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Is the Allocation of Time Gender Sensitive to Food Price Changes? An Investigation of Hours of Work in Uganda

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ABSTRACT

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

JEL Classification: J16, J22, J43, Q11

Keywords: food prices, labour supply, gender, Uganda

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1. Introduction

After a period of relative stability of staple food prices, the world has experienced a dramatic spike in the price of these commodities. As a result, a widespread debate on the implications of this shock for welfare and food security has emerged (Caracciolo et al., 2014; Dimova, 2015). This issue is particularly relevant for low-income countries, where people spend a large share of their income on food (Mukasa and Berloffa, 2015) and raises concern that hunger and poverty might further increase around the world. At the same time, most African economies are still dominated by agriculture, mainly based on smallholder farming. Hence, the most vulnerable and the most affected by price surges will be poor farm households, due to their high dependency on the food market (Benson et al, 2008). As Barret and Dorosh (1996) argue, a "real food price increase raises 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). Women are the most vulnerable, especially in developing countries, where their paid and, mostly, unpaid work secures the household's survival (Gammage, 2010). Women are subject to 'discrimination' in the time allocation of labour. In fact, they are rarely engaged in remunerated activities so their full involvement in unpaid family labour excludes the possibility of empowerment (Ilahi, 2001). In other words, their labour is traditionally used for household production rather than in 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 their non-labour market time is reserved for home production activities.

The world prices of staple foods have increased since 2006, with a sharp rise in cereal prices during 2007-08 (Simler, 2010). Worldwide, the main causes of the food price spike are attributable to various factors, including droughts, low stocks of cereals and oilseeds, increased feedstock use in the production of biofuels, increased food production costs, rapidly rising oil prices, and financial speculation in the US markets.

This paper discusses the price instability of *matooke*[1] and cassava in Uganda, a country initially 'excluded' from the global food price crisis thanks to its position partially isolating it from the international markets (Simler, 2010). Specifically, the study seeks to trace the extent to which food price changes may affect the gendered patterns of time allocation in a low-income country. Indeed, as Dito (2011) suggests, food price shocks can determine a variation in the hours devoted to both on- and off-farm activities. Our empirical investigation uses a sample drawn from the Uganda National Household Survey (2009-2010; 2010-2011; 2011-2012), a household panel survey that collected data on socio-economic characteristics at the household and individual levels, also providing information on agriculture and on time use. In Uganda, food prices were relatively stable until the first half of 2008, rising annually by about 5 percent (Uganda Bureau of Statistics; Benson et al., 2008). Subsequently, the country was hit by the food price crisis (Van Campenhout et al., 2013).

This paper represents an additional contribution to studies on the labour response to price shocks from a gender perspective by using time as the primary criterion for analysis. Indeed, as will be argued in the following paragraphs, time is one of the major obstacles to poverty reduction, especially in terms of the division of labour by gender. Specifically, the main purpose of our research is to understand whether and how male and female working hours respond to price changes. To the best of our knowl-

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

edge, little research has taken into account these effects on labour supply or, more specifically, how price changes may affect time use. Additionally, as Kumar and Quisumbing (2011) note, the literature lacks empirical evidence on the gendered impacts of crises. Considering that women are often the 'shock absorbers' in a household, tending to reduce their own consumption to leave more food for the other household members (Kumar and Quisumbing, 2011), it may be expected that women also bear the brunt of price surges in their time use. Moreover, time is allocated according to both economic and non-economic criteria that reflect the specificity of cultural and societal rules. As Ilahi (2001) argues, "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, whereas men are often employed in income-generating activities, women perform household chores or participate in agricultural work on their household farm. Therefore, this paper seeks to extend impact analyses of food price movements to both male and female labour behaviour. In particular, the purpose is to test whether changes in staple food prices perpetuate a gender bias. In fact, the division of labour may be further radicalized at the expense of time spent on domestic activities, especially child care, which is traditionally a female task. In this study, labour time is measured along five dimensions: paid, domestic, non-labour market, farm and agricultural employment. Unfortunately, the labour time data available have a number of missing weekly values. This limitation justifies the implementation of a censoring model, also known as the Tobit approach (Tobin, 1958), which is integrated with a hybrid model to control for individual fixed effects.

Given the consistent share of rural farmers in the data set, we account for this feature by considering the net market position of households, i.e. if households are net buyers or net sellers of food. In addition, controlling for crop seasonality is especially significant as an indicator of the path of food prices.

The paper is structured as follows. Section 2 presents the literature concerning time allocation. Section 3 illustrates the empirical strategy adopted. Section 4 addresses the characteristics of our data. After reporting and discussing the results in Section 5, Section 6 presents our conclusions.

