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THREE ESSAYS ON WOMEN'S EMPOWERMENT IN AGRICULTURE. EMPIRICAL EVIDENCE FOR NEPAL AND UGANDA.

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To my grandmothers,

who knew what female disempowerment in agriculture means

TABLE OF CONTENTS

Three essays on women's empowerment in agriculture.
Empirical evidence for Nepal and Uganda

INTRODUCTION 1

Structure of the thesis 2

Data and Methodology 4

Main findings 5

Bibliography 7

CONCLUSION 131

1. Does land titling promote women's empowerment?
Evidence for Nepal **11**

1. INTRODUCTION 13
2. WOMEN AND LAND PROPERTY RIGHTS 15
3. CASE STUDY 17
4. DATA 18
   - 4.1 Empowerment 19
   - 4.1.1 Empowerment measures 20
   - 4.2 Land Property rights 22
5. METHODOLOGY 24
6. RESULTS 25
7. CONCLUSION 31
8. REFERENCES 34

2. Is time allocation gender sensitive to food price changes? An investigation of male and female labour supply in Uganda. 41

1. INTRODUCTION 43
2. TIME ALLOCATION ACROSS HOUSEHOLD MEMBERS . . 45
3. CASE STUDY 49
4. DATA AND METHODOLOGY 53
   - 4.1 Data description 53
   - 4.2 Sample selection 53
   - 4.3 Labour time behaviour 54
   - 4.4 Food prices 60
   - 4.5 Other explanatory variables 61
   - 4.6 Net Market Position: net buyers and net sellers of staple food 64
   - 4.7 Empirical strategy 66
5. ESTIMATION RESULTS AND DISCUSSION 68
6. CONCLUSION 78

Appendices

APPENDIX A 80

APPENDIX B 84

7. REFERENCES 90

3. Agricultural productivity in Uganda: does gender matter? 96

1. INTRODUCTION 98
2. RELATED LITERATURE 103
3. MODEL DESCRIPTION 107
4. DATA 111
5. RESULTS AND DISCUSSION 114
6. CONCLUSION 118

Appendices

APPENDIX A 120

7. REFERENCES 126

LIST OF TABLES AND FIGURES

CHAPTER 1:

Does land titling promote women's empowerment? Evidence for Nepal.

Table 1 : Descriptive statistics of the three empowerment measures 22

Table 2 : Distribution of the three empowerment measures . . . 22

Table 3 : Percentage of women having the final say on household's decisions, depending on land ownership 23

Table 4 : Descriptive statistics for all the variables used in the models 26

Table 5 : Regression results from Logit, Ordered Logit and OLS models 28

CHAPTER 2:

Is time allocation gender sensitive to food price changes?
An investigation of male and female labour supply in Uganda.

Table 1: Budget share of food consumption, by wave and place of residence 51

Table 2: Survey description 53

Table 3: Total weekly and annual labour time, disaggregated by gender, wave and working group, of the regression sample . . . 58

Table 4: Weekly and annual labour time without zero values, disaggregated by gender, wave and working group, of the regression sample 59

Table 5: Real price indices for the main food consumed in Uganda (expressed in Ugandan shillings) 61
Table 6: Descriptive statistics of the full regression sample (10117) 63
Table 7: Yearly hours of work of the estimated Hybrid Tobit model for market and non-market activities, disaggregated by gender . 70
Table 8: Yearly hours of work of the estimated Hybrid Tobit model for household farming and agricultural labour time, disaggregated by gender 76
Table 9: Descriptive statistics of the full male and female sample (15093) 80
Table 10: Net market position 81
Table 11: Total weekly and annual labour time, disaggregated by gender, wave and working group, of the full sample 82
Table 12: Total weekly and annual labour time without zero values, disaggregated by gender, wave and working group, of the full sample 83
Table 13: Yearly hours of work of the estimated Hybrid Tobit model for market and non-market activities, disaggregated by gender, for all the main food items 84
Table 14: Yearly hours of work of the estimated Hybrid Tobit model for household farming and agricultural labour time, disaggregated by gender, for all the main food items 87

Figure 1: Uganda position within the African continent 49
Figure 2: Food and Non-Food price indices 50
Figure 3: Nominal retail prices of Matooke (Mbarara district) . 52

CHAPTER 3:
Agricultural productivity in Uganda: does gender matter?

Table 1: Quantity of the main crops harvested (in KGs) by acre of area under cultivation (2009-10 & 2010-11) 101
Table 2: Descriptive statistics by gender of the plot manager . 113
Table 3: Panel Tobit with fixed-effects of the value of productivity of all the crops 115
Table 4: Panel Tobit with fixed-effects of the value of productivity of all the crops, with modality of land acquisition and annual domestic hours of work as further control variables 117

Table 5: Panel Tobit with random-effects of the value of productivity of all the crops 120
Table 6: Panel Tobit with random-effects of the value of productivity of all the crops, with modality of land acquisition and annual domestic hours of work as further control variables 121
Table 7: Panel Tobit with fixed-effects of the value of productivity of matooke, maize and beans 122
Table 8: Panel Tobit with random-effects of the value of productivity for matooke, maize and beans 123
Table 9: Panel Tobit with fixed-effects of the value of productivity of all the crops, with fallow as a further control variable 124
Table 10: Panel Tobit with random-effects of the value of productivity of all the crops, with fallow as a further control variable 125

Figure 1: Uganda annual matooke yield (1993-2013) 102

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INTRODUCTION

"The full and complete development of a country, the welfare of the world and the cause of peace require the maximum participation of women on equal terms with men in all fields" .

(UN Convention on the Elimination of all Forms of Discrimination against Women, 1979)

Understanding the contribution that women make in rural economies is essential: in fact, their contribution to growth and poverty reduction is particularly important when investigating the agricultural economies of all developing countries. According to Stamp (1989), "in development discourse, women are no longer entirely invisible, even if they still get far from equal time". Indeed, including gender issues in agricultural research is being widely recognized as an essential step towards the understanding of rural development. As a result, adding the gender variable for analyzing farm-related issues is the response to the assumption that : "Yes, gender makes a difference" (Poats, 1991). We argue that paying attention to gender is a matter of development: as will be highlighted many times within the thesis, women's involvement in the productive activities is overwhelming. In fact, it extends from the production of food crops, tending animals, crop harvesting, to collecting fuel and firewood, child and elderly care, food processing and preparation. For these multiple reasons, women can be considered as the engine of the household, whose livelihoods and well-being highly depend on them. However, many of these activities are not considered as "economically active employment" (FAO, 2011) in national accounts. Additionally, as FAO (2011) stated: "Agriculture is underperforming in many developing countries for a number of reasons. [...] women lack of resources and opportunities they need to make the most productive use of their time."

Moreover, it is important to shed light on the confusion on the use of the words sex and gender: in fact, while "sex differences refer to innate biological differences between men and women" (Quisumbing, 1996), gender is a social construct on which relationships between men and women are often placed. Despite gender roles vary between and within countries and regions, depending on the socio-economic and cultural formal and informal rules, overall women face many constraints, both in terms of access and control over productive resources, constructed by societal norms that rigidly embrace male dominance (Nkhonjera, 2011). Therefore, this involves them in a vicious cycle of poverty.

Moreover, they are subjected to a high vulnerability: even if they are the main producers of food and responsible of the household management, they are often marginalised both within the household itself and at the community level. On this purpose Lawanson (2008) confirms the idea of women as *second-class citizens*, with the only duty of reproduction, notwithstanding their crucial role in productive tasks.

In recent years, the need to reduce gender inequalities has received much attention from the international community. Since the 1975 *World Conference on Women*, organized by the United Nations, many have been the attempts to establish concrete measures to insert into the global agenda. In this regard, the Convention on the Elimination of all Forms of Discrimination against Women (1979) pointed out that "State Parties shall take all the appropriate measures to eliminate discrimination against women in rural areas" (CEDAW, 1979; Crowley, 1999). Additionally, through the Beijing Declaration (1995), the women's empowerment and gender equality have been recognized as relevant issues in the international agenda, enough to being part of the Millennium Development Goals. Furthermore, since Boserup's *The role of women in economic development* (1970), the literature growingly advocates the socio-economic contribution that women offer in both developed and developing economies. Also the *Women's Empowerment in Agriculture Index (WEAI)*, developed by the International Food Policy Research Institute (IFPRI) represents a technical attempt to measure women's empowerment, due to the recognized connection among it, food security and agricultural and economic growth.
This research project is an attempt to produce an evidence-based study on the gender gap in low income countries, namely Nepal and Uganda. More specifically, we will try to show why it is important to include gender issues in the agricultural and development analyses, and why it is necessary to recognize the essential role women play in enhancing the economic growth of low-income countries such as those considered in the present analysis.

Structure of the Thesis

Although addressing different research paths, the three papers that compose the thesis have the same topic in the background: women's empowerment as the most relevant strategy to empower the economy of developing countries. The papers contribute to the gender debate in development economics, through the assessment of three issues that have received particular attention by the related literature:

- *How much does land titling enhance female decision-making power?*
- *Is there a gender effect of food price change on labour supply?*
- *Is there a gender dimension in agricultural productivity?*

In Paper 1 *"Does land titling promote women's empowerment? Evidence for Nepal"* the central aim is the assessment of whether land titling could enhance the decision-making power of Nepalese women. Indeed, land is one of the relevant means that determine the economic well-being of peasants, as well as an individual measure of social status (Roy and Tisdell, 2002; Kumar and Quisumbing, 2012). However, frequently women in low-income countries suffer from the exclusion from its access and control. Also in the case of Nepal, although the *Muluki Ain* (2002) extended partially the land inheritance right to them, female ownership rules are not offered overall, and women are formally marginalised within the economic sector, in spite of their active involvement in many agricultural tasks.
The research question explored in this paper is thus the following:

- *Does land ownership represent an essential condition in reinforcing female farmers' role within their respective households?*

In Paper 2, *"Is time allocation gender sensitive to food price changes? An investigation of male and female labour supply in Uganda"* the potential impact of the food price instability on the labour supply side is investigated. More specifically, we control for the presence of a gender dimension in *labour coping strategies*. Hence, in this work multiple research questions are sought to being explored:

- *To what extent food price instability influences labour supply of both men and women?*
- *Are women more shock-absorbers than men?*

Finally, in Paper 3, *"Agricultural productivity in Uganda: does gender matter?"* the analysis is focused on the gender differences in agricultural productivity, using the sex of the plot manager as gender indicator. In fact, as it is emphasized in various parts of the study, land is the major means of agricultural production, and women are often excluded not only from its ownership, but also from its access and management. On this purpose, since land titling alone is not sufficient to increase agricultural productivity, we will take into consideration the three aspects of ownership, access, and management simultaneously.
In this study, the main research questions addressed are:

- *Is there empirical evidence of gender differentials in agricultural productivity?*

- *Is sex of the land manager a potential determinant of the gender gaps in crop production?*

Data and Methodology

Since women's empowerment is dealt from different perspectives, different empirical strategies have been implemented. In the first article, we draw data from the Women's Questionnaire of the *Nepal Demographic Household Survey (DHS, 2011)*. DHS contains detailed data on land and farm ownership and management. According on research purpose, we have investigated the relationship between land entitlement and the decision-making power of female farmers implementing three different approaches, depending on the empowerment measure used: an *OLS*, an *Ordered Logit* and a *Logit* models.
In both the second and the third paper data are drawn from the *Uganda National Panel Survey*, a nationally representative program implemented through the technical and financial support of the World Bank *Living Standard Measurement Study - Integrated Survey on Agriculture (LSMS-ISA)*. Whilst in the second paper we use data from the three panel waves (2009-10; 2010-11; 2011-12), in the third one we have employed only the first two waves (2009-10; 2010-11). In the second paper we have based our analysis on the Household Questionnaire, that collects data both at the household and the individual level. However, in order to control for the net market position of farm households, that informs us on whether households were *net buyers* or *net sellers*, we combine the dataset with some sections of the Agricultural Questionnaire, where information on food quantities sold and harvested are contained. The analysis has been performed using an *Hybrid Tobit model* (Neuhaus and Kalbfleish, 1998; Allison, 2005). In the third paper instead the analysis has been carried out using mainly the Agricultural Questionnaire, where specific information on the plot management are contained. However, as data are at the household level, in order to extrapolate data on gender, we need to take into consideration some sections of the Household Questionnaire. To estimate the potential gender differences in agricultural productivity, a Tobit fixed-effects model, firstly introduced by Honoré (1992), has been implemented.

Main Findings

The analysis carried out in the first paper represents an important contribution to the literature about the women's empowerment in agriculture, focusing on the role land titling could exert in enhancing the decision-making power of Nepalese female farmers. As we expected, land ownership is an effective source of empowerment. This result is robustly confirmed by the fact that, contrariwise, women who do not own land and do not work on the household farm assist to a decrease of their decisional power.

As concerns the second paper, our results support the hypothesis that women are the real "shock absorbers" when exogeneous events, like food price changes, occur: in fact, we have found that annual paid hours increase for both men and women, although the magnitude of the female coefficient is higher. This may be due to the role of women as food suppliers for the household components, particularly children and the elderly: in fact, the higher the food price, the higher should be the remunerated hours needed to guarantee the same food intake to household members. However, the hours devoted to the other labour time categories (non market, domestic and agricultural ones) reduce.

Results from the third paper are consistent with the previous findings of the related literature: plot managed by women are less productive than plots managed by men. However, due to the limits of the data, we can only talk about *partial gender differences in agricultural productivity*, as we cannot control for gaps in inputs access, such as fertilizers, training services, machineries, and so on, that with no doubt have a great influence on the agricultural productivity.

Bibliography

[1] Allison, P. (2005). *Fixed effects regression methods for longitudinal data using SAS*. Cary, North Carolina: SAS Institute Inc.

[2] Boserup, E. (1970). *The role of women in economic development*. New York: St. Martin's.

[3] Crowley, E. (1999). *Women's right to land and natural resources: some implications for a human rights-based approach.* Rome: FAO Rural Development Division.

[4] Food and Agriculture Organization (2011). *The state of food and agriculture: Women in Agriculture. Closing the gender gap for development.* Rome: FAO.

[5] Honoré, B.E. (1992). Trimmed Lad and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects. *Econometrica* 60(3): 533-565.

[6] Lawanson, O.I. (2008). *Female labour force participation in Nigeria: determinants and trends*. Oxford Business & Economic Conference Program.

[7] Kumar, N. and Quisumbing, A. (2012). Inheritance practices and gender differences in poverty and well-being in Ethiopia. *Development Policy Review* 30(5): 573-595.

[8] Neuhaus, J.M., McCulloch, C.E. (1998). Separating between-and within-cluster covariate effects in the analysis of clustered data. *Biometrics* 54(2): 638-645.

[9] Nkhonjera, C.C. (2011). *The role of women's empowerment on agricultural development in Malawi.* MSc Thesis: University of Reading, United Kingdom.

[10] Poats, S. (1991). *The role of gender in agricultural development.* Consultative Group on International Agricultural Research: University of Cornell.

[11] Roy, K.C. and Tisdell, C.A. (2002). Property rights in women's empowerment in rural India: a review. *International Journal of Social Economics* 29(4): 315-334.

[12] Quisumbing, A. (1996). Male-female differences in agricultural productivity: methodological issues and empirical evidence. *World Development* 24(10): 1579-1595.

[13] Stamp, P. (1989). Women in development as a field of enquiry: issues and conceptual problems. In *Women's management in Africa.* International Development Research Centre, IDRC Report 238e. Ottawa, ON: IDRC.

[14] United Nations General Assembly (1979). *Convention on the elimination of all forms of discrimination against women (CEDAW).* New York: UN General Assembly.

CHAPTER 1

Does land titling promote women's empowerment?

Evidence for Nepal.

Abstract

Women's land titling is recognized as an important tool to promote women's empowerment in agriculture, as well as a means to fight poverty. However, most rural women still have low access to land, despite their crucial role in the agricultural sector. This paper uses the National Demographic and Health Survey (2011) to investigate the role female land rights have in promoting their empowerment - expressed in terms of decision-making power - in Nepal. Our results demonstrate that women's final say within the household increases with land ownership.

Keywords: land property rights, Nepal, empowerment, gender

JEL codes: D13, J16, Q15.

1. INTRODUCTION

Despite the dominant and important role that women play in the agricultural sector, many are the constraints to their full involvement in the socio-economic scenario entrapping them in a vicious cycle of poverty. In fact, women face many forms of inequality, both in terms of access and control over productive resources, constructed by societal norms that rigidly embrace male dominance (Nkhonjera, 2011). Systematic differences in land tenure regimes between men and women contribute to the radicalization of inequality and poverty for women (Lastarria-Cornhiel, 2009). They are subjected to vulnerability: even if they are the main producers of food and responsible of the household management, at the same time they neither benefit of an actual decisional power within the household itself, nor of land rights. As FAO (2011) pointed out, in many countries of the Sub-Saharan Africa the agricultural production could increase if women would have the same possibilities of access to productive resources. Meanwhile, the 1979 FAO report of the World Conference on Agrarian Reform and Rural Development supported the idea of ensuring women's equitable access to land and other productive resources (FAO, 1979). This notwithstanding, a substantial assets gap between women and men persists. The Convention on the Elimination of all Forms of Discrimination against Women (1979) states in Article 14 that "State Parties shall take all the appropriate measures to eliminate discrimination against women in rural areas, [...], and to have access to [...] and equal treatment in land and agrarian reform" (CEDAW, 1979; Crowley, 1999). Similarly, the Strategic Objective A.2 of the Beijing Declaration (1995) reflects this concern: in particular, it defines the legislative and administrative framework aimed at guaranteeing and enshrining the ownership and inheritance rights to women. The United Nations Millennium Declaration, namely the Third Millennium Development Goal, as well as the World Bank (IBRD/World Bank, 2009), even recognize the achievement of gender equality and women's empowerment as being essential.

A large and growing body of literature has investigated the role of land prop-

erty rights in promoting women's empowerment, emphasizing the central role that they would have to fight poverty. As Mutangadura (2006) states, "the traditional exclusion of women from property and land ownership is the most damaging global human rights violation experienced in many developing countries". Also Kachika (2009) noted that poverty reduction and the achievement of Millennium Development Goals cannot take place without a whole access and control over land.

The aim of this paper is therefore to contribute to the analysis of empowerment of women working in agriculture. The specific question addressed in this study is whether land titling can enhance working women's empowerment by increasing their decision-making power within the household. Previous studies have used the level of education as proxy of women's degree of empowerment. We build, instead, an indicator of women's decision power within the households as a proxy of empowerment, since we believe that empowerment is a multifaceted concept, that may be approximated by several types of measures. This topic has been previously explored by Allendorf (2007), whose results show a significant relationship between women's land rights and their decisional power within the household. This study reinforces this evidence, showing that female land ownership is a necessary condition for ensuring women's empowerment in agriculture, so that lack of ownership and access to land constitutes a fatal barrier to women's empowerment.

As in the study by Allendorf, we focus on Nepal. Differently from the empowerment scale adopted by Allendorf, we introduce a new measure of empowerment that is more precise in accounting for the variability of female decision-making power within the household. We draw our sample from *Demographic and Health Survey* (2011), which contains information on both female decision-making power and asset ownership at the individual level. One limit of our analysis is represented by the potential endogeneity of land ownership, according to which more empowerment could increase the probability of owning land. This problem is not easy to overcome, due to the difficulty to identify a robust instrumental variable in the dataset we use, and to the absence of panel data

that would allow us to take account of unobserved heterogeneity by means of fixed effects. It must be said, however, that the fact that women in developing countries become land owners mostly through inheritance (Deere and Doss, 2006; RDI, 2009; Kumar and Quisumbing, 2012), might support the hypothesis of exogeneity of land ownership.

The paper is organized as follows: in Section 2 we lay out the theoretical dimension of land property rights by emphasizing the gender-bias in their assignment. In Section 3, we give a brief description of the Nepalese female farmers' property status. In Section 4 we present the data, focusing in particular on the two variables whose association we want to investigate (namely empowerment and land property rights). In Section 5 we describe our methodological approach. We present the findings of our research in Section 6 and in Section 7 we conclude.

2. WOMEN AND LAND PROPERTY RIGHTS

Land is an important asset that determines the economic well-being of peasants, and granting ownership rights is fundamental for the sustainable development of agriculture (Roy and Tisdell, 2002). Furthermore, it is considered a fundamental mean to escape poverty and to ensure the household's food security (Pena *et al.*, 2008), as well as a measure of social status. In many developing countries, land remains unequally distributed in favour of male heads of the household, undermining women's opportunity to exert any form of control over it (Nightingale, 2006). Land could create a sense of self-worth and provide physical safety and psychological security (RDI, 2009). Ensuring land rights to women could thus reduce the gender inequalities and dependence on men for their survival, but formal discrimination still persist (Rao, 2005). As Jacobs (2004) pointed out, land is a symbol of patrilineage continuity and of male authority, so that women's land rights are still largely discriminated against (Mutangadura, 2004). Existing research evidences that strengthening women's economic and legal rights has a real and positive impact on women's labour force participation, investment and agricultural productivity (Hallward-Driemeier *et al.*, 2013; Pena *et al.*, 2008; Goldstein and Udry, 2005; Yngstrom, 2002). Ku-

mar and Quisumbing (2012), for example, point out the positive implications of women assets in terms of increased investments in the next generation's health, nutrition and schooling, stressing the long term benefits in terms of women's well-being. In Zimbabwe, for example, only widowed and divorced women with custody of children could be granted land, even if the share is less than that one granted to men (Gaidzanwa, 1994). Instead Peterman *et al.* (2010) argue that women, particularly widows, in sub-Saharan Africa are victims of an asset disinheritance, which could be considered as a form of gender-based violence (Izumi, 2007). Contrariwise, in Malawi the inheritance land laws have been revised, recognizing equal opportunities to inherit land regardless the gender belonging (Nkhonjera, 2011), notwithstanding the reluctance of the customary land regulation. Also the World Development Report 2014 states that "laws in most of the world allow women to own assets, but several countries, particularly in South Asia and Sub-Saharan Africa, still have gender-specific ownership rights that limit women's ability to acquire, sell, transfer, or inherit property" (World Bank, 2014). Following Agarwal (2003) the three sources of arable land - namely the State, the family and the market – typically allocate land to male households' heads. In other words, the three forms of distribution are gender-biased. This is even confirmed by Kevane and Gray (1999) who, evoking the Sub-Saharan women's condition, report that they are "owners of crop" instead of "owners of land". A study about land management in China (Hare *et al.*, 2008) stated that recognizing land titling to women reduces the probability of the household to fall into poverty, and this is also validated by the purpose of the third Millennium Development Goal[1].

This property structure has implications for women's decision-making both intra-households and within the community. Control over land is a key domain

[1]There are many studies (Udry *et al.*, 1995; Quisumbing, 1995; Edriss, 2005; Goldstein and Udry, 2005; Peterman *et al.*, 2010; Rahman, 2010; Kilic *et al.*, 2013) that stress on the positive role of female farmers for the agricultural productivity (e.g. groundnuts in Malawi). Additionally, several studies have found that redistributing inputs between men and women in the household increases the allocation of resources to food (Hoddinot and Haddad, 1995; Duflo and Udry, 2004).

for exercising choice, especially in agriculture where, as emphasized by a large part of the studies, men own most of the assets and exercise most of the decision power. In this vein, legal property rights could be positive for women, since they would change their bargaining power within their households. As noted by Duflo (2012), in fact, the decision-making sphere is still "monopolized" by men, due to the widespread cultural barriers that women face[2]. Agarwal (1994) outlines how, in the rural context, the bargaining power has a bidirectional relationship with land entitlement: in fact, while the weakness of the bargaining power can reduce the access to production inputs, at the same time the lack of property rights can reduce the capability/possibility of bargaining, reinforcing the social and economic insecurity.

3. CASE STUDY

Nepal is an economy based on agriculture, with about 80 percent of the economically active labour force engaged in the agricultural activities (Bhandari, 2004). In this country farm and agricultural wage are the income sources for most of the population. Land represents a crucial source of economic livelihoods, with rural households more likely to own land than the urban ones (DHS, 2011). As Bhandari asserts, "Land is more than a physical entity; it has been, and continues to be, the economic backbone of the agrarian system and the rural power structure" (Allendorf, 2007). Women play an important role in farming activities. They participate to different agricultural activities, as plowing, irrigation, harvesting. Some studies about female farm workers in South Asia (Rahman, 2010; Hasnah *et al.*, 2004) show that female labour is as productive as the male one. Nonetheless, they are often discriminated with respect to men: as the World Bank (2014) argues, "women farmers frequently have lower access than men to agricultural extension and advisory services, often due in part to biased membership rules or requirements" and are treated as invisible farmers

[2]She finds that these barriers are not a prerogative of developing countries, as they persist in the developed world: according to a series of experiments, women leaders are evaluated more negatively than male leaders.

(Ovwigho and Ifie, 2014). Despite their active role into the agricultural production, women do not fully share its benefits, as they are not recognized full property rights of land. As in other Southern Asian countries, inheritance is the most usual way to grant women's property rights (RDI, 2009). The Muluki Ain (Eleventh Amendment) of the Country Code of Nepal (2002) introduced some progress in this field: daughters who have inherited ancestral property must return their share to their heirs (brothers) in case of marriage, but this restriction does not apply to land jointly purchased by the married couple. At the same time, widows inherit from deceased husbands. While generally land is owned by men, the Demographic and Health Survey (2011) highlights that almost the 10 percent of Nepalese women own land. As Allendorf (2007) points out, this could depend on more egalitarian inheritance practices that have taken place in the country: as the author suggests, some parents decide to give land to daughters because they have not sons, they have plenty of land or for other reasons. Additionally - she affirms - urban women who have other sources of income could decide to buy land. Moreover, even if the Interim Constitution (2007) provides equal access to land through inheritance, purchase, leaseholds and government land allocations, informally women are still discriminated from land titling. In 2013, the Second National Conference of Farmer Women emphasized the need to ensure equal land rights to female farmers, helping to increase the understanding on the importance of making land ownership less gender-biased.

4. DATA

The data used in the present study are drawn from the *2011 Demographic and Health Survey (DHS)*, a nationally representative cross-sectional household survey. It is structured in four core questionnaires (Household, Women, Men and Children), of which we use only the Women one, according to the aims of the paper previously mentioned. A total of 12.674 eligible women were surveyed (age between 15 and 49), from whom we draw our sample of 3600 women. As we are interested in women's empowerment in agriculture, we have selected

only women employed in the agricultural sector, who are currently married and reside with their husbands or partners. In this way, we have discarded female headed households where women would be the primary decision makers by default (mostly widowed women). In this section we describe the variables supposed to be related to the empowerment of Nepalese women in agriculture, with a special focus on land property rights. On this purpose we have built proxies for both empowerment and land ownership.

