}}$. Basically, the higher the economic activity the more bonds foreign investors wish to hold. From the point of view of the firms, given the huge need of foreign currency to finance the net exports deficit, they wish to issue all the foreign currency bonds that RoW is demanding. Yet these bonds are pretty costly: the interest rate must guarantee that the risk to invest in such an underdeveloped country is well remunerated. In particular foreign investors accept an interest rate i_{bf} that is comprehensive of a risk premium that grows with the external debt to GDP ratio, λ , with derivative ϕ :

$$p_{bf} = \frac{1}{i_{bf}} \quad (2.22)$$

$$i_{bf} = i_{F0} + \phi \lambda \quad (2.23)$$

$$\lambda = \frac{er p_{bf} B_f}{Y} \quad (2.24)$$

Foreign agents may be worried about unpredictable future depreciations due to unsustainable external debt burdens. Depreciations directly translate into capital losses for foreign investors. Moreover, being aware of the possibility of balance sheet effects, foreign investors interpret a high burden of external debt as a high risk of default (Rocha and Oreiro 2013, Kohler 2017). This reflects also the Africa premium debate which sees African countries paying excessive premia on their borrowing, often unjustified because of a lack of consideration of other structural factors (UNDP 2023). Indeed, the pro-cyclicality of CRA ratings across developing markets has been a major concern, as ratings tend to improve during boom periods and worsen during downturns, exacerbating the macroeconomic situation in the country. Within our framework the risk premium, as we will see from the simulations, will be among the mayor factors that could lead to an exploding dynamic of the current account. The higher ϕ the more fragile will be any equilibrium of the Balance of Payments.

To conclude this section, we must better define the banking sector's behaviour. If the desired investment is still higher than the amount that can be financed through retained profits $\theta\Pi$, domestic currency bonds B_h and foreign currency bonds B_f , the banking system will let firms borrow the residual financing in forms of loans L at the interest set by the banking system:

$$L = L_{-1} + I - \theta R - p_b \Delta B - er p_{bf} \Delta B_f \quad (2.25)$$

$$i_L = i^* \quad (2.26)$$

$$M_s = L \quad (2.27)$$

Finally, equation (2.27) states a simple concept: given that the banking system has zero net worth, since their profits are completely distributed to households, the total supply of deposits, M_s must be always equal to the stock of loans.

Closing the model: exchange rate determination

Following Godley and Lavoie (2007) and Carnevali (2022) we assume that the exchange rate is determined by the market forces (demand and supply of foreign currency) within the Balance of Payments equation. As noted by Taylor (2004), this requires us to assume away any changes in foreign reserve accumulation of the banking system (that aggregates commercial banks and the central banks). If we should consider a positive constant stock of foreign reserves, we should rewrite (2.27) as follows:

$$\Delta M_s = \Delta L + er \Delta OR \quad (2.27')$$

Where $er OR$ is the stock of non-interest-bearing reserves of foreign currency (say foreign currency cash) expressed in terms of units of domestic GDP. Even if $\Delta OR = 0$ because of the floating regime, in this case the banking system equation must be written in levels as, following Godley and Lavoie (2007, Chapter 12, page 461), now bank's balance sheet would include foreign reserves that are susceptible to capital gains due to changes of the exchange rate ($\Delta er OR_{-1}$)¹¹⁰. These capital gains, if not transferred to the households' sector, could imply a positive net worth of banks. Therefore, to avoid further complexities, it's easier to assume a null stock of foreign reserves, $OR = 0$ in order to prevent any positive capital gains of the banks.

Now, we know already the equations of the Current account and the Financial Account:

$$CA = NX + er i_{F-1} F_1 - er B_{f-1} \quad (2.28)$$

¹¹⁰ Thus, the identity $M_h = L + er OR$ can't be true unless capital gains are transferred to households.

$$FA = er p_{bf} \Delta B_f - er \Delta F \quad (2.29)$$

The exchange rate thus must be determined in the equilibrium equation of the BoP. If we take $CA + FA = 0$ and solve for er , we obtain:

$$er = \frac{NX}{\Delta F - i_{F-1} F_{-1} - p_{bf} \Delta B_f + B_{f-1}} \quad (2.30)$$

As already discussed, this equation lets the exchange rate be determined both by trade and financial flows such that any related parameter change would have an immediate and lasting impact on the exchange rate. An alternative closure is the one suggested (yet considered “disturbing”) by Taylor (2004). First, we must recall the dynamic of the Net Foreign Asset Position and its identity from the balance sheet:

$$NFA = NFA_{-1} - FA + \Delta er F_{-1} - \Delta(er p_{bf}) B_{f-1}$$

$$NFA = er F - er p_{bf} B_f$$

These two equations are exactly the same, as the former is the dynamic version of the latter. If we want to solve for the exchange rate, we must make them two distinct equations. The easier way is to redefine the former as follows:

$$NFA = NFA_{-1} + CA + \Delta er F_{-1} - \Delta(er p_{bf}) B_{f-1} \quad (2.31)$$

Since we know that it must be always true that $CA = -FA$, we can express the NFA dynamic as a function of the current account, while the exchange rate must be determined through the macro constraint of the balance sheet:

$$er = \frac{NFA}{F - p_{bf} B_f} \quad (2.30')$$

Whatever is the flexible exchange rate closure, stock flow consistency will guarantee, by Walras' Law, that the following identity is always true:

$$M_d = M_s$$

One could think that the general open economy behavior of our model should be similar to the OPENFLEX model by Godley and Lavoie (2007), yet we must note two main differences: first, our model is a growth model that achieves steady growth equilibria rather than steady state equilibria as the capital accumulation function do not include a desired stock of productive capital as a limit to investment; second, our model does not include a government that spends and imposes taxes, whose dynamics could complicate the picture.

2.3 The normalized model

Before simulating the model, it is good practice to normalize all endogenous variables by the capital stock and attempt to derive the analytical solution, at least for the short run. This approach could enhance the understanding of the model's dynamics and how potential equilibria are reached.

Table 2.3 Normalized variables list

Variable	Definition	Description
Flows		
u	Y/K_{-1}	Degree of capacity utilization
c	C/K_{-1}	Normalized consumption
g	I/K_{-1}	Accumulation rate
nx	NX/K_{-1}	Trade balance to capital ratio
y_h	Y_h/K_{-1}	Household disposable income to capital ratio
cg	CG/K_{-1}	Normalized capital gains
ca	CA/K_{-1}	Current Account to capital ratio
fa	FA/K_{-1}	Financial account to capital ratio
Stocks		
v_h	V_h/K	Household wealth to capital ratio
l	L/K	Bank Loans to capital ratio
b	B/K	Normalized bonds
f	F/K	Foreign Assets to capital ratio
b_f	B_f/K	Foreign currency Bonds to capital ratio
m_d	M_d/K	Normalized money demand

m_s	M_s/K	Normalized money supply
nfa	NFA/K	Net Foreign asset position to capital ratio

Table 2.3 shows how we defined the normalized variables. The basic principle is that all flows are normalized by K_{-1} while all stocks are normalized by K . We obtain the following equations:

$$u = c + g + nx \quad (2.1n)$$

$$nx = b_0 + b_1 er^{b_3} - b_2 u \quad (2.2n)$$

$$y_h = (1 - h)u + (1 - \theta)r + i_{L-1}l_{-1} + b_{h-1} + er i_{F-1}f_{-1} \quad (2.3n)$$

$$c = \alpha_1 y_h + \alpha_2 v_{h-1} \quad (2.4n)$$

$$v_h = \frac{v_{h-1}}{1 + g} + \frac{y_h - c + cg}{1 + g} \quad (2.5n)$$

$$cg = (er - er_{-1})f_{-1} + (p_b - p_{b-1})b_{f-1} \quad (2.6n)$$

$$b_h = (\lambda_{10} + \lambda_{11}r_b + \lambda_{12}r_f)\frac{v_h}{p_b} + \lambda_{13}\frac{y_h}{p_b(1 + g)} \quad (2.7n)$$

$$f = (\lambda_{20} + \lambda_{21}r_b + \lambda_{22}r_f)\frac{v_h}{er} + \lambda_{23}\frac{y_h}{er(1 + g)} \quad (2.8n)$$

$$m_d = v_h - p_b b_h - erf \quad (2.9n)$$

$$r_b = i_B \quad (2.10n)$$

$$r_f = i_F \quad (2.11n)$$

$$i_B = i^* \quad (2.12n)$$

$$i_F = i_f^* \quad (2.13n)$$

$$p_b = 1/i_b \quad (2.14n)$$

$$g = \gamma + \delta r \quad (2.15n)$$

$$r = hu - b_{-1} - i_{L-1}l_{-1} - er b_{f-1} \quad (2.16n)$$

$$b = b_h \quad (2.17n)$$

$$b_f = \frac{\eta_0 u}{p_{bf}} \quad (2.18n)$$

$$p_{bf} = \frac{1}{i_{bf}} \quad (2.19n)$$

$$i_{bf} = i_{F0} + \phi \lambda \quad (2.20n)$$

$$\lambda = \frac{er p_{bf} b_f}{u} (1 + g) \quad (2.21n)$$

$$l = \frac{l_{-1}}{1 + g} + \frac{g - \theta r}{1 + g} - p_b \left(b - \frac{b_{-1}}{1 + g} \right) - er p_{bf} \left(B_f - \frac{B_{f-1}}{1 + g} \right) \quad (2.22n)$$

$$i_L = i^* \quad (2.23n)$$

$$m_s = l \quad (2.24n)$$

$$CA = nx + er i_{F-1} f_{-1} - er b_{f-1} \quad (2.25n)$$

$$fa = er p_{bf} [b_f (1 + g) - b_{f-1}] - er [f (1 + g) - f_{-1}] \quad (2.26n)$$

$$er = \frac{nx}{[f (1 + g) - f_{-1}] - i_{F-1} f_{-1} - p_{bf} [b_f (1 + g) - b_{f-1}] + b_{f-1}} \quad (2.27n)$$

$$nfa = \frac{nfa_{-1}}{1 + g} + \frac{ca}{1 + g} + \Delta er \frac{f_{-1}}{1 + g} - \Delta (er p_{bf}) \frac{b_{f-1}}{1 + g} \quad (2.28n)$$