2. Background Literature

Household time allocation has been treated by an extensive body of literature, although the issue has only recently been investigated by a few studies in the context of developing countries (Ilahi, 2001). Since the initial work of Mincer (1962) and Becker (1965), time distribution within households, including work at home and leisure time, has been investigated by various authors. In Becker's theory, household time is assumed to be maximized through a utility function, so that time is considered in the same way as a commodity. Gronau (1976) explored the relationship between the wage increases and changes in working time, differentiating between men and women. He found that not only a shift from work at home (which also includes child care) to labour market activities occurs, but also a reduction in leisure time, mainly affecting women. Moreover, Hill (1989) investigated the context-specificity of time allocation and argued that the presence of a consistent 'informal' sector, where women are engaged in economic activity and simultaneously care for children and do home-related duties, "complicates the labor supply decisions" (p. 144). Furthermore, the composition of male and female time allocated to work differs not only on a 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 involves domestic and labour market work. This issue pertains particularly to women (Medeiros et al., 2007), who often give up their autonomy to care for 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 women (which include caring for the elderly and children, preparing food, cleaning, housework, collecting water and firewood, and so on), as well as reinforcing the gender gap can complicate their participation in more economically productive activities. Additionally, the composition of the household, its size and the number, age and gender of children also impact time patterns, and this is especially true for women. A similar assumption is made by Warner and Campbell (2000), who note that "women have virtually no leisure time." Thus, gender discrepancies in time allocation represent a substantial source of disempowerment, which at the same time consistently affect development. When evaluating the effects of rising food prices, most studies focus on the welfare implications for consumers, partially ignoring the fact that most of the poor are also producers. A proper assessment of 'producer effects' requires analysis not only of the possible expansion of food production and consequent income improvement but also of the time distribution across labour market, non-labour market and agricultural activities. Klasen et al. (2011) point out that "gender discrimination in the labor market is a common phenomenon in both developed and developing countries," even though "discrimination in the latter is rather associated with differential access to wage employment" (p. 4). Regarding price shocks, a large part of the recent literature focuses 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 can have on labour supply (Black et al., 2009). Probably one of the first studies 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 buyers or net sellers. Examining time use and time burdens in sub-Saharan Africa is crucial for many reasons. First, the concept of time poverty is strictly related to income poverty because of its consequences for the household and individual wellbeing. As women are predominantly engaged in farming activities, external shocks such as a food price changes may inevitably alter the time use of household members, mainly women. This is because they assume various tasks and responsibilities so that the more time they spend on paid and unpaid work the less time they have available for leisure and rest. This explains the notion of time poverty, which "can be understood in terms of the lack of adequate time to sleep and rest" (Gabbage, 2010). Hence, the following sections investigate exactly how this happens.

3. Empirical Strategy

Our primary interest is in measuring the effects of staple food price instability on the female and male labour supplies in terms of the hours devoted to labour market, non-labour market and agricultural activities. In our model, male and female household members have the following utility functions:

$$\begin{aligned} U_q &= U_q(t_q^l, z_q^a) \\ U_j &= U_j(t_j^l, z_j^a) \end{aligned} \tag{1}$$

where $q, j = i$ represents female and male members, t^l is leisure time, z^a is a composite consumption good consumed by each adult such that $z_q^a + z_j^a = z^a$. This is produced as a combination of male and female household production time (domestic t^d; on the household farm t^f) and of goods purchased in the market $z^a = g(t_q^d, t_j^d, t_q^f, t_j^f, \mathbf{x})$.
Individuals maximize their utilities subject to their own time constraints and to the household budget constraint:

$$T_i = t_i^w + t_i^d + t_i^f + t_i^l \tag{2}$$

$$w_q t_i^w + w_j t_m^w + \mathbf{p}_{\mathbf{sf}}^{'} \mathbf{q}_{\mathbf{sf}}(\mathbf{t}_{\mathbf{q}}^{\mathbf{f}} + \mathbf{t}_{\mathbf{j}}^{\mathbf{f}}) = \mathbf{p}'\mathbf{x} + \mathbf{p}_{\mathbf{sf}}^{'} \mathbf{x}_{\mathbf{sf}} \tag{3}$$

where t_i^w is time dedicated to labour market work, w is wages, $\mathbf{p}$ and $\mathbf{x}$ are the vectors of prices and quantities of goods bought on the market, $\mathbf{p}_{\mathbf{sf}}^{'}$ and $\mathbf{x}_{\mathbf{sf}}$ the vectors of prices and quantities of staple food bought on the market and $\mathbf{q}_{\mathbf{sf}}$ is the quantity of staple food produced in the household farm and sold on the market.

The solution of the model yields the supply functions of the three uses of time for male and female partners:

$$\begin{aligned} t_i^w &= t_i^w(w_q, w_j, p, p_{sf}, F) \\ t_i^d &= t_i^d(w_q, w_j, p, p_{sf}, F) \\ t_i^f &= t_i^f(w_q, w_j, p, p_{sf}, F) \end{aligned} \tag{4}$$

where each category depends on wages and the prices of staple food and other consumption goods, and F are personal and family characteristics .