4.1. Empowerment

Empowerment is a multifunctional concept, which embraces different aspects of both individual and collective life. As it is a subjective notion, depending on own life experiences, personality and aspirations (Alkire *et al.*, 2012), a unique definition of empowerment cannot be provided. Kabeer (1999) defines empowerment as the process by which people acquire the ability to make choices. In other words, it is a dynamic process of change. Similarly, Alsop *et al.* (2006) argues for an explanation of empowerment as "the process of enhancing an individual's or group's capacity to make purposive choices and to transform those choices into desired actions and outcomes". Instead Narayan (2002) proposes a definition of empowerment in terms of "expansion of assets and capabilities of poor people to participate in, negotiate with, influence, control, and hold accountable institutions that affect their lives". Women's empowerment and economic development are closely related: as Duflo (2012) highlights, a bidirectional relationship exists as, while on the one side some constituents of development, as health, education, political participation and rights, could bring down gender inequalities, on the other side the persistence of the mentioned inequalities delays development. Assets at which women have access have a paramount significance in terms of empowerment, and could increase their bargaining power. In this vein, Quisumbing and Maluccio (2003) argue that the bargaining power within a household is determined, among various factors, by control over resources. Particularly, female land ownership could influence the bargaining power within a household. Meanwhile, according to Datta (2008)

ownership of resources (e.g. land) "does not automatically imply an increased ability to act according to one's preferences". Based on this way, the policy actions for land property rights represent a crucial step for their empowerment, by raising their decision-making and autonomy at household, community and national level. Finally, the Women's Empowerment in Agriculture Index (WEAI), developed by IFPRI, gives an important and innovative contribution in this field: it is a multidimensional index, which measures the degree of women's empowerment within five domains (1. decisions about agricultural production, 2. access to and decision making power over productive resources, 3. control over use of income, 4. leadership in the community, and 5. time allocation).

4.1.1. Empowerment Measures

The empowerment measures we have constructed are based on four decision domains available in the dataset we used. Respondents were asked who in their household decides (1) on how to spend money derived from husband's earnings, (2) on respondent's health care, (3) on major household purchases, and (4) on visits to family or relatives. Then we categorized the answers in four options: decisions taken alone by the women interviewed, decisions taken jointly with their husband/partner, decisions taken only by their husband/partner and decisions taken by someone else. The vast majority of decisions were made jointly with their partners, even if few of them (particularly those concerning health, large purchases and visits), were taken by someone else[3].

Hence we created three empowerment measures. Differently from Allendorf (2007) we have created a first measure of empowerment (*final say*) to compare women who have final say alone on at least one of the four decisions with those who made all the four decisions jointly with their partners or who have no decisional power on all domains. This is a binary variable that assumes the value of one if she has the final say on at least one of the four decisions, and

[3] Actually, women were also asked who usually decided to spend the respondent's earnings, but we could not use it due to the low number of observations with respect to the other decisional domains (356).

zero otherwise. As reported in Table 2 below, we can observe that most of the women of our sample makes decisions jointly with their partners/husbands, or have not any decisional power (almost 69 percent). Subsequently, to better exploit the information on the variability of women's decision power available in the data, we have constructed a discrete measure of empowerment, *empscore*, summing up the score variables created for each decisional domain, each ranging from 1 to 4, where score 1 is attributed when decisions are taken by someone else, 2 when decisions are taken by the husband only, 3 when decisions are taken jointly with their partner and 4 if they decide alone. *Empscore* ranges from 4 to 16. Higher scores indicate a higher level of empowerment, and vice versa. Table 2 shows that only a little percentage of women are able to make decisions alone, while most of them have no decision power, or anyway decisions are taken jointly with their partners. The third measure of empowerment we have employed in our analysis, is derived by grouping the empscore values, so that 1 identifies the lowest, 2 a middle-low, 3 a middle-high and 4 the highest level of empowerment (in detail: 1 represents the values of empscore between 4 and 7; values among 8 and 10 are encoded in group 2; 3 groups values between 11 and 13, and finally 4 corresponds to values ranging between 14 and 16). The Cronbach's alpha of 0.84, measuring the internal reliability of this empowerment scale, demonstrates that the grouping of the four decisions into the empowerment scale is consistent. As Table 2 shows, again decisions are made mainly by other people (someone else or the husbands/partners), or at least by women together with their own husbands/partners, and only 8 percent of them has the power to make decisions alone.

Table 1: Descriptive statistics of the three empowerment measures.

Variable	*Nb of obs.*	*Mean*	*Standard Deviation*	*Min.*	*Max.*
Final say	3600	0.31	0.46	0	1
Empscore	3600	8.98	3.57	4	16
Empowerment scale	3600	2.11	0.99	1	4

Source: Author's calculation using Nepal DHS (2011).

Table 2: Distribution of the three empowerment measures.

Variable	*Absolute Frequencies*	*Percentage Frequencies*
Final Say		
0	2477	68.81
1	1123	31.19
Empscore		
4	772	21.44
6	390	10.83
7	165	4.58
8	341	9.47
10	366	10.17
11	151	4.19
12	740	20.56
13	253	7.03
14	110	3.06
15	82	2.28
16	96	2.67
Empowerment Scale		
1	1327	36.86
2	841	23.36
3	1144	31.78
4	288	8.00

Source: Author's calculation using Nepal DHS (2011).

4.2. Land Property Rights

In the Demographic and Health Survey - Women Questionnaire, women had to answer to the following question: *"Do you own any land alone or jointly?"*.

From these data, we have found that the vast majority of them (more than 90% of the selected sample) did not have any land. Following Allendorf (2007), we created a measure of land ownership, which combines information about land ownership with information about women's working condition (i.e working as contributing family members, as self-employed or as employees). In fact, taking into consideration only information about land ownership could lead to some bias: even if our aim is to understand the role of women's land titling in enhancing their empowerment, in any case considering women who do not own land but work in the family land is different from treating women neither possess any land nor work in the family farm. Given these considerations, hence we created three categories of land titling:

- *lives in landless household*: women who do not own land and work for someone else;
- *lives in landed household*: women who have not any land titling, but work in the family land;
- *land owners*: women who own land themselves and are self-employed.

Below (Table 3) we have reported the cross-tabulation showing the percentage of women having the final say on household's decisions, on the basis of the women's land ownership.

Table 3: Percentage of women having the final say on household's decisions, depending on land ownership.

	Has final say on at least one decision alone or jointly (%)	*Has final say on all the decisions alone or jointly (%)*	*Has final say on all decisions alone (%)*
Lives in landed household	76	19	28.8
Owns land herself	94	31.1	44.5
Lives in landless household	83.2	21.3	36.9

Source: Author's calculation using Nepal DHS (2011).

It shows that, in general, women who own land themselves are those ones who have a higher decision-making power. In particular, as can be seen, there is a preponderance of female landowners who have final say in almost one decision alone or jointly (94%), even if it can be stated that also the share of female landowners who have final say alone is high enough (44.5)[4]. In general, looking for the data, it can be observed that the higher share of women take almost one decision alone or jointly (even in this case the percentage could be "biased' by the fact that most of the decisions are taken jointly). Farther, we can observe that living in landless households seems to be related to a higher decisional power of women working in agriculture with respect to those who live in landed households. However, this statement is not supported by the regression results when controlling for the other explanatory variables taken into consideration within the analysis. In the following section we give a brief explanation of the methodology we adopted.

5. METHODOLOGY

As we have three different women's empowerment measures (see Table 1 above), we had to take on three approaches, one for each dependent variable. Thereafter, we first apply a *Logit Regression Model*, where the dependent variable is identified by the dummy *final say*:

$$Final\ Say = F(\boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 FemaleLandTitling + \boldsymbol{\beta}_k OtherIndVar) = \frac{1}{1 + e^{(\boldsymbol{\beta}_o + \boldsymbol{\beta}_1 FemaleLandTitling + \boldsymbol{\beta}_k OtherIndVar}} \quad (1)$$

As in the other models, the independent variables chosen concerned both women's characteristics (age, level of education, caste ethnicity, religion, type

[4]Percentages are computed as the ratio of women who take decisions divided by the total number of women for each land titling category, and then multiplied by 100: e.g. 299 is the total number of women who own land themselves, and of them 133 make all the decisions alone. Therefore we have: 133/299 = 0.445*100 = 44.5. The same reasoning applies for the other land titling and decisional categories reported in the Table 3 above.

of earnings) as well as their land entitlement. In this approach, as well as in the Ordered Logit model we will discuss on after, the independent variables are supposed to increase or decrease the probability of women to have final say within the household. Whereupon we adopt an *Ordered Logit Regression Model*, which is the most appropriate approach for ordinal dependent variables - in this case the scale of empowerment (defined *empowerment*):

$$Empowerment = F(\boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 FemaleLandTitling + \boldsymbol{\beta}_k OtherIndVar) = \frac{1}{1 + e^{(\boldsymbol{\beta}_o + \boldsymbol{\beta}_1 FemaleLandTitling + \boldsymbol{\beta}_k OtherIndVar}} \tag{2}$$

Finally we use an *Ordinary Least Square (OLS)* approach, with the measure of empowerment variability used as dependent variable:

$$Empowerment\ Variability = F(\boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 FemaleLandTitling + \boldsymbol{\beta}_k OtherIndVar) + \varepsilon \tag{3}$$

In the results of both the ordered logit and logit models, we report the odds ratios (OR henceforth)[5]. Specifically, results can be explained in terms of percentage variation:

$$\Delta\% = 100 * [OR - 1] \tag{4}$$

After having given a brief explanation of the analytical procedures implemented and on the principal issues behind this choice, in the next section we will present some of the findings.

6. RESULTS

The descriptive statistics concerning the independent variables adopted in the analysis are set out in Table 4. It is apparent that most of the women of

[5]The OR is the ratio of the probability that an event takes place for individuals exposed to the event itself divided by the same probability for unexposed individuals.

the sample are young wives, with an average age of 33 years. As many of them are unpaid - and this could be related to the lack or low bargaining power that, at the same time, could be due also to the fact they are mostly uneducated - the household's wealth is mainly middle/lowest.

Table 4: Descriptive statistics for all the variables used in the models.

Variable	*Nb of observations: 3600 women empowerment sample (%)*
Land rights	
Lives in landless household	9.8
Owns land herself	8.31
Lives in landed household (Ref.)	79.6
Urban residence	13.44
Caste ethnicity	
High Caste	41.6
Tibeto-Burman	38.2
Other (Ref.)	20.2
Household wealth	
Richest	6.5
Richer	14.5
Middle	21.7
Poorer	25.4
Poorest (Ref.)	32
Wife of the household head	74.4
Age	mn: 33.5 sd: 9
Employment remuneration	
Paid in cash	4.6
Paid in kind	7.58
Paid both in kind and in cash	5.31
Unpaid (Ref.)	82.5
Education	
Women's education	
Primary	17.2
Secondary or more	18.5
None (Ref.)	64.3
Husband's education	
None or unknown	26.56
Primary	28.8
Secondary	37.7
Higher	7

Source: Author's calculation using Nepal DHS (2011).

Table 5 presents the results of the three estimated models. Firstly, it presents the findings regarding the association between women's land ownership and their ability to make decisions alone on at least one decision. We have used a Logit

regression analysis to predict this relationship, and Table 5 shows the OR. First, land ownership increases the probability of having the final say alone on at least one decision by 52 %. At the same time being empowered seems to be less likely for women who live in landless household, but this association is not statistically significant. As regards the employment remuneration, being paid in cash or simultaneously in cash and in kind increases the probability of being more empowered, while payments in kind have not any statistical significance. Surprisingly, household wealth is not statistically significant. Caste is not associated to a higher decisional power, with the exception of the Tibeto-Burman women, who are more likely to take almost one decision alone. This finding is consistent with that one of Allendorf (2007), who explained it with the higher freedom of movement of this ethnic group. When comparing education levels, only the secondary one appears to affect the female farmers' possibility to make decisions alone: this is not unexpected, as higher education should be correlated to a higher consciousness of their rights and role within the society. Finally, considering the place of residence, urban location does not exert any statistically significant influence in enhancing women's empowerment.

Table 5: Regression results from Logit, Ordered Logit and OLS models.

	Final say, OR	***Empowerment Scale, OR***	***Empscore***
constant	0.12 (0.03)		4.74*** (0.32)
Place of residence			
Urban	1.20 (0.14)	1.02 (0.1)	0.03 (0.18)
Religion			
Hindu	1.00 (0.12)	0.82** (0.08)	-0.19 (0.18)
Caste ethnicity			
High Caste	0.97 (0.11)	0.97 (0.09)	0.02 (0.16)
Tibeto-Burman	1.26** (0.14)	1.15 (0.10)	0.37** (0.16)
Other (Ref.)	1.00	1.00	
Household wealth			
Richest	1.26 (0.22)	1.81*** (0.28)	0.97*** (0.27)
Richer	1.09 (0.14)	1.36*** (0.15)	0.54*** (0.19)
Middle	0.88 (0.1)	1.19** (0.11)	0.35*** (0.16)
Poorer	0.94 (0.09)	1.24*** (0.10)	0.38*** (0.15)
Poorest (Ref.)	1.00	1.00	
Wife of the household head	1.16 (0.12)	2.87*** (0.26)	1.89*** (0.15)
Age	1.02*** (0.01)	1.03*** (0.005)	0.06*** (0.008)
Employment remuneration			
Paid in cash	1.96*** (0.39)	2.23*** (0.40)	1.48*** (0.32)
Paid in kind	1.03 (0.16)	1.66*** (0.22)	0.99*** (0.24)
Paid both in kind and in cash	1.99*** (0.37)	1.80*** (0.30)	1.37*** (0.3)
Unpaid (Ref.)	1.00	1.00	
Education			
Primary	1.02 (0.11)	1.23** (0.11)	0.31** (0.16)
Secondary or more	1.44*** (0.17)	1.68*** (0.17)	0.92*** (0.18)
None (Ref.)	1.00	1.00	
Land rights			
Lives in landless household	0.94 (0.16)	0.72*** (0.11)	-0.63** (0.27)
Owns land herself	1.52***(0.2)	1.70*** (0.2)	1.08*** (0.2)
Lives in landed household (Ref.)	1.00	1.00	
Nb. of observations		3600	
R-squared	0.03	0.03	0.03

Source: Author's calculation using Nepal DHS (2011). Standard errors into brackets.

Turning to the results of the ordered logit analysis, a clear benefit of female land ownership in the empowerment of Nepalese women is evident: as data highlight, the odds that a woman is more empowered are 70% larger if they own land. By comparison, the odds of women who live in landless household reduces their probability of having a higher decisional power by 28%. As expected, the different types of remuneration are a source of empowerment. Specifically, receiving payment in cash increases the odds that a woman is empowered by 123%, while being paid in kind increases it by a half. As expected, on the other hand, the detention of a source of income acquired independently reduces the need to remain anchored to the male economic support. Likewise, primary education is associated to an increase of the odds by 23%, while the secondary more than doubles the odds. Alike, the household wealth has a crucial importance in promoting the decision-making power of the women: as expected the richest quintile, inter alia, improves the odds of a woman to a greater extent than the poorer one. Additionally, being wife of the household head considerably raises their possibility of being more empowered. As pointed out in the logit analysis, the fact that higher education qualification increases the decisional role of women within the household could be associated to the higher awareness of their role and importance within society. Caste belonging has been inserted in the specification model, but it appears to have not a significant influence on the women's empowerment. This is in contrast with the findings of Allendorf (2007), as well as with the Logit regression results we presented above (and with the OLS ones that we will show later in the section): in fact they found that Tibeto- Burman women were more likely to be more empowered, in part due to the more egalitarian gender norms that are common in this caste. Conversely, it can be observed that Hindu religion reduces the odds of being empowered by 18%. This can be attributed to the gender roles within Hindu society: in fact, as Dube (1988) and Banerjee (2003) state, the image of the male dominance is embedded within the societal structure. As repeatedly emphasized and hypothesized, female land titling is positively associated to the role women play in the decision-making process within the household. However, as the gender studies

evidence, land does not represent the only source of empowerment. In fact access to other productive resources (e.g. fertilizer, machinery, etc.), as well as to technology and advisory services (Obayelu and Ogunlade, 2006), could further promote their active role in the agricultural sector. Besides, comparing the odds ratios for land ownership with those concerning employment remuneration - namely payment in cash - it can be observed that land ownership is relatively less beneficial than working with cash payments.

Finally, the OLS results confirm that land titling has a crucial role in determining the decisional power of female farmers. Contrariwise, women who live in landless households appear to have less decision power compared to those who work in landed households (the reference category) and, even more, those who own land. In part it can be considered as obvious, as they do not possess land and work outside the household. Clearly, all the three types of employment remuneration increase the autonomy of women, giving them less dependence from men: particularly being paid in cash improves the women's decisional power. Empowerment also depends on the level of education they have achieved: in fact, as the table shows, women who have a secondary or more qualification seem to have a higher decision-making power than those ones who have a primary education, probably because education gives them more awareness about their rights and duties. Also being wife of the household head is significant for enhancing women's empowerment. Even age has a positive impact on the women's final say: this could be explained in terms of "weakness" of young wives and "enforcement" of their role after a certain period they live in the household. Additionally, the household wealth, as well as the caste membership, seem to have a significant impact on women's agency within the household decisional domain: specifically, a highest level of wealth, as well as belonging to the Tibeto-Burman castes, have a positive association with the increase in empowerment. Finally, considering the place of residence, specifically the urban location, all the three regression models adopted in the present analysis agree on its statistical non significance. Overall, the results we obtained implementing three different models all confirm our hypothesis: recognizing land titling to female

farmers is an important source - even if not the only one - of empowerment, and could represent another step forward to increase women's empowerment in agriculture.

7. CONCLUSION

This paper sets out to determine the role of land titling in promoting working women's empowerment in agriculture in Nepal. Specifically, the purpose was to investigate whether female land ownership could increase their decision-making power within the household, which we use as a proxy of empowerment. In fact land represents the basic capital asset in agriculture, and its ownership is considered a means to get out of poverty. As the related literature emphasizes, despite their active role and their importance in the agricultural sector, the majority of women has not any property right. This fact has negative implications, as it increases the dependence and vulnerability to which women in general, and even more those ones from rural developing areas, are traditionally subjected. For this reason, even if we know that other productive assets (e.g. money, machinery, fertiliser, technology, etc.) all could positively affect women's role in the agricultural sector, in this study we focus on land, whose property could certainly be considered crucial for women's empowerment in agriculture. To this end, we have constructed three measures of empowerment, on the basis of women's ability to make decisions alone or jointly with their partners, as opposed to the case in which decisions are taken by their partners alone or by someone else. Following Allendorf (2007), we have first created a dummy variable, which differentiates between women who make at least one decision in one of the four decisional domains described in the data section, with the other ones. Addind to Allendorf's model, we buid a second indicator, an ordinal empowerment scale that ranges between 1 and 4, depending on the degree of women's involvement in the decision-making process within the household. Finally, we have introduced a new measure of empowerment on a continuous scale, ranging between 4 and 16, that measures the degree of women's decision-power and reflects more accurately its variability.

All the three ways to proxy empowerment confirm the hypothesis that recognizing land titling to women could effectively promote their empowerment, expressed in terms of decisional power, in the Nepali context. Obviously, as pointed out several times in this paper, land alone can effectively ensure a temporary empowerment of female farmers. In fact it must be associated to a change of both formal and informal rules within society, that could recognize the central role of women and their importance. At the same time, women should have access to other productive inputs (such as credit, machineries, extension services) that may have important effects in terms not only of agricultural productivity, but also of both women and household's health. Additionally, our findings show that employment remuneration, and more specifically being paid in cash, increases the odds ratio of being more empowered. As stated before, this could depend on the fact that earning money raises women's autonomy, permitting them to move out of the traditional male dependence. Hence, while land ownership does not appear to be superior to being paid in cash, it surely plays a crucial role in women's empowerment in agriculture. However, even if in the last decades the need of recognizing women as active members of the economy and not as invisible farmers has been emphasized, many barriers persist. Particularly in countries like Nepal, where informal rules determine the persistence of a male-dominated society, increasing the influence women can exert within the family is still difficult. At the same time, our findings reinforce the hypotheses of the benefits of land ownership, that Allendorf (2007) had already studied. At the same time our results reveal that Nepal has registered important progress in terms of women's empowerment: specifically, in 2011 the share of women who have final say alone has increased by almost 8 percent in each category of land titling, respecting to DHS 2001 (the dataset used by Allendorf). This is a successful achievement, particularly in a context where women are still discriminated. However, whilst this study offers some insight into the effects of land ownership on gender roles within the Nepalese agricultural sector, a number of weaknesses must be pointed out. First of all, the absence of other important variables, as the ownership of livestock (that

is another relevant asset in agricultural contexts), as well as other productive assets could not provide a wider understanding of the effective empowerment of women in agriculture: in fact, as previously specified, land ownership is not sufficient to raise women's decisional power. Secondly, the nature of data does not permit to do a longitudinal evaluation of women's empowerment. After all, empowerment is a process of change, that cross-sectional data (as those used in this study) cannot reflect. Therefore, more research is needed, possibly having at disposal panel data, in order to analyse the empowerment for what it truly is: a process of growth and change, that occurs not only at an individual, but mainly at a collective level.

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8. REFERENCES

[1] Agarwal, B. (1994). Gender and command over property: a critical gap in economic analysis and policy in South Asia. *World Development*22(10): 1455-1478.

[2] Agarwal, B. (1994). A field of one's own: gender and land rights in South Asia. Cambridge: Cambridge University Press.

[3] Agarwal, B. (2003). Gender and land rights revisited: exploring new prospects via the state, family and market. *Journal of Agrarian Change*3(1)(2): 184-224.

[4] Agarwal, B. (2011). Bargaining and gender relations: within and beyond the household. *Feminist Economics* 3(1): 1-51.

[5] Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A.R., Seymour, G., Vaz, A. (2012). The women's empowerment in agriculture index. *IFPRI Discussion Paper 01240*: 1-66.

[6] Aly, H.Y. and Shields, M.P. (2010). Gender and agricultural productivity in a surplus labor traditional economy: empirical evidence from Nepal. *Journal of Developing Areas* 42(2): 111-124.

[7] Allendorf, K. (2007). Do women's land rights promote empowerment and child health in Nepal?. *World Development*35(11): 1975-1988.

[8] Alsop, R., Bertelsen, M., Holland, J. (2006). *Empowerment in practice: from analysis to implementation.* Washington, DC: World Bank.

[9] Banerjee, S. (2003). Gender and nationalism: the masculinization of Hinduism and female political participation in India. *Women's Studies International Forum* 26(2): 167-179.

[10] Bhandari, P. (2004). Relative Deprivation and Migration in an Agricultural Setting of Nepal. *Population and Environment* 25(5): 475-499.

[11] Crowley, E. (1999). *Women's right to land and natural resources: some implications for a human rights-based approach.* Rome: FAO Rural Development Division.

[12] Datta, N. (2008). Joint titling - a win-win policy? Gender and property rights in urban informal settlements in Chandigarh, India. *Feminist Economics* 12 (1-2): 271-298.

[13] Deere, C.D., Doss, C.R. (2006). *Gender and the Distribution of Wealth in Developing Countries.* UNU-WIDER World Institute for Development Economics Research Research Paper 115: UNU-WIDER.

[14] Dube, L. (1988). On the construction of gender: Hindu girls in patrilineal India. *Economic and Political Weekly* 23(18): 11-19.

[15] Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic Development* 50(4): 1051-1079.

[16] Duflo, E. and Udry, C. (2004). *Intrahousehold resource allocation in Côte d'Ivoire: social norms, separate accounts and consumption choices.* Working Paper w10498. Cambridge, MA: National Bureau of Economic Research.

[17] Edriss, A.K. (2005). Gender differential in groundnut productivity in Sub-Saharan Africa: the case of Lilongwe and Salima Adds in central Malawi. *Bunda Journal of Agriculture, Environmental Science and Technology* 3: 29-37.

[18] Fafchamps, M. and Quisumbing, A.R. (2001). Control and ownership of assets within rural Ethiopian households. International Food Policy Research Institute- Food Consumption and Nutrition Division Discussion Paper (120). Washington, DC: IFPRI.

[19] Food and Agricultural Organization (1979). *Report of the World Conference on Agrarian Reform and Rural Development.*Rome, IT: FAO.

[20] Food and Agricultural Organization (2011). *The state of food and agriculture: Women in Agriculture. Closing the gender gap for development.* Rome, IT: FAO.

[21] Field, E. (2007). Entitled to work: urban property rights and labor supply in Peru. *The Quarterly Journal of Economics* 122(4): 1561-1602.

[22] Gaidzanwa, R. (1994). Women's land rights in Zimbabwe. *A journal of opinion* 22(2): 12-16.

[23] Goldstein, M. and Udry, C. (2005). *The profits of power: land rights and agricultural investment in Ghana.* Economic Growth Center Discussion Paper 929. New Haven, CT: Economic Growth Center.

[24] Hallward-Driemeier, M., Hasan, T., Rusu A.B. (2013). *Women's legal rights over 50 years: What is the impact of reform?.* World Bank Policy Research Working Paper 6617. Washington DC: World Bank.

[25] Hare, D., Yang, L. and Englander, D. (2008). Land management in rural China and its gender implications. *Feminist Economics* 13 (3-4): 35-61.

[26] Hasnah., Fleming, E., Coelli, T. (2004). Assessing the performance of a nucleus estate and smallholder scheme for oil palm production in West Sumatra: A stochastic frontier analysis. *Agricultural System* 79: 17-30.

[27] Hoddinott, J. and Haddad, L. (1995). Does female income share influence household expenditures? Evidence from Côte d'Ivoire. *Oxford Bulletin of Economics and Statistics* 57(1): 77-96.

[28] International Bank for Reconstruction and Development/World Bank (2009). *Gender in agriculture sourcebook.* Washingtion DC, US: World Bank.

[29] Izumi, K. (2007). Gender-based violence and property grabbing in Africa: a denial of women's liberty and security. *Gender and Development* 15(1): 11-23.

[30] Jacobs, S. (2004). Livelihoods, security and needs: gender relations and land reform in South Africa. *Journal of International Women's Studies* 6(1): 1-19.

[31] Kabeer, N. (1999). Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and Change* 30: 435-464.

[32] Kachika, T. (2009). *Women's land rights in Southern Africa: consolidated baseline findings from Malawi, Mozambique, South Africa, Zambia and Zimbabwe.* London: Niza and ActionAid International.

[33] Kevane, M. and Gray L.C. (2010). A woman's field is made at night: gendered land rights and norms in Burkina Faso. *Feminist Economics* 5(3): 1-26.

[34] Kilic, T., Palacios-Lopez, A., Goldstein, M. (2013). Caught in productivity trap. A distributional perspective on gender differences in Malawian agriculture. *Policy Research Working Paper* 6321. Washington, DC: World Bank.

[35] Kumar, N. and Quisumbing, A. (2012). Inheritance practices and gender differences in poverty and well-being in Ethiopia. *Development Policy Review* 30(5): 573-595.

[36] Lawanson, O.I. (2008). *Femal labour force participation in Nigeria: determinants and trends.* Oxford Business & Economic Conference Program.

[37] Lastarria-Cornhiel, S. (2009). *Women's role in agriculture and in rural welfare: access to land and resources.* Expert Group Meeting,"The Impact of the Implementation of the Beijing Declaration and Platform for Action on the Achievement of the Millennium Development Goals," United Nations, Geneva, November. 2009.

[38] Mutangadura, G. (2004). *Women and land tenure rights in Southern Africa: a human rights- based approach.* London: Church House, Westminster.

[39] Narayan, D. (2002). *Empowerment and poverty reduction.* Washington, DC: World Bank.

[40] Nepal Ministry of Health and Population, New ERA, and ICF International Inc.(2012). *Nepal Demographic and Health Survey* 2011. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and ICF International, Calverton, Maryland.

[41] Nightingale, A. (2006). *The nature of gender: work, gender and environment.* Institute of Geography Online Paper Series(GEO-030), University of Edimburgh.

[42] International Food Policy Research Institute (2012). *Women's empowerment in agriculture index.* Washington, DC: IFPRI.