While the Walras' Law equation:

$$m_d = m_s$$

We can now discuss about analytical solutions. To derive short run equilibria analytical values requires us to solve the goods market for u while considering all lagged stock related variables to be exogenous. The long run equilibria then can be derived by studying the system of dynamic equation of the stock related variables, generally the domestic and foreign debt ratios. The problem is that this model implies non-linear solutions even in the short run. Thus, compared to the closed economy, where the solutions were relatively easy to derive, in this case it is better to illustrate the equilibria directly through numerical simulations. To emphasise the high complexity that characterize the short run solutions here we briefly illustrate the problem.

The short run system of equations can be reduced to a 2x2 system, where the two endogenous are u and er . From the equation of u we can still observe a familiar result:

$$u = \frac{k_2 er + k_3 + b_0 + b_1 er^{b_3} + \gamma}{k_1}$$

Where:

$$k_1 = 1 - \alpha_1(1 - \theta h) - \delta h + b_2$$

$$k_2 = \alpha_1 i_{F-1} f_{-1} - \alpha_1(1 - \theta) b_{f-1} - \delta b_{f-1}$$

$$k_3 = \alpha_1 [-(1 - \theta) b_{-1} + \theta i_{L-1} l_{-1} + b_{h-1}] + \alpha_2 v_{h-1} - \delta b_{-1} - \delta i_{L-1} l_{-1}$$

The term k_1 is clearly the Keynesian multiplier and of course the whole model makes sense as long as $k_1 > 0$. Indeed, the parameters must be set such that the Keynesian stability condition is respected. The term k_2 instead can represent the autonomous demand arising from net interest income matured on foreign currency denominated assets. Conversely, k_3 represents the autonomous demand due to domestic currency net of interest income. Finally, $b_0 + \gamma$ is the traditional autonomous component of demand, due to exports and animal spirits, while $b_1 er^{b_3}$ is the element related to the improvement on the trade balance due to better international competitiveness. We can already observe that this last term introduces nonlinearity into the eventual solution. However, even if $b_3 = 1$, nonlinearities would still persist in the system, particularly in the exchange rate equation. Let's examine the exchange rate equation more

closely to identify those nonlinearities and confirm their presence. If (2.29n) seems too complex, we can consider instead the alternative closure:

$$er = \frac{nfa}{f - p_{bf}b_f} \quad (2.27n')$$

According to this equation the exchange rate is determined by *current* stock variables both at the numerator and at the denominator. If we should solve (2.27n') for the exchange rate by extracting on the right side of the equal all the components that depends on *er*, we should plug in equation (2.8n), (2.18n) and (2.28n). Thus, independently from whether *nx* is non-linearly dependent on *er*, the exchange rate would still be present at the numerator and at the denominator of equation (2.27n'). To this we must add that, with the right manipulations, also *u* is present at the numerator and at the denominator of (2.27n'). The same argument applies to the original closure, equation (2.27n). Therefore, the non-linearity of the short run system of equation is inevitable and so will be for the long-run dynamic analysis. The only way to proceed is through numerical simulations.

2.4 Simulating the baseline model and sensitivity analysis

We must check whether the model is capable of achieving a meaningful equilibrium. Moreover, a good praxis is to verify if the model is robust to parameters change. A sensitivity analysis is thus required. Our baseline scenario is based upon the parameters' configuration indicated by Table 2.4. Parameters' values have been selected such that the baseline scenario, if capable of achieving an equilibrium, features some characteristics typical of developing countries: a current account deficit, a trade balance deficit, and high external debt to GDP ratio.

Table 2.4 Baseline values of parameters

Parameter	Baseline Value	Description
h	0.2	Non-wage share
b_0	0.03	Autonomous Exports
b_1	0.03	Competitiveness coefficient
b_2	0.25	Propensity to import
b_3	0.035	Competitiveness Coefficient
θ	0.25	Share of reinvested profits
α_1	0.6	Propensity to consume out of income
α_2	0.15	Propensity to consume out of wealth
λ_{10}	0.5	Portfolio parameter
λ_{11}	1.5	Portfolio parameter
λ_{12}	1.2	Portfolio parameter
λ_{13}	0.05	Portfolio parameter
λ_{20}	0.2	Portfolio parameter
λ_{21}	1.5	Portfolio parameter
λ_{22}	1.2	Portfolio parameter
λ_{23}	0.05	Portfolio parameter
i^*	0.022	Domestic interest rate
i_f^*	0.02	Foreign interest rate
γ	0.07	Animal spirits
δ	0.25	Propensity to invest out of profits
η_0	0.033	Foreign demand for bonds coefficient
ϕ	0.01	Risk premium coefficient

Figure 2.1 Sensitivity to γ (gamma)

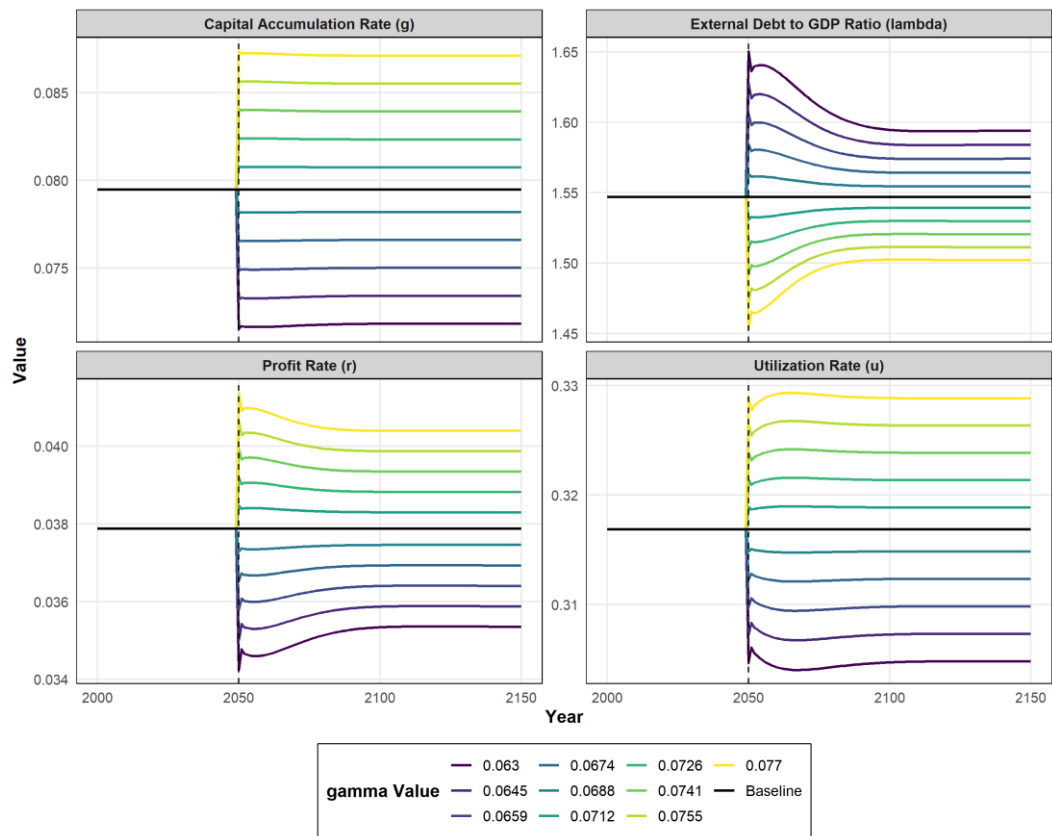


Figure 2.2 Sensitivity to α_1 (alpha1)