The empirical strategy consists in estimating a reduced form of system (5). We model hours of work y_{it} spent on the different types of activity and apply the following Tobit model for panel data:

$$y_{it} = \beta p_{sf,it} + \gamma F_{it} + \alpha_i + \lambda_t + u_{it}, u_{it} \sim Normal(0, \sigma^2) \tag{5}$$

where α_i is an individual effect and λ_t is a time effect.

However, the Tobit approach fits a random-effects model but it does not contemplate fixed effects. Honoré (1992) developed a semiparametric estimator for Tobit fixed effects, but we have found some difficulty in implementing it in this paper. To remedy for this, we construct a fixed-effect version of our basic model by implementing a hybrid model technique (Schunk, 2013; Allison, 2005; Neuhaus and Kalbfleish, 1998) in which the fixed- and random-effects models are combined, obtaining the advantages

of both models. Allison (2005) claims that the "hybrid method allows for the estimation of fixed effects coefficients for time-varying predictors 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 ($\bar{X}_i = n_i^{-1} \sum_{h=1}^{n} X_{it}$) [2], which allows differences between entities to be measured, and the within-cluster one, ($X_{it} - \bar{X}_i$), that captures the effects of the units 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. This methodology has the advantage of allowing correlation between heterogenity and the regressors (also known as 'correlated random effects', see Woolridge, 2010).
Hence, our hours of work equations - one for each of the five working time categories - can be specified as:

$$y_i^k = \beta_0 + \beta_1 X_i + \beta_B \bar{X}_i + \beta_W (X_i - \bar{X}_i) \tag{6}$$

where y_i^k describes the individual yearly hours of work disaggregated by gender for each working category k (labour market, domestic, non-labour market, farming and agricultural working hours). X_i is the vector of covariates which are time-invariant (such as education), $\bar{X}_i$ reflects the between component B and ($X_i - \bar{X}_i$) are 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.

4. Data

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 national 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 questionnaires (socioeconomic, woman, agriculture, community and price modules), only the household and some parts of the agricultural questionnaires are used as they contain all the data needed for the analysis. The UNHS provides, *inter alia*, detailed information about household composition, education, time use, economic activities, and consumption of food and non-food goods. Nearly 3000 households were interviewed, with a randomly-selected share of split-off households formed after the 2005/06 survey. The total numbers of households and individuals per wave are presented in Table 1 below:

[2] For more details, see also Mundlak, 1978; Allison, 2005; Schunck, 2013; Sjölander *et al.*, 2013.

Table 1: Survey description

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

Source: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12).

For the purpose of our analysis, we select men and women aged between 15 and 64[3] who answer the questions concerning hours of work reporting zero or positive values. Specifically, since the information on hours of work is collected by means of several questions asking whether the individual had performed each kind of work activity and for how many hours in the past week, our sampling rule was to select individuals who had one valid (i.e. non-missing) observation for the labour activity in which people participate the most. In the Ugandan case, this is 'fetching firewood' for females and 'making major repairs' for males.[4] If individuals did not participate in an activity, they were assigned a missing value in the data (this was mostly the case for female wage work). On the basis of this selection rule, for the other work activities we assign the recorded positive value or zero if the value is missing. After this selection, our sample is reduced to 15,093 individuals – 7,302 men and 7,791 women. However, since our main interest is in analysing the relationship between hours of work and prices of staple food, due to missing values for prices in some districts of Uganda, when we run the regression the total number of observations is further reduced to 10,117 individuals, of which 4,869 are men and 5,248 are women. [5]

Labour time behaviour

Time is a scarce resource, and determining how much 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 a 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 and animal husbandry are performed within the household (Skoufias, 1996). Tiberti and Tiberti (2015), for example, assume that each household member aged between 15 and 60 years has 10 hours per day of leisure time. However, this amount of leisure does not take into account 'extra-time' devoted to household chores, such as caring for children, cooking and so on. This matters particularly for women. Therefore, the measure of the labour supply should be extended to include both time

[3] According to the UNHS, Section 8 of the Household Questionnaire – referring to Labour Force Status – was formally administered to individuals falling in the age group '5 years and above'. Unfortunately, when controlling for labour hours data on hours of work were also available for people below this age category. As there were many outliers, we decided to focus on the 'formal' working group.

[4] In general, most of the questions in the section 'non-market activities' contain information, so that the number of missing items is very low.

[5] These become 9302 – 4488 men and 4814 women respectively – when taking into consideration all the main staples consumed, as shown in the tables reported in Appendix B.

worked for a wage and time devoted to home and farming activities. The time use module, which was administered to all the household members over five years of age, 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]: Working for someone else for pay?; An employer?; An own-account worker?; Helping without pay in a household business?; An apprentice?; Working on the household farm or with household livestock?' Additionally, in the section 'Non-labour market activities' specific questions were asked about the hours spent in the previous seven days on fetching firewood, collecting water, milling, making handicrafts, hunting and fishing, making major repairs to the dwelling or farm, constructing the dwelling or farm and agricultural activities.