[43] Nkhonjera, C.C. (2011). *The role of women's empowerment on agricultural development in Malawi.* MSc Thesis: University of Reading, United Kingdom.

[44] Obayelu, A.E. and Ogunlade, I. (2006). Analyses of the uses of information and communication technology for gender empowerment and sustainable poverty alleviation in Nigeria. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)* 2(3): 45-69.

[45] Ovwigho, B.O. and Ifie, P.A. (2014). Effects of the Women in Agriculture (WIA) Programme on Welfare of Rural Women in Uvwie Block of the Agricultural Development Programme (ADP), Delta State, Nigeria. *Journal of Agriculture and Veterinary Science* 7(1): 50-54.

[46] Pallas, S. (2011). Women's land rights and women's empowerment: one and the same? In Verschuur, C. (Dir.). *Du grain à moudre.*

Genre, développement rural et alimentation. Actes de colloques genre et développement. Berne: DDC-Commission nationale suisse pour l'Unesco. Genève: IHEID.

[47] Pena, N., Maiques, M., Castillo, G.E. (2008). Using rights-based and gender-analysis arguments for land rights for women: some initial reflections from Nicaragua. *Gender and Development* 16(1): 55-71.

[48] Peterman, A., Quisumbing, A., Behrman, J., Nkonya, E. (2010). Understanding gender differences in agricultural productivity in Uganda and Nigeria. *Journal of Development Studies, Special Issue on Agriculture* 47(10): 1482-1509.

[49] Quisumbing, A. (1995). Gender differences in agricultural productivity: a survey of empirical evidence. *Food Consumption and Nutrition Division Discussion Paper* (5): 1-59.

[50] Quisumbing, A.R. and Maluccio, J.A. (2003). Resources at marriage and intrahousehold allocation: evidence from Bangladesh, Ethiopia, Indonesia and South Africa. *Oxford Bulletin of Economics and Statistics* 65(3): 283-327.

[51] Rao, N. (2005). Gender equality, land rights and household food security: discussion of rice farming systems. *Economic and Political Weekly* 40(25): 2513-2521.

[52] Rahman, S (2010). Women's labour contribution to productivity and efficiency in agriculture: empirical evidence from Bangladesh. *Journal of Agricultural Economics* 61(2): 318.342.

[53] Roy, K.C. and Tisdell, C.A. (2002). Property rights in women's empowerment in rural India: a review. *International Journal of Social Economics* 29(4): 315-334.

[54] Rural Development Institute (2009). *Women's inheritance rights to land and property in South Asia: a study of Afghanistan, Bangladesh, India, Nepal, Pakistan and Sri Lanka.* Seattle, US: RDI.

[55] Udry, C., Hoddinott, J., Alderman, H., Haddad, L. (1995). Gender differentials in farm productivity: implications for household efficiency and agricultural policy. *Food Policy* 20(5): 407-423.

[56] UN General Assembly (1979). Convention on the elimination of all forms of discrimination against women. Office of the United Nations High Commissioner for Human Rights: Geneva. Available at **http://www.un.org/womenwatch/daw/cedaw/**

[57] United Nations (1995). *Beijing Declaration and Platform for Action.* Beijing, China: Fourth World Conference on Women. Available at **http://www.un.org/womenwatch/daw/beijing/platform/**

[58] Unni, J. (1999). Property rights for women: case for joint titles to agricultural land and urban housing. *Economic and Political Weekly* 34(21): 1281-1286.

[59] World Bank (2014). *Gender at work. A companion to the World Development report on jobs.* Washington, DC: World Bank.

[60] World Bank (2014). *World Development Report 2014: Risk and opportunity. Managing risk for development.* Washington, DC: World Bank.

[61] Yngstrom, I. (2002). Women, wives and land rights: situating gender beyond the household in the debate over land policy and changing tenure system. *Oxford Development Studies* 30(1): 1-39.

CHAPTER 2

Is time allocation gender sensitive to food price changes?

An investigation of male and female labour supply in Uganda.

Abstract

Dramatic spikes in food prices, like those observed over the last years, represent a real threat for food security in developing countries, with severe consequences for many aspects of the human life. In fact, price instability can also affect the intra-household allocation of time, thus changing the labour supply of women, who traditionally play the role of "shocks absorbers". In this paper we investigate the relationship between the change in the prices of the two major staples consumed, *matooke* and cassava, have had on the labour time allocation of Ugandan households. We exploit the panel nature of the Uganda National Household Survey to control for individual fixed-effects, adopting a *Tobit-hybrid* model. Our results show that, in correspondence with the change in food prices, gender differentials in the intra-household allocation of labour actually occur. We find that, overall, women work significantly more, since the additional hours women work in the market are not counterbalanced by a relevant reduction in the other labour activities. For men, we do not find any significant effect.

Keywords: price change, labour supply, gender, Uganda.

JEL codes: J16, J22, J43, Q11

1. INTRODUCTION

After a period of relative stability of staple food commodity prices, the world has experienced a dramatic spike in the price of such commodities, that has generated a widespread debate on the welfare implications it could have, and for the risks in terms of food security (Caracciolo *et al.*, 2014; Dimova, 2015). This issue is particularly relevant for low-income countries, where people spend a large share of their income for food (Mukasa and Berloffa, 2015), leading to a concern that hunger and poverty will increase across the world. At the same time, the role of agriculture is central for most of the African countries: hence the most vulnerable and affected by price surges will be poor farm households, due to their high dependency on the food market (Benson *et al*, 2008). As argued by Barret and Dorosh (1996) "real food price increase raise gross incomes of the many farmers who make gross commodity sales, while small farm households that are net purchasers of food may suffer substantial instantaneous declines in welfare" (p. 667). In this regards, women are the most vulnerable, since they are in a subordinated position, and this is particularly marked in developing countries: in fact, they are rarely engaged in remunerated activities, such that their full involvement in unwaged family labour holds out the possibility of empowerment (Ilahi, 2001). In other words, their labour is traditionally used for household production rather than for the labour market (Aly and Shields, 2010). Likewise, as Quisumbing (1996) claims, it is difficult for a woman to choose between market participation and leisure, since part of non-market time is reserved to home production activities.

In this paper we focus on the case of Uganda, a country firstly "excluded" by the global food price crisis, thanks to its geographical isolation from the international markets, using the three panel waves of the Uganda National Household Survey (2009-2010; 2010-2011; 2011-2012) for the empirical analysis.
World prices of staple foods have increased since 2006, with a sharp rise in cereal prices during 2007-08 (Simler, 2010). The widespread consequences affected

both developed and developing countries, and Uganda was no exception. However, although the Ugandan food markets are relatively isolated from the global markets, such that most of the principal major food (as *matooke*[1]) are traded at local level, the country has been still hit by the food price crisis, as observed by Van Campenhout *et al.* (2013). This fact occurred even though food prices remained relatively stable until the first half of 2008, rising annually at about 5 percent (Uganda Bureau of Statistics, UBOS). Thus far, a growing body of the literature have explored the causes and consequences of food price shocks, with a special focus on the welfare aftermath among poor people, predicting severe negative implications for the welfare of the poorest. Meanwhile, little research took into account the effects on labour supply and, more specifically, on how the price trend may shape time use. Indeed, as suggested by Dito (2011), food price shocks could determine a variation in hours devoted to both on and off-farm activities.

This paper thus could contribute to the study on the labour response to price shocks from a gender perspective, using time as the primary criterion of analysis. Indeed, as it will be argued in the following paragraphs, time is one of the major obstacle to poverty reduction, especially when considering the gender division of labour. Specifically, the main purpose of our research is to understand whether and how male and female labour time respond to price changes. As noted by Kumar and Quisumbing (2011), in fact, literature lacks of empirical evidence of the gendered impacts of the crisis. Moreover, a number of authors have considered the welfare effects of the recent price crisis, mainly taking into account the change in food consumption and production. Considering that women are often the "shock absorbers" of the household, as they tend to reduce their own consumption to leave more food for the other household members (Kumar and Quisumbing, 2011), it can be supposed that also in their

[1] *Matooke*, also known as *matoke*, is a starchy banana cooked and consumed as a staple food.

time use women bear the brunt of price surges. Moreover, time is allocated according to both economic and non-economic criteria, that reflects the specificity of the cultural and societal rules. As argued by Ilahi (2001), "social roles and norms dictate a segregation of activities by gender", with implications for "the capacity of individuals to reallocate their labor in response to economic incentives and to maximize productivity and efficiency" (Kes and Swaminathan, 2005). Indeed, whereby men are often employed in income-generating activities, women perform household chores or participate to the agricultural tasks of their household farm. Hence, this paper seeks to extend the impact analyses of food price movements to both male and female labour behaviour. In particular, the purpose is to test if changes in staple food prices may perpetuate the *gender bias*. In fact, the division of labour could be further radicalized, at the expense of the time spent for domestic activities, especially care of children, traditionally a female task.

Given the consistent share of rural farmers, the net market position (namely if households are net buyers or net sellers) will be included into the analysis, to get a more complete picture of how the price spike influenced Ugandan workers. In this research we will focus on five dimension of labour time: paid, domestic, non-market, farm and agricultural employment. According to the significant number of zero values in labour time, a censoring model, also known as *Tobit approach* of Tobin (1958) has been adopted, controlling for the individual fixed-effects through a hybrid model. The paper is organized as follows. Section 2 presents the literature concerning the time allocation. Section 3 describes the case study. Section 4 describes the data and the estimation strategy. Section 5 presents the results and section 6 concludes.

2. TIME ALLOCATION ACROSS HOUSEHOLD MEMBERS

Household's allocation of time has been treated by a wide part of the literature, and recently a number of studies have examined the determinants and the distribution of time in developing countries (Ilahi, 2001). Since Mincer (1962)

and Becker's "A theory of the allocation of time" (1965), many papers have investigated the time distribution within household, also including work at home, as well as leisure time. In Becker's theory the household time is supposed to be maximized through a utility function, so that time is considered in the same way as a commodity. Gronau (1976), for example, explored the relationship between the wage rate increase and the working time change, differencing between men and women: he found that not only a shift from work at home (that also include children care) to market activities had occurred, but also a reduction in leisure time, mainly affecting women. Many of the related literature tested the change in time allocation as a maximization of the utility function, where people are subjected to the time constraint (T):

$$max\ U = (W_t,\ L_t), \tag{1}$$

$$time\ constraint : T = t_i^p + t_i^d + t_i^c + t_i^f + t_i^l \tag{2}$$

where W_t denotes hours of working time, whereas L_t indicates the hours of leisure time[2]. Assuming that the allocation of time across the different time use categories is also dependent on the household welfare, we can write the supply function of the uses of time:

$$t_i^k = t_i^k(p_t^{sf}, v) \tag{3}$$

where, for each individual i, each time use category ($k = p,\ d,\ c$ and l) depends on the price of staple foods (sf) at time t[3] and on both household and

[2] $p,\ d,\ c,\ f$ and l are time use categories (paid work, domestic tasks, child care, farming activities and leisure time) for each individual i.

[3] Likewise, we suppose that the time use function is also affected by the wage of each individual, but most of the concerning observations were not available. Additionally, the price of food also conditions the goods expenditure. Therefore, in our empirical model we include household expenditure on food and non-food items as proxies of the household wealth, that

individual characteristics, *v.* Moreover, Hill (1989) reasoned on the context-specificity of time allocation: as she argues, the presence of a consistent "informal" sector, through which women are both engaged in the economic activity and simultaneously care for children and do home-related duties, "complicates the labor supply decisions" (p. 144). Besides, she defines the choice of labour participation as a trichotomous problem, since they "may choose to work in the formal sector of the labor market, in the informal sector [...], or they may choose not to work" (p.144). Furthermore, the composition of male and female time allocated to work differs not only on the gender basis, but also between urban and rural areas. Ilahi (2000), for example, asserts that while men work less than women both in rural and urban areas, rural women work more than their urban counterparts. Considering that time is a scarce resource, its allocation implies a trade-off, which generally interests domestic and market work. This issue pertains particularly women (Medeiros *et al.* (2007)), who often gives up their autonomy for caring their own household. The multiplicity of roles and responsibilities that women and men play is unbalanced against women. Furthermore, non-economic criteria, such as societal and cultural norms, affect time distribution: specifically, the reproductive responsibilities burdening to women (that include caring elderly and children, preparing food, cleaning and housework, collecting water and firewood, and so on), beyond reinforcing the gender gap, could complicate their participation to more economically productive activities. Additionally, the composition of the household, as well as the household size, the number, age and gender of children, also engrave the time patterns, and this is especially true for women. A similar assumption is made by Warner and Campbell (2000), who noted that "women have virtually no leisure time". Thus, gender discrepancies in time allocation depict a substantial source of disempowerment that, at the same time, consistently affect development.

When evaluating the effects of rising food prices, generally most of the studies focused on the welfare implications on consumers, partially ignoring that most

could potentially affect time use.

of the poor are also producers. A properly assessment of the "producers effects" requires analyzing not only the possible expansion of food production and the consequent income improvement, but also the time distribution across market, non-market and agricultural activities. Klasen *et al.* (2011) pointed out that "gender discrimination in the labor market is common phenomenon in both developed and developing countries", even if "discrimination in the latter is rather associated with differential access to wage employment" (p. 4). As regards price shocks, a large part of the recent literature focused primarily on the income and consumption effects (Caracciolo *et al.*, 2014; Bellemare *et al.*, 2013; Benson *et al*, 2008; Headey and Fan, 2008), omitting the influence they could have on labour supply (Black *et al.*, 2009). Probably one of the first research on the impact of the 2007/08 food crisis at the household level was that of Benson, Mugarura, and Wanda (2008). Using the 2005/2006 Uganda National Household Survey (UNHS), containing information on more than 7.000 households, they observed that the incidence of food price movements depends on the net market position, namely whether households are net buyer or net sellers.

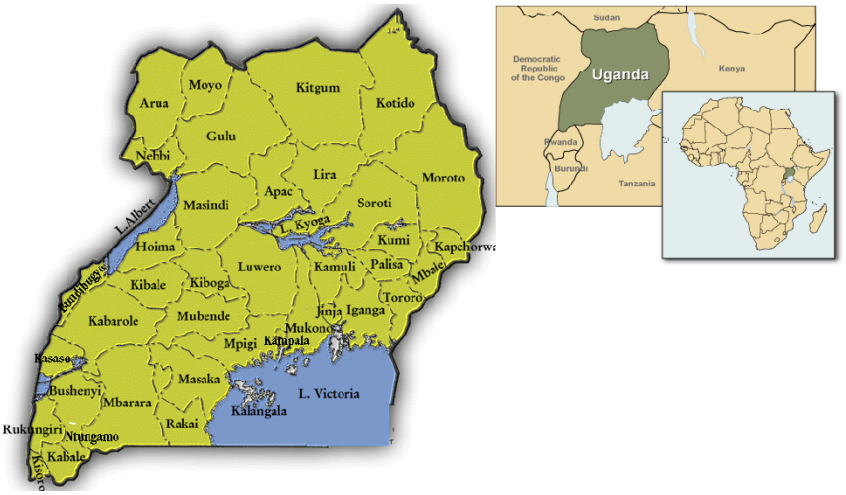
The examination of time use in Sub-Saharan Africa is crucial for many reasons. Firstly, the concept of time poverty is strictly related to income poverty, for its consequences for the household and individual well-being. Namely, time constitutes a constraint for labour, especially for women on which, besides the other productive activities, bear the burden of domestic work. Therefore, given that women have primary responsibility for cultivating food crops for the household consumption, changes in food prices may influence the availability of time for the household members engaged in such activities. Additionally, time is a key component in the analysis of poverty, especially when accounting for the female labour one: since women are predominantly engaged in farming activities, rather than in the paid ones, external shocks such as food price rise can be expected to increase the time spent on it, eroding their available leisure time, as well as the hours spent on domestic tasks and children care. Indeed, plenty of evidence suggest female hours spent on housework is much higher than the male ones. Hence, how exactly they worked out will be investigated in the following

sections.

3. CASE STUDY

Worldwide, the main causes of the food price spike are attributable to different factors, including droughts, low stocks for cereals and oilseeds, increased feedstock use in the production of biofuels, raised costs of food production, rapidly rising oil prices, as well as the financial speculation in the US markets. Conversely, in Uganda food prices have been relatively stable for many years (Benson *et al.*, 2008). This can be attributed to its geographical location. Actually, Uganda is located in the East African highlands, and its insulated position partially isolated it from the international markets (Simler, 2010).

Figure 1: Uganda position within the African continent.

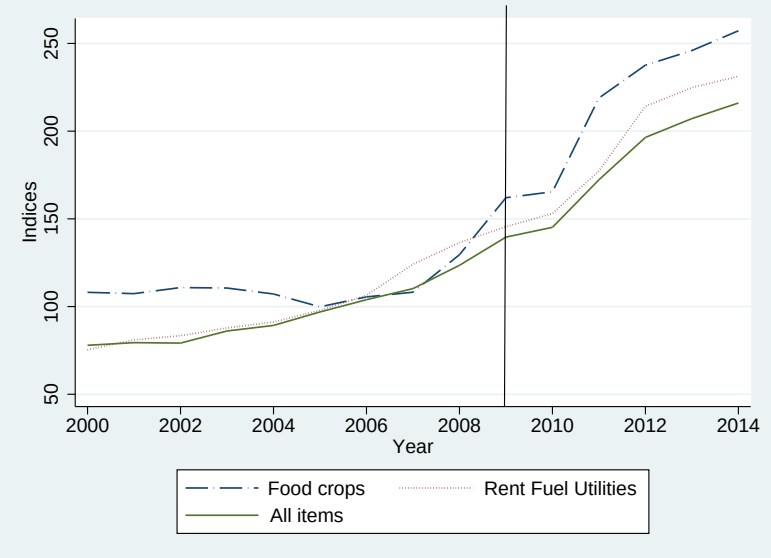


Source: **http://theisn.org/** and **fao.org**

As the Uganda Bureau of Statistics (UBOS) data display, the *annual* inflation rate of food crops for April 2008 was 1.7%, whereas the *monthly* inflation rate indicates a 6.7% increase over March prices. Since the first half of 2008, when Uganda experienced the first rise in food prices, the pattern of food prices has been extremely volatile. Actually, likewise the global markets, Uganda registered a sharp increase in food prices, also relative to other items, since 2009 as

shown in Figure 2 below, but the situation eased off during 2010. Afterwards, a new price hike took place since the beginning of 2011.

Figure 2: Food and Non-Food price indices.



Source: Uganda Bureau of Statistics.

Unlike many developing countries where a single commodity is the dominant food source (rice for Asia, for example), Uganda has a relatively different mix of staple food, including *matooke*, maize, cassava, potato and beans. Table 1 shows the share of the consumption value[4], disaggregated by place of residence (urban or rural) and year. Matooke is the dominant staple food in all the three years, particularly in the urban areas, whilst cassava, potato and maize appears prominently in the rural areas[5]

[4]Food items purchased out of home, own produced and received in kind as a gift are aggregated into the unique category of consumption. These are expressed in Uganda Shillings.

[5]This statement pertains food items consumed in the first and the third wave, to a greater extent for cassava.

Table 1: Budget share of food consumption, by wave and place of residence.

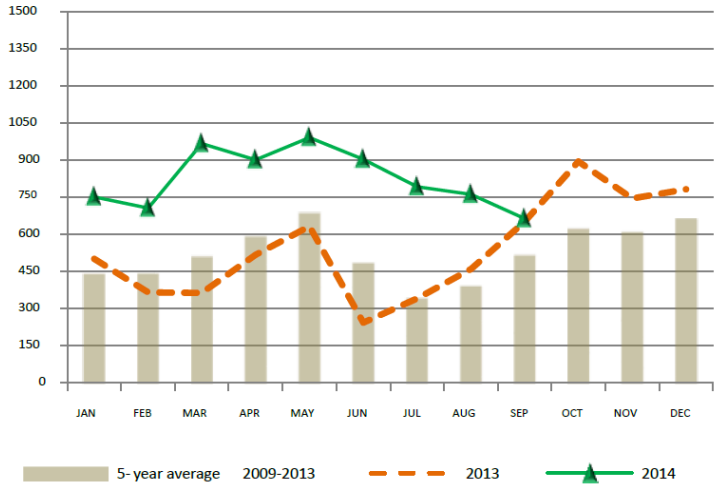
	UNHS 2009-10		*UNHS 2010-11*		*UNHS 2011-12*	
	Rural	***Urban***	***Rural***	***Urban***	***Rural***	***Urban***
Matooke	0.245 (0.17)	0.210 (0.15)	0.351 (0.25)	0.244 (0.18)	0.228 (0.17)	0.177 (0.14)
Cassava	0.24 (0.2)	0.150 (0.15)	0.219 (0.2)	0.121 (0.12)	0.249 (0.21)	0.144 (0.16)
Potato	0.178 (0.16)	0.118 (0.12)	0.293 (0.24)	0.166 (0.17)	0.168 (0.16)	0.092 (0.09)
Maize	0.182 (0.18)	0.120 (0.14)	0.184 (0.17)	0.149 (0.15)	0.164 (0.16)	0.112 (0.13)
Cereals	0.128 (0.13)	0.122 (0.12)	0.152 (0.16)	0.146 (0.15)	0.134 (0.14)	0.107 (0.1)
Beans	0.181 (0.16)	0.14(0.13)	0.19 (0.21)	0.129 (0.18)	0.159 (0.13)	0.134 (0.11)
Fruits & Vegetables	0.04 (0.05)	0.038 (0.05)	0.07 (0.14)	0.066 (0.13)	0.027 (0.04)	0.026 (0.02)

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12). Standard deviation into brackets.

Figure 2 depicts the matooke price trend of the Mbarara district: since matooke represents an important share of food consumption, we report the

pattern of its retail price (prices refer to the period 2009-2014, and only for 2013 and 2014 singularly). Data are from the Uganda Price Bulletin (October 2014), which uses the Famine Early Warning Systems Network (FEWS NET) Uganda, a USAID-funded activity, which is specialized in the monitoring of trends in staple food prices in countries vulnerable to food insecurity.

Figure 3: Nominal retail prices of Matooke (Mbarara district).



Source: FEWSNET Uganda, 2014.

Matooke shows a fluctuating trend, following an upward trend in the last year. Especially in 2013, we can observe a raise in the average values, whereas in 2014 prices appear to decrease. Such a substantial increase in food price, where food expenditure is such a relevant share of household budgets, must have impacted not only the consumption side, but also the individual labour supply behaviour.

4. DATA AND METHODOLOGY

4.1. ***Data description***

The analysis relies on the last three waves of the *Uganda National Household Survey (UNHS; 2009-10, 2010-11, 2011-12)*, a multipurpose nationally household survey conducted by the Uganda Bureau of Statistics (UBOS), with the support of the *Living Standard Measurement Study-Integrated Survey on Agriculture (LSMS-ISA)* project of the World Bank. Composed of five modules (Socio-economic, woman, agriculture, community and price modules), only the household and some sections of the agricultural questionnaires have been used, as they contains all the data needed for the analysis. The UNHS provides, inter alia, detailed information on household characteristics, i.e. age, gender, education and economic activity, as well as on the level and structure of the household expenditure. Nearly 3000 households were interviewed, with a randomly-selected share of split-off households formed after the 2005/06 survey. The total number of households and individuals by wave are presented in Table 2 below:

Table 2: Survey description.

Years	***Number of households***	***Number of individuals***
2009-10	2975	18734
2010-11	2716	19180
2011-12	2850	21279

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12).

4.2. Sample selection

For the purposes of the study, we restricted our sample to a total number of 15093 panel adult men and women. With more details, we concentrate our empirical analysis on men and women, aged between 15 and 64[6] who report

[6]According to the UNHS, Section 8 of the Household Questionnaire - referring to the Labour Force Status - have been formally administered to individuals falling in the age group

zero or positive values. Specifically, as the number of missing was relevant[7], above all for paid job, we create the category of working people on the basis of the labour variable for which we have more observations (99% of our sample), namely "Fetching firewood" for women and "Making major repairs" for men[8]. Then, we create a binary variable, *working people*, at which we attributed 1 whenever zero or positive data were present in the considered questions, and 0 otherwise. After that, we substituted missing values of the "labour hours variables" with zero whenever the variable *working people* assumed the value of 1. Therefore, our sample reduces to 15.093 working individuals (7.302 and 7.791 men and women respectively).
However, due to missing prices in some districts, when running the regression the total number of observations further reduces to 10117 individuals, of which 4869 are men and 5248 are women[9].

4.3. Labour time behaviour

Time is a scarse resource, and the determination of time to spend on various activities is very difficult (Medeiros *et al.*, 2007). On average, an adult is recommended to sleep for almost eight hours per day, but this cannot be considered a generalized recommendation, above all in developing countries. In fact, in rural economies a variety of activities, such as farm production, domestic tasks, animal husbandry, are performed within the household (Skoufias, 1996). Tiberti and Tiberti (2015), for example, assumed that each household member aged between 15 and 60 years has 10 hours per day of leisure time. At the same time, the amount of leisure does not consider the "extra-time" devoted to inside household chores, such as caring children, cooking, and so on. This

"5 years and above". Unfortunately, when controlling for labour hours, data on labour time were present also for people below this age category. As there were many outliers, we decided to focus on the "formal" working group.

[7] It is attributable to the high number of non-working respondents in paid labour questions.

[8] In general, most of the questions in the section "non-market activities" contained information, so that the number of missing was low.

[9] They become 9302 -4488 and 4814 men and women respectively- when taking into consideration all the main staples consumed, as shown in tables reported in Appendix B

matter particularly for women. Therefore, the measure of labour supply should be extended to include both time worked for a wage and time devoted to home and farming activities.
The questionnaire provides detailed information on different labour activities. Specifically, interviewees were asked "*In this (main) job/business that [NAME] had during the last week, was [NAME]":*

1. Working for someone else for pay?
2. An employer?
3. An own-account worker?
4. Helping without pay in a household business?
5. An apprentice?
6. Working on the household farm or with household livestock?

Additionally, in the section "*Non-market labour activities*", specific questions were asked about the hours devoted (in the 7 days before the interview)to:

1. Fetching firewood.
2. Collecting water.
3. Milling.
4. Making handicrafts.
5. Hunting and fishing.
6. Making major repairs in their dwelling or farm.
7. Constructing your dwelling or farm.
8. Agricultural activities.

In order to simplify the analysis, we collapsed all these information into five broad categories:

- ⋆ ***market work***: it includes wage and employer hours and own-account workers;[10]

- ⋆ ***non-market restricted activities***: unfortunately, we have not domestic data at disposal. More specifically, this type of information were present only for the last two waves. Therefore, in order to level our data, we decided to refer to fetching firewood, collecting water and milling as proxies for domestic work;

- ⋆ ***non-market extended work***: obtained adding to the previous working group data listed above ("Non-market labour activities"), excluding agriculture;

- ⋆ ***working on the household farm***: it considers only hours devoted to the management of the household farm;

- ⋆ ***agricultural work***: it accounts all the hours spent in working in agriculture.[11]

Data about working time are recorded on a weekly basis. For the purposes of our analysis, we decided to convert them on annual hours, by multiplying the total working hours- diversified by activities- by 52 (the total available weeks in a year). We assumed that each household member works 15 hours per day (that includes hours spent on market, on farm and domestic tasks). Therefore, in a week the total time devoted to working is equal to 105 hours, that become 5475 in a year. Considering that the total annual available time is 8760, the total amount of leisure time (that comprises also "sleeping" time), obtained by subtracting 8760 by the annual working hours, will be 3285 h/year. In Table 3 annual and weekly hours for all the time-use categories previously mentioned are shown. They are reported differentiated by wave and gender. As argued, the

[10] Own-account workers refers to people who work in a business for themselves. For this reason we included them in the market group.