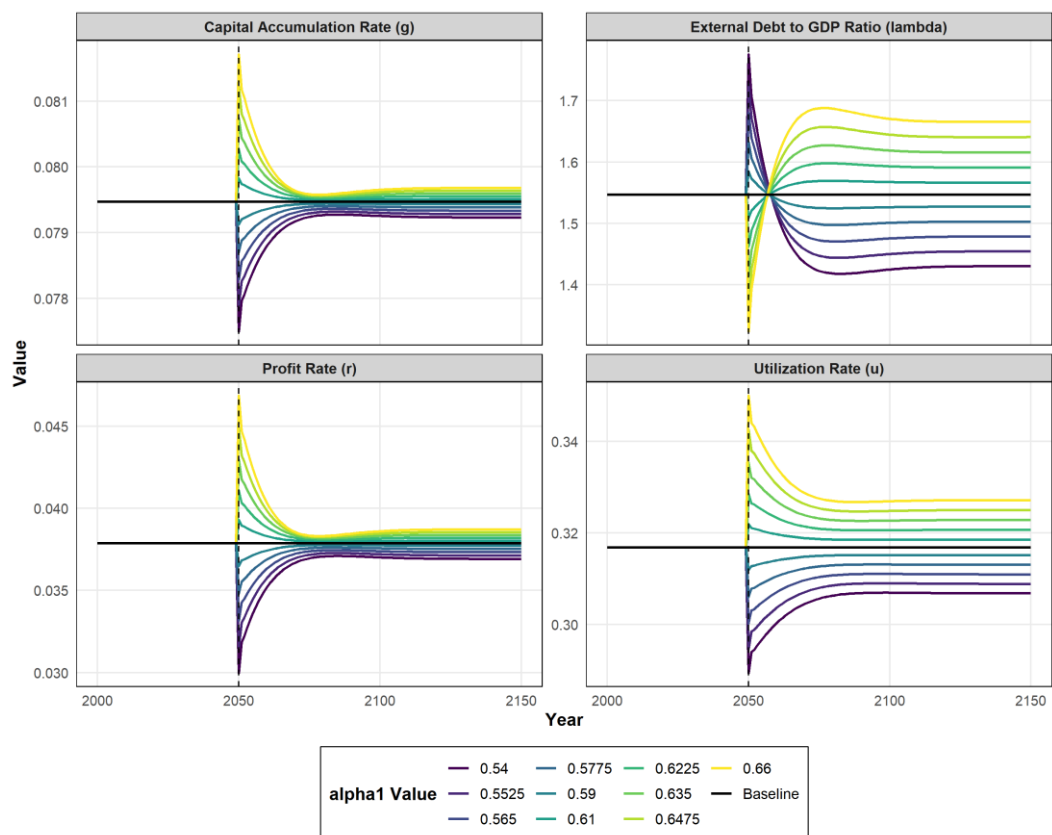


Figure 2.3 Sensitivity to b_0 (b_0)

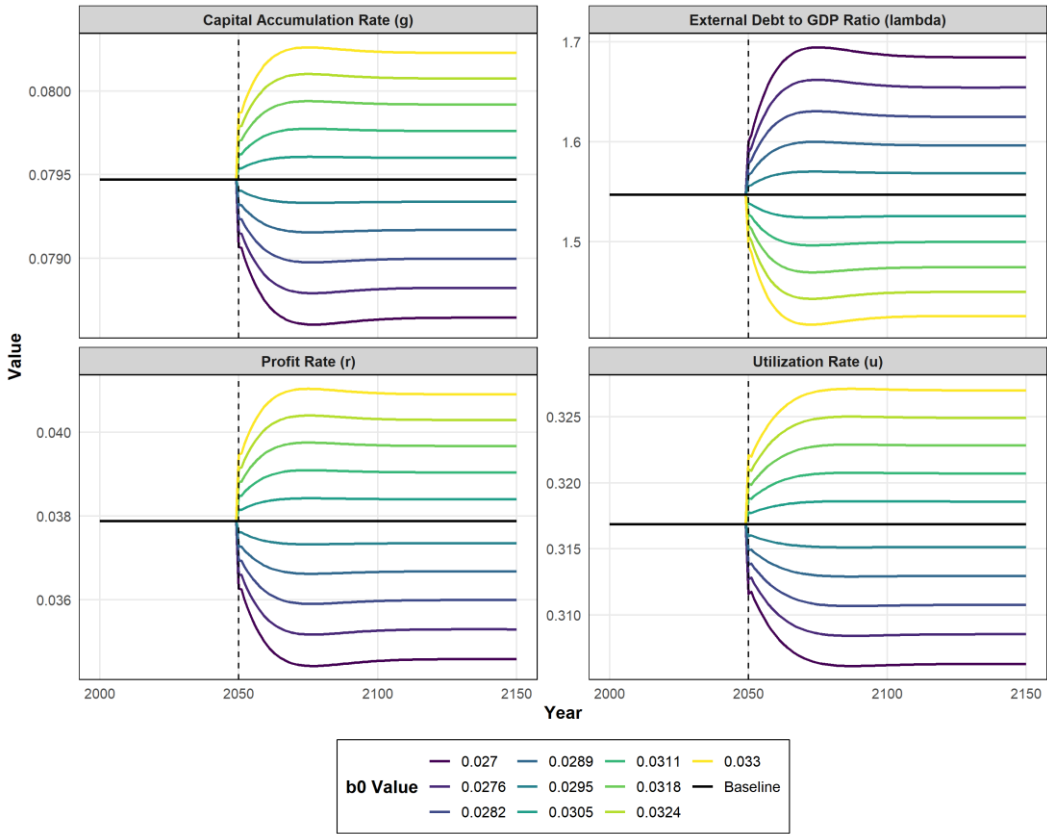
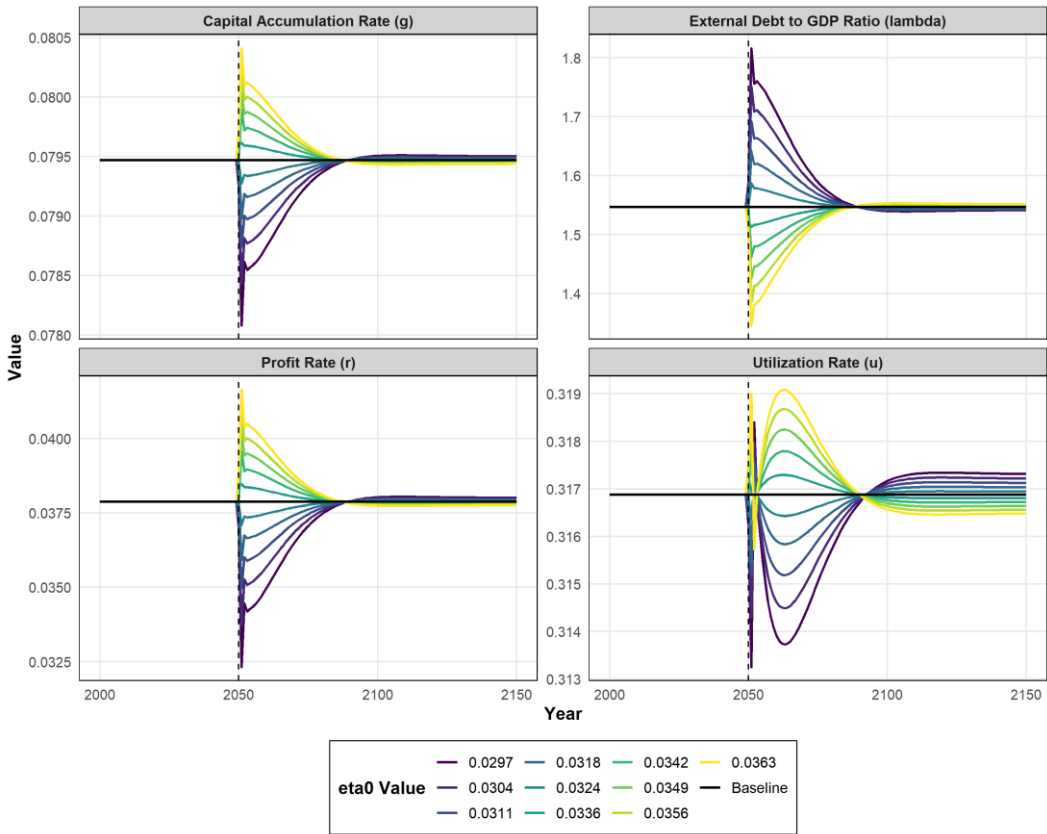


Figure 2.4 Sensitivity to η_0 (η_0)



Figures 2.1-2.4 show the sensitivity analysis performed by shocking four particular parameters, respectively the animal spirits (γ), the propensity to consume out of income (α_1), the autonomous component of exports (b_0), and the parameter regulating the demand for bonds by foreign investors (η_0).

The normalized model is then simulated in R using the NLEQSLV package ("non-linear equation solver"). Initially, we determine the steady-state values by solving the model without time lags, effectively treating it as a time-independent model. If steady-state solutions exist, these values, when used as initial conditions in the dynamic model, remain constant in every period we simulated, indicating that the model is already at its steady-state equilibrium. The solid black line representing the baseline scenario in Figures 2.1–2.4 illustrates this. Note that every baseline variable in the normalized model is constant at its steady state, while in the “levels” version of the model, flow and stock variables would keep growing due to our Kaleckian assumption on the capital accumulation function. In that case the model would achieve a steady growth equilibrium, where all variables grow at the same growth rate. Moreover, coherently with the normalized model, if we should normalize all stocks and flows by capital, we would obtain the same equilibria values.

The sensitivity test involves applying a shock to a selected parameter after fifty periods. For each parameter, we display ten different shock intensities. Lighter lines represent scenarios where the shocked parameter is higher than the baseline, while darker lines indicate a lower level. This shock disrupts the steady-state equilibrium, temporarily pushing the system out of balance. If the system is able achieve a new steady state, it demonstrates the model's robustness, allowing it to accommodate a wide range of parameter configurations. This seems to be the case as in Figures 2.1-2.4 the model always converges to a new steady state.