In order to simplify the analysis, we collapse all this information into five broad categories. Labour market work includes waged and employer hours and own-account work[6]. Moreover, although they may be remunerated, agricultural workers are not considered paid labourers in this data source. Since we do not have data on all kinds of domestic chores for the whole panel, we can only use information on hours of work fetching firewood, collecting water and milling, which we aggregate in the variable 'non-labour market restricted activities,' which we use as a proxy for domestic hours of work. Instead, non-labour market extended work is obtained by taking into account all the labour information about the 'non-labour market activities' contained in the questionnaire (thus including the domestic labour category previously described) and excluding agriculture. Finally, working on the household farm only considers hours devoted to the management of the household farm while agricultural work accounts for hours spent working in agriculture[7] The data about working time are recorded on a weekly basis. For the purposes of our analysis, we decide to convert them into annual hours by multiplying the total working hours – for each activity – by 52 (the total number of weeks in a year). We assume that each household member works 15 hours per day (which includes hours spent on labour market work, farm and domestic tasks). Therefore, in a week the total time devoted to working is equal to 105 hours, which become 5,475 in a year. Considering that the total annual available time is 8,760 hours, the total amount of leisure time (which also comprises 'sleeping' time), obtained by subtracting the 5,475 working hours, is 3285 hours/year. Table 2 shows the weekly hours for all the time-use categories previously mentioned. They are reported differentiated by wave and gender. As explained, the regression sample reduces to 10,117 working individuals. Therefore, basic statistics were predicted on this sample, as presented in Table 4.

As expected, women are more engaged in agricultural and farming activities, for which we can observe an increase in their time use in the period considered, while their participation in domestic and non-labour market activities reduces. As regards labour market work, a decrease of about 7% is registered between the two first waves and then the hours grow again. Additionally, it can be noted that the number of observations is further reduced. Nevertheless, men seem to work more hours in remunerated activities, with a constant trend in all the three wave years. Moreover, as expected, the time they devote to domestic activities is less than that for their female counterparts.

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

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

Table 2: Total weekly hours of work, disaggregated by gender and wave of the regression sample

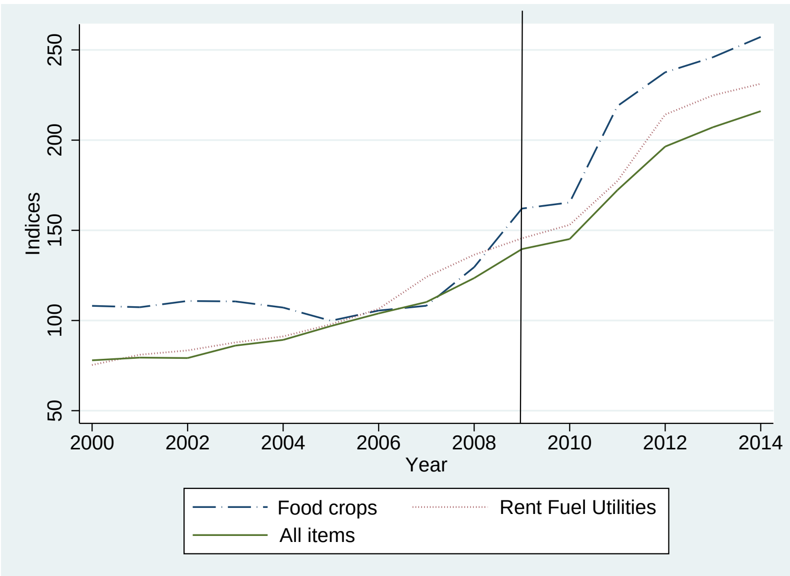
	Market		*Domestic**		*Non-market*		*HH farm*		*Agriculture*	
					2009-10					
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Weekly	15.56	7.16	2.04	6.1	2.51	6.64	7.25	9.23	7.11	7.43
	(25.08)	(18.79)	(4.14)	(8.44)	(5.78)	(9.01)	(12.19)	(11.81)	(12.19)	(11.2)
					2010-11					
Weekly	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)
					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)
Sample	10117 (4869 & 5248 men and women respectively)									

Source: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12). Standard deviation in parentheses.
*A proxy that includes fetching firewood, collecting water and milling, since information on domestic chores is not available.