[11] In order to avoid possible errors in the estimation, we control whether time spent on household farm and agriculture coincide. We found that only for a few individuals hours in the two activities were the same. Thus, we decided to keep the two working activities separate.

regression sample reduces to 10117 working individuals. Therefore basic statistics were predicted on this sample, as presented in Table 6 above. Moreover, in order to give a complete framework, in Table 9 in Appendix, we also present statistics for the whole sample (15.093). As affirmed, time data contain many zero values: for this reason we also set out the average labour time "depurated" by the presence of zero values (Table 4).

As expected, most of the women spent their time in the agricultural and farming activities, for which we can observe an increase within the time period considered, offset by a reduction in domestic and non-market activities. As regards market work, indeed, a decrease of about 7% has been registered between the two first waves, and then hours grow again. Additionally, it can be noted that, obviously, the number of observations is further reduced. Notwithstanding, men seem to work more hours in remunerated activities, with a constant trend in all the three wave years. Moreover, as expected, their time devoted to domestic activities is less than for their female counterpart. After having defined the data structure, in the next section the empirical specification will be set up.

Table 3: Total weekly and annual labour time, disaggregated by gender, wave and working group, of the regression sample.

	2009-10									
	Market		***Domestic***		***Non-market***		***HH farm***		***Agriculture***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Weekly	15.56	7.16	2.04	6.1	2.51	6.64	7.25	9.23	7.11	7.43
	(25.08)	(18.79)	(4.14)	(8.44)	(5.78)	(9.01)	(12.19)	(11.81)	(12.19)	(11.2)
Annual	808.86	372.41	106.29	317.15	130.3	345.33	377.20	479.83	369.61	386.17
	(1304.18)	(977.1)	(215.09)	(439.12)	(300.47)	(468.58)	(633.94)	(613.91)	(633.81)	(582.17)
	2010-11									
Weekly	15.82	8.13	1.75	5.81	2.15	6.22	5.98	7.58	4.96	5.83
	(26.15)	(18.32)	(4.23)	(7.6)	(5.18)	(7.97)	(11.22)	(11.63)	(10.35)	(10.75)
Annual	822.76	422.68	89.53	302.32	111.69	323.21	311.32	394.29	258.16	303.17
	(1292.18)	(952.75)	(191)	(395.11)	(269.27)	(414.45)	(583.62)	(604.75)	(538.23)	(558.94)
	2011-12									
Weekly	15.65	7.29	1.75	5.74	1.96	6	7.93	9.94	5.82	7.59
	(26.15)	(18.39)	(4.23)	(7.75)	(4.62)	(8.06)	(12.69)	(12.29)	(11.03)	(11.95)
Annual	813.71	379.1	91.09	298.29	101.81	312.19	412.45	516.75	302.51	394.58
	(1359.78)	(956.06)	(219.97)	(403.08)	(240.28)	(419.13)	(659.88)	(638.83)	(573.55)	(621.52)
Sample	10117 (4869 & 5248 men and women respectively)									

Source: Author's calculation using UNHS 2009/10, 2010/11 and 2011/12. Standard deviation into brackets.

Table 4: Weekly and annual labour time without zero values, disaggregated by gender, wave and working group of the regression sample.

					2009-10					
	Market		***Domestic***		***Non-market***		***HH farm***		***Agriculture***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Weekly	42.92	38.73	5.54	9.05	6.39	9.62	18.85	18.75	18.37	16.07
	(23.69)	(26.22)	(5.1)	(8.89)	(7.77)	(9.43)	(12.95)	(10.23)	(13.31)	(11.51)
Annual	2231.64	2014.13	288.06	470.66	332.14	500.27	980.52	975.19	955.4	835.41
	(1231.80)	(1363.58)	(270.32)	(462.51)	(403.98)	(490.5)	(673.19)	(531.78)	(691.97)	(598.27)
Number of observations	668	360	680	1312	723	1344	709	958	713	900
					2010-11					
Weekly	42.8	36.16	5.1	8.96	6.11	9.4	18.88	19.04	17.68	17.51
	(22.71)	(21.92)	(4.76)	(7.8)	(7.22)	(8.13)	(12.41)	(11.02)	(12.53)	(11.94)
Annual	2225.49	1880.49	270.23	466.09	317.75	488.63	981.54	990.28	919.35	910.36
	(1180.68)	(1139.61)	(247.71)	(405.42)	(375.48)	(422.93)	(645.21)	(572.92)	(651.36)	(620.93)
Number of observations	366	245	328	707	348	721	314	434	278	363
					2011-12					
Weekly	49.52	42.9	5.03	8.5	5.41	8.8	19.92	19.8	18.1	17.91
	(22.05)	(21.49)	(5.91)	(8.1)	(6.35)	(8.40)	(12.87)	(10.27)	(12.50)	(12.34)
Annual	2574.95	2230.66	261.73	442.09	281.29	457.35	1035.82	1029.45	941.08	931.17
	(1146.71)	(1117.73)	(307.32)	(420.99)	(330.33)	(437.01)	(669.25)	(533.91)	(650.07)	(641.87)
Number of observations	523	302	576	1199	599	1213	659	892	532	753
Sample	10117 (4869 & 5248 men and women respectively)									

Source: Author's calculation using UNHS 2009/10, 2010/11 and 2011/12. Standard deviation into brackets.

4.4. Food Prices

All the three UNHS includes detailed price information on the household survey. These are contained in the Household Food Consumption Expenditure Section, which records data at household level. The questionnaire comprehends both market and farm gate price (they differ from each other because in the first one transport and marketing services costs are included), even though in our analysis market prices only are taken into consideration. To avoid excluding many observations, due to the presence of many missing values, we computed prices at district level. Specifically, we used the average market price at the district level and its variation to measure price instability.[12] Afterwards, nominal district prices have been deflated with the monthly consumer price index, so that all prices are expressed as price indices in January 2008 Ugandan shillings (to obtain real prices, it is sufficient to multiply it with 100).[13].

In table 5 below the price indices of the main food categories (namely: matooke, cassava, maize, beans and fruits and vegetables) for each panel year are reported:

[12] For some district data were missing in all the three waves, or at least in one of the survey rounds. However, we decided to keep all the price variables in the main analysis, as missing are unevenly distributed among the price variables, so that dropping some district would have meant erasing information.

[13] According to the Uganda Bureau of Statistics the Consumer Price Index for food crops, computed using 2005/6 as the base year, was equal to 103.8. This discretional choice is attributable to the first price spike registered in the country. Following Edmonds and Pavcnik (2005), we decided to consider the price deflator at national level, and not at the regional one, "because we do not want the deflator to drive the variation in price".

Table 5: Real price indices for the main food consumed in Uganda (expressed in Uganda shillings).

	2009-10	*2010-11*	*2011-12*
	Mean	***Mean***	***Mean***
Matooke	49.90	39.53	44.11
Cassava	11.18	12.08	20.02
Maize	7.99	15.24	13.63
Cereals	14.12	12.45	20.58
Beans	10.6	5.98	12.74
Fruits & Vegetables	4.86	6.82	7.3

Source: Author's calculation using UNHS 2009/10, 2010/11 and 2011/12.

As can be observed, whilst for most of the staples reported in Table 5 the real price indices increased in the reference period, for matooke -that, in comparison, is the item with the higher price- there was a decreasing trend in 2010, offset by a rise in the following year (2012)[14].

4.5. Other explanatory variables

The socio-economic variables, such as education, age, marital status, urban/rural and regional place of residence chosen as a control, are all at individual level. Education is a categorical variable, taken the value of 1 for those one who have no education, 2 for people who have a primary education level, while 3 and 4 refer to women and men who reach a secondary and higher education respectively.[15] Additionally, we introduce also a seasonality binary variable, used to control for the cropping season during which the questionnaire has been administered. Also the household size, as well as the total number of children aged 5

[14]In percentage terms, there was a reduction of almost 21% between the first two panel years, followed by a new increase of at least 11.5%.

[15]In order to make the interpretation of the related coefficient more straightforward, we constructed four dummy variables, one for each level of education.

or below have been considered, as we suppose that they could have a significant influence on time labour, especially for women.[16] Moreover, the value of the total food and non-food expenditure information have been used to construct a proxy of the household welfare: indeed, we expect that higher prices impact more on poorer than in richer households. The basically descriptive statistics are presented in Table 6 below, and they refer to the full regression sample of both working men and women (10117 individuals). Unfortunately, due to the presence of many missing in food price variables, as stated before, we had to take into account only the share of people on which regression run.[17]. Turning to the descriptive statistics, most of the sample individuals live in rural areas (about 70%), as expected, are spouses married monogamously, and have almost a primary education level. Whether the mean values of the control variable are about similar between men and women, however we can observe that household are mainly headed by men.

[16] Although we were aware that titling measures, such as farm, land and inputs ownership could influence time allocation, particularly hours devoted to farming work, we do not consider them, as it is the scope of another essay.

[17] In Appendix A we set out also the ones concerning the whole working sample.

Table 6: Descriptive statistics of the full regression sample (10117).

	2009-10		2010-11		2011-12	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
	Mean		*Mean*		*Mean*	
Household characteristics						
Age	32.06 (13.58)	32.31 (13.15)	32.6 (13.5)	34.2 (13.08)	33.9 (13.7)	35.38 (13.17)
Relationship to the household head						
Head	0.56 (0.5)	0.18 (0.38)	0.55 (0.5)	0.21 (0.41)	0.55 (0.5)	0.21 (0.41)
Spouse	0.02 (0.13)	0.51 (0.5)	0.02 (0.15)	0.48 (0.5)	0.02 (0.15)	0.49 (0.5)
Son or Daughter	0.32 (0.47)	0.22 (0.42)	0.32 (0.46)	0.22 (0.41)	0.32 (0.47)	0.21 (0.41)
Marital status						
Married monogamously	0.44 (0.5)	0.45 (0.5)	0.42 (0.49)	0.42 (0.5)	0.43 (0.5)	0.43 (0.5)
Married polygamous	0.11 (0.31)	0.14 (0.35)	0.12 (0.32)	0.15 (0.36)	0.12 (0.32)	0.15 (0.36)
Divorced or Separated	0.03 (0.18)	0.08 (0.27)	0.04 (0.19)	0.09 (0.28)	0.03 (0.17)	0.09 (0.28)
Widow	0.006 (0.08)	0.07 (0.26)	0.007 (0.08)	0.08 (0.27)	0.007 (0.08)	0.07 (0.26)
Never Married	0.41 (0.49)	0.26 (0.44)	0.42 (0.5)	0.26 (0.44)	0.42 (0.49)	0.26 (0.44)
Household size	7.67 (3.46)	7.43 (3.29)	7.69 (3.71)	7.48 (3.40)	7.72 (3.52)	7.43 (3.26)
Number of children (0-5)	1.09 (1.05)	1.09 (1.03)	0.88 (0.96)	0.88 (0.93)	0.68 (0.77)	0.66 (0.74)
Level of education						
No education	0.05 (0.22)	0.16 (0.36)	0.03 (0.18)	0.13 (0.34)	0.03 (0.17)	0.12 (0.32)
Primary education	0.86 (0.35)	0.78 (0.42)	0.84 (0.37)	0.77 (0.42)	0.85 (0.36)	0.79 (0.41)
Secondary education	0.07 (0.26)	0.05 (0.21)	0.09 (0.29)	0.07 (0.26)	0.09 (0.28)	0.07 (0.26)
Higher education	0.02 (0.13)	0.02 (0.12)	0.043(0.2)	0.02 (0.15)	0.03 (0.17)	0.02 (0.14)
Household wealth						
First expenditure quintile	0.17 (0.38)	0.19 (0.39)	0.31 (0.46)	0.31 (0.5)	0.15 (0.35)	0.17 (0.37)
Second expenditure quintile	0.2 (0.4)	0.2 (0.4)	0.24 (0.42)	0.22 (0.41)	0.17 (0.38)	0.18 (0.38)
Third expenditure quintile	0.23 (0.42)	0.25 (0.43)	0.2 (0.4)	0.2 (0.4)	0.22 (0.41)	0.22 (0.41)
Fourth expenditure quintile	0.24 (0.43)	0.22 (0.41)	0.15 (0.35)	0.15 (0.36)	0.22 (0.41)	0.21 (0.41)
Fifth expenditure quintile	0.16 (0.37)	0.15 (0.35)	0.12 (0.33)	0.11 (0.31)	0.25 (0.43)	0.22 (0.31)
Place of residence						
Urban	0.24 (0.43)	0.25 (0.44)	0.29 (0.45)	0.31 (0.46)	0.26 (0.44)	0.27 (0.44)
Rural	0.76 (0.43)	0.75 (0.44)	0.71 (0.45)	0.69 (0.46)	0.74 (0.44)	0.73 (0.44)
Region						
Kampala	0.08 (0.27)	0.08 (0.27)	0.10 (0.30)	0.1 (0.3)	-	-
Central	0.25 (0.43)	0.27 (0.44)	0.28 (0.45)	0.30 (0.46)	0.33 (0.47)	0.35 (0.48)
Eastern	0.26 (0.44)	0.24 (0.43)	0.21 (0.41)	0.20 (0.4)	0.27 (0.44)	0.27 (0.44)
Northern	0.22 (0.42)	0.21 (0.41)	0.24 (0.43)	0.24 (0.44)	0.18 (0.38)	0.15 (0.36)
Western	0.2 (0.5)	0.2 (0.4)	0.17 (0.37)	0.15 (0.36)	0.22 (0.42)	0.23 (0.42)
Total regression sample	1913	2035	1268	1382	1688	1831

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12). Standard deviation into brackets.

Finally, by virtue of the high dependence of most of the Ugandan households by food price, we introduce also the Net market position, which will be detailed in the next paragraph.

4.6. Net Market Position: net buyers and net sellers of staple food

Households in Uganda are typically both producers and consumers of a range of commodities. Therefore, when looking at the price change consequences, many factors have to be taken into account: the geographical location, namely the belonging district and the residence area (urban or rural) are relevant aspects. Van Campenhout *et al.* (2013), for example, found that the reduction in welfare due to the increase in the price of matooke have been more incisive for urban rather than rural people. Additionally, Dimova (2015) deduces that "rising food prices may boost welfare in contexts where the poor (especially women) are among the largest net food producers and may generate new employment [...]" (p.1), thus improving welfare. Higher prices, in fact, may hurt the welfare of net buyers, especially if the good demand is inelastic, as in the case of staple food. Meanwhile, the impact on producers may be ambigous as, if on one hand food price increase could have an income effect, on the other one the expansion in food production may be not accompanied simultaneously by an increase in demand, causing a null welfare effect. At the same time, such analysis requires to explore the implications of food price spikes for both urban and rural consumers and producers. Finally, consumers and producers decisions are not separable, particularly in the case of smallholder farmers. Thereafter, a key consideration when analysing the degree to which individual time use is likely to be affected by food price change is the identification of the Net Market Position (NPR, henceforth). In fact, although the impact of higher food prices can be very diverse, depending by commodity, by country, and also by the characteristics of the households, generally it can be stated that, whereas food purchasers can be affected adversely[18], on the other hand food producers

[18]Rising prices reduces the real purchasing power of such households. Ivanic and Martin (2008) multi-country study of the first-order welfare changes of households shed light the

may benefit from this increase.

Conceptually, a net buyer of food is an individual/household who spend more to purchase food than he receives from his food sales. Conversely, net sellers of food are those whose food sales are higher than the quantity purchased (Benson *et al.*, 2008). For each household it has been determined considering the total market value of quantities sold (Q_i^s) and consumed (Q_i^c)[19] of the following food items categories: *matooke*, cassava, potato[20], maize, cereals[21], beans, fruits and vegetables, and other food. In more detail, a household is defined as a net seller if (Q_i^s)>(Q_i^c), and otherwise for net buyers. According to our sample data, the majority of the Ugandan households are net buyers of food, with the exception of *matooke*, for which the 16.4% of households are net sellers (Table 10 in Appendix A). At the same time, disaggregating by the area of residence, we can observe that for all the staples net sellers are concentrating in rural areas (for matooke, for example, the value raises to 18.8%). Conversely, the majority of net buyers are polarised in the urban ones.

However, as Benson *et al.* (2008) remark, "while conceptually the idea of net sellers and net buyers is relatively clear, defining who is net seller or a net buyer can be more problematic" (p. 519). Indeed, the examination of consumption of *staple food* and the categorization of households into such "market" groups can neglect the share of people who do not participate in food markets.[22] For these reasons, we expanded our assessment to the share of households who consume what they produce (we defined them as "autarkic"). Data point up that for most of the staples (except for maize and cereals), the majority are autarkic households who set aside a share of their production for own consumption. However, we insert as control variables only net purchasers.

overall negative impact on poverty.

[19]The value of consumption includes only the items purchased out of home.

[20]Potato includes Irish, fresh and dried potatoes, according to the food list available into the dataset.

[21]This category comprehends millet, sorghum and rice.

[22]This is the case of autarkic households, who consume what they produce, or who received food "informally", as a gift.

4.7. ***Empirical strategy***

Our primary interest is to measure the effects of food prices on female and male labour supply, in terms of hours devoted to market, non-market and agricultural activities. Labour supply equations could therefore be estimated using a system in which each labour activity is computed through five different equations, each for the labour activities into consideration. Since the dependent variable, namely time use, has a number of zero values, a censored regression model - also referred to as Tobit model - is to be preferred (McDonald and Moffit, 1980). Specifically, censoring applies when the values of the dependent variable should be restricted to a range of values, e.g. higher than zero. Therefore, the model takes into account the probability of being "observed", namely the probability of working and therefore to have labour time above zero (Greene, 2008). So, the total effect of x on y can be decomposed into two parts: "1) the change in the dependent variable for the observations above the limit, weighted by the probability of being above the limit; 2) the change in the probability of being above the limit, weighted by the expected value of y if above" (McDonald and Moffitt, 1980). Thus the equation assumes the following form:

$$y_{it}* \ = \ X_{it}\beta \ + \ \alpha_i \ + \ \epsilon_{it} \qquad \epsilon_{it} \sim N(0, \sigma^2) \tag{4}$$

$$y_{it} = max(0, y*_{it}), \quad i = 1, ..., N \qquad t = 1, ..., T. \tag{5}$$

where $y*$ denotes the latent variable, which satisfies the classical linear model assumptions: in fact it has a normal, homoskedastic distribution with a linear conditional mean[23], i is the individual index and t the time period. Moreover, X_{it} is a vector of exogeneous variables, β is a vector of the parameters of interest and α_i is the unobserved individual specific effect. Finally, the error term ϵ is assumed to be a normal random variable with mean zero and variance σ^2.
In the traditional Tobit model, the data are censored at 0. Thus the observed

[23]For a detailed and straightforward description of the model, see also Wooldridge, 2002.

y can be defined by the following measurement equation:

$$y_i = \begin{cases} y* & \text{if } y* > 0 \\ 0 & \text{if } y* \leq 0 \end{cases} \tag{6}$$

It implies that the observed variable y equals y^* when $y^* \geq 0$, and $y = 0$ when $y^* < 0$ (Wooldridge, 2002). However, in this paper we introduce an upper limit, 5475, according to the hypothesis that working people work 15 hours per day (that become 5475 in a year), as already pointed out in the data section. Therefore, we can rewrite the equation as:

$$y_i = \begin{cases} y* & \text{if } 0 > y* > 5475 \\ 0 & \text{if } y* \leq 0 \\ 5475 & \text{if } y* \geq 5475 \end{cases} \tag{7}$$

Thus, when interpreting coefficients, the estimation has to be considered as the effect of the regressors on the latent variable. Moreover, when considering panel data, the error term ϵ_{it} can be disaggregated into:

$$\epsilon_{it} \; = \; \alpha_i \; + \; \lambda_t \; + \; u_{it} \tag{8}$$

where α_i is the individual effect (indicating all the unobservable characteristics specific to the unit i that is assumed constant over time), λ_t is the time effect (representing all the unobservable characteristics of time period t, assumed as constant for all the cross-sectional units in the sample), and u_{it} is the random term which varies over time and individuals, assumed to be uncorrelated over time (Calzolari *et al.*, 2001).

However, the Tobit approach fits a random-effects model, not contemplating the fixed-effects. Honoré (1992) developed a semiparametric estimator for Tobit fixed-effects, but it is difficult to implement in this paper. To remedy for this, we construct a fixed-effect version of our basic model by implementing an hybrid model technique (Schunk, 2013; Allison, 2005; Neuhaus and Kalbfleish,

1998), in which both the fixed and random-effects models are combined, taking advantage from both models. Allison (2005) claims that the "hybrid method allows for the estimation of fixed-effects coefficients for time-varying while also estimating the effects of time-invariant predictors"(p. 105). According to the model specification, the time-varying covariates are decomposed into two components: the between-cluster covariate ($\bar{X}_i = n_i^{-1} \sum_{k=1}^{n} X_{ij}$) [24], that allows to measure differences between individuals, and the within-cluster one, $(X_{ij} - \bar{X}_i)$, that captures the effects of the entity over time. More specifically, while the between-cluster predictors measure the cluster mean, the within component indicates the deviations of each covariate from the cluster mean.
Hence, our labour time equations - each for the five working time categories - can be specified as:

$$LT_i^k = \beta_0 + \beta_1 X_i + \beta_B \bar{X}_i + \beta_W (X_i - \bar{X}_i) \tag{9}$$

where LT describes the individual labour time (in annual hours), disaggregated by gender, for each working category k (that, as stated yet, refers to market, domestic, non-market, farming and agricultural working hours, respectively). However, X_i is the vector of covariates which are time-invariant (such as education), $\bar{X}_i$ reflects the between component B, whereas $(X_i - \bar{X}_i)$ illustrates the within predictors, W of time-varying variables for both working men and women. The equation system has been estimated using the statistical software STATA 13.

5. ESTIMATION RESULTS AND DISCUSSION

Our main purpose is seeking to determine how food price instability relate to labour time among working men and women. The estimates are presented in Tables 7 and 8. Although the information about time use are on a weekly basis within the questionnaire, the analysis has been carried out using the annual ones.

[24] In our model cluster is represented by working men and women. For more details, see also Mundlak, 1978; Allison, 2005; Schunck, 2013; Sjölander *et al.*, 2013.

To take into consideration the geographical differences in prices, market prices at district level are used, as explained in section 4.4. Additionally, in order to capture possible differences in time use at geographical level, we also introduce regions as explanatory variables (namely: Northern, Southern, Eastern, and Center macro-areas). Before commenting the results, we need to point out that the number of censored observations is particularly high for market hours, due to the high number of zero values, and remarkably low for the non-market labour activities (for which, as already pointed out, positive values have been recorded). Finally, we reduce our empirical analysis to the two major staples consumed, matooke and cassava: this choice has led to a final regression sample of 10117 people, namely 4869 and 5248 men and women respectively (the reduction of the sample is given by the presence of missing values in the price data). For a comprehensive analysis, we also test the model incorporating the other food categories[25]. Lastly, as claimed in Brown *et al.* (2013), due to the censored nature of the dependent variables, findings are explained in terms of the expected value, $E(y|y > 0)$, that means that it is conditional on $y > 0$.

[25]Results are drawn in tables 13 and 14 in Appendix: in this case the regression sample reduces to 9302 people.

Table 7: Yearly hours of work of the estimated Hybrid Tobit model for market and non-market activities, disaggregated by gender.