2.5 Simulating a BoP crisis

If the model is robust to a wide range of parameters, this does not mean that instability can't arise. In particular we are interested on how pressures on the BoP could lead our economic system toward an explosive dynamic of rising Current Account deficits and exploding external debt. We are interested on two main “triggers”: first, capital flights due to changed portfolio preferences have always been at the core of balance of payment crisis; second, a rise of the foreign (dollar) interest rate was among the main triggers of the debt crises of the '80s.

Capital Flights

We know that households wish to allocate a share of their wealth to foreign assets. What happens when they change their preferences? Assume that domestic investors do not trust anymore the economy and its fragile financial market in generating economic growth, maybe also because they believe that the actual size of the external debt to GDP is very close to unsustainability. Thus, these economic agents decide to “fly” to safe foreign assets: they sell domestic assets and buy foreign ones. This preference shift is analogous to a change in the parameters $\lambda_{10}(\downarrow)$ and $\lambda_{20}(\uparrow)$.

One possibility is that a relatively moderate capital flight hits the economy, without compromising the stability of the system. Still, capital flights would result in worsened economic activity, as shown in the next figures.

Figure 2.5 Impact of moderate capital flights

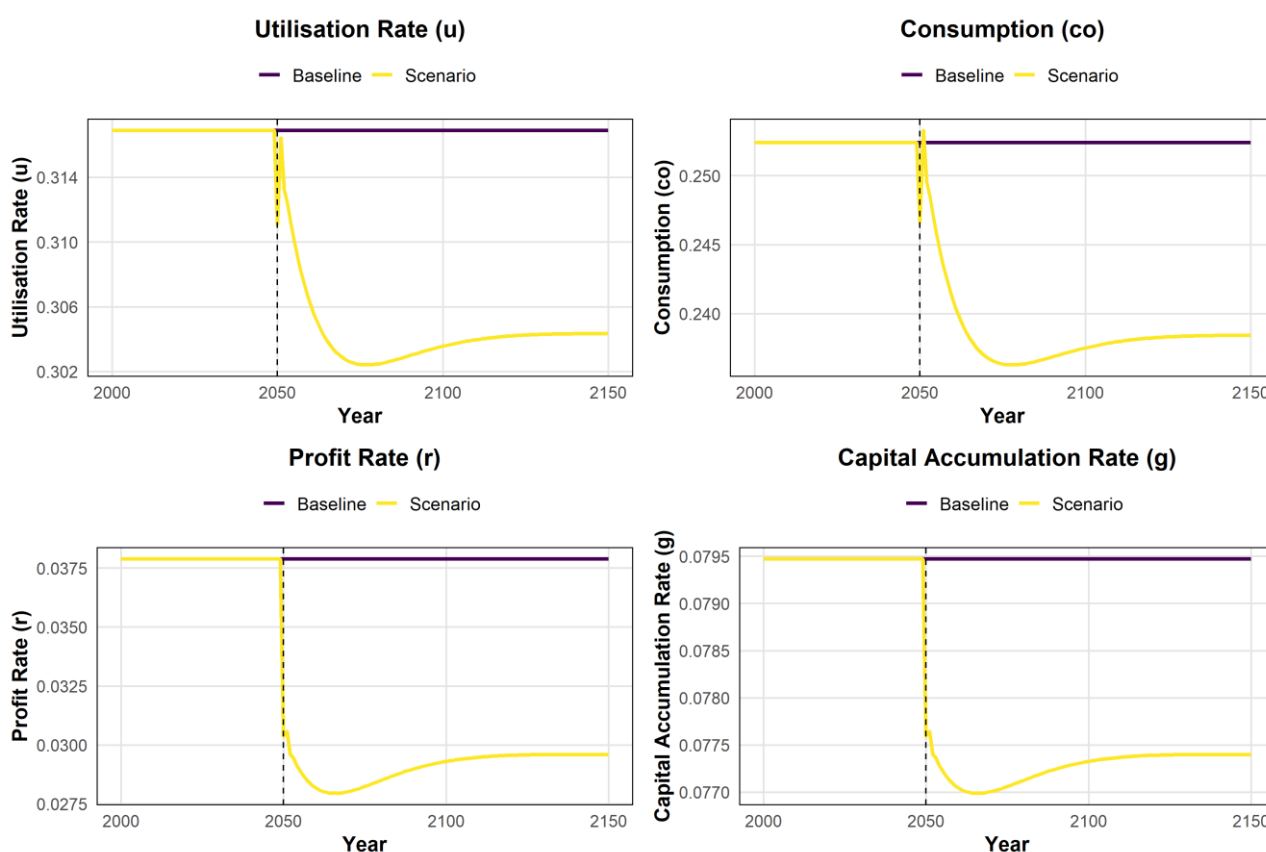
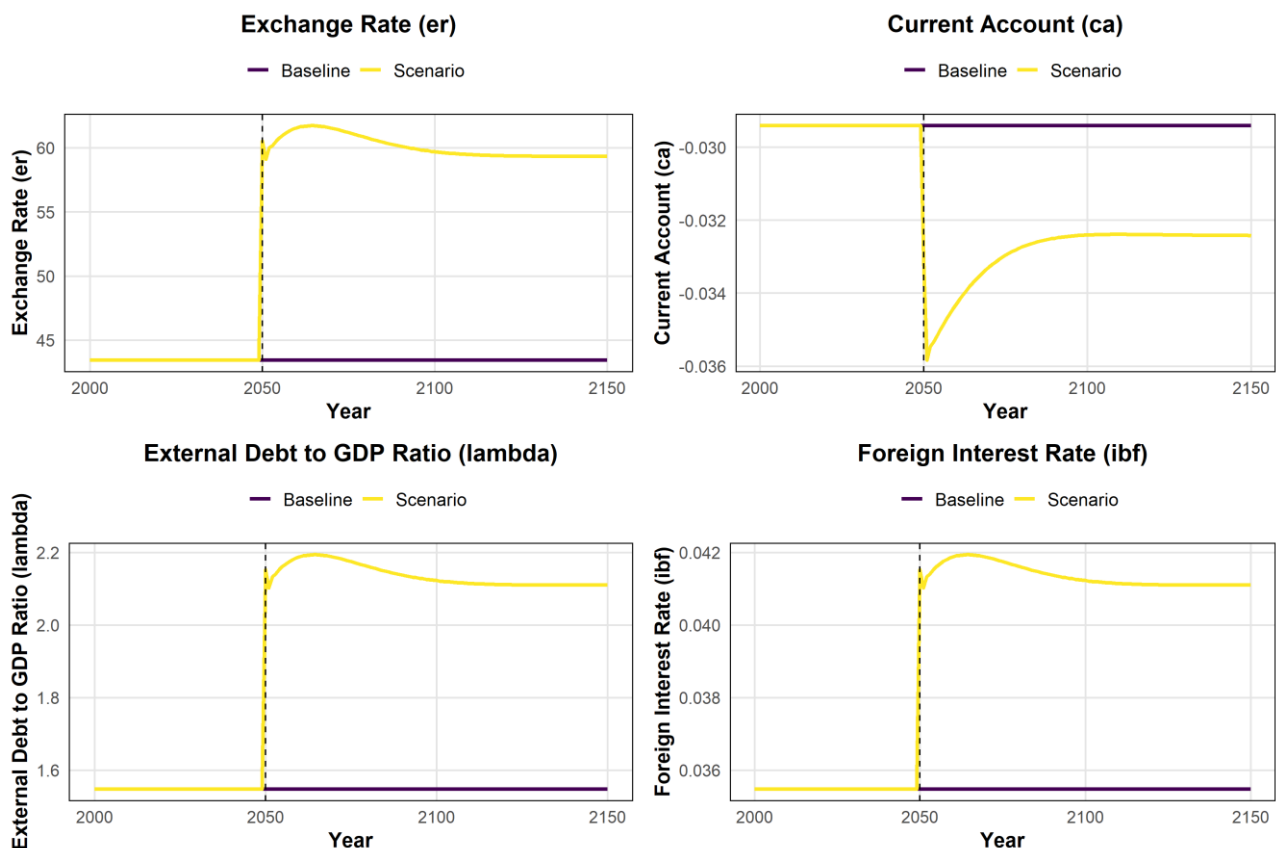


Figure 2.5 and 2.6 illustrate the impact on the economic system of a shift of portfolio preferences in favor of foreign assets (λ_{10} decreases from 0.5 to 0.4 while λ_{20} increases from 0.2 to 0.4). Figure 2.5 shows a deterioration in variables related to economic activity and aggregate demand, driven by open-economy dynamics. As depicted in Figure 2.6, increased demand for foreign assets exerts pressure on the exchange rate, leading to its depreciation. This

depreciation raises the external debt-to-GDP ratio. Consequently, foreign investors, perceiving reduced confidence in the domestic economy, demand a higher premium on foreign currency-denominated debt. The interest rate on foreign currency-denominated bonds, a primary source of foreign currency, rises, increasing firms' debt service burden. Higher debt service costs lower the profit rate, reducing the own funds available for investment. As a result, firms cut back on capital accumulation, leading to decreased utilization and consumption.