Food Prices

The Uganda Bureau of Statistics (UBOS) data show that the *annual* annual inflation rate for food crops for April 2008 was 1.7%, whereas the *monthly*inflation rate shows a 6.7% increase over the March prices. From the first half of 2008, when Uganda experienced the first rise in food prices, the pattern of food prices was extremely volatile. In fact, as in the global markets, Uganda registered a sharp increase in food prices from 2009, also relative to other items, as shown in Figure 2 below, but the situation eased off during 2010. Afterwards, a new price hike took place from the beginning of 2011.

Figure 1: Food and Non-Food price indices.



Source: Uganda Bureau of Statistics.

All three waves of the UNHS household survey include detailed price information. This is contained in the Household Food Consumption Expenditure Section, which records data at the household level.

The questionnaire covers both market and farm gate prices (they differ because in the first price transport and marketing costs are included), although in our analysis only market prices are taken into consideration. To avoid excluding many observations due to the presence of many missing values, we compute prices at the district level. Specifically, we use the average market price at the district level and variations in it to measure price instability.[8] 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)[9].
In Table 3 below the budget share for consumption and the price indices of matooke and cassava for each panel year are reported:

Table 3: Budget share of food consumption and real price indices of the two main staple food in Uganda

	UNHS 2009-10		**UNHS 2010-11**		**UNHS 2011-12**	
			Budget share of food consumption			
	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)
			Food Prices			
Matooke	49.90 (23.54)		39.53 (21.07)		44.11 (23.42)	
Cassava	11.18 (6.84)		12.08 (8.43)		20.02 (22.72)	

Source: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12). Standard deviation in parentheses.

As can be observed, for matooke, which registered the higher price, there was a decreasing trend in 2010, offset by a rise in the following year (2012)[10].

Other explanatory variables

The socio-economic variables chosen as controls, such as education, age, marital status, urban/rural and regional place of residence are all at the individual level. Education is a categorical variable, which takes value 1 for those who have no education, 2 for people who have primary education, 3 for secondary education and 4 refers to people who have higher education[11] Additionally, we also introduce a seasonality binary variable to control for the cropping season during which the questionnaire was administered. Household size and the total number of children aged 5 or below are also considered as

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

[9]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 decide to consider the price deflator at the national level and not at the regional one "because we do not want the deflator to drive the variation in price"

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

[11]In order to make the interpretation of the relative coefficient more straightforward, we construct four dummy variables, one for each level of education.

we imagine that these factors could have a significant influence on labour time, especially for women[12] Moreover, the value of the total food and non-food expenditure is used to construct a proxy for household welfare. We expect higher prices to impact more on poorer than richer households. The basic descriptive statistics are presented in Table 4 below, and they refer to the full regression sample of working men and women (10,117 individuals). Unfortunately, due to the presence of many missing food price variables, as stated before, we have to only take into account the share of people for which the regression is run. Turning to the descriptive statistics, most of the sample individuals live in rural areas (about 70%), as expected, are spouses married monogamously, and almost all have a primary education level. While the mean values of the control variable are approximately similar for men and women, we can observe that the households are mainly headed by men.

[12]Although we were aware that title measures, such as farm, land and input ownership could influence time allocation, particularly hours devoted to farming work, we do not consider them as this is the scope of another paper.

Table 4: Descriptive statistics for all the control variables

	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: Authors' elaboration based on UNHS (2009-10; 2010-11; 2011-12). Standard deviation in parentheses.

Finally, by virtue of the high dependence of most Ugandan households on food prices, we also introduce the net market position, as will be detailed in the next paragraph.

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 consequences of price changes many factors have to be taken into account, and in particular geographical location. Van Campenhout et al. (2013), for example, find that the reduction in welfare due to the increase in the price of matooke was more incisive for urban than rural people. Additionally, Dimova (2015) considers 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 demand for goods is inelastic, as in the case of staple food. Meanwhile, the impact on producers may be ambiguous because on the one hand a food price increase can have an income effect and on the other hand an expansion in food production may be not simultaneously accompanied by an increase in demand, causing a zero welfare effect. At the same time, such analyses require the implications of food price spikes for both urban and rural consumers and producers to be explored. Finally, the decisions of consumers and producers are not separable, particularly in the case of smallholder farmers. Thus, a key consideration when analysing the degree to which individual time use is likely to be affected by food price changes is identification of the net market position (NPR, henceforth). In fact, although the impact of higher food prices can be very diverse depending on the commodity, the country and also the characteristics of households, it can generally be stated that while food purchasers can be affected adversely[13],food producers may benefit from an increase. However, as Benson et al. (2008) remark, "while conceptually the idea of net sellers and net buyers is relatively clear, defining who is a net seller or a net buyer can be more problematic" (p. 519).
Conceptually, a net buyer of food spends more on purchasing 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). The situation of each household is determined by considering the total market value of the quantities sold (Q_i^s) and consumed (Q_i^c)[14]of the following food item categories: matooke, cassava, potato,[15], maize, cereals[16], beans, fruit 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 as a net buyer. According to our sample data, the majority of Ugandan households are net buyers of food, and for matooke 16.4% of households are net sellers.