	Market		***Domestic***		***Non-market***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Food prices						
Between matooke	5.88 (3.66)	14.53*** (4.96)	0.75 (0.54)	-1.36*** (0.56)	1.11* (0.67)	-1.53*** (0.58)
Within matooke	1.2 (2.59)	7.97** (3.53)	-0.12 (0.44)	-1.15** (0.48)	-0.54 (0.56)	-1.20*** (0.51)
Between cassava	4.74 (5.59)	24.52**(6.74)	-1.52 (0.57)	-0.06 (0.82)	-0.17 (1.06)	-0.32 (0.86)
Within cassava	-2.2 (3.52)	-3.01 (4.08)	-0.58 (0.65)	0.81 (0.64)	-0.54 (0.82)	0.96 (0.69)
Net market position						
Buyer of matooke	457.59*** (123.06)	470.84*** (148.19)	-44.91* (23.8)	-32.63 (22.93)	-69.97** (30.20)	-32.42 (24.13)
Buyer of cassava	188.6* (111.11)	286.61** (135.51)	63.78*** (20.24)	23.22 (20.12)	83.73*** (25.47)	25.09 (21.25)
Cropping season						
Second cropping season	44.94 (85.98)	6.45 (110.77)	-3.4 (14.44)	11.65 (14.54)	-8.97 (18.16)	15.44 (15.34)
Household characteristics						
Relationship to the household head						
Spouse	538.66* (290.82)	-1438.62*** (218.56)	-154.75** (76.61)	36.01 (30.42)	-47.10 (83.02)	15.63 (31.87)
Son or Daughter	-2198.4*** (319.64)	-2222.40*** (340.05)	145.19*** (47.43)	121.72 ***(44.52)	190.86*** (58.2)	117.1*** (46.49)
Marital status						
Married polygamous	77.98 (157.34)	239.58 (201.54)	-156.64*** (33.18)	7.4 (24.24)	-195.45*** (39.63)	-1.9 (25.37)
Divorced or Separated	257.28 (268.48)	625.36** (288.43)	245.79*** (42.82)	-29.35 (41.84)	263.40*** (53.29)	-42.92 (43.73)
Widow	359.25 (549.5)	394.10 (308.4)	129.37 (99.75)	-121.57*** (41.96)	102.79 (125.57)	-104.74** (43.71)
Never Married	-576.77* (311.3)	-1190.73*** (371.03)	279.47*** (47.2)	-130.49*** (49.76)	255.61*** (57.86)	-174.92*** (52.04)
Household size						
Between size	-116.04***(21.48)	-78.9*** (28.17)	-19.76*** (3.24)	-26.89*** (3.15)	-22.99*** (3.98)	-26.24***(3.29)
Within size	-852.08** (438.7)	502.62 (772.80)	61.51 (88.52)	-39.003 (103.25)	81.97 (114.65)	-51.31 (109.82)

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	Market		*Domestic*		*Non-market*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Number of children (0-5)						
Between child	154.66** (75.70)	-120.36 (101.25)	49.07*** (11.65)	89.96*** (11.16)	56.57*** (14.23)	85.25*** (11.65)
Within child	301.65** (129.05)	-123.41 (170.59)	55.08*** (22.49)	88.72*** (22.35)	42.84 (28.83)	95.67*** (23.79)
Level of education						
Primary education	910.89** (268.03)	448.49** (207.92)	-18.9 (41.10)	-55.1** (23.14)	-4.78 (50.59)	-35.34 (24.26)
Secondary education	1610.7*** (310.89)	1910.67*** (300.66)	-119.6** (51.77)	-245.56*** (40.93)	-130.24** (63.37)	-243.85*** (42.88)
Higher education	1508.77***(406.67)	1437.32*** (518.72)	-347.95*** (82.32)	-433.16*** (78.45)	-388.1*** (100.53)	-446.67*** (82.45)
Household wealth						
Second expenditure quintile	45.44 (134.55)	448.44** (183.44)	-24.51 (21.68)	34.08 (21.55)	-18.75 (27.35)	47.27** (22.84)
Third expenditure quintile	201.74 (135.52)	357.46* (186.68)	-26.31 (22.76)	-8.71 (22.26)	-13.93 (28.61)	-0.59 (23.56)
Fourth expenditure quintile	386.25***(154.01)	653.03*** (209.72)	-84.25*** (25.20)	-83.14*** (24.98)	-107.98*** (31.78)	-76.05*** (26.4)
Fifth expenditure quintile	293.67 (190.87)	711.71*** (260.57)	-84.44*** (29.73)	-117.62*** (31.67)	-88.50*** (37.45)	-114.61*** (33.40)
Place of residence						
Urban	1307.9*** (135.10)	1749.28*** (170.16)	-150.55*** (23.53)	-165.12*** (22.22)	-182.63*** (28.95)	-171.33*** (23.2)
Region						
Central	149.75 (195.08)	101.25 (231.09)	131.05*** (41.86)	-22.33 (41.18)	187.28*** (53.23)	35.86 (43.38)
Eastern	-675.28*** (234.78)	-395.96 (294.75)	135.05*** (44.81)	190.90*** (44.38)	199.74*** (56.54)	196.69*** (46.70)
Northern	-342.17 (240.80)	691.54** (297.96)	8.35 (46.04)	473.58*** (45.32)	105.57* (57.86)	479.53*** (47.72)
Western	-466.89** (232.17)	-406.90 (292.05)	122.57*** (44.52)	123.71*** (43.6)	163.33*** (56.18)	129.81*** (45.89)
Survey round						
2010-11	-178.88* (107.4)	-39.46 (142.09)	-0.91 (18.18)	-9.51 (19.02)	-12.03 (23.16)	-17.51 (20.2)
2011-12	-110.57 (107.23)	-306.16** (143.26)	-11.24 (18.58)	56.03*** (19.44)	-45.6* (23.89)	34.9* (20.69)
Constant	-822.1** (416.73)	-3073.54*** (508.11)	-247.84*** (69.44)	311.45*** (66.002)	-352.14*** (86.59)	333.79*** (69.32)
Sigma u	1695.45*** (65.47)	2041.70*** (92.46)	219.94*** (11.08)	215.97*** (11.84)	252.31*** (14.43)	215.66*** (12.88)
Sigma e	1765.03*** (42.40)	1850.36*** (58.4)	332.05*** (7.49)	429.81*** (6.88)	438.43*** (9.40)	461.66*** (7.27)
Rho	0.48 (0.02)	0.55 (0.03)	0.30 (0.03)	0.20 (0.02)	0.25 (0.02)	0.18 (0.02)
Number of observations	4869	5248	4869	5248	4869	5248

*Source: Author's elaboration from UNHS 2009-10, 2010-11 and 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard errors into brackets.*

The Table 7 above presents the results. First, changes in food market prices, namely matooke and cassava, have differentiated effects on male and female labour behaviour. For instance, the model indicates that the between-women effect of a unitary change in the price index of matooke is positive only for the market work, resulting in an opposite effect in domestic and non-market hours. Certainly, these findings may be because matooke is one of the most important staple food in the dietary composition of the Ugandan population, so that women engaged in paid jobs should work more to buy it. Contrariwise, we found no significant impact on male labour time. Along the same line, the average labour time for women spending their time in market tasks increases following an average change in cassava price, whilst no statistically significant results are shown from the other working categories. On the other hand, the within-women effect suggests that, for a given woman, a unitary variation in the matooke real price index is associated to an increase in time devoted to market tasks by 7.97 hours, counterbalanced by a reduction in both domestic and non-market activies. However, this last statement only applies to matooke, for which coefficients are significantly different from zero. Surprisingly, being net buyer of plantains results in an increasing trend on market labour time for both men and women, although the magnitude is different, with a slightly higher value in the female one. One of the possible explanation is that, as women are more concerned for the family food intake than men, they are more likely to increase their paid time work. For instance, in line with the increase in remunerated labour hours, men reduce the time devoted to domestic tasks, whereas for women the coefficient is not significant. Among household's characteristics the number of children is particularly influential for both men and women: in fact it is associated to an average increase in all the working market and non-market activities at both between and within individual level, although their presence encumber more on women than men. In fact, it can be observed an increase in domestic time of about 88 hours per annum *vs.* the 55 for male individuals. On the contrary, in line with our hypothesis, the between-household size impacts negatively all the working activities time considered here for both men and women,

albeit this consideration is shown only at between level. Interestingly, the level of education is associated to a consistent increase in male and female market labour time, followed by a complementary reduction in the non-market activities. In details as expected, being more educated determines a greater increase in both male and female market labour, combined with a decrease in the other labour activities considered. However, in this case, whether the reduction in the domestic and non-market labour categories matches our expectation (as women devote higher hours to the mentioned activities), the hybrid model shows that for women with a secondary level of education there is a higher increase in paid hours than for their male counterpart. Moreover, living in urban areas increases annual market hours by respectively 1308 and 1749 hours for men and women, while reducing the time spent in the other labour activities. As concerns the place of residence, estimation results show that living in urban areas is associated to an increase in paid hours, higher for women than for men (probably for the same reasons stated above about the contribution of women to household food intake, particularly for children and the elderly). Otherwise, in line with our expectation, we assist to a reduction of both domestic and non-market activities with, once again, a larger decrease for female than male labour time. As regards the relationship with the household head, being a female spouse is associated to a reduction in paid hours, though an increase in labour time is registered in both domestic and non-market extended hours. However, results are not statistically significant. Instead, the opposite results are registered for male spouses. Moreover, despite the difference in the magnitude of the coefficients, with the only exception of market labour, we can note that both female and male children follow the same positive time pattern. Also the marital status plays an important role: for example, the labout time change seems to be more significant for divorced or separated women, probably because they are the only ones who have to deal with the food maintenance of the household. The regional location too is important in the analysis of price instability and the impact it have on time allocation. In general, we registered an increasing pattern for at least all the activities, even though results are different. As concerns the house-

hold wealth, both richer men and women are the ones who seem to increase the hours devoted to remunerated hours over the panel time, accompanied by a more pronounced decreasing pattern in the non-market and domestic hours. The only "gender" difference is found for non-market working time, for which results describe asignificant increasing time trend for poorer women.

Moving to working on the household farm and agricultural activities, illustrated in Table 8, we can see that also in this case the effect of the price change is different between men and women. Firstly, the between effect of matooke is surprisingly negative for both men and women, whilst we can observe an opposite effect for male time devoted to the agricultural tasks. Moreover, the within predictor of hours spent on household farming suggests that, for a given woman, there is a decrease, whilst it is statistically not significant for men. Additionally, being a net buyer of both matooke and cassava is associated to a reduction in both the two activities for both men and women. This is in line with the results of the previous estimation: in fact, being a net buyer is associated to a higher value in paid work time, since buying the same quantity of matooke need a higher income. As regards the relationship to the household head, we can see a positive and statistical significant increase for female time spent on both farming and agricultural tasks, offset by an opposite effect for men. Indeed, the increase in the household farming and agricultural time associated to increasing household size may be related to the need to guarantee a certain food requirement to the other household components, particularly children and the elderly, as described yet. The higher the level of education, the greater is the decrease in both the activities now considered (to a larger extent for men than for women), also the household wealth is related to a higher decrease in annual labour time for the richest than for the poorest people even though, once in this case, the effect is more prominent for the female components. Surprisingly, we found that women who live in urban areas enhance their time devoted to the agricultural tasks, contrariwise to the negative trend in the household farming hours for both the gender. Finally, differently from the findings concerning market and non-market annual labour time, in the second cropping season findings

reveal an increasing statistically significant trend in both the household farming and agricultural labour time (with the exception of the male household farming hours).

Table 8: Yearly hours of work of the estimated Hybrid Tobit model for household farming and agricultural labour time, disaggregated by gender.

	Household farm		***Agriculture***	
	Men	*Women*	*Men*	*Women*
Food prices				
Between matooke	-4.7*** (1.62)	-5.54*** (1.21)	5.26*** (1.61)	1.78 (1.27)
Within matooke	-1.74 (1.26)	-1.26** (0.93)	-0.4 (1.33)	0.38 (1.08)
Between cassava	-4.28* (2.56)	-10.96*** (1.84)	-5.25** (2.53)	-9.36*** (1.95)
Within cassava	1.84 (1.82)	-0.82 (1.32)	0.95 (1.93)	2.14 (1.55)
Net market position				
Buyer of matooke	-451.29*** (80.62)	-331.93*** (53.21)	-429.24** (81.68)	-292.78***(58.77)
Buyer of cassava	-59.98*** (62.02)	-136.25*** (44.22)	-57.7 (64.48)	-87.67* (49.92)
Cropping season				
Second cropping season	67.03 (42.77)	177.61*** (30.06)	79.35* (44.46)	154.93*** (33.93)
Household characteristics				
Relationship to the household head				
Spouse	-562.61*** (181.42)	200.62*** (64.22)	-434.49 ***(172.45)	166.65** (69.79)
Son or Daughter	187.66 (148.88)	-64.9 (98.45)	-240.53 (147.16)	-260.33** (106.9)
Marital status				
Married polygamous	-160.38** (81.28)	1.68 (50.61)	-79.003 (78.64)	65.68 (54.01)
Divorced or Separated	-240.78* (144.3)	-103.6 (91.07)	-339.79** (144.87)	89.65 (97.38)
Widow	-510.07 (324.45)	101.44 (87.93)	-585.58* (340.5)	274.9*** (93.61)
Never Married	-412.51*** (148.48)	-424.01*** (109.43)	-191.93 (146.32)	-276.05** (120.19)
Household size				
Between size	49.04*** (9.47)	31.13*** (6.69)	38.72*** (9.43)	34.84***(7.16)
Within size	45.39 (242.28)	87.61 (192.73)	288.17 (250.9)	204.51 (212.83)

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	Household farm		*Agriculture*	
	Men	*Women*	*Men*	*Women*
Number of children (0-5)				
Between child	23.63 (33.6)	7.66 (23.66)	59.42* (33.26)	9.15 (25.16)
Within child	-69.22,(62.19)	49.75 (43.004)	-60.54 (66.32)	94.91* (50.81)
Level of education				
Primary education	-329.79*** (111.5)	-85.78* (47.68)	-254.80** (111.4)	-24.42 (51.53)
Secondary education	-1015.28*** (148.76)	-763.002*** (101.12)	-483.33*** (141.41)	-154.19 (96.27)
Higher education	-1441.16*** (297.3)	-632.55*** (195.71)	-742.23*** (246.83)	-708.81*** (231.80)
Household wealth				
Second expenditure quintile	-41.41 (61.47)	-67.09 (41.95)	-27.33 (64.15)	-122.96*** (48.37)
Third expenditure quintile	5.42 (65.44)	-85.19* (44.40)	-91.10 (68.05)	-116.84** (50.62)
Fourth expenditure quintile	-189.51*** (73.15)	-199.12*** (50.93)	-124.77* (75.52)	-187.89*** (57.63)
Fifth expenditure quintile	-200.45** (88.53)	-328.7*** (66.96)	-322.74*** (93.34)	-360.31*** (75.34)
Place of residence				
Urban	-1075.20*** (79.77)	-868.13*** (53.46)	-981.29*** (78.20)	797.73*** (56.53)
Region				
Central	633.77*** (211.9)	412.53***(134.98)	1009.48*** (207.13)	812.05***(155.70)
Eastern	627.23*** (216.57)	382.03*** (139.25)	806.81*** (212.05)	726.87*** (159.78)
Northern	635.69*** (217.62)	249.2* (140.60)	1065.32*** (212.76)	772.62*** (160.87)
Western	889.13*** (214.94)	902.06*** (137.26)	1000.48*** (210.29)	1095.26*** (158.1)
Survey round				
2010-11	-67.63 (53.39)	-53.85 (38.02)	-236.13*** (56.6)	-126.16*** (44.66)
2011-12	64.66 (154.53)	109.81*** (37.92)	-201.45*** (58.45)	11.72 (44.95)
Constant	-333.63 (264.43)	155.38 (173.22)	-987.02*** (260.002)	-801.86*** (194.60)
Sigma u	699.23*** (32.003)	516.66*** (22.44)	619.003*** (35.35)	451.12*** (28.73)
Sigma e	984.92*** (22.05)	765.99*** (14.7)	1052.24*** (24.38)	904.46*** (18.11)
Rho	0.34 (0.02)	0.31 (0.02)	0.26 (0.03)	0.2 (0.02)
Number of observations	4869	5248	4869	5248

*Source: Author's elaboration from UNHS 2009-10, 2010-11 and 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard errors into brackets.*

6. CONCLUSION

The main objective of this paper is to study the effects of soaring food prices on both male and female labour time in Uganda, in order to verify if a gender dimension of the recent crisis exists. At this purpose, we make use of a Hybrid Tobit model with fixed-effects, with both between and within predictors. Given the purposes of the analysis, we use data at both individual and household level from the last three waves of the Uganda National Household Survey panel (2009-10; 2010-11; 2011-12), focusing our analysis on both working women and men (where this notion refers to individuals who have given a positive answer to the time labour questions).

Taking into account the two staple foods mainly consumed, *matooke* and cassava, we found that a gender differential occured on labour time. In detail we observe that, over time, the raise in paid hours is more pronounced for women than men. Contrariwise, the time spent in all the other activities appears to be decreasing. Surprisingly, the hours spent on the household farm is negatively associated to a price increase (this statement concerns only the between effect) for both working men and women, whilst for the agricultural labour time we found a positive and significant cluster mean for men, whereas for women it is positive, but not significant. Conversely, when controlling for the cassava price, the estimated between-effect for both men and women is negative. Therefore, it is possible to assert that there is a *substitution effect* in labour time, particularly evident for women who, even if decreasing both non-market and agricultural annual hours, have to increase their paid hours more than men. One of the possible reasons may be related to the pivotal "*food subsistence role*" women play within the household. More precisely, as the initial amount of remunerated hours was significantly lower for women than for men, being net buyer of both matooke and cassava determines a more prominent increase of market labour time for women than for their male counterpart. When teasing out by food and non-food expenditure quintiles our findings demonstrate a higher increase of paid labour

time for the richest individuals, associated with a more prominent decrease in the other work categories considered.

Taken together, the findings of this study support the idea that women are *shocks absorbers*, since they are the ones who have to change more their labour behaviour in order to meet the household needs. To be more precise, whilst apparently the increase in market labour time and the consequent decrease in the other labour categories may be seen as a form of women's empowerment, after the price increase women work more than before, and in this context of material and time deprivation, it is hard to interpret this as an increase in empowerment.

Table 9: Descriptive statistics of the full male and female sample (15093).

	2009-10		*2010-11*		*2011-12*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
	Mean		*Mean*		*Mean*	
Household characteristics						
Age	31.9 (13.58)	33.4 (13.26)	32.87 (13.6)	34.4 (13.26)	33.9 (13.6)	35.4 (13.26)
Relationship to the household head [a]						
Head	0.55 (0.5)	0.18 (0.39)	0.54 [0.5]	0.21 (0.40)	0.54 (0.5)	0.21 (0.41)
Spouse	0.02 (0.13)	0.51 (0.5)	0.03 (0.15)	0.49 (0.5)	0.03 (0.16)	0.48 (0.5)
Son or Daughter	0.33 (0.47)	0.23 (0.42)	0.33 (0.47)	0.23 (0.42)	0.33 (0.47)	0.22 (0.42)
Marital status						
Married monogamously	0.43 (0.5)	0.43 (0.5)	0.42 (0.5)	0.42 (0.5)	0.43 (0.5)	0.42 (0.5)
Married polygamous	0.11 (0.32)	0.16 (0.36)	0.12 (0.33)	0.16 (0.37)	0.13 (0.33)	0.17 (0.37)
Divorced or Separated	0.03 (0.17)	0.07 (0.26)	0.03 (0.17)	0.08 (0.26)	0.03 (0.17)	0.08 (0.27)
Widow	0.008 (0.09)	0.08 (0.26)	0.007 (0.09)	0.08 (0.27)	0.006 (0.08)	0.08 (0.27)
Never Married	0.42 (0.5)	0.26 (0.44)	0.42 (0.5)	0.26 (0.44)	0.41 (0.5)	0.26 (0.44)
Household size	7.7 (3.4)	7.43 (3.22)	7.7 (3.42)	7.43 (3.22)	7.69 (3.42)	7.41 (3.22)
Number of children (0-5)	1.11 (1.05)	1.10 (1.03)	0.9 (0.92)	0.88 (0.9)	0.67 (0.76)	0.66 (0.75)
Level of education						
No education	0.06 (0.24)	0.2 (0.4)	0.04 (0.21)	0.15 (0.36)	0.04 (0.21)	0.15 (0.36)
Primary education	0.85 (0.36)	0.75 (0.43)	0.84 (0.36)	0.77 (0.42)	0.84 (0.36)	0.77 (0.42)
Secondary education	0.07 (0.25)	0.04 (0.21)	0.09 (0.28)	0.06 (0.24)	0.09 (0.28)	0.06 (0.24)
Higher education	0.02 (0.13)	0.01 (0.11)	0.03 (0.16)	0.02 (0.13)	0.03 (0.16)	0.02 (0.13)
Household wealth						
First expenditure quintile	0.18 (0.38)	0.19 (0.39)	0.33 (0.47)	0.35 (0.48)	0.17 (0.37)	0.19 (0.39)
Second expenditure quintile	0.2 (0.4)	0.20 (0.40)	0.25 (0.43)	0.24 (0.43)	0.18 (0.41)	0.2 (0.39)
Third expenditure quintile	0.23 (0.42)	0.25 (0.44)	0.18 (0.39)	0.19 (0.39)	0.22 (0.41)	0.21 (0.41)
Fourth expenditure quintile	0.23 (0.42)	0.21 (0.41)	0.14 (0.35)	0.14 (0.35)	0.21 (0.41)	0.20 (0.40)
Fifth expenditure quintile	0.16 (0.37)	0.14 (0.35)	0.09 (0.29)	0.08 (0.28)	0.22 (0.42)	0.20 (0.40)
Place of residence						
Urban	0.22 (0.42)	0.23 (0.42)	0.22 (0.42)	0.23 (0.42)	0.22 (0.41)	0.23 (0.42)
Rural	0.78 (0.42)	0.77 (0.42)	0.78 (0.42)	0.77 (0.42)	0.78 (0.41)	0.77 (0.42)
Region						
Kampala	0.07 (0.25)	0.07 (0.25)	0.06 (0.24)	0.07 (0.25)	-	-
Central	0.2 (0.4)	0.21 (0.41)	0.2 (0.4)	0.21 (0.41)	0.26 (0.44)	0.28 (0.45)
Eastern	0.27 (0.44)	0.25 (0.44)	0.27 (0.44)	0.26 (0.43)	0.27 (0.44)	0.26 (0.44)
Northern	0.27 (0.44)	0.26 (0.44)	0.27 (0.44)	0.26 (0.44)	0.27 (0.44)	0.26 (0.44)
Western	0.20 (0.4)	0.21 (0.4)	0.2 (0.4)	0.21 (0.4)	0.2 (0.4)	0.21 (0.4)
Total regression sample	2434	2597	2434	2587	2434	2597

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12). Standard deviation into brackets.

[a] In the table the information on the intrahousehold relationships were restricted, excluding all the other members living in the household - parents and servants.

Table 10: Net market position.

	Net Sellers			***Net Buyers***			***Autarkic***		
	All	*Rural*	*Urban*	*All*	*Rural*	*Urban*	*All*	*Rural*	*Urban*
Matooke	0.16	0.19	0.08	0.13	0.07	0.35	0.26	0.3	0.14
	(0.37)	(0.4)	(0.27)	(0.34)	(0.26)	(0.48)	(0.44)	(0.46)	(0.34)
Cassava	0.11	0.13	0.05	0.16	0.12	0.26	0.34	0.4	0.13
	(0.32)	(0.34)	(0.22)	(0.36)	(0.3)	(0.44)	(0.47)	(0.5)	(0.34)
Potato	0.09	0.09	0.05	0.17	0.11	0.35	0.35	0.43	0.16
	(0.28)	(0.3)	(0.22)	(0.37)	(0.32)	(0.48)	(0.48)	(0.5)	(0.37)
Maize	0.25	0.29	0.11	0.3	0.22	0.58	0.20	0.24	0.07
	(0.43)	(0.45)	(0.3)	(0.46)	(0.4)	(0.5)	(0.40)	(0.43)	(0.25)
Cereals	0.14	0.17	0.082	0.28	0.20	0.56	0.16	0.19	0.06
	(0.35)	(0.37)	[0.12]	(0.45)	(0.4)	(0.5)	(0.37)	(0.39)	(0.24)
Beans	0.23	0.27	0.09	0.28	0.21	0.53	0.37	0.43	0.15
	(0.42)	(0.45)	(0.29)	(0.45)	(0.41)	(0.5)	(0.48)	(0.5)	(0.36)
Fruits & Vegetables	0.17	0.2	0.08	0.69	0.63	0.87	0.30	0.36	0.10
	(0.38)	(0.4)	(0.27)	(0.46)	(0.48)	(0.34)]	(0.46)	(0.48)	(0.3)
Total labour sample	15093	11683	3410	15093	11683	3410	15093	11683	3410

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12). Standard deviation into brackets.

Table 11: Total weekly and annual labour time, disaggregated by gender, wave and working group of the full sample.

					2009-10					
	Market		***Domestic***		***Non-market***		***HH farm***		***Agriculture***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Weekly	14.4	6.76	2.13	7.03	2.62	7.5	7.51	9.63	6.97	7.38
	(24.08)	(17.78)	(4.57)	(9.67)	(6.17)	(10.06)	(12.90)	(12.59)	(12.18)	(11.41)
Annual	748.53	351.71	111.01	365.74	136.39	389.95	390.28	500.96	362.42	383.60
	(1252.16)	(924.57)	(237.88)	(502.62)	(320.87)	(522.92)	(670.98)	(654.82)	(633.56)	(593.51)
					2010-11					
Weekly	13.49	6.26	1.92	6.58	2.35	6.97	7.35	9.55	5.69	6.96
	(23.42)	(16.36)	(3.67)	(8.02)	(5.19)	(8.87)	(12.003)	(12.31)	(10.74)	(11.09)
Annual	701.23	325.5	99.9	342.11	122.07	362.64	382.44	496.65	295.85	362.02
	(1217.83)	(850.83)	(190.79)	(417.04)	(270.07)	(461.24)	(624.18)	(640.24)	(558.45)	(576.58)
2011-12										
Weekly	13.81	6.54	1.78	6.54	2.18	6.85	8.49	10.35	6.59	8.52
	(24.89)	(17.26)	(4.23)	(8.18)	(5.43)	(8.63)	(12.95)	(12.54)	(11.57)	(12.48)
Annual	718.09	340.07	92.63	340.13	113.52	356.08	441.49	538.30	342.64	443.09
	(1294.03)	(897.58)	(220.17)	(425.59)	(282.62)	(448.62)	(673.45)	(651.92)	(601.73)	(649.18)
Sample	15093 (7302 & 7791 men and women respectively)									

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12). Standard deviation into brackets.

Table 12: Total weekly and annual labour time without zero values, disaggregated by gender, wave and working group of the full sample.

	Market		*Domestic*		*Non-market*		*HH farm*		*Agriculture*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
2009-10										
Weekly	41.17	36.29	5.76	10.17	6.64	10.64	19.39	19.38	18.34	16.18
	(23.57)	(25.01)	(5.97)	(10.16)	(8.35)	(10.49)	(14.13)	(11.41)	(13.5)	(11.97)
Annual	2140.92	1887.15	299.55	528.86	345.44	553.09	1008.43	1007.74	953.65	841.4
	(1226.14)	(1300.35)	(310.26)	(528.24)	(434.33)	(545.56)	(734.88)	(593.12)	(701.78)	(622.47)
Number of observations	851	484	902	1796	961	1831	942	1291	925	1184
2010-11										
Weekly	41.54	35.57	5.37	9.4	6.21	9.8	18.63	19.26	16.64	16.17
	(22.89)	(21.89)	(4.37)	(8.09)	(6.88)	(9.10)	(12.45)	(10.9)	(12.46)	(11.69)
Annual	2160.50	1849.7	279.49	488.71	322.97	509.34	968.63	1001.40	865.5	840.93
	(1190.23)	(1138.28)	(227.31)	(420.48)	(357.97)	(473.38)	(647.29)	(566.54)	(647.67)	(607.90)
Number of observations	790	457	870	1818	920	1849	961	1288	832	1118
2011-12										
Weekly	47.47	40.24	5.24	9.25	6.02	9.60	19.93	19.81	18.39	18.52
	(23.03)	(21.85)	(5.89)	(8.35)	(7.64)	(8.83)	(12.88)	(10.65)	(12.52)	(12.39)
Annual	2468.68	2092.82	272.62	481.11	312.93	499.32	1036.24	1030.19	956.39	962.94
	(1197.82)	(1136.21)	(306.03)	(434.02)	(397.31)	(459.02)	(669.50)	(553.65)	(650.96)	(644.43)
Number of observations	708	422	827	1836	883	1852	1037	1357	872	1195
Sample	15093 (7302 & 7791 men and women respectively)									

Source: Author's elaborations, using UNHS (2009-10; 2010-11; 2011-12). Standard deviation into brackets.

Table 13: Yearly hours of work of the estimated Hybrid Tobit model for market and non-market activities, disaggregated by gender, for all the main food items.