Figure 2.6 Impact of moderate capital flights

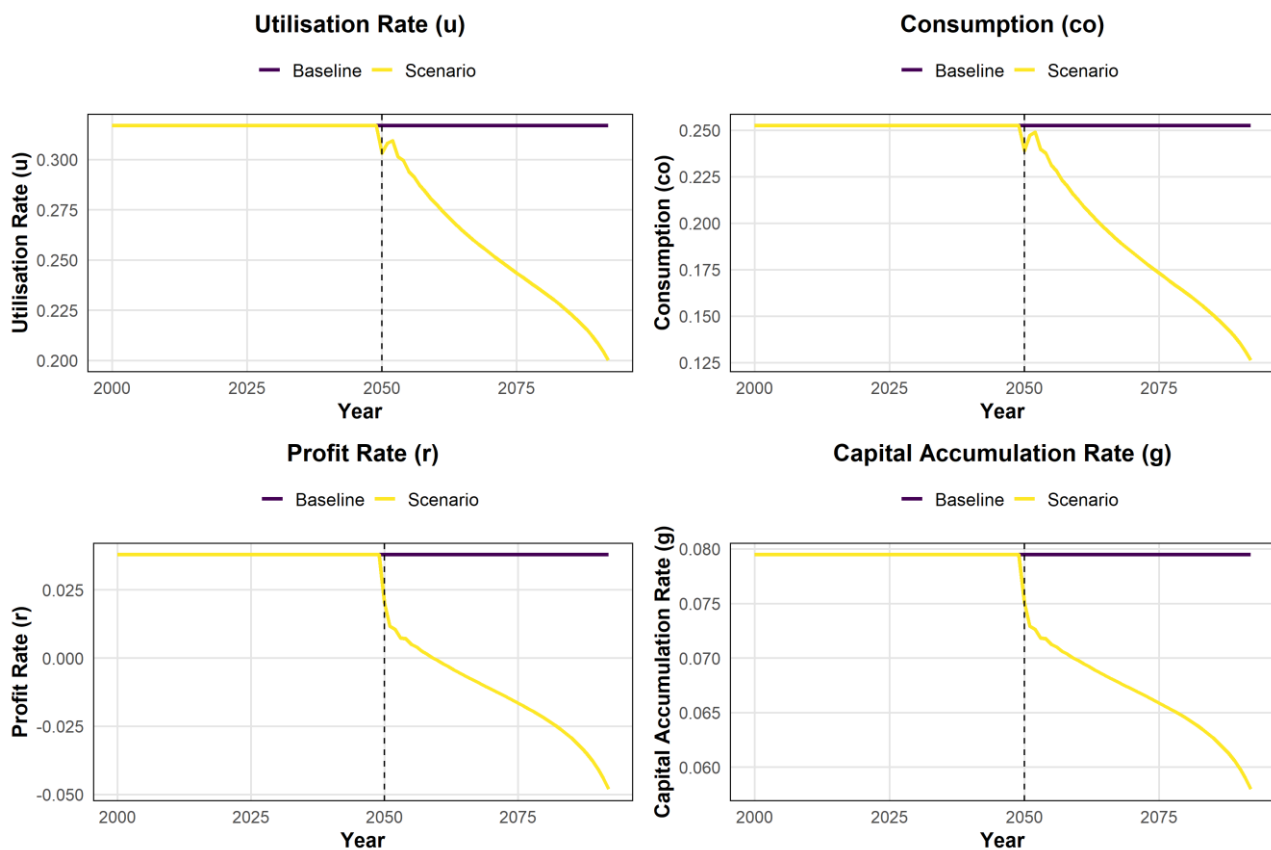


Furthermore, we observe a deterioration of the current account deficit. On one side there is a boost of exports due to the improved competitiveness that followed the depreciation. Indeed, even if we don't show it, the trade balance deficit slightly improves. On the other side, however, the negative net interest income due to higher external debt service completely offsets the improvement in the balance of goods and services. We conclude that even moderate capital flights, therefore, when the economy is particularly exposed to external debt and a CA deficit, would have a negative impact on the economy.

The experiment we observed is still a “sustainable” scenario, in the sense that the economic system after some periods adjusts toward another stable equilibrium. Within this theoretical world, a policy maker could just accept the reality of a worsen economic activity, without

worrying about any instability. Different is the case of more drastic capital flights. Now let's assume that domestic households, or at least the richest among domestic households (remember that our households' sector is aggregate) are extremely worried about the current economic conditions thus decide to sell most of their domestic currency denominated assets (deposits and bonds) and buy foreign assets. The parameter λ_{10} now is set from 0.5 to 0.1 and λ_{20} from 0.2 to 0.8. Figure 2.7 and 2.8 illustrates this extreme scenario.

Figure 2.8 Impact of extreme capital flights



The directions of the dynamics of these variables resemble the previous scenario, but the model now fails to reach a new equilibrium. Indeed, each variable exhibits an explosive trajectory. As shown in Figure 2.8, aggregate demand-related variables are declining at an accelerating pace. Conversely, Figure 2.9 illustrates that the open economy variables are surging. The depreciation triggered by capital outflows places the economy on an unstable path, fuelled by a vicious cycle of currency depreciation, escalating external debt, and increasing risk premiums on foreign currency-denominated bonds, which must be issued in growing quantities. In this case, however, foreign currency borrowing is primarily used to service the rapidly expanding external debt, plunging the economy into a full-blown debt overhang crisis. Certainly, the larger the economy's trade balance deficit, the more vulnerable it becomes to capital flight.

We are sure that the economy won't find any steady state equilibrium as our R solver at a certain period violates the Walras' law that so far was respecting (the same model on Eviews will be unable to find any solution). While theoretically our economy explodes into a massive recession, if we think in more realistic terms, it is plausible that at a certain point foreign investors will stop financing the domestic economy, forcing it to declare a default on foreign debt. Alternatively, the economy could deviate back to a stable path if in the meanwhile structural reforms are able to change the productive structure of the economy (see Figure 2.10).