5. Results and Discussion

Our main aim is to determine how food price instability relates to hours of work among working men and women. The estimates are presented in Tables 5 and 6. Although the information about time is on a weekly basis in the questionnaire, the analysis has been carried out using annual figures. To take into consideration geographical differences in prices, market prices at the district level are used, as previously explained. Additionally, in order to capture possible differences in time use at the geographical level, we also introduce regions as explanatory variables (namely: northern, southern, eastern, and central macro-areas). Before commenting on the results, we need to point out that the number of censored observations is particularly high for labour market hours due to a high number of zero values, and remarkably low for non-labour market work activities (for which, as previously pointed out, positive values have been recorded). Finally, we reduce our empirical analysis to the two major staples consumed, matooke and cassava. This choice leads to a final regression sample of 10,117 people – 4869 men and 5248 women (the reduction of the sample size is caused by missing values in the price data). For a comprehensive analysis, we also test the model incorporating the other food

[13]Rising prices reduce the real purchasing power of such households. Ivanic and Martin's (2008) multi-country study on the first-order welfare changes for households sheds light on the overall negative impact on poverty.
[14]The value of consumption only includes items purchased outside the home.
[15]Potato includes Irish, fresh and dried potatoes, according to the food list available in the dataset.
[16]This category covers millet, sorghum and rice.

categories (Table 8), which confirms the main results. Lastly, as Brown et al. (2013) state, due to the censored nature of the dependent variables the findings are explained in terms of the expected value, $E(y|y > 0)$, which means that they are conditional on $y > 0$. The findings reported in Table 5 show that women's paid time is more sensitive to changes in the matooke and cassava prices. For instance, the model indicates that the between-women effect of a unitary change in the price index for matooke is only positive for labour market work, with an opposite effect on domestic and non-labour market hours. Certainly, these findings may be because matooke is one of the most important staple foods in the Ugandan population's diet, so that women engaged in paid jobs will need to work more hours to buy it. On the contrary, we find no significant impact on male hours of work. Along the same lines, the average hours of work for women spending their time on labour market tasks increases following an average change in the cassava price, while no statistically significant results are shown for the other working categories. On the other hand, the within-women effect suggests that, for a given woman, a unitary variation in the real price index of matooke is associated with an increase in the time devoted to labour market tasks of 7.97 hours, which is counterbalanced by a reduction in both domestic and non-market activities. However, this last statement only applies to matooke, for which the coefficients are significantly different from zero. Surprisingly, being a net buyer of plantains results in an increasing trend in labour market hours of work for both men and women, although the magnitude is different, with a slightly higher value for women. One possible explanation is that as women are more concerned with the family food intake than men they are more likely to increase their paid work time. For instance, in line with the increase in remunerated labour hours, men reduce the time they devote to domestic tasks, whereas for women the coefficient is not significant. Among the household characteristics, the number of children is particularly influential for both men and women. In fact, it is associated with an average increase in all labour market and non-labour market activities at both the between and within individual levels, although the presence of children encumbers women more than men: an increase of about 88 hours per annum in domestic time can be observed for women vs. 55 for men. On the contrary, in line with our hypothesis, the between-household size negatively impacts all the working activities considered here for both men and women, although this result is only apparent at the between level. Interestingly, level of education is associated with a consistent increase in both male and female labour market hours of work, which is followed by a corresponding reduction in non-labour market activities. In detail, as expected, being more educated determines a greater increase in both male and female labour market work, which is combined with a decrease in the other labour activities considered. However, in this case, while the reduction in the domestic and non-labour market work categories matches our expectations (as women devote more hours to the activities mentioned), the hybrid model shows that for women with a secondary level of education there is a greater increase in paid hours than there is for their male counterparts. Moreover, living in urban areas increases annual labour market hours by 1,308 and 1,749 hours for men and women respectively and reduces the time spent on the other work activities. As for the place of residence, the estimation results show that living in urban areas is associated with an increase in paid hours, which is greater 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 expectations, we find a reduction in both domestic and non-labour market activities with, once again, a larger decrease for female than male hours of work. Regarding the relationship with the household head, being a female spouse is associated with a reduction in paid hours, although an increase in hours of work is registered for both domestic and non-labour market extended hours. However, the results are not statistically significant. Instead, opposite results are registered for male spouses. Moreover, despite a difference in the magnitude of the coefficients, with the only exception of labour market work we note that both female and male children follow the same positive time pattern. Marital status also plays an important role. For example, the change in working time seems to be more significant for divorced or separated women, probably because they are the only ones dealing with the food maintenance of the household. The impact of regional location on time allocation is also important in the analysis of price instability. In general, we find an increasing pattern for all the activities, even though the results are different. As for household wealth, both richer men and women seem to increase the hours they devote to remunerated work in the period studied. This is accompanied by a more pronounced decreasing pattern for the non-labour market and domestic hours. The only 'gender' difference is found for non-labour market working time, for which the results describe a significant increasing time trend for poorer women.