	Market		***Domestic***		***Non-market***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Food prices						
Between matooke	3.31 (4.01)	13.56*** (5.42)	0.50 (0.6)	-0.66 (0.62)	0.43 (0.74)	-0.84 (0.65)
Within matooke	3.002 (2.89)	8.35*** (3.91)	-0.56 (0.48)	-1.45*** (0.52)	-1.14* (0.62)	-1.49*** (0.56)
Between cassava	-0.14 (6.20)	27.86*** (7.42)	-1.3 (0.99)	0.94 (0.92)	-0.79 (1.22)	0.78 (0.97)
Within cassava	-1.02 (4.09)	-3.35 (4.73)	-0.70 (0.75)	1.07 (0.73)	-0.43 (0.96)	1.15 (0.78)
Between potato	1.1 (8.02)	-6.93 (10.63)	-1.95 (1.2)	0.26 (1.13)	1.11 (1.46)	-0.36 (1.19)
Within potato	-0.27 (4.22)	3.36 (5.39)	-1.66** (0.70)	-0.82 (0.71)	-1.48 (0.89)	-0.73 (0.76)
Between maize	-43.45** (19.38)	-60.50** (26.13)	-3.27 (2.91)	-5.27* (2.89)	-5.29 (3.64)	-3.60 (3.05)
Within maize	-8.41 (13.55)	-13.82 (18.67)	-0.42 (2.14)	-4.73** (2.27)	-2.66 (2.79)	-4.21* (2.42)
Between cereals	16.4 (19.33)	-19.17 (26.20)	4.05 (2.86)	-3.66 (2.83)	0.90 (3.53)	-2.93 (2.98)
Within cereals	21.03* (11.24)	27.38* (14.66)	-1.97 (1.89)	3.43* (1.91)	-3.86 (2.42)	4.29** (2.05)
Between beans	59.59 (36.84)	12.31 (48.81)	8.74 (5.44)	-13.95*** (5.12)	10.47 (6.74)	-13.64*** (5.38)
Within beans	-1.97 (20.18)	36.3 (25.94)	4.14 (3.28)	3.63 (3.46)	-1.03 (4.25)	4.65 (3.69)
Net market position						
Buyer of matooke	377.07*** (128.88)	386.65*** (152.02)	-54.19** (25.14)	-35.07 (24.07)	-83.95*** (32.21)	-31.32 (25.43)
Buyer of cassava	106.01 (115.75)	158.58 (139.55)	58.42** (20.91)	19.63 (20.88)	81.91*** (26.58)	23.64 (22.14)
Buyer of potato	163.41 (112.57)	556.46*** (132.6)	17.84 (21.21)	-20.34 (20.6)	6.56 (27.06)	-25.88 (21.85)
Buyer of maize	226.52** (105.05)	26.46 (129.7)	-50.19*** (18.83)	-63.56*** (18.63)	-30.27 (23.95)	-63.10*** (19.75)
Buyer of cereals	151.35 (104.15)	158.94 (130.26)	-38.47** (18.57)	-14.96 (18.81)	-41.92* (23.68)	-20.87 (19.95)
Buyer of beans	227.29** (108.87)	215.12 (133.31)	-5.24 (19.38)	-4.32 (19.45)	5.48 (24.61)	-9.78 (20.66)
Cropping season						
Second cropping season	37.85 (89.62)	8.81 (113.09)	-5.61 (15.08)	9.27 (15.22)	-13.46 (19.15)	9.33 (16.12)

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	Market		***Domestic***		***Non-market***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Household characteristics						
Relationship to the household head						
Spouse	386.78 (297.48)	-1445.96*** (219.22)	-126.005* (77.19)	22.81 (31.13)	-14.04 (84.69)	1.4 (32.76)
Son or Daughter	-2188.59*** (325.88)	-2093.74*** (340.94)	158.08*** (48.84)	112.45*** (45.72)	194.69*** (60.54)	102.8** (48.0)
Marital status						
Married polygamous	52.05 (161.68)	385.95* (202.94)	-158.91*** (34.68)	1.15 (25.10)	-200.91*** (41.78)	-6.58 (26.4)
Divorced or Separated	299.84 (275.93)	542.93* (292.7)	254.38*** (44.43)	-28.21 (43.06)	273.55*** (55.77)	-40.09 (45.18)
Widow	282.19 (551.91)	-396.76 (309.01)	146.37 (100.96)	-138.29*** (42.96)	132.72 (128.09)	-119.54*** (44.94)
Never Married	-619.28* (317.54)	-1200.76*** (373.12)	254.59*** (48.54)	-145.21*** (51.02)	240.28***(60.14)	-186.8*** (53.6)
Household size						
Between size	-106.34*** (22.23)	-66.79** (28.87)	-19.11*** (3.37)	-28.46*** (3.33)	-22.29*** (4.18)	-28.16*** (3.5)
Within size	-874.57** (439.93)	567.8 (763.85)	53.88 (89.02)	-41.38 (103.32)	75.90 (116.71)	-53.76 (110.34)
Number of children (0-5)						
Between child	163.50** (77.09)	-120.86 (102.14)	42.45*** (12.05)	91.32*** (11.59)	50.84*** (14.82)	87.23*** (12.16)
Within child	262.70* (136.53)	-124.31 (177.06)	78.77***(23.91)	97.56*** (23.74)	56.47* (30.98)	107.72*** (25.36)
Level of education						
Primary education	940.61*** (279.38)	347.19* (210.75)	-5.75 (43.88)	-62.16*** (24.07)	2.72 (54.23)	-39.45 (25.35)
Secondary education	1604.55*** (322.66)	1752.51*** (302.97)	-100.35* (54.54)	-255.06*** (42.26)	-116.40* (67.15)	-248.19*** (44.46)
Higher education	1479.84*** (414.68)	1274.64*** (515.63)	-327.53*** (83.80)	-455.44*** (81.40)	-377.34*** (103.04)	-466.48*** (85.89)

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	Market		***Domestic***		***Non-market***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Household wealth						
Second expenditure quintile	-0.04 (147.46)	378.96* (195.27)	-9.69 (23.63)	39.26* (23.44)	-3.12 (30.07)	53.97** (24.92)
Third expenditure quintile	95.40 (153.47)	229.93 (205.82)	-8.51 (25.75)	20.67 (25.11)	-2.70 (32.68)	32.08 (26.67)
Fourth expenditure quintile	205.62 (178.13)	456.54* (234.37)	-54.11* (29.15)	-45.08 (28.73)	-83.29** (37.07)	-32.83 (30.48)
Fifth expenditure quintile	-0.18 (220.47)	395.64 (293.9)	-51.73 (34.76)	-61.16* (36.64)	-61.51 (44.28)	-52.74 (38.81)
Place of residence						
Urban	1210.41*** (140.83)	1597.33*** (176.55)	-136.95*** (24.7)	-143.24 (23.66)	-163.15*** (30.59)	-147.39*** (24.83)
Region						
Central	232.76 (205.33)	185.32 (242.34)	98.94** (43.31)	-11.77 (42.76)	178.41*** (55.54)	39.71 (45.21)
Eastern	-433.12* (257.85)	-573.63* (324.2)	119.14*** (47.56)	136.9*** (47.28)	204.78*** (60.44)	144.20*** (49.91)
Northern	148.87 (384.66)	359.19 (497.86)	43.07 (63.74)	326.99*** (62.01)	159.62** (80.07)	340.63*** (65.38)
Western	143.73 (275.31)	127.04 (351.56)	152.39*** (49.76)	109.06** (48.83)	191.84*** (63.17)	109.76** (51.57)
Survey round						
2010-11	74.82 (153.05)	398.96* (206.61)	14.75 (25.1)	46.23* (26.22)	-20.01 (32.53)	38.02 (28.03)
2011-12	-183.76 (159.65)	-485.19** (206.99)	13.58 (26.34)	49.17* (28.08)	7.84 (34.04)	16.35 (29.95)
Constant	-1482.32** (671.84)	-2129.54*** (861.76)	-337.78*** (104.44)	592.32*** (99.42)	-435.88*** (130.69)	597.32*** (104.73)
Sigma u	1665.69*** (68.23)	1988.3*** (93.1)	217.12*** (11.9)	210.51*** (13.05)	246.001*** (16.003)	210.25*** (14.29)
Sigma e	1771.83*** (44.9)	1831.58*** (60.18)	331.81*** (8.05)	431.23*** (7.38)	445.19*** (10.24)	465.06*** (7.82)
Rho	0.47 (0.03)	0.54 (0.03)	0.3 (0.03)	0.19 (0.02)	0.23 (0.03)	0.17 (0.02)
Number of observations	4488	4814	4488	4814	4488	4814

*Source: Author's elaboration from UNHS 2009-10, 2010-11 and 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard errors into brackets.*

Table 14: Yearly hours of work of the estimated Hybrid Tobit model for household farming and agricultural labour time, disaggregated by gender, for all the main food items.

	Household farm		***Agriculture***	
	Men	*Women*	*Men*	*Women*
Food prices				
Between matooke	-4.15***(1.74)	-3.56*** (1.28)	7.58*** (1.75)	5.55***(1.36)
Within matooke	-2.94** (1.36)	-1.29 (1.01)	-0.31 (1.45)	0.96 (1.18)
Between cassava	-3.65 (2.80)	-9.97*** (1.97)	-2.41 (2.77)	-6.85*** (2.08)
Within cassava	1.94 (2.06)	-0.74 (1.47)	-0.72 (2.20)	0.59 (1.74)
Between potato	2.86 (3.33)	0.16 (2.27)	-2.07 (3.41)	-0.81 (2.44)
Within potato	-2.59 (1.97)	-2.12 (1.36)	4.12* (2.15)	0.52 (1.63)
Between maize	23.67 (8.12)	11.58** (5.71)	12.08 (8.31)	-1.52 (6.23)
Within maize	1.07 (6.01)	4.87 (4.33)	4.10 (6.43)	5.38 (5.07)
Between cereals	7.35 (8.16)	15.76*** (5.78)	-9.58 (8.40)	5.25 (6.25)
Within cereals	-4.80 (5.28)	3.86 (3.82)	-14.22** (5.94)	-3.64 (4.56)
Between beans	-27.95* (15.49)	-34.58*** (10.38)	-27.58* (15.84)	-26.36** (11.09)
Within beans	-5.05 (9.39)	-0.22 (6.72)	10.42 (10.1)	0.94 (7.87)
Net market position				
Buyer of matooke	-389.18*** (85.83)	-302.47*** (55.74)	-392.28*** (87.68)	-276.09*** (61.83)
Buyer of cassava	-20.93 (64.16)	-100.86** (45.39)	11.8 (67.05)	-36.41 (51.32)
Buyer of potato	-295.22*** (69.31)	-276.61*** (46.25)	-271.88*** (72.04)	-335.15*** (52.9)
Buyer of maize	-326.47*** (57.24)	-159.34*** (38.86)	-346.98*** (59.67)	-264.79***(44.21)
Buyer of cereals	-38.63 (55.9)	-122.63*** (39.59)	-87.08 (58.61)	-139.86*** (45.03)
Buyer of beans	-237.7***(58.41)	-265.22***(41.29)	-153.27*** (61.20)	-253.09*** (46.92)
Cropping season				
Second cropping season	61.3 (44.61)	159.54***(31.25)	52.75 (46.69)	144.34*** (35.17)

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	Household farm		***Agriculture***	
	Men	*Women*	*Men*	*Women*
Household characteristics				
Relationship to the household head				
Spouse	-466.87*** (181.05)	175.44*** (64.53)	-393.87** (177.04)	77.53 (69.6)
Son or Daughter	152.52 (150.58)	-80.56 (98.47)	-300.42** (151.28)	-308.49*** (107.28)
Marital status				
Married polygamous	-154.57* (82.65)	-23.60 (50.96)	-87.58 (81.11)	746.58*** (156.06)
Divorced or Separated	-251.64*** (148.36)	-91.6 (91.88)	-315.09** (151.58)	590.49*** (161.44)
Widow	-289.83 (317.76)	89.42 (87.78)	-389.97 (338.9)	575.73*** (183.31)
Never Married	-395.06*** (150.11)	-462.26*** (109.57)	-146.77 (150.36)	907.85*** (162.99)
Household size				
Between size	37.42*** (9.75)	21.46*** (6.82)	29.15*** (9.90)	21.92*** (7.33)
Within size	35.24 (240.30)	95.54 (190.74)	261.22 (252.82)	225.97 (211.10)
Number of children (0-5)				
Between child	11.73 (34.01)	8.21 (23.84)	59.18* (34.16)	21.50 (25.41)
Within child	-68.52 (66.83)	67.91 (45.91)	-78.28 (71.74)	92.17* (54.32)
Level of education				
Primary education	-312.68 **(114.93)	-51.51 (48.24)	-266.15*** (116.06)	-1.6 (52.09)
Secondary education	-952.42*** (153.04)	-694.47*** (101.95)	-455.46***(147.04)	-100.38 (96.87)
Higher education	-1453.7*** (302.54)	-527.59*** (196.39)	-686.02*** (249.3)	-652.31*** (237.86)

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	Household farm		***Agriculture***	
	Men	*Women*	*Men*	*Women*
Household wealth				
Second expenditure quintile	53.49 (66.58)	10.87 (45.44)	58.99 (70.23)	-22.05 (52.17)
Third expenditure quintile	190.77*** (73.80)	101.64** (50.13)	104.46 (77.41)	107.71* (56.98)
Fourth expenditure quintile	59.92 (84.5)	55.04 (58.29)	139.22 (88.29)	117.99* (65.93)
Fifth expenditure quintile	142.53 (103.04)	-8.19 (76.19)	5.25 (109.05)	38.18 (85.49)
Place of residence				
Urban	-939.44*** (81.54)	-735.42*** (54.86)	-886.70*** (81.84)	-662.69*** (58.38)
Region				
Central	575.32*** (213.04)	327.87** (135.54)	943.23*** (210.19)	746.58*** (156.06)
Eastern	512.09*** (219.8)	289.12** (141.43)	625.59*** (216.99)	590.49*** (161.44)
Northern	520.63** (248.79)	120.66 (163.51)	748.84*** (247.80)	575.73*** (183.31)
Western	557.25*** (222.65)	663.3*** (142.25)	783.24*** (220.27)	907.85*** (162.99)
Survey round				
2010-11	-186.04*** (72.22)	-79.75 (51.19)	-296.60*** (78.67)	-200.32*** (61.3)
2011-12	93.51 (75.66)	70.17 (54.72)	-178.68** (82.01)	4.54 (64.52)
Constant	-276.36*** (339.92)	261.58*** (227.46)	-523.4 (341.83)	-451.54* (249.54)
Sigma u	649.38*** (34.82)	473.87*** (24.41)	570.9*** (39.97)	376.48*** (34.82)
Sigma e	991.50*** (23.93)	765.39*** (15.87)	1065.72*** (26.65)	910.61*** (19.7)
Rho	0.3 (0.03)	0.28 (0.02)	0.22 (0.03)	0.15 (0.03)
Number of observations	4488	4814	4488	4814

*Source: Author's elaboration from UNHS 2009-10, 2010-11 and 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard errors into brackets.*

7. REFERENCES

[1] Abdulai, A., Regmi, P. P. (2000). Estimating labor supply of farm households under nonseparability: empirical evidence from Nepal. *Agricultural Economics* 22: 309-320.

[2] Abrar, S., Morrissey, O., Rayner, T. (2004). Aggregate agricultural supply response in Ethiopia: a farm-level analysis. *Journal of International Development* 16: 605-620.

[3] Adeyonu, A.G. (2012). Gender dimensions of time allocation of rural farming households in Southwest Nigeria. *Current Research Journal of Social Sciences* 4(4): 269-276.

[4] Ajah, J. (2013). Analysis of gender time allocation to farm work in Abuja, Nigeria. *International Journal of Development and Sustainability* 2(4): 2197-2205.

[5] Allison, P. (2005). *Fixed effects regression methods for longitudinal data using SAS*. Cary, North Carolina: SAS Institute Inc.

[6] Aly, H.Y., Shields, M.P. (2010). Gender and agricultural productivity in a surplus labor, traditional economy: empirical evidence from Nepal. *The Journal of Developing Areas* 43(2): 111-124.

[7] Antonopoulos, R. (eds.) (2009). The Current Economic and Financial Crisis: A Gender Perspective. *The Levy Economics Institute Working paper* 562: 1-43.

[8] Apps, P. (2003). Gender, time use and models of the household. *IZA Discussion Paper* 796: 1-62.

[9] Apps, P., Rees, R. (1996). Labour supply, household production and intra-family welfare distribution. *Journal of Public Economics* 60: 199-219.

[10] Bardasi,E., Wodon, Q. (2006). Measuring time poverty and analyzing its determinants: concepts and application to Guinea. *Munich Personal RePEc Archive* 11082: 75-95.

[11] Bardasi, E., Wodon, Q. (2010). Working long hours and having no choice: time poverty in Guinea. *Feminist Economics* 16(3): 45-78.

[12] Barrett, C.B., Dorosh, P.A. (1996). Farmer's welfare and changing food prices: nonparametric evidence from rice in Madagascar. *American Journal of Agricultural Economics* 78: 656-669.

[13] Becker, G.S. (1965). A Theory of the Allocation of Time. *The Economic Journal* 75(299): 493-517.

[14] Bedemo, A., Getnet, K., Kassa, B. (2013). Determinants of labor market participation choice of farm households in rural Ethiopia: multinomial logit analysis. *Journal of Economics and Sustainable Development* 4(1): 133-141.

[15] Bellemare, M.F., Barrett, C.B., Just, D.R. (2013). The welfare impacts of commodity price volatility: evidence from rural Ethiopia. *American Journal of Agricultural Economics* 95(4): 877-899.

[16] Benson, T., Mugarura, S., Wanda, K. (2008). Impacts in Uganda of rising global food prices: the role of diversified staples and limited price transmission. *Agricultural Economics* 39: 513-524.

[17] Benson, T., Minot, N., Pender, J., Robles, M., von Braun, J. (2013). Information to guide policy responses to higher global food prices: The data and analyses required. *Food Policy* 38: 47-58.

[18] Bhalotra, S., Umaña-Aponte, M. (2010). The Dynamics of Women's Labour Supply in Developing Countries. *IZA Discussion Paper* 4879: 2-57.

[19] Black, D.A., Kolesnikova, N.A., Taylor, L.J. (2009). Local Price Variation and Labor Supply Behavior. *Federal Reserve Bank of St. Louis Review* 91(6): 613-625.

[20] Brown, S., Garino, G., Taylor, K. (2013). Household debt and attitudes toward risk. *Reviews of Income and Wealth* 59(2): 283-303.

[21] Calzolari, G., Magazzini, L., Mealli, F. (2001). Simulation-based estimation of Tobit model with random effects. *Munich Personal RePEc Archive* 22985: 1-22.

[22] Caracciolo, F., Depalo, D., Macias, J.B. (2014). Food price changes and poverty in Zambia: an empirical assessment using household microdata. *Journal of International Development* 26: 492-507.

[23] Depalo, D., Fedeli, S. (2011). Heterogeneity in the cultural expenditures of municipalities. Evidence from Italian data (1998-2006). *Working Paper* Sapienza University, Roma 139: 2-33.

[24] Dimova, R. (2015). The welfare impact of rising food prices: the welfare impact of rising food prices differes for net food consumers and net producers. *Iza World of Labor*135: 1-9.

[25] Dito, B.B. (2011). *Intra Household Labor Supply, Agricultural Shocks and Women's Bargaining Power in Rural Ethiopia*. Paper presented at DIAL development conference: Shocks in developing countries. Paris, June 30thand July 1st.

[26] Edmonds, E.V., Pavcnik, N. (2005). The effect of trade liberalization on child labor *Journal of International Economics* 65: 401- 419.

[27] Famine Early Warning Systems Network (2014). Price Watch August 2014 Prices. Available at ***http://www.fews.net/global/price-watch/november-2015***

[28] Greene WH (2008). Econometric Analysis. 6th edition. Prentice Hall.

[29] Gronau, R. (1976). Leisure, home production and work: the theory of the allocation of time revisited. *National Bureau of Economic Research Working Paper* 137:1-50.

[30] Headey, D., Fan, S. (2008). Anatomy of a crisis: the causes and consequences of surging food prices. *Agricultural Economics* 39: 375-391.

[31] Hill, M.A (1989). Female labor supply in Japan. Implications of the informal sector for labor force participation and hours of work. *The Journal of Human Resources* 24(1): 143-161.

[32] Honoré, B.E. (1992). Trimmed lad and least squares estimation of truncated and censored regression models with fixed-effects. *Econometrica* 60(3): 533-565.

[33] Hundley, G. (2000). Male/Female earnings differences in self-employment: the effects of marriage, children and the household division of labor. *Industrial and Labor Relations Review* 54(1): 95-114.

[34] Ilahi, N. (2000). *The intra-household allocation of time and tasks: what have we learnt from the empirical literature?* Gender and Development Working Paper 13. Washington, DC: World Bank.

[35] Ilahi, N. (2001). *Gender and the allocation of adult time. Evidence from the Peru LSMS panel data.* Policy Research Working Paper 2744. Washington, DC: World Bank.

[36] Klasen, S., Lechtenfeld, T., Povel, F. (2011). *What about the women? Female headship, poverty and vulnerability in Thailand and Vietnam.* Courant Research Centre: Poverty, Equity and Growth Discussion Papers 76: 1-36.

[37] Kumar, N., Quisumbing, A.R. (2011). Gendered impacts of the 2007-08 food price crisis: evidence using panel data from rural Ethiopia. International Food Policy Research Institute Discussion Paper 01093. Washington, DC: IFPRI.

[38] Maddala, G.S. (1987). Limited dependent variable models using panel data. *The Journal of Human Resources* 22(3): 307-338.

[39] McDonald, J.F., Moffitt, R.A. (1980). The uses of Tobit Analysis. *The Review of Economics and Statistics* 62(2): 318-321.

[40] Medeiros, M., Osório, R.G., Costa, J. (2007). Gender inequalities in allocating time to paid and unpaid work: evidence from Bolivia. Levy Institute Working Paper 495. Annandale-on-Hudson, NY: the Levy Economics Institute.

[41] Mincer, J. (1962b). Labor force participation of married women. In H. G. Lewis (Ed.), *Aspects of Labor Economics*. Princeton, NJ: Princeton University Press.

[42] Mukasa, A.N, Berloffa, G. (2015). Welfare dynamics and exposure to food price shocks in Uganda under non-separability: how relevant is the net market position? : 1-48.

[43] Mundlak, Y. (1978). Pooling of Time-Series and Cross-Section Data. *Econometrica* 46(1): 69-85.

[44] Neuhaus, J.M., McCulloch, C.E. (1998). Separating between-and within-cluster covariate effects in the analysis of clustered data. *Biometrics* 54(2): 638-645.

[45] Quisumbing, A. (1996). Male-female differences in agricultural productivity: methodological issues and empirical evidence. *World Development* 24(10): 1579-1595.

[46] Schunk, R. (2013). Within and between estimates in random-effects models: Advantages and drawbacks of correlated random effects and hybrid models. *The Stata Journal*: 1-76.

[47] Skoufias, E. (1996). Intertemporal substitution in labor supply: micro evidence from rural India. *Journal of Development Economics* 51: 217-237. Simler, K.R. (2010). *The short-term impact of higher food prices on poverty in Uganda.* World Bank Policy Research Working Paper 5210. Washington, DC: World Bank.

[48] Tiberti, L., Tiberti, M. (2015). Rural policies, price change and poverty in Tanzania: an agricultural household model-based assessment. *Journal of African Economies*: 1-37.

[49] Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica* 26(1): 24-36.

[50] Van Campenhout, B., Pauw, K., Minot, N. (2013). *The impact of food price shocks in Uganda: first-order versus long-run effects.* IFPRI Discussion Paper 01284. Washington, DC: International Food Policy Research Institute.

[51] Warner, J.M., Campbell, D.A. (2000). Supply response in an agrarian economy with non-symmetric gender relations. *World Development* 28(7): 1327-1340.

[52] Wooldridge, J.M. (2002). *Introductory Econometrics: A modern approach. Second Edition.*South Western, Mason: USA.

CHAPTER 3

Agricultural productivity in Uganda: does gender matter?

Abstract

The analysis of women's empowerment in agriculture cannot leave aside the problem of understanding the sources of gender differences in agricultural productivity. Using the Uganda LSMS-ISA (2009-10; 2010-11) we estimate the value of productivity of crops grown per acre of harvested land at the household level, on the basis of the gender of the land manager. Results from the Tobit model with fixed effects confirms the findings of the existing literature: in fact, controlling also for socio-economic variables and plot characteristics (soil quality, topography, distance from the homestead), as well as for the use of inputs (both labour and other inputs than labour) female managed plots are less productive than plots managed by men. Better individual agricultural data disaggregated by gender may allow to better identify the reasons of such productivity gap.

Keywords: Agricultural productivity; gender gap; land; Uganda.

JEL codes: J16, J43, Q12

1. INTRODUCTION

Traditional agriculture in Sub-Saharan Africa is characterized by gender division of labour in tasks and crops (Ezumah and Di Domenico, 1995). Albeit women assist men in the farming activities, so as to be defined as productive partners in agriculture (Oladejo *et al.*, 2011), they are still subjected to an "assets discrimination": besides control over land, access to fertilizer and other inputs, also extension and training services for improved technologies are denied to them.

Since the 1970s, a considerable body of the literature has emphasized the role of women in the agricultural production (Salome, 2014; Elbehri and Lee, 2011; Elad and Houston, 2002; Warner, 2000; Quisumbing, 1996; Udry, 1996; Bassett, 1993; Blevins and Jensen, 1991). The lower productivity of female headed farms is a much debated issue. The main reasons of this gender gap can be attributed to gender differences in: a) access to and control over agricultural inputs; b) tenure system, credit and extension services constraints, that affect investments on technologies; c) informal rules that influence the management and marketing of the agricultural output (Kilic et al., 2015). Studies in this vein show that yield differentials are partly due to gender-specific assets and to the credit constraints women face (Thapa, 2008). Also FAO (2011) has recognized that equal access to productive resources "could increase yields by 20-30%" (FAO, 2011). Since land is one of the most important economic resource, the recognition of its entitlement may be relevant for increasing productivity (Masterson, 2007). In fact, its ownership motivates farmers to "make efficiency-enhancing improvements"(Masterson, 2007) towards technical investments (for example, by the introduction of improved seeds or machineries). Rural women farmers are crucial for food production and food security (Salome, 2014). Aside from the inside home tasks, if men are considered as the main responsible of cash crops, women are viewed as the most accountable for the production of subsistence food for home consumption (Doss, 2002). However, despite their vital role in agriculture and food security, women continue to have lower access to a range

of productive resources, information and financial assets. This discrimination has direct consequences for land productivity (Koru and Holden, 2008).

Measuring gender differences in productivity is cumbersome, due to the complexity of farming systems, as well as to the lack of data on inputs and outputs differentiated by gender. Indeed, plot level information separated by gender management would be essential for this analysis. Moreover, confusion about notions of sex and gender contributes to complicate this kind of analysis. As stated by Quisumbing (1996) "sex differences are due to innate biological differences between men and women. Gender differences, [...] arise from the socially constructed relationship between men and women" (p.1580). Furthermore, this difficulty is also linked with a variety of farming systems, so that estimating these differences in plots managed jointly by men and women is more complicated (Njuki *et al.*, 2006).

A common limitation of studies measuring the gender differences in agricultural productivity is that they rely on proxies of individual access to assets and inputs, and this is one major reason why results are only partially representative of the individual true productivity. Therefore, this article sets out to investigate the extent to which gender differences exist in agricultural productivity, and whether land ownership and management may influence this gap. In this study, knowing that land ownership could not be a sufficient condition for explaining possible differences between plots managed by female and male owners[1], we decide to combine land ownership, access and use of plots, and agricultural output management as the gender land indicator.

Data for this study are drawn from the 2009-10 and 2010-11 waves of the *Uganda Living Standard Measurement Survey- Integrated Survey on Agriculture* (LSMS-ISA henceforth). We use the Agricultural Questionnaire, that contains informa-

[1]This statement could be more valid for women, who in the case of ownership, acquire land through inheritance. Moreover ownership does not automatically imply management since land could be rented-out, so that productivity depends on external factors not directly imputable to the landowner, such as the use of fertilizers or other inputs.

tion about the farm management, the inputs use and the output at the household level. In order to recover as much individual information as possible, we combine the household level information drawn from the agricultural dataset with the individual information available in the household dataset. This allows us to take into account also socio-demographic individual indicators, such as age, education, household size and gender composition of the agricultural household. In this paper the analysis will be focused on Uganda, a country where agriculture represents a core sector of the economy and where, according to FAO, there is an almost egualitarian participation of men and women in the agricultural activities[2]. The production system is based on smallholder subsistence farming, dominated by the production of food crops, such as plantains (mainly known as "matooke"), cereals, cassava and oilcrops (as can be seen in Table 1 below, where we report the quantity harvested, expressed in kilograms, at the household level). Since these data contain many zero values (due, for example, to the fact that when households were visited, plots could have been cultivated, but not harvested yet), we draw also data "cleaned" by the presence of zero. Despite its capacity to reach the domestic needs, Uganda imports food products like wheat, whereas exports are dominated by coffee, followed by cotton, tea, tobacco and maize.