2.9 Impact of extreme capital flights

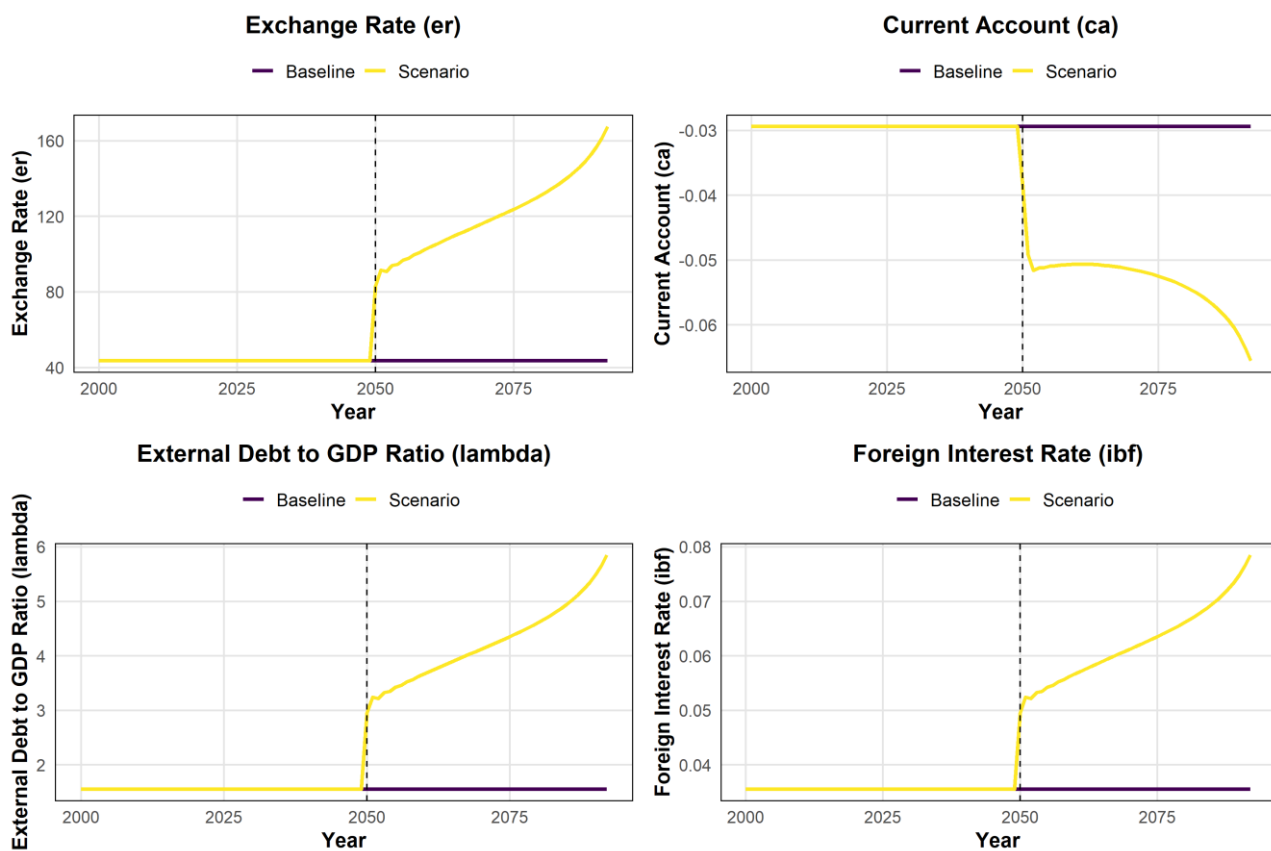
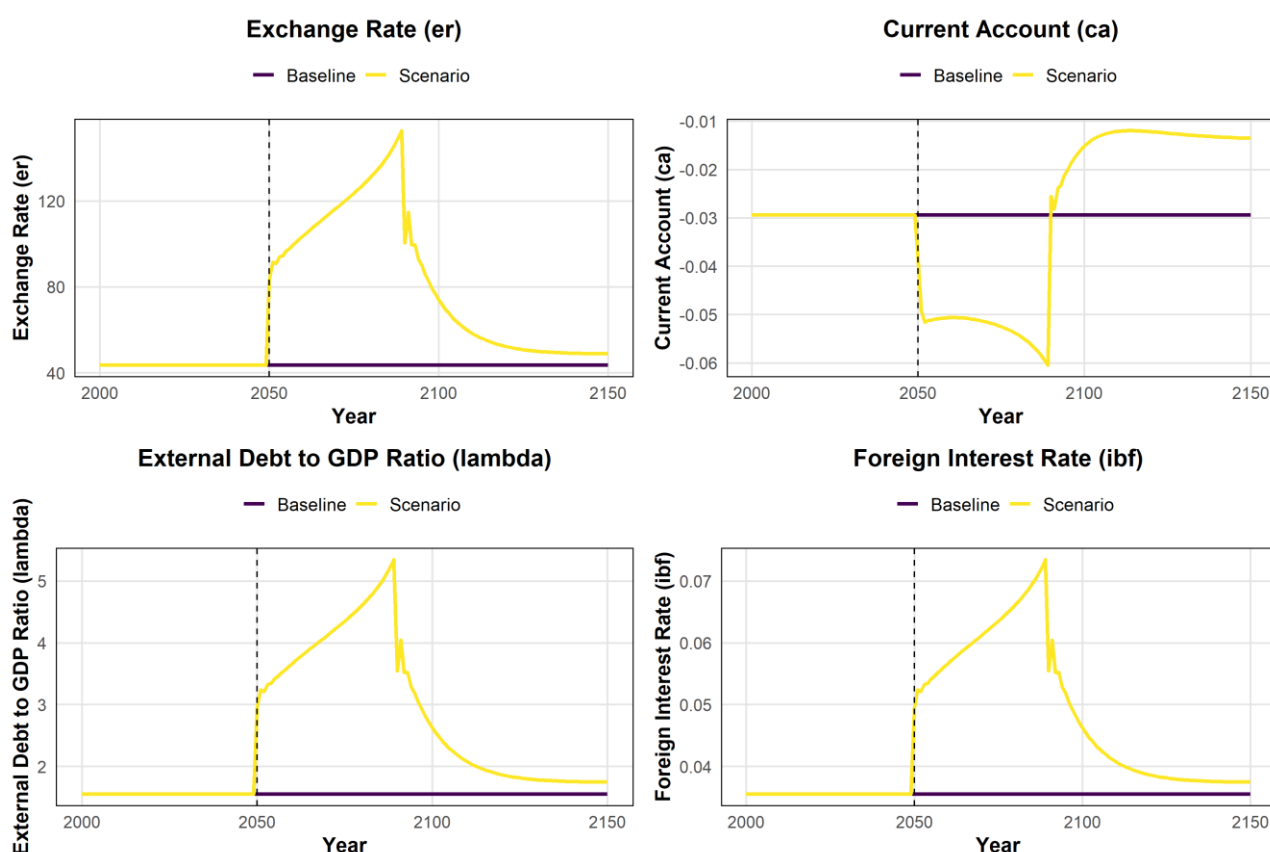


Figure 2.10 illustrates what happens if, during the BoP crisis triggered by capital flights, domestic firms are able to improve their import dependency (in this case b_2 diminishes from 0.25 to 0.15, thirty periods after the capital flights). We observe that the economy deviates from its unstable path toward a stable one, as firms now are much less dependent on imports. Less imports implies that the trade balance improves with the current account that turns positive. A CA surplus entails that foreign currency enters the economy with less reliance on external borrowing: the country has recovered from instability. The problem, however, is how to promote this structural change. The answer surely can't be found within this simple stylized model.

Figure 2.10 Structural reforms during the BoP crisis

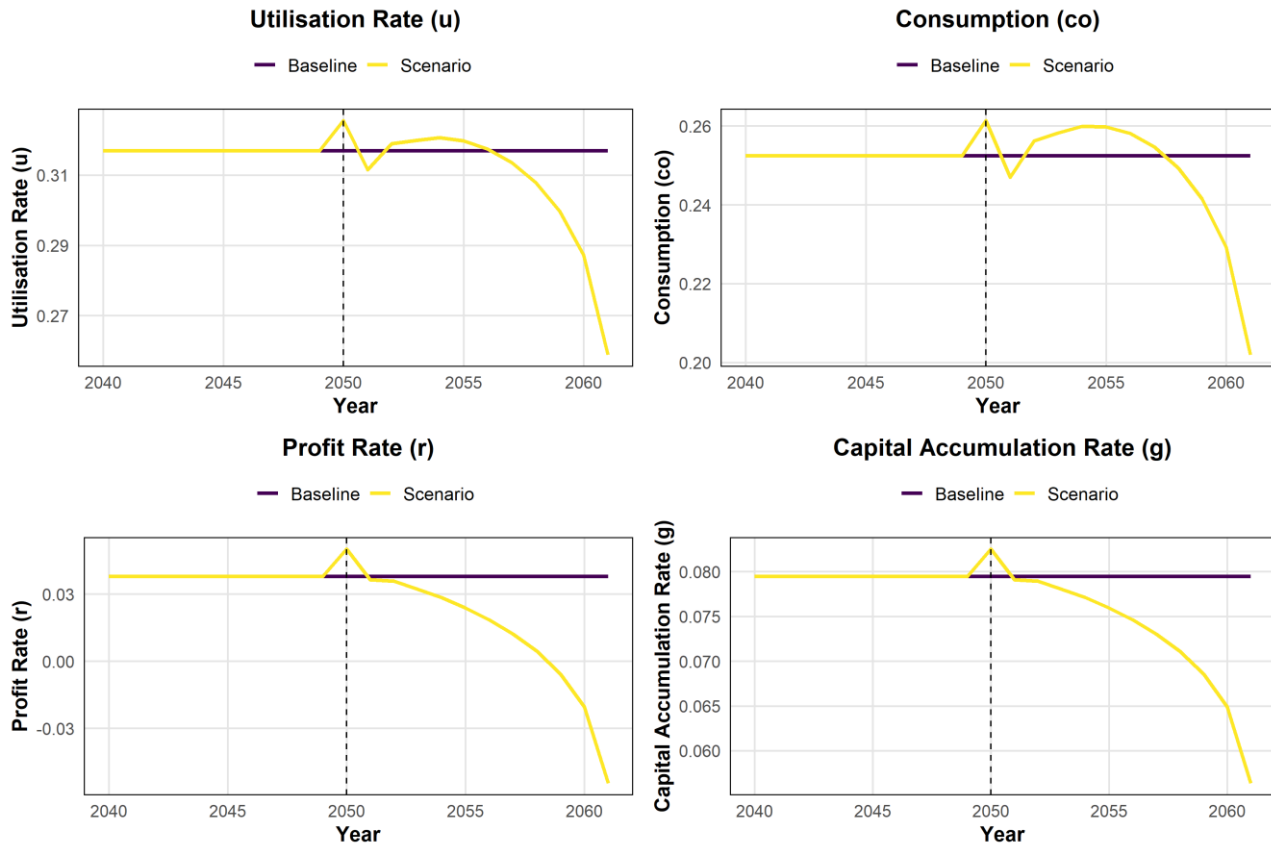


Foreign interest rate hike

Now we illustrate what happens in case the foreign country decides to hike its interest rate level. We are mainly interested on the unstable dynamic it could create. We are thinking in particular about the origin of the debt crisis in the '80s. The '80s debt crisis was triggered by a combination of rising U.S. interest rates, falling commodity prices, and excessive borrowing by developing countries, particularly in Latin America. Indeed, in the '70s, Latin American nations borrowed heavily in U.S. dollars from Western banks, fuelled by low (real) interest rates and abundant petrodollar liquidity. These loans were often used for state-led development projects or to finance imports, but when U.S. interest rates soared in the early 1980s to combat inflation, debt servicing costs jumped to unsustainable levels. It followed that many countries failed to defend the exchange rate, resulting in a sudden depreciation that aggravated the already skyrocketing debt service. Simultaneously, declining commodity prices reduced export revenues, making it impossible for countries like Mexico, Brazil, and Argentina to repay their dollar-denominated debts, leading to defaults and a regional crisis.