Moving to working on the household farm and agricultural activities, which are illustrated in Table 6, we see that also in this case the effect of the price change is different for men and women. First, the between effect of the matooke price is surprisingly negative for both men and women, while we observe an opposite effect for male time devoted to agricultural tasks. Moreover, the within predictor of hours spent on household farming suggests that, for a given woman, there is a decrease, while it is not statistically significant for men. Additionally, being a net buyer of both matooke and cassava is associated with a reduction in both 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 with a higher value for paid work time, since buying the same quantity of matooke needs a higher income. As regards the relationship with the household head, we see a positive and statistically significant increase for female time spent on both farming and agricultural tasks, which is offset by an opposite effect for men.

Table 5: Yearly hours of work of the estimated Hybrid Tobit model for market and non market hours of work, 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: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard deviation in parentheses.

Table 6: Yearly hours of work of the estimated Hybrid Tobit model for household farming and agricultural hours of work, 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: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively.
Standard deviation in parentheses.

Indeed, the increase in household farming and agricultural time associated with increasing household size may be related to the need to guarantee a certain food requirement to the other household members, particularly children and the elderly. The higher the level of education, the greater is the decrease in both these activities (to a larger extent for men than for women). Household wealth is also related to a greater decrease in annual hours of work for richer than for poorer people, even though the effect is more prominent for females. Surprisingly, we find that women who live in urban areas increase the time they devote to agricultural tasks, contrary to the negative trend for household farming hours for both genders. Finally, unlike the findings concerning labour market and non-labour market annual hours of work, in the second cropping season there is an increasing statistically significant trend for both household farming and agricultural hours of work (with the exception of male household farming hours).

Robustness check

The model estimated is used to assess the impact on the labour supply of changes in the price of matooke and cassava in the period between 2009 and 2012. For a broader assessment, we replicate the analysis by extending the model to data from the UNHS 2005-2006. However, time is not expressed in the same way in all the waves. Consequently, we test the basic model holding only the labour market, domestic[17] and household farming hours of work. Table 7 shows the coefficients of the Tobit model with fixed effects separately for each labour time variable. The sign of the between covariate associated with the change in the price of matooke is positive and the covariate is greater for women than for men, as expected. This is in line with the main findings: women are more concerned with household food subsistence, and this explains their greater responsiveness in terms of remunerated time. The within coefficient, instead, is not statistically significant, while the between estimate for cassava is highly positive for women. The estimates for the net market position are both statistically significant and take the expected sign (228.60 and 184.73 for men and women respectively). Nevertheless, the magnitude of the coefficients is unexpectedly greater for men than for women (with the exception of female buyers of cassava, who experience a large increase in their paid time). A possible explanation might be that women may have restricted decision-making power over household expenditure, or may have limited access to the market so that men do more spending on food. Looking at household characteristics, most of the estimates concerning women are highly significant. As envisaged, being a female spouse or a daughter is associated with a decrease in labour market hours of work. The same trend is observed for men and women who have never married, although for men the coefficient is smaller. Household size reduces the time men devote to paid work and the coefficients are highly significant. Women's paid time, instead, is not significant. Contrary to expectations, the number of children in the family determines a greater increase in remunerated time for men than for women (i.e. the between coefficient is only significant for women working in the labour market. Conversely, the within coefficient is positive and significant only for men). In line with the main empirical analysis, the estimates for level of education and household wealth suggest that more educated and richer people increase the time they spend on paid work. In detail, particularly men and women with secondary education seem to spend more time on paid work, while people with a higher education show a positive

[17] Unfortunately, data about milling are not available, this variable is limited to 'Fetching firewood' and 'Collecting water'

trend, but slightly less. This may be consistent with the limited share of people in the sample who have high levels of education. Regarding household wealth, instead, being rich, proxied by food and non-food expenditure, may allow workers to put more hours into the labour market, while poorer people may need to cope with more unpaid work.

Considering the survey rounds, the last wave (2011-12) shows a greater reduction in paid hours for both men and women, probably in order to compensate for the smaller cut in the unpaid working categories considered. Moving to domestic and farming time, the sign of the between coefficients confirms the principal estimates: women reduce the hours they spend on domestic and farming work (although only slightly) and men only decrease farming time. Consistently with what occurs for paid work, the opposite sign for net buyers of matooke indicates that both men and women reduce their unpaid working time. Unlike the other time use variables, women allocate more time to the farm during the second cropping season, perhaps because harvesting and other related farming tasks may need more contribution from women as men are more engaged in remunerated jobs.