[2]For more information, see **http://http://faostat.fao.org/CountryProfiles/Direct.aspx?lang=en&area=226, accessed on November 18, 2015.**

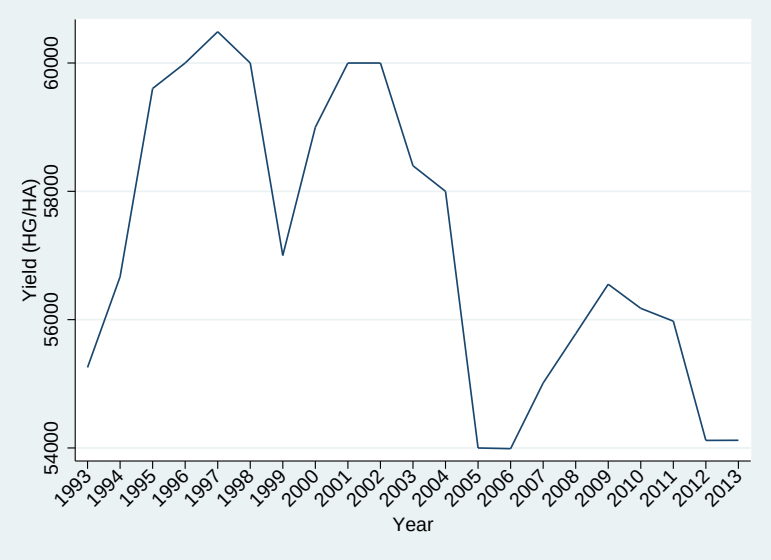
Table 1: Quantity of the main crops harvested (in KGs) by acre of area under cultivation (2009-10 & 2010-11).

	Whole	*Nb of observation*	*Without zero values*	*Nb of observation*
Matooke	6.23	2689	14.68	1140
	(53.18)		(80.92)	
Cassava	19.93	2689	86.58	619
	(219.31)		(451.02)	
Beans	10.7	2689	25.12	1145
	(142.65)		(217.84)	
Maize	19.74	2689	50.40	1053
	(175.32)		(277.47)	
Potato	17.06	2689	107.16	428
	(474.45)		(1186.33)	

Source: Author's calculation from Uganda LSMS-ISA 2009-10 and 2010-11. Standard deviation into brackets.

However, focusing on matooke, over the last two decades we can observe that its agricultural productivity has shown a fluctuating trend, as Figure 1 below shows, with a decreasing trend since the start of the food price crisis.

Figure 1: Uganda annual matooke yield (1993-2013).



Source: FAOSTAT. Accessed on November 18, 2015.

In order to model gender productivity, we use a Tobit approach with fixed effects[3]. For robustness check, we also run the random-effects model, reporting results in Appendix.

Findings reveal that gender differences exist in crop productivity, suggesting that plot-level productivity is lower in female-headed plots, possibly due to the many constraints women face (access to inputs, credit, extension services). The paper is structured as follows. We first give a brief overview of the literature related to gender productivity. We then turn to model (Section 3) and data description (Section 4). We present our results and their discussion in Section 5. Section 6 concludes with suggestions for further research and policy implication.

[3]As the Tobit model in STATA 13 does not contemplate fixed effects, we implemented the Honoré (1992) pantob estimator.

2. RELATED LITERATURE

The literature investigating differentials in agricultural productivity by gender is growing. Since Boserup's *Woman's role in economic development* (1970), many studies have tried to assess the role of women in agriculture.

The existing evidence on gender differentials in agricultural productivity, is mixed: if one set of empirical studies agrees on the lower level of productivity of women (Djurfeldt *et al.*, 2013; Bezabih and Holden, 2010; Holden *et al.*, 2001; Udry *et al.*, 1995; Jacoby, 1992), another set has found no significant differences between productivities of male and female farmers. Djurfeldt *et al.* (2013) demonstrated that in sub-Saharan Africa only 15% of the landholdings are held by women who, due to their limited access of inputs, reach lower levels of yields. Similarly, Koru and Holder (2008) observe yield differentials between men and women, identifying the causes in discrepancies in the resource endowments, inputs use and market access. This view is also shared by Tiruneh *et al.* (2001), who pointed out that if male and female headed households had the same access to inputs, their level of productivity may likely be the same. In the same line, Alene *et al.* (2008) claims that men and women farmers are equally efficient as farm managers, and their responsiveness to price incentives is alike. Contrariwise, Akresh *et al.* (2005) concludes that plots managed by women are less productive than the ones controlled by men, even after controlling for observable peculiarities of the plot, such as the plot size[4]. This result is also offered by Aly *et al.* (2010) who, however, controlling for differences in irrigation and use of improved seeds, report that such differences reduce and become insignificant. In a similar manner Mêdagbé *et al.* (2010) suggest that, although women reach a lower level of productivity since they lack control over productive resources, they are as technically efficient as men. As Quisumbing states (1995), few studies related to this issue "control for individual endowments by

[4]Since women control less land than men, plot size is another relevant issue to be explored when analyzing differences in gender productivity. Overall, plots managed by women are smaller than the male ones, engraving the output harvested.

gender, and even fewer for relationships between individual characteristics (for example, education, [...]) and input choice" (p.3), leading to possible overestimated differences in productivity due to gender.

As Quisumbing (1995) demonstrates, female farmers are as equally efficient as the male ones (in six of the seven country studies she reviews, in fact, the coefficients are insignificant, with the exception of Burkina Faso). Also Adesina and Djato (1997) pointed out that female rice growers in Côte d'Ivoire are as efficient as men. In part, these results are associated to the nature of data used in the related empirical research: as will be explained later, in fact, agricultural surveys are mainly administered at household rather than at individual level, so that it is often difficult to identify the gender of the plot manager or owner. Farther, most of these studies use the sex of the household head as the unique gender indicator. However, even if this issue may be addressed through individual data on household members (as in the case of the LSMS-ISA), obtaining information on the use of inputs by gender is harder. One of the possible implications is that female farmers outcome may be underestimated, leading to the consideration that they are less productive than men, not accounting that the allocation of resources may be Pareto inefficient within the household itself.

Land productivity, which is the total output divided by size of the farm, is the traditional measure used in this field of analysis (Lastarría-Cornhiel, 1988), although the criticism due to the focus on one input as land (Masterson, 2007). Since land plays a pivotal role in agriculture, and due to the fact that in developing countries women are often excluded from its control, emphasizing the role of gender gaps in land ownership/management could help explaining the gender gap in agricultural productivity. In this regard, Foltz *et al.* (2000) assert that insecure property rights "reduce investments in land management, productive assets, and new technologies". However, also in this strand of literature, the findings are mixed: Bellemare (2013), for example, suggests that formal land titling does not affect productivity in Madagascar, even though the rights to leasing out land is negatively associated to it. In this vein, the Fast Track Land Reform Programme (FTLRP) in Zimbabwe has not been accompanied by a raise

in agricultural production (Zikhali, 2008). On the other hand, Anyaegbunam *et al.* (2010) show that land ownership is positively associated to agricultural productivity in Nigeria. This view is also supported by Alsop *et al.* (1996). In line with this, the study of Bezabih and Holden (2010) reports that, while land certification impacts positively on plot-level productivity, however the effect is more pronounced for male-headed households than for female-headed ones. Furthermore, some studies (Place and Migot-Adholla, 1998; Carter and Olinto, 1996) shed light on the potential endogeneity of land titling, and on the problem of the potential spurious correlation between land tenure and productivity if endogeneity is ignored. Even though owning land may increase investment on it, in this paper we assume that land ownership is not a sufficient condition for explaining gender trends in agricultural productivity. Indeed, as land ownership for women is highly associated with inheritance, in order to examine more closely the links between gender, land and agricultural productivity, we combine land ownership, access and use of plots, and agricultural output management, deriving the variable of "plot manager", and using the sex of the plot manager (as we will describe later) as a gender indicator.

2.1. Land Tenure system

Land ownership is a relevant issue, particularly in rural contexts, where livelihoods are highly dependent on agriculture. In many parts of the world, women obtain access to land through the male components of the family (husbands, fathers or sons), even though land titling is generally allowed only to men (Doss *et al.*, 2014) and this is also the case of Uganda. There, as in most countries of sub-Saharan Africa, women inherit land only in exceptional circumstances (i.e. when there are no male heirs, see Asiimwe, 2014. There are some exceptions to this general rule, depending on the specific country legislation: for example, in Nepal the Eleventh Amendment of the Constitution partially extends the possibility to inherit and own land also to female individuals).

However, when dealing with land rights, it is useful to explore the conceptual and empirical distinction between ownership and access over land (Lastarria-

Cornhiel, 1997): land ownership, in fact, implies rights related to the control and decision over production, while the access to land is related to its use, without any decisional right over production. The Uganda Land Act of 1998 disciplines the land tenure, ownership and management of the land. In particular, it held the four historical types of land tenure: freehold, leasehold, *mailo* and customary:

- **freehold** is the ownership of land that guarantees full power of use and "the compulsory registration of title in perpetuity" (GoU, 2013).
- **leasehold** is a way of tenure that, as freehold, "referred to as individual tenure" (Okuku, 2006). It grants a person to take possession and using land for a specified or limited period. These rights are bestowed by an agreement with the owner of the land, according to certain conditions and payment of a rent.
- **mailo** was created during the colonial period, through the 1900 Buganda agreement. The land ownership was given to the Buganda chiefs and notables (Deininger *et al.*, 2008). It permits the separation between the separation of land from the ownership by a lawful or *bona fide* occupant, enabling the holders to exercise all the powers of ownership;
- **customary** tenure is a traditional ownership tenure system, on the basis of which land may be owned by the community, clan, families or individuals. Landholders under this system do not have a formal land title, although "All Ugandan citizens owning land under customary tenure may acquire certificates of ownership [...] of customary tenure" (Article 237(4)(a) of the 1995 Constitution and Section 4(1) of the Land Act, 1998).

A further amendment introduced the concept of "family land": land is considered the source of livelihoods for the household members, and it cannot be transferred without the consent of all the individuals depending on it, including women and children (Deiningen *et al.*, 2008). The article 33 of the Uganda

Constitution states that women shall be accorded equal rights and treatment as men, including equal opportunities in political, economic and social activities (Constitution of the Republic of Uganda, 1995). As Doss *et al.* (2014) pointed out, the type of customary land may influence the farmer's behaviour, in terms of long-term interest and investments.

3. MODEL DESCRIPTION

To assess the extent of possible male-female differences in the agricultural productivity in Uganda, we estimate the productivity as a measure of the value of all the crops produced at the household level per acre of land under cultivation. Following Owens *et al.* (2003), this is carried out by multiplying the physical quantities of all the crops produced per acre (converted to kilograms) by their unit price, aggregating crops production across plots[5]. The unit price has been calculated for each household, by dividing the value of the total sales by the overall quantity sold. Whether missing were present, due probably to the lack of food sold, we imputed productivity considering the median price of the district where the household lives. The value of the multi-crop productivity is expressed in Ugandan shilling. Farther, although the low number of observations, we also estimate the value of productivity for the main crops produced, namely *matooke*, cassava, potato (both sweet and Irish), maize and beans, reporting findings in the Appendix.

As the scope of this study is to investigate gender differences in agricultural productivity in Uganda, we propose to introduce as gender indicator a variable that differs from the ones used in the existing related literature: the gender of the "*land manager*", that considers both the head of the household head, and of his/her spouse. More specifically, with the notion of "land manager" we refer to the person who, in each household, has the ownership and right use of plots,

[5]The agricultural questionnaire records data at both the plot and parcel levels. Despite the presence of multiple plots, most of the information collected mainly concerns the "plot 1". However, to avoid the loss of data available for all the plots cultivated by each household, we aggregated all the data about both input and output across plots.

and who manages the plots output. In detail, we create three measures of plot managing (they are all dummies), one complementary to the other ones, even though the empirical analysis has been carried out using the one we consider the most explaining (land management, as already explained) :

- *gender land ownership*: it is the basic index of land titling, which assumes the value of 1 whether land is owned by the female head or spouse, and 0 for their male counterparts;

- *gender land ownership and use*: in this case, always diversifying by men and women, we attribute the value of 1 to all the land in which women exert not only a property right, but where they have the right to use it. This is a fundamental assumption, particularly in contexts where the land entitlement is not automatically associated to the asset use, and this is especially evident for women;

- *gender land ownership, use and output management*: this variable is derived by the integration of the plots output management with the ownership and use of plots. In fact, we consider that land ownership itself and land use may not be sufficient conditions in explaining the gender differences in agricultural productivity. In effect, since women are often excluded from the agricultural production management and from its selling, we assume that the attendance in the output management might explain possible gender gaps in the agricultural productivity[6]. For the explained reasons, the empirical model has been implemented using the gender of the plot manager. In detail, we create a binary variable, taken the value of 1 if household plots are owned by female head or spouses, they have the right to access and use them, and the right to manage the agricultural output, and 0 for men. Farther, differently from the existing empirical studies on this field, that use only the sex of the household head

[6]However, we control for possible differences between landowners and plot managers by gender, finding that in most of the households landowners at the same time manage the output.

as a gender indicator (mainly because gender-disaggregated data on access and use or ownership of the plots are often recorded at the household level, and the household head is often the respondent of the questionnaire), we extended our analysis to both the household head and his/her spouse. This is a relevant issue, even because restricting the analysis to the household head might be narrow: in countries such as Uganda, indeed, most of the households are headed by men, so that many women would be excluded and gender bias in productivity might be overestimated.
However, to avoid possible biases deriving from the overlapping in the land management between the head of the household and his/her spouse, we control for the cases of "mixed land management". We find that few plots are managed by both of them simultaneously, but we get rid of them in order to not distort the final results.

3.1. Empirical specification

Following the existing literature on this field, the Cobb-Douglas production funtion is used by taking the logarithms on both sides of the equation, as drawn below:

$$ln\ Y_{ij} = \alpha_0\ +\ \alpha_1 T_{Gj}\ +\ \beta\ lnI_j\ +\ \tau\ lnL_j\ +\ \gamma S_j\ + \sigma H_i\ +\ \epsilon \qquad (1)$$

where Y_{ij} is the logged value of total crops produced (per acre) in the j^{th} plots managed by the i^{th} male or female land manager, T is the land manager of plots j, differentiated by gender, I is the log of the quantity of inputs used (expressed in kilograms), namely organic and inorganic fertilizers, and pesticides, per acre of plots, L is labour input (family and hired, measured in person days)[7], S is a vector of land characteristics (soil type and quality, topography and water sources), indexed by the j_{th}

[7]Following Tiberti and Tiberti (2015), due to the presence of zero values in all the inputs data, we computed the logarithmic form by adding one to all the original values, to then transform them.

plots[8], and ϵ is the error term.

As the related literature shows, some problems of endogeneity in inputs choice may arise, so that instrumental analysis may be required, though in this specific case we do not adopt any instrumental variable methodology. It is important to bear in mind that we are estimating a measure of partial differences in gender productivity (as Quisumbing, 1995, suggests), as a thorough analysis requires specific data on crops grown by women, as well as inputs access and their use disaggregated by gender, that are not available in this survey[9]. Usually, the Cobb-Douglas production function is estimated by an Ordinary Least Squares (OLS) model. However, in this specific case, the productivity measure contains a consistent number of zero values, which may occur for different reasons. For example, the plots could have been cultivated, but not harvested yet at the time of the visit. Alternatively, the cultivated crops could have been lost due to adverse whether shocks, pests or other natural disasters[10]. Moreover, the area could have been left fallow to improve soil quality[11], or used as pasture or grazing land, or abandoned due to economic inability to cultivate it (e.g. high cost of inputs)(Peterman *et al.*, 2011). For these reasons, rather than dropping plots for which zero productivity is observed, the panel censored regression model has been implemented, as it may be the most suitable econometric procedure given the left censoring of the dependent variable at zero (Tobin, 1958; Honoré, 1992).

The model we estimate is therefore the following:

$$ln\ Y_{ij}^{*} \ = \ land\ management_{ij} + \beta\ X_{ij} + \alpha_i + \epsilon_{it} \qquad (2)$$

[8]The plot characteristics indices are in a binary form, to make their interpretation more straightforward, as the questionnaire codes each of them in a categorical form.

[9]Eventually, we could have extrapolated these information on the basis of the plot manager. However, we implemented the model also separately for male and female plot managers, but many of the control variables were dropped once the model was run.

[10]An explicit question was asked to households about the quantity lost, but it refers to the unit of crops already harvested.

[11]At this regard, we introduce a binary index for fallow plot as a control variable. Results are reported in Appendix.

$$ln\ Y_i\ = Y_i^*\ if\ Y_{ij}^*\ >\ 0$$
$$ln\ Y_i\ = 0\ if\ Y_{ij}^*\ \leq\ 0$$
$$i = 1, ..., N \quad and \quad \epsilon_{it} \sim (0, \sigma^2)$$

where i and j are the indices for individuals and plots respectively, Y is the indicator of the plots-level productivity, Y^* is the latent dependent variable, that is equal to the observed Y if $Y*$ is higher than zero, *land management* is the plot management indicator, differentiated by gender, X is the vector of household and plot characteristics, α_i is the individual effect, and ϵ_{it} is the error term, assumed to be independent and identically distributed (i.i.d) as a Normal distribution, with zero mean and fixed variance, and N is the number of observations (Ai *et al.*, 2015; Peterman *et al.*, 2011; Gourieroux, 2000; Maddala, 1987). When considering a model with panel data, the error term ϵ_{it} can be decomposed into:

$$\epsilon_{it} = \alpha_i + \lambda_t + u_{it} \tag{3}$$

where α_i is the individual effect (representing all the unobservable characteristics specific to the unit i, assumed constant over time), λ_t is the time effect (indicating all the unobservable characteristics of time period t, constant for all the cross-sectional units in the sample), and u_{it} is a random term that varies over time and individuals (Calzolari *et al.*, 2001). However, Tobit is a random-effects model, that does not control for the unobserved heterogeneity. For this reason we implemented a Tobit model with fixed effects (Honoré, 1992), although for robustness check we report results from the random-effects model in Appendix.

4. DATA

In this study data available are from the First and Second *Uganda National Household Survey (2009-10 and 2010-11)*, collected by the Uganda Bureau of Statistics (UBOS, henceforth), with the support of the World

Bank *Living Standard Measurement Surveys -Integrated Survey on Agriculture (LSMS-ISA)* program[12]. The survey is conducted annually on a nationally representative sample of households, which are visited twice over the year, separately for the dry and rainy seasons, in order to better capture seasonal information about consumption and agricultural outcomes[13]. For the purposes of the research, we integrated some sections of the *household questionnaire*, in which data at the individual level about the socio-demographics and economic characteristics of the household were contained, with the agricultural one, that has been administered only to households engaged in the agricultural sector. Through this merging we obtained a panel sample of 3.254 households. As in most agricultural surveys, data are collected at the household level. However, the LSMS-ISA includes information both at the plot and parcel level, regarding both inputs and outputs. During each interview, in fact, each household who held a plot of land was asked to report information on quantities cultivated and harvested, crops sold or own consumed. All the quantities of output are recorded in local units and subsequently converted in kilograms. Furthermore, indication about the size of each plot, its manager and owner, the handler of the output, the use of labour and non-labour inputs, as well as on the ownership of livestock have been collected. The survey also contains information on family and hired labour, which are measured in time units[14]. In detail, households have been visited twice, during the first (January-June) and second cropping season (July-December). However, as for plots and crops, we aggregate data across the two seasons.

[12]For more details, see the Uganda National Panel Surveys, Basic information document, available at **http://econ.worldbank.org/.**

[13]In principle, the questionnaire has to be answered by the household head or, in his/her absence, by an adult member of the household. However, in our sample is mainly the household head who provide the requested information.

[14]Specifically, the questionnaire records the number of household members working on the plot, and the days spent on it by both household members and hired labourers where they are used. Hiring days are recorded for men, women and children. For homogeneity reasons with hired labour, we focus on the days of work, using them as time measures.

Table 2: Descriptive statistics by gender of the plot manager.

Descriptive statistics by gender of the plot manager.		
	Male-managed plot	***Female-managed plot***
Outcome variable		
Value of total productivity (KG/acres) in Shillings (log)	9.49	7.96
Plot manager characteristics		
Only landowner	0.726	0.274
Landowner and manager overlap	0.73	0.27
Age of the Household Head (years)	47.3	54
Level of education of the Household Head		
No education		
Primary education	0.81	0.58
Secondary education	0.07	0.05
Higher education	0.009	0.007
Household characteristics		
Household size	7.20	5.91
Number of female children (0-5)	1.03	1.03
Number of male children (0-5)	1.04	1.03
Number of female adults	1.60	1.81
Number of male adults	1.78	1.70
Region of residence		
Northern	0.25	0.27
Western	0.26	0.22
Eastern	0.29	0.27
Plot characteristics		
GPS-based plot size (acres)	5.07	3.85
Plot ownership status		
Only male owner	0.73	
Only female owner	0.27	
Mixed ownership	0.02	
Land tenure		
Customary	0.73	0.27
Freehold	0.72	0.28
Mailo [a]	0.69	0.31
Location		
Hilly	0.15	0.13
Flat	0.6	0.55
Gentle slope	0.54	0.56
Steep slope	0.06	0.04
Valley	0.06	0.06
Agro-ecological zones		
Savannah	.04	.06
Arid and semi-arid	0.1	0.12
Highlands	0.09	0.08
Distance from the homestead (index of minutes) [b]	1.99	2.01
Soil quality		
Good	0.75	0.69
Fair	0.47	0.50
Poor	0.11	0.09
Plot cultivation		
Intercropped	0.44	0.43
Monocrop	0.29	0.32
Water source		
Irrigated	0.03	0.03
Rainfed	0.97	0.97
Swamp	0.05	0.05
Labour inputs (in time units)[c]		
Family labour	84.08	75.9
Men hired labour	2.84	2.59
Female hired labour	5.02	5.29
Children hired labour	7.53	7.33
Other inputs (log)		
Organic fertilizer (kg/acres)	131.52	42.12
Chemical fertilizer (kg/acres)	0.72	0.13
Pesticide (kg(acres)	0.11	0.10
Improved seeds (1 if yes, 0 otherwise)	0.85	0.79
Livestock ownership (1 if yes, 0 otherwise)	0.16	0.9
Number of observations	2226	816

Source: Author's calculation from Uganda LSMS-ISA 2009-10 and 2010-11.

[a]Note the total number of households who manage land under mailo regime are only 116.

[b]In the questionnaire minutes are recorded approximately , reporting a value according to the time distance from the homestead (1"Less than 15 mn"; 2 "15mn-30mn"; 3 "30 mn-60mn"; 4 "1hour-2 hours"; 5 "Over 2 hours").

[c]As already explained, the notion "time units" refers to the days of work.

The descriptive statistics differentiated by the gender of the plot manager are presented in Table 2. They clearly confirm the existence of a gender gap: in fact the value of output per acre, our measure of productivity, is lower in female-managed plots respective to the male one. Moreover, the size of plots managed by women is, on average, smaller than the plots managed by men. Additionally, in most of the households land is owned by men (73% *vs.* 27%). In comparison, male-managed plots make use of a higher share of inputs (both labour and non-labour): specifically, the quantity (in KGs/acre) of both the organic and chemical fertilizers is particularly high in male plots, although the difference in the use of pesticides between male and female-managed plots is very low. Similarly, we found that the average days spent by female hired labour is slightly higher in female plots, although in general the amount of both family and hired labour by gender of the manager is very similar. Lastly, concerning the plot topography and soil quality, no substancial differences can be observed.

5. RESULTS AND DISCUSSION

We have estimated the model using the Honoré-fixed effects *pantob* routine in Stata 13[15]. For robustness check, we have also estimated the Tobit model with random effects for all the model specifications, reporting results in the Appendix. Table 3 presents the plots regression results at the household level of the logarithm of productivity of all crops harvested by the households. We have used as a gender indicator of land the variable "plot manager" rather than the landowner only, for the reasons already explained. Finally, while in the paper we have considered the value of the total output harvested, we also run the model considering the major food crops separately (namely, matooke, beans and maize). We do not report the results for "cassava" and "potatoes" since the model did not converge (and, if it did, some of the explanatory variables of interest were dropped.).

[15]It is a Gauss program that estimates a censored Tobit model with panel data. The program is available at **http://www.princeton.edu/ honore/stata/.**

Table 3: Panel Tobit with fixed-effects of the value of productivity of all the crops.

	Fixed effects
Gender of the plot manager	-9.1*** (2.45)
Household characteristics	
Age of the household head (years)	-4.05*(2.4)
Age of the household head squared (years)	0.03 (0.02)
{Level of education of the Household Head}	
Primary education	-0.12 (2.1)
Secondary education	-3.59 (4.25)
Household size (log)	-variable dropped by the pantob estimator
Plot characteristics	
Location	
Distance from the homestead (index of minutes)	-0.46 (0.31)
Water source	
Irrigated land (log)	-3.17 (2.47)
Soil quality	
Good	1.003 (1.06)
Fair	-0.87 (0.68)
Labour inputs (log of time units)	
Family labour	0.15 (0.66)
Men hired labour	-0.55 (1.19)
Female hired labour	-0.18 (1.2)
Other inputs (log)	
Organic fertilizer (kg/acres)	-0.29 (0.23)
Chemical fertilizer (kg/acres)	-0.07 (0.53)
Pesticide (kg(acres)	1.68* (0.94)
Use of improved seeds (1 if yes,0 otherwise)	3.13*** (1.05)
Livestock ownership (1 if yes,0 otherwise)	1.74 (1.19)
Agri-ecological zone	
Arid/Semi-arid	-2.91 (3.77)
Highlands	3.44** (1.67)
Number of observations	1628

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **, * significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errors into brackets.

As can be seen, plot managed by women are significantly associated with lower productivity. Including the impact deriving from the use of inputs (both labour and other than labour) did not reveal any difference between male and female-managed plots in the household-fixed effects model, with the exception of pesticides, whose use seems to be positively related to the value of productivity of all the crops harvested in female-managed plots. Another important finding concerns the use of improved seeds, which is positively correlated to crop production. The analysis of agricultural productivity cannot ignore the

role of agro-ecological zones (*AEZ*, henceforth). According to FAO, Uganda can be divided into seven *AEZ*, with similar ecological conditions (soil type, topography, rainfall), farming systems and practices. Even so, following Wasige (2009), and due to the availability of data, we divided Uganda into three broad agro-ecological zones: savannah, arid/semi-arid and highlands [16]. Therefore, we introduce the regional ecological area as another control variable. Nevertheless, we do not insert the plot *topography* as a control, as already contained on the agro-ecological zone as explanatory variable. As can be observed, for plots located in the highlands the total value of crop production seems to be higher for plots managed by female farmers. The variable "household size" has been dropped once the model run[17]. However, when assessing the gender gap in agricultural productivity, we assume that considering the allocation of time devoted to domestic tasks would be necessary for a wide explanation, as women spend more time than men in domestic activities. For this reason, the average domestic hours spent by male and female head and spouse have been introduced in the model. This variable has been extracted from the household questionnaire, where labour time information at individual level have been collected. Anyway, we run the model adding further controls, such as the modality of land acquisition, besides the domestic annual hours (disaggregated by gender)[18]. Results are reported in Table 4 below[19]

[16] For more details, see Wasige, 2009, p.7.

[17] This may be due to the proximity of the two panel waves, so that the household size may not change from year to year, not allowing the model to "capture" the differences.

[18] Agri-ecological zones has not been inserted in this specification, as most of the explanatory variables dropped. Contrariwise, we add the topography of plots as control variable.

[19] In the present table, the topography of the plot is controlled through the variable *plot topography*. For this reason the *agri-ecological zones* have not been inserted.