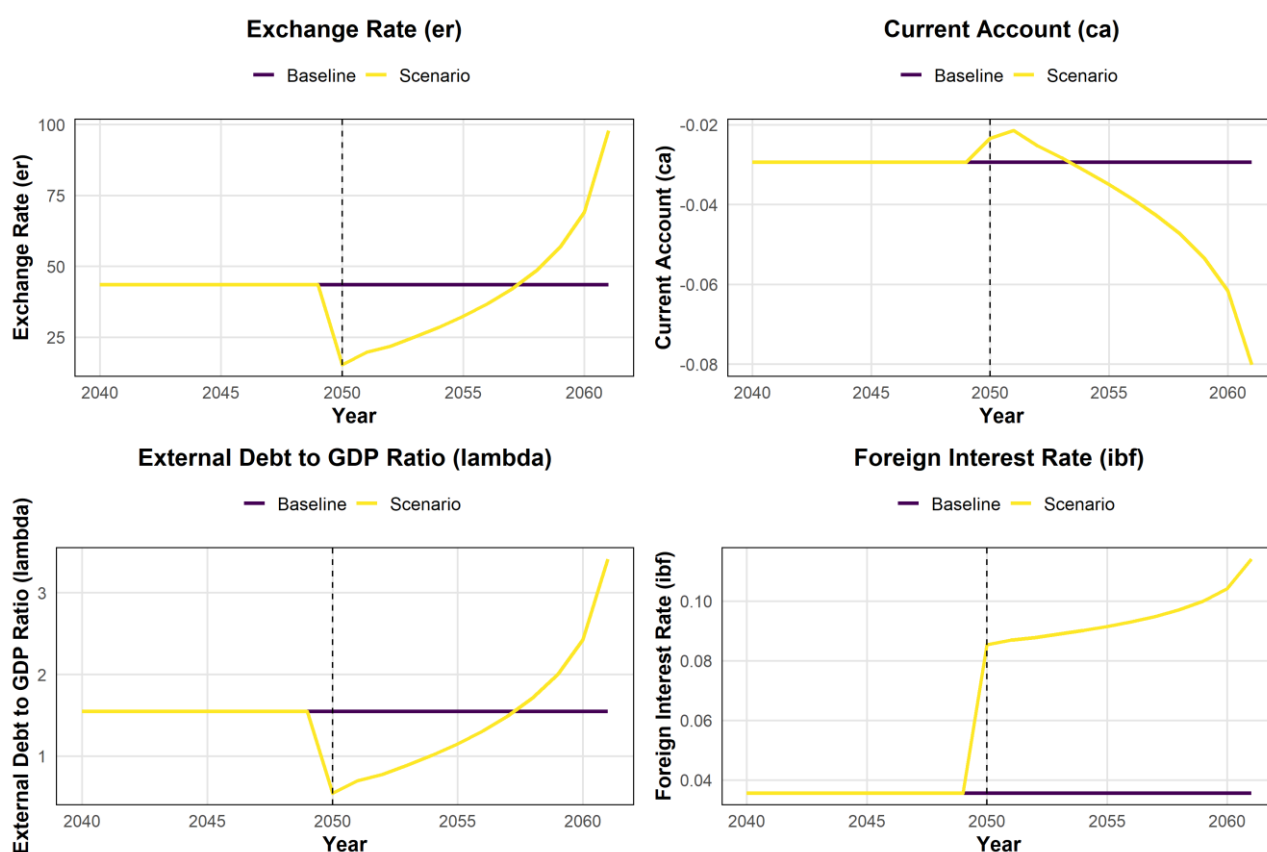
Similarly to the aggressive restrictive monetary policies of the Federal Reserve in the first half of the '80s, the foreign interest rate i_f^* is hiked to a level more than twice higher, from 0.02 to 0.055. Figures 2.11 and 2.12 illustrate the resulting dynamic.

Figure 2.11 Impact of a foreign interest rate hike



Once again, an unstable dynamic is originated by the excessive external borrowing accumulated due to the current account deficit. Yet in the short run we observe a small window of periods where the foreign interest rate hike seems to boost aggregate demand and an exchange rate appreciation. Indeed, the interest hike is immediately translated into a higher interest rate on the foreign currency bonds (and thus a lower price), attracting the attention of foreign investors who increases their demand b_f . This positive feedback on the economy is just temporary as soon it becomes clear that the current level of the interest rate on foreign currency denominated bonds is actually unsustainable. What follows is an already told story: rising interest rate, rising debt service and a depreciation that makes the dynamic even more unsustainable. On the real economy side, the huge cost of debt service pushes the profit rate to negative values; firms slow their capital accumulation and consequently economic activity is reduced.

Figure 2.12 Impact of a foreign interest rate hike



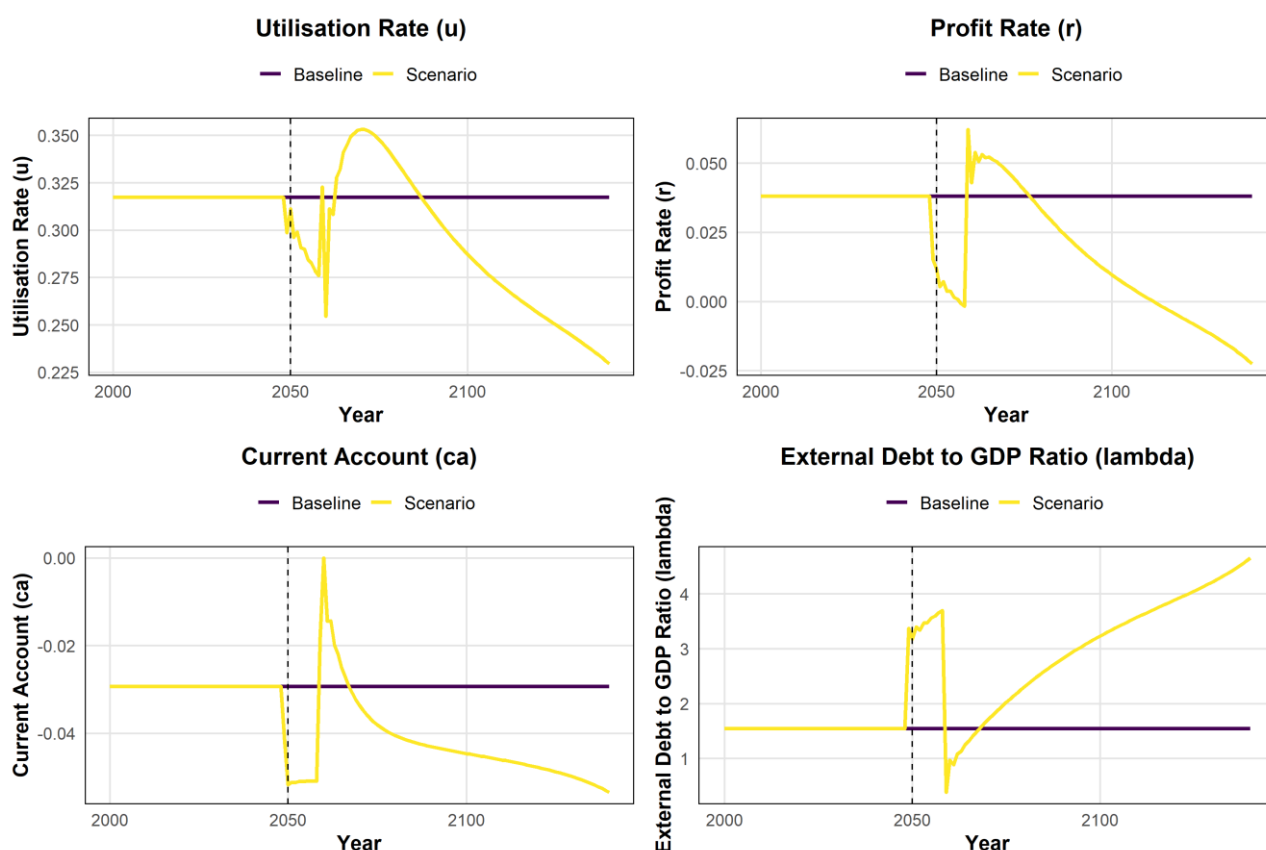
Discussion: African issues

What can this model tell us about the current looming crisis in LICs countries, especially the more burdened countries of Sub-Saharan Africa?

As we have often stressed, external debt problems are not a mere matter of mismanagement or excessive expenditures but rather a phenomenon due to many internal and external causes that struck a country into a fragile or unstable equilibria with no silver bullets that guarantee a simple exit. Sub Saharan African countries, despite the debt relief programs amid the '00s, weren't able to turn the renewed fiscal space into policies promoters of structural change: debt cancelation just delayed the acceleration of an unstable dynamic. Translated into the model, this could be represented with a scenario where "enlightened" foreign lenders, observing the economy entering into an unstable trajectory of the external debt, agree to cancel the external debt stock previously accumulated.

In Figure 2.13 we show the results of the simulation where, some periods after the spread of a debt crisis, the accumulated external debt stock, $pb_f B_{f-1}$ is set to zero.