Table 4: Panel Tobit with fixed-effects of the value of productivity of all the crops, with modality of land acquisition and annual domestic hours of work as further control variables.

	Fixed effects
Gender of the plot manager	-8.07** (4.04)
Household characteristics	
Age of the household head (years)	-3.18(3.41)
Age of the household head squared (years)	-0.01(0.04)
Level of education of the Household Head	
Primary education	-0.56(4.26)
Secondary education	-0.24 (7.77)
Household size (log)	- variable dropped by the pantob estimator
Plot characteristics	
Location	
Distance from the homestead (index of minutes)	0.39 (0.43)
Water source	
Irrigated land (log)	-1.89 (3.19)
Soil quality	
Good	-0.17 (1.39)
Fair	-1.24 (0.93)
Topography	
Hilly	1.89 (1.37)
Flat	0.3 (1.47)
Valley	1.34 (1.28)
Labour inputs (log of time units)	
Family labour	-0.61 (0.99)
Men hired labour	-0.08 (2.61)
Female hired labour	-2.53 (2.19)
Other inputs (log)	
Organic fertilizer (kg/acres)	-0.41* (0.23)
Chemical fertilizer (kg/acres)	-0.04 (0.68)
Pesticide (kg(acres)	3.48** (1.43)
Use of improved seeds (1 if yes, 0 otherwise)	3.07* (1.63)
Livestock ownership (1 if yes, 0 otherwise)	3.14* (1.64)
Modality of land acquistion	
Male land inherited	-1.29 (1.40)
Female land inherited	1.17 (2.76)
Domestic time (log of annual hours)	
Men	0.33 (0.22)
Women	0.37**(0.17)
Number of observations	839

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **,* significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errors into brackets.

Firstly, we can observe how the total number of observation reduces dramatically. Notwithstanding, these results confirm the lower value of output associated to female plot-managed. As concerns the way through which land is acquired, the coefficients are not statistically influential on the productivity, neither for both men nor for women. Surprisingly, time devoted to domestic tasks seems controversial: in fact, the model shows off a positive sign for female domestic time. A possible explanation might be that in this model the variable is a proxy of domestic time, that includes milling, fetching firewood and collecting water, activities that may be strictly related to the agricultural tasks. Moreover, differently from the basic model, in this specification the livestock ownership is associated to a raise in crop production, that may be linked to the importance of livestock use, such as cows, as agricultural inputs.

6. CONCLUSION

In this paper we aim to contribute to the growing literature on gender gaps in agricultural productivity. Notwithstanding the usual data limitations encountered in gender analyses, our study adds to the literature, introducing the new perspective of plots managed by men and women. In fact, given the limits that this strand of research faces, due to the lack of gender disaggregated data about land ownership and management, we have been able to build a gender indicator of plot management, thanks to the household section of the Living Standard Measurement Survey - Integrated Survey on Agriculture (2009-10 and 2010-11) for Uganda. We find that plots managed by women seem to be less productive than plots run by men. Also considering for the way by which land is acquired, as well as for hours spent in domestic tasks, female managed-plots seem to be less productive than plots managed by men. Unfortunately, data about the access to and the use of inputs are at household level, so that we have not been able to properly identify the actual reasons of the lower value of crop productivity we have found in female-managed plots. In any case, beyond the limits relating the data features, another important aspect that could affect our results, but that we did not take into consideration due to the low number

of data, is the accessibility to extension services, from which women are often excluded. In sum the generalisability of these results is subject to certain limitations. For instance, because of the lack of gender differentiated data on crops grown by women and men respectively, the measure of productivity we have computed is only a partial indicator of the gender bias in productivity. Our results imply that, since land titling and land management are not sufficient conditions to fully disclose women's contribution to agricultural production, increasing women's access to inputs and to the market for selling the grown crops might represent an important avenue towards women's empowerment.

APPENDIX A

Table 5: Tobit with random-effects of the value of productivity of all the crops.

	Random effects
Gender of the plot manager	-2.21* (0.76)
Household characteristics	
Age of the household head (years)	-0.005 (0.14)
Age of the household head squared (years)	-0.001 (0.001)
Level of education of the Household Head	
Primary education	-0.55 (0.89)
Secondary education	-1.76 (1.42)
Household size (log)	-1.36* (0.76)
Plot characteristics	
Location	
Distance from the homestead (index of minutes)	0.11 (0.26)
Water source	
Irrigated land (log)	-2.05 (2.14)
Soil quality	
Good	3.28*** (0.73)
Fair	0.9 (0.86)
Labour inputs (log of time units)	
Family labour	1.27*** (0.45)
Men hired labour	-0.47 (1.07)
Female hired labour	1.26 (1.03)
Other inputs (log)	
Organic fertilizer (kg/acres)	0.58 (0.19)
Chemical fertilizer (kg/acres)	0.24 (0.99)
Pesticide (kg(acres)	2.35** (1.2)
Use of improved seeds (1 if yes, 0 otherwise)	1.31* (0.75)
Livestock ownership (1 if yes, 0 otherwise)	1.44 (0.91)
Agri-ecological zones	
Arid/Semi-arid	-4.36*** (1.16)
Highlands	1.23 (1.01)
Constant	1.35 (4.06)
sigma_u	5.51*** (0.5)
sigma_e	9.04*** (0.31)
rho	0.27 (0.04)
Number of observations	1628

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **, * significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errors into brackets.

Table 6: Panel Tobit with random-effects of the value of productivity of all the crops, with modality of land acquisition and annual domestic hours of work as further control variables.

	Random effects
Gender of the plot manager	-4.29* (2.43)
Household characteristics	
Age of the household head (years)	0.56 (0.4)
Age of the household head squared (years)	-0.01* (0.004)
Level of education of the Household Head	
Primary education	0.39 (1.44)
Secondary education	-2.68 (2.06)
Household size (log)	-2.57** (1.17)
Plot characteristics	
Location	
Distance from the homestead (index of minutes)	0.12 (0.37)
Water source	
Irrigated land (log)	-1.56 (2.8)
Soil quality	
Good	1.96** (0.99)
Fair	0.35 (0.86)
Topography	
Hilly	3.81*** (1.13)
Flat	0.16 (0.83)
Valley	3.61** (1.59)
Labour inputs (log of time units)	
Family labour	2.3*** (0.69)
Men hired labour	-0.24 (1.7)
Female hired labour	-1.3 (1.77)
Other inputs (log)	
Organic fertilizer (kg/acres)	0.12 (0.31)
Chemical fertilizer (kg/acres)	1.51 (1.51)
Pesticide (kg(acres)	3.16** (1.54)
Use of improved seeds (1 if yes, 0 otherwise)	1.55 (0.99)
Livestock ownership (1 if yes, 0 otherwise)	5.68*** (1.29)
Modality of land acquisition	
Male land inherited	-1.57* (0.85)
Female land inherited	2.31 (2.47)
Domestic time (log of annual hours)	
Men	0.10 (0.18)
Women	-0.27* (0.16)
Constant	-10.44 (8.99)
sigma_u	4.09*** (0.87)
sigma_e	9.34*** (0.45)
rho	0.16 (0.07)
Number of observations	839

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **, * significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errord into brackets.

Table 7: Panel Tobit with fixed-effects of the value of productivity of matooke, maize and beans.

	Matooke	***Maize***	***Beans***
	Fixed effects	***Fixed effects***	***Fixed effects***
Gender of the plot manager	-9.41*** (2.72)	5.99 (10.37)	2.23 (4.17)
Household characteristics			
Age of the household head (years)	-5.18*** (2.10)	-10.68** (5.08)	2.27*** (1.14)
Age of the household head squared (years	0.02 (0.02)	0.07 (0.05)	-0.04 (0.02)
Level of education of the Household Head			
Primary education	3.50 (3.49)	-1.65 (6.08)	-9.83*** (3.59)
Secondary education	-2.36 (4.15)	-6.47 (16.81)	-12.39 (10.28)
Household size (log)	-	-88.73*** (29.64)	-
Plot characteristics			
Location			
Distance from the homestead (index of minutes)	0.13 (0.49)	-2.25** (0.98)	0.66 (0.68)
Water source			
Irrigated land (log)	-4.32 (2.82)	5.78 (6.30)	4.67 (4.49)
Soil quality			
Good	0.55 (1.71)	4.8* (2.67)	1.36 (1.91)
Fair	-1.36 (1.12)	1.8 (2.36)	-0.68 (1.49)
Topography			
Hilly	2.05* (1.12)	2.58 (3.56)	3.22* (1.7)
Flat	0.19 (1.15)	2.51 (3.13)	0.12 (1.61)
Valley	-1.44 (1.53)	5.63 (6.02)	3.83 (2.75)
Labour inputs (log of time units)			
Family labour	0.98 (1.06)	1.59 (1.45)	4.27*** (1.32)
Men hired labour	0.87 (1.46)	-3.56 (4.97)	-7.82*** (2.13)
Female hired labour	0.26 (2.15)	-3.57 (4.20)	-4.46 (3.35)
Other inputs (log)			
Organic fertilizer (kg/acres)	0.17 (0.19)	-1.46 (1.09)	-0.58 (0.35)
Chemical fertilizer (kg/acres)	-1.03 (0.67)	-8.78 (8.54)	-0.04 (1.25)
Pesticide (kg/acres)	0.38 (1.27)	2.1 (2.94)	-3.19 (2.13)
Use of improved seeds (1 if yes, 0 otherwise)	-1.95 (1.95)	9.43*** (2.78)	5.61*** (2.1)
Livestock ownership (1 if yes, 0 otherwise)	-1.89 (1.98)	-0.52 (3.38)	2.86 (2.96)
Number of observations	1736	2020	1950

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **, * significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errors into brackets.

Table 8: Panel Tobit with random-effects of the value of productivity for matooke, maize and beans.

	Matooke	*Maize*	*Beans*
	Random effects	***Random effects***	***Random effects***
Gender of the plot manager	-0.79 (1.37)	-3.4 (2.61)	-0.49 (1.56)
Household characteristics			
Age of the household head (years)	-0.18 (0.25)	-0.24 (0.49)	0.23 (0.3)
Age of the household head squared (years	0.002 (0.002)	-0.01 (0.005)	-0.003 (0.003)
Level of education of the Household Head			
Primary education	1.55 (1.55)	1.25 (3.01)	-2.0 (1.77)
Secondary education	2.16 (2.54)	1.11 (4.82)	-2.99 (2.98)
Household size (log)	-0.27 (1.35)	-1.89 (2.47)	-1.54 (1.56)
Plot characteristics			
Location			
Distance from the homestead (index of minutes)	-0.40 (0.48)	0.32 (0.88)	1.58*** (0.54)
Water source			
Irrigated land (log)	0.28 (3.55)	-3.83 (7.22)	8.45** (4.03)
Soil quality			
Good	2.23 (1.29)	6.57*** (2.43)	5.39*** (2.67)
Fair	-1.13 (1.05)	1.26 (2.07)	1.81 (1.29)
Topography			
Hilly	6.31*** (1.2)	-1.90 (2.96)	7.79*** (1.58)
Flat	-3.54*** (1.00)	7.12*** (2.05)	0.53 (1.25)
Valley	1.33 (1.75)	-0.64 (3.94)	2.56 (2.19)
Labour inputs (log of time units)			
Family labour	-0.33 (0.78)	5.75*** (1.45)	4.21*** (1.32)
Men hired labour	-0.62 (1.67)	0.80 (3.45)	-1.55 (2.22)
Female hired labour	4.11*** (1.60)	-1.68 (3.33)	-0.13 (2.12)
Other inputs (log)			
Organic fertilizer (kg/acres)	1.79*** (0.25)	-3.10*** (0.93)	0.63* (0.37)
Chemical fertilizer (kg/acres)	0.24 (1.58)	-3.25 (3.99)	1.21 (1.93)
Pesticide (kg(acres)	1.51 (1.86)	1.95 (3.91)	0.37 (2.16)
Use of improved seeds (1 if yes, 0 otherwise)	-1.52 (1.49)	11.14*** (2.36)	5.50*** (1.53)
Livestock ownership (1 if yes, 0 otherwise)	0.94 (1.51)	2.97 (3.01)	3,27* (1.91)
Constant	-15.52** (7.25)	-45.83*** (13.55)	-45.95*** (8.87)
sigma_u	11.55*** (0.81)	19.45*** (1.71)	10.86*** (1.1)
sigma_e	9.32*** (0.58)	21.96*** (1.33)	13.95*** (0.86)
rho	0.61 (0.05)	0.44 (0.06)	0.38 (0.06)
Number of observations	1736	2020	1950

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
***, **, * significant at 0.01, 0.05 and 0.10 level, respectively.
Standard errors into brackets.

Table 9: Panel Tobit with fixed-effects of the value of productivity of all the crops, with fallow as a further control variable.

	Fixed effects
Gender of the plot manager	-8.51*** (2.4)
Household characteristics	
Age of the household head (years)	-4.03** (1.98)
Age of the household head squared (years	0.002 (0.02)
Level of education of the Household Head	
Primary education	-0.95 (2.11)
Secondary education	-1.62 (3.92)
Household size (log)	31.86*** (9.37)
Plot characteristics	
Location	
Distance from the homestead (index of minutes)	-0.40 (0.48)
Water source	
Irrigated land (log)	0.83 (0.97)
Soil quality	
Good	0.83 (0.97)
Fair	-0.78 (0.65)
Topography	
Hilly	0.69 (0.77)
Flat	0.87 (0.78)
Valley	0.26 (1.004)
Labour inputs (log of time units)	
Family labour	0.42 (0.59)
Men hired labour	0.58 (1.11)
Female hired labour	-0.65 (1.2)
Other inputs (log)	
Organic fertilizer (kg/acres)	-0.24 (0.18)
Chemical fertilizer (kg/acres)	-0.05 (0.44)
Pesticide (kg(acres)	0.86 (1.13)
Use of improved seeds (index per plot)	2.86*** (0.97)
Livestock ownership	1.10 (1.12)
Fallow	0.95 (0.8)
Number of observations	2060

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **, * significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errord into brackets.

Table 10: Panel Tobit with random-effects of the value of productivity of all the crops, with fallow as a further control variable.

	Random effects
Gender of the plot manager	-1.3* (0.67)
Household characteristics	
Age of the household head (years)	-0.08 (0.12)
Age of the household head squared (years	0.001 (0.001)
Level of education of the Household Head	
Primary education	-0.08 (0.76)
Secondary education	-1.48 (1.28)
Household size (log)	-1.47** (0.65)
Plot characteristics	
Location	
Distance from the homestead (index of minutes)	0.16 (0.24)
Water source	
Irrigated land (log)	-1.63 (1.93)
Soil quality	
Good	3.1*** (0.65)
Fair	0.52 (0.56)
Topography	
Hilly	3.31*** (0.72)
Flat	-0.08 (0.53)
Valley	2.78 (1.003)
Labour inputs use (log of time units)	
Family labour	1.52*** (0.40)
Men hired labour	0.58 (0.92)
Female hired labour	0.78 (0.87)
Other inputs (log)	
Organic fertilizer (kg/acres)	0.47*** (0.17)
Chemical fertilizer (kg/acres)	0.58 (0.99)
Pesticide (kg(acres)	2.27** (1.05)
Use of improved seeds (1 if yes, 0 otherwise)	1.41** (0.70)
Livestock ownership (1 if yes, 0 otherwise)	2.26 (0.79)
Fallow	-1.20* (0.63)
Constant	-0.02 (3.57)
sigma_u	5.45*** (0.46)
sigma_e	9.13*** (0.28)
rho	0.26 (0.04)
Number of observations	2060

Source: Author's calculation using the LSMS-ISA 2009-10 and 2010-11.
****, **, * significant at 0.01, 0.05 and 0.10 level, respectively.*
Standard errors into brackets.

7. REFERENCES

[1] Adesina, A.A., Djato, K.K. (1997). Relative efficiency of women as farm managers: Profit function analysis in Côte d'Ivoire. *Agricultural Economics* 16: 47-53.

[2] Ai,C., Li, H., Lin, Z., Meng, M. (2015). Estimation of panel data partly specified Tobit regression with fixed effects. *Journal of Econometrics* 188: 316-326.

[3] Akresh, R. (2005). Understanding Pareto inefficient intrahousehold allocations. *IZA Discussion Paper* 1858: 1-32.

[4] Alene, A.D., Manyong, V.M., Omanya, G.O., Mignouna, H.D., Bokanga, M., Odhiambo, G.D. (2008). Economic efficiency and supply response of women as farm managers: comparative evidence from Western Kenya. *World Development* 36(7): 1247-1260.

[5] Aly, H.Y., Shields, M.P. (2010). Gender and agricultural productivity in a surplus labor, traditional economy: empirical evidence from Nepal. *The Journal of Developing Areas* 43(2): 111-124.

[6] Anyaegbunam, H.N., Okoye, B.C., Asumugha, G.N., Ogbonna, M.C., Madu, T.U., Nwakor, N., Ejechi, M.E. (2010). Labour productivity among small- holder cassava farmers in South East agro ecological zone, Nigeria. *African Journal of Agricultural Research* 5(21): 2882-2885.

[7] Asiimwe, J. (2014). Making women's land rights a reality in Uganda: advocacy for co-ownership by spouses. *Yale Human Rights and Development Journal* 4(1): 171-187.

[8] Bassett, T.J. (1993). Introduction: the land question and agricultural transformation in Sub-Saharan Africa. *Land in African agrarian systems*: 3-31.

[9] Bellemare, M.F. (2013) The productivity impact of formal and informal land rights: evidence from Madagascar. *Land Economics* 89: 272-290.

[10] Bezabih, M., Holden, S. (2010). The role of land certification in reducing gender gaps in productivity in Rural Ethiopia. *Environment for Development Working Paper* 10(23): 1-38.

[11] Bezabih, M., Holden, S. (2006). Tenure insecurity, transaction costs in the land lease market and their implications for gendered productivity differentials. Paper presented at the International Association of Agricultural Economists Annual Meeting. Queensland, Australia: 12-18 August 2006.

[12] Blevins, A., Jensen, K. (1991). Farm women's labor contributions to agricultural operations. *Great Plains Research* 1(2): 215-232.

[13] Boserup, E. (1970). *Woman's role in economic development.* London: George Allen & Unwin.

[14] Calzolari,G., Magazzini, L., Mealli, F. (2001). Simulation-based estimation of Tobit model with random effects. *MPRA Paper* 22985: 1-22.

[15] Carter, M.R., Olinto, P. (2003). Getting institutions "Right" for whom? Credit constraints and the impact of property rights on the quantity and composition of investment. *American Journal of Agricultural Economics* 85(1): 173-186.

[16] Deininger, K., Ayalew Ali, D., Yamano, T. (2008). Legal knowledge and economic development: the case of land rights in Uganda. *Land Economics* 84(4): 593-619.

[17] Djurfeldt, A.A., Djurfeldt, G., Bergman Lodin, J. (2013). Geography of Gender Gaps: Regional Patterns of Income and Farm–Nonfarm Interaction Among Male- and Female-Headed Households in Eight African Countries. *World Development* 48: 32-47.

[18] Doss, C.R. (2002). Menś crops? Womenś crops? The gender patterns of cropping in Ghana. *World Development* 30(11): 1987-2000.

[19] Doss, C., Meinzen-Dick, R., Bomuhangi,A., (2014). Who owns the land?: Perspectives from rural Ugandans and implications for large-scale land acquisitions. *Feminist Economics* 20(1): 76-100.

[20] Elad, R.L., Houston, J.E. (2002). Seasonal labor constraints and intra-household dynamics in the female fields of southern Cameroon. *Agricultural Economics* 27(1): 23-32.

[21] Elbehri, A., Lee, M. (2011). *The role of women producer organizations in agricultural value chain.* Food and Agriculture Organization. Rome, IT: FAO.

[22] Ezumah, N.N., Di Domenico, C. (1995). Enhancing the role of women in crop production: a case study of Igbo women in Nigeria. *World Development* 23(10): 1731-1744.

[23] Foltz, J., Larson, B.A., Lopez, R. (2000). Land tenure, investment, and agricultural production in Nicaragua. *Development Discussion Paper. Central America Project Series* 738: 1-28.

[24] Government of Uganda. Ministry of lands, housing and urban development(2013). *The Uganda national land policy.* Kampala: GoU.

[25] Gourieroux, C. (2000). *Econometrics of Qualitative Dependent Variables.* Cambridge University Press. Cambridge, UK.

[26] Holden, S., Shiferaw, B., Pender, J. (2001). *Market imperfections and land productivity in the Ethiopian highlands.* International Food Policy Research Institute Discussion Paper, 5. Washington, DC: IFPRI.

[27] Honoré, B.E. (1992). Trimmed Lad and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects. *Econometrica* 60(3): 533-565.

[28] Jacoby, H.G. (1992). Productivity of men and women and the sexual division of labor in peasant agriculture of the Peruvian Sierra. *Journal of Development Economics* 37 (1)(2): 265-287.

[29] Kilic, T., Palaciós-Lopez, A., Goldstein, M. (2015). Caught in a productivity trap: a distributional perspective on gender differences in Malawian agriculture. *World Development* 70 : 416-463.

[30] Koru, B., Holden, S. (2008). Difference in maize productivity between male- and female-headed households. *Ethiopian Development Research Institute*: 1-23.

[31] Lastarria-Cornhiel, S. (1997). Impact of privatization on gender and property rights in Africa. *World Development* 25(8): 1317-1333.

[32] Maddala, G.S. (1987). Limited Dependent Variable Models Using Panel Data. *The Journal of Human Resources* 22(3): 307-338.

[33] Masterson, T. (2007). Female land rights, crop specialization, and productivity in Paraguayan agriculture. *Levy Economic Institute of Bard College Working Paper* 504: 1-27.

[34] Medagbé, F.M.K., Diagne, A., Simtowe, F., Agboh-Noameshie, A.R., Adégbola, P.Y. (2010). Gender discrimination and its impact on income, productivity, and technical efficiency: evidence from Benin. *Agriculture Human Values* 27: 57-69.

[35] Njuki, J.M., Kihiyo, V.B.M., O'Ktingati, A., Place, F. (2006). *Productivity differences between male and female managed farms in the Eastern and Central highlands of Kenya.* Paper prepared for presentation at the International Association of Agricultural Economists Conference. Goald Coast, Australia.

[36] Oladejo, J.A., Olawuyi, S.O., Anjorin, T.D. (2011). Analysis of women participation in agricultural production in Egbedore local government area

of Osun State, Nigeria. *International Journal of Agricultural Economics & Rural Development* 4(1): 1-11.

[37] Okuku, J.A. (2006). The land act (1998) and land tenure reform in Uganda. *Africa Development* XXXI(1): 1-26.

[38] Owens, T., Hoddinott, J., Kinsey, B. (2003). The impact of agricultural extension on farm production in resettlement areas of Zimbabwe. *Economic Development and Cultural Change* 51(2): 337-357.

[39] Peterman, A., Quisumbing, A., Behrman, J., Nkonya, A. (2011). Understanding the complexities surrounding gender differences in agricultural productivity in Nigeria and Uganda. *Journal of Development Studies* 47(10): 1482-1509.

[40] Place, F., Migot-Adholla, S.E. (1998). The economic effects of land registration on smallholder farmm in Kenya: evidence from Nyeri and Kakamega districts. *Land Economics* 74: 360-373.

[41] Quisumbing, A. (1995). *Gender differences in agricultural productivity: a survey of empirical evidence*. International Food Policy Research Institute Discussion Paper, 5. Washington, DC: IFPRI.

[42] Quisumbing, A. (1996). Male-female differences in agricultural productivity: methodological issues and empirical evidence. *World Development* 24(10): 1579-1595.

[43] Republic of Uganda (1995). *Constitution of the Republic of Uganda*.

[44] Salome, E. (2014). Role of women in agricultural activities in Abua-Odual local government area of Rivers State, Nigeria. *World Rural Observation* 6(2): 1-6.

[45] Thapa, S. (2008). Gender differentials in agricultural productivity: evidence from Nepalese household data. *Munich Personal RePEc Archive Paper* 13722: 1-16.

[46] Tiruneh, A., Tesfaye, T., Mwangi, W., Verkuijl, H. (2001). *Gender differentials in agricultural production and decision-making among smallholders in Ada, Lume, and Gimbichu Woredas of the Central Highlands of Ethiopia.* International maize and wheat improvement centre (CIMMYT). Veracruz El Batán, Mexico: CIMMYT.

[47] Uganda Bureau of Statistics (2009). *Manual of instructions for Uganda National Panel Survey 2009/10.* Kampala: UBOS.

[48] Udry, C., Hoddinott, J., Alderman, H., Haddad, L. (1995). Gender differentials in farm productivity: implications for household efficiency and agricultural policy. *Food Policy* 20(5): 407-423.

[49] Udry, C. (1996). Gender, Agricultural Production, and the Theory of the Household. *Journal of Political Economy* 104(5): 1010-1046.

[50] Zikhali, P. (2008). Fast Track Land Reform and Agricultural Productivity in Zimbabwe. *University of Gothenburg Working Paper* 322: 1-25.

[51] Warner, J.M., Campbell, D.A. (2000). Supply response in an agrarian economy with non-simmetric gender relations. *World Development* 28(7): 1327-1340.

[52] Wasige, J.E. (2009). *Assessment of the impact of climate change and climate variability on crop production in Uganda.* End of project technical report. Makerere University: Kampala.

CONCLUSION

This PhD thesis investigates the sources of women's empowerment in low-income countries, namely Nepal and Uganda. More specifically, we seek to assess the role of land entitlement, food price instability and plot management respectively in affecting the woman's condition in rural contexts.

Three main research paths have been followed in the thesis: the first one has led to the finding that extending land ownership to women employed in the agricultural sector can increase their decision-making power within the household, where decisional independence is used as a measure of empowerment. This finding is confirmed by the evidence stemming from the three estimation strategies implemented. Even if paid work increases more female decisional independence, ownership of land is an important source of economic growth and women's empowerment.

As a number of studies emphasized, in fact, possessing land is an incentive to invest on it, with positive implications for agricultural production.

Production is the main focus of the third paper, that investigates whether agricultural productivity varies with the sex of the plot manager. In line with previous findings in the literature, we find that plots managed by women are less productive than those managed by men. However, this may also be related to reasons we are not able to control for, such as limited access of women to more productive assets, like fertilizers, machineries, extension services and so on, on which, unfortunately, gender-disaggregated data are not available.

Finally, in the second paper we contribute to the recent growing research on the impact of food prices, through a gender analysis on the labour supply side. This is the other research path we followed in the thesis. To the best of our knowledge, this is the first attempt in this regard, also because generally this kind of studies does not take into consideration the gender dimension. However, the results confirm the traditional role of women as "shock absorbers": in fact, we found that food price instability has affected more female than male paid labour work. Many are the possible explanations, but the most relevant is related to the fact that women have the burden to ensure household members subsistence, so that changes in food prices may lead them to increase their market labour time in order to guarantee food security.

In general, we can conclude affirming that findings from the three essays confirm the idea that women are often excluded at both social and economic level, with implications for the household well-being and for the economic growth. In fact, as emphasized by the major part of the related literature, women have a

crucial role for the subsistence of the household members, particularly children and the elderly, so that their vulnerability has extendend negative effects. This vulnerability may be attributed to the multi-tasking characteristics of women, that is innate, but also related to socio-cultural constructs.

Therefore, despite the growing attention paid by the international community, and the evidence provided by academic research, gender continues to be a factor of discrimination.