Figure 2.13 Impact of debt relief in time of external debt instability

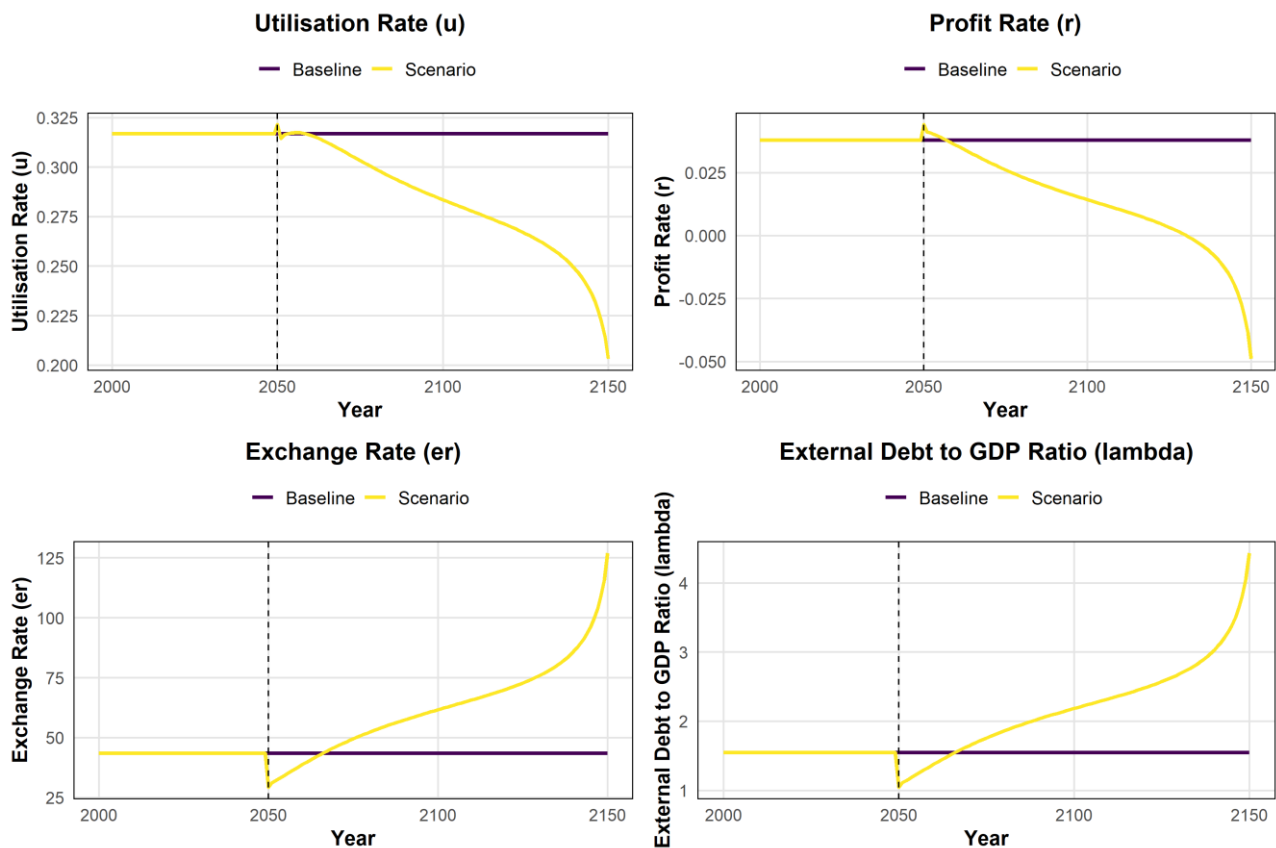


We assumed that in 2050 capital flights push the economy toward instability, indeed we observe lower profits and utilisation and higher current account and external debt to GDP. In the next 9 periods the economy is getting worse and worse. Hopefully, after ten periods the country is able to negotiate with investors an extremely generous complete debt relief: the debt to GDP ratio is drastically reduced to apparently sustainable levels. This gives a boost to the real economy as the absence of debt service increases net profits and capitalists' will to invest. After the debt relief, the improvement of utilisation is a sign of increased economic activity, at least in the short-medium run. The problem is that domestic households never changed back their portfolio allocation preferences. The debt relief thus results into a temporary deceleration of the unstable dynamic caused by capital flights: in line with Vaggi and Prizzon (2014), in long run the vicious circle of external instability would overcome any positive effects of the debt cancelation.

In this simple experiment we refer to household's portfolio preferences as the main cause of instability, but it is immediate to think about the huge financial resource drainage caused in Africa by the illicit financial flows (Afolabi 2024, Ndikumana and Boyce 2021) and profit

repatriations (Fofack and Ndikumana 2010), two practices deeply embedded in the financial system of the region. This resource drainage is aggravated by the higher and higher debt service cost that is surging because of the various causes we described in the first chapter. Within this simple framework we could argue that the recent financing of the African current account features high country risk premiums¹¹¹ $\phi\lambda$ compared to the past where debt was overall more concessional. If we acknowledge that these premia are determined by Credit Rated Agencies (CRAS) with a misconception of the economic reality and fundamentals in Africa (UNDP 2023), we will better understand why more and more countries are indirectly forced to damaging practices (say austerity measures, anti-climate policies or withdrawals from relief programs, Griffith-Jones and Kraemer. 2021) to mitigate any signal that could induce CRAs to negatively update their evaluation and put further distress on the debtor countries. Trivially, in this model even a moderate exogenous shift of the premium parameter would lead the economy toward instability, see Figure 2.14.

Figure 2.14 Impact of a change of the interest premium



¹¹¹ In our model the risk premium is the degree to which the CRAs evaluate the risk of default on external debt. A misjudgement could mean that even a low level of external debt to GDP ratio, λ , would generate an elevated interest on the foreign currency bonds because of a too harsh judgment on its stability, proxied by the parameter ϕ .

We assume that at a certain period investors decide that the actual premium on the foreign currency bonds' interest is too low given the actual size of the external debt to GDP. The parameter ϕ increases from 0.012 to 0.018. We see in Figure 2.14 that the exogenous shift of investors' risk perception alone drives the economy toward instability. A small, indebted country thus could end in a dangerous trap, once the foreign debt is exposed to the financial markets. On one hand it must ensure investors that solvency is at the centre of their budgeting choices. On the other hand, more proactive policies that could foster development and growth are constrained by the need of not altering investor's perception, that generally favour budget cuts. In both cases, the country has the hands tied and is forced to survive in a fragile low growth equilibrium.

Finally, debt instability could be caused by a sudden deterioration of the structure of the trade balance. In the time after the debt relief, Africa has seen a period of elevated economic growth, in part due to the particularly favourable commodity price conjuncture driven by Chinese demand between 2010-2014 (Christensen 2016). The exports helped to accumulate the foreign currency necessary to pay for the debt service. But when Chinese demand slowed, African countries weren't able to divert their production toward renewed international competitiveness. In our model this is equivalent to a reduction of the parameter b_0 and/or a lower b_3 (see equation 2.2n): lower autonomous demand for exports causes exchange rate depreciation putting further pressure the need for external financing. This parameters' shift would entail a dynamic opposite to Figure 2.12 and similar to Figure 2, where debt relief would just slow the explosive accumulation of foreign liabilities.

2.6 Conclusions

In this final section, we summarize the primary contributions of our model, which marks a significant step forward in the theoretical framework of this PhD thesis by extending the Kaleckian growth model developed in Chapter 3 to an open economy context, while preserving its inherent stability properties and introducing novel sources of instability stemming from foreign currency debt dynamics. This extension enriches the model by incorporating the complex dynamics of trade and financial flows within a stock-flow consistent (SFC) framework, specifically designed to capture the vulnerabilities of small, indebted economies, particularly those characteristics of low-income countries (LICs). By modelling a flexible exchange rate regime and introducing the Rest of the World (RoW) sector, as outlined in Section 2.1, the chapter illustrates how external shocks—such as capital flights driven by shifts in portfolio

preferences or abrupt increases in foreign interest rates—can trigger a Balance of Payments (BoP) crisis. Such crises manifest through runaway debt accumulation, escalating debt service costs, and severe recessions that crowd out capital accumulation, thereby hindering economic development.

The numerical simulations, detailed in Section 2.4, including the baseline scenario and sensitivity analyses, confirm the model's robustness to moderate parameter variations, as it consistently achieves new steady-state equilibria, as shown in Figures 2.1–2.4. However, under extreme scenarios, such as significant capital flights or a sharp hike in foreign interest rates, as explored in Section 2.5, the model reveals the potential for explosive dynamics, where exchange rate depreciation, rising risk premiums on foreign currency-denominated bonds, and worsening current account deficits create a vicious cycle of instability, echoing the debt crises of the 1980s in Latin America. A key finding from the simulations is the critical role of structural reforms, particularly those reducing import dependency (e.g., a reduction in the propensity to import, as shown in Figure 2.10), in redirecting the economy toward a stable path by improving the trade balance and reducing reliance on external borrowing. This result emphasizes that external debt sustainability is more effectively achieved through structural transformation of the productive system, as argued in Chapter 2, rather than through fiscal retrenchment or restrictive monetary policies.

By elucidating the interplay between external financial conditions, exchange rate dynamics, and domestic economic activity, this chapter provides a robust theoretical foundation for understanding the fragility of small open economies and offers valuable insights for policymakers aiming to mitigate the risks of BoP crises. The model also seems capable of capturing certain relevant dynamics of the surging debt crisis in SSA countries. Debt relief programs are a temporary solution that slow the debt exploding process. Phenomenon like the illicit financing flows and profit repatriations are among the main forces that drives debt instability, paired with a reduced demand for exports. Moreover, the new financing landscape has seen a reduction of the degree of concessionally of borrowing in favour of market driven capital inflows, whose financing purpose is far from a long run development perspective on the region. The natural outcome is an elevated cost of external debt, which becomes extremely exposed to the ambiguous judgements of foreign financial institutions.

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