Among household characteristics, household size determines a reduction in domestic tasks and an increase in farming ones. This is not surprising as the domestic variable captures activities not strictly related to traditional caring tasks (like fetching firewood and collecting water). Instead, the larger the number of adults in the household, the greater will be the possibility of engaging them in farming work. The number of children aged 0-5 is associated with an increase in domestic hours, which is slightly larger for women than for men. This is a plausible result: the bulk of child care clearly falls on women, but unfortunately this information is not captured by the variable considered. However, the positive sign of the coefficients, as discussed above, might be explained by the fact that fetching firewood and water are two useful 'services' for household subsistence. Moreover, the sign of the variables for individual levels of education and household wealth supports the idea that more education and household richness are less linked to unpaid work. In fact, more educated and richer people tend to do more paid than unpaid work, as reasoned above.

Finally, if living in urban areas is able to increase paid time, it also contributes to reducing the time devoted to domestic and farming tasks for both genders. Hence, it could conceivably be inferred that the time use of people who do not live in rural areas tends to be less linked to agricultural tasks.

Table 7: Yearly hours of work of the estimated Hybrid Tobit model for market, domestic and household farming hours of work

	Market		***Domestic***		***Household farm***	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Food prices						
Between matooke	7.99*** (3.13)	9.12** (4.03)	-0.07 (0.82)	-1.83*** (0.71)	-9.61*** (2.27)	-7.14*** (1.52)
Within matooke	-0.58 (1.96)	2.79 (2.64)	-0.61 (0.56)	-0.31 (0.49)	0.48 (1.43)	-1.31 (0.96)
Between cassava	4.90 (4.65)	22.78*** (6.13)	-2.56** (1.23)	0.62 (1.10)	-5.73* (3.30)	-10.49*** (2.35)
Within cassava	-3.86 (2.99)	0.72 (3.94)	0.08 (0.88)	-0.74 (0.80)	1.59 (2.21)	-2.19 (1.61)
Net market position						
Buyer of matooke	228.69*** (91.43)	184.73* (112.41)	-59.06** (27.92)	-18.61 (24.19)	-445.13*** (83.10)	-437.7***(53.12)
Buyer of cassava	61.11 (82.76)	274.52*** (100.73)	32.88 (24.15)	9.22 (20.81)	-91.13 (67.53)	-215.67***(44.96)
Cropping season						
Second cropping season	28.01 (63.41)	7.15 (80.52)	20.50 (17.89)	15.98 (15.41)	68.38 (47.75)	73.79** (31.26)
Household characteristics						
Relationship to the household head						
Spouse	316.18 (209.47)	-1307.81*** (138.49)	-141.09* (77.73)	84.58*** (28.21)	-708.01*** (181.5)	125.44** (58.81)
Son or Daughter	-2018.25*** (187.09)	-2050.29*** (232.72)	168.66*** (44.90)	121.52*** (44.45)	265.005* (142.67)	-86.24 (97.01)
Marital status						
Married polygamous	19.75 (98.90)	106.01 (122.64)	-194.03*** (32.86)	2.08 (22.55)	-4.56 (74.93)	-16.76 (46.22)
Divorced or Separated	129.9 (173.47)	661.62*** (187.89)	295.06*** (43.66)	27.43 (39.79)	-316.09** (142.39)	-56.12 (84.6)
Widow	-109.93 (367.67)	-82.65 (191.57)	42.97 (106.55)	-67.01* (39.49)	-621.91* (320.98)	55.39 (82.07)
Never Married	-287.65* (170.28)	-1222.67*** (245.97)	235.98*** (42.18)	-90.9* (49.33)	-758.01*** (137.60)	-576.4*** (107.89)
Household size						
Between size	-147.77*** (21.26)	-39.73 (27.51)	-37.82*** (5.66)	-25.58***(4.83)	54.78*** (15.1)	45.36*** (10.02)
Within size	-206.60** (96.64)	-141.54 (133.81)	6.53 (24.95)	-19.40 (23.64)	-62.17 (64.2)	-66.53 (48.85)

Continued from previous page

	Market		Domestic		Household farm	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Number of children (0-5)						
Between child	123.26 (139.02)	9.12** (4.03)	169.18*** (36.75)	198.39*** (28.52)	116.69 (99.33)	46.37 (60.75)
Within child	318.45*** (59.04)	2.79 (2.64)	52.61*** (16.87)	55.98*** (15.03)	9.95 (43.66)	-46.58 (29.27)
Level of education						
Primary education	597.98*** (155.9)	166.80 (119.64)	-44.44 (39.98)	-44.66** (21.10)	-238.94** (103.74)	-42.97 (43.20)
Secondary education	994.41***(190.39)	1501.32*** (196.21)	-177.42*** (52.09)	-295.02*** (40.75)	-903.42*** (143.01)	-491.31*** (93.49)
Higher education	846.09*** (260.3)	717.81** (371.43)	-366.79*** (81.18)	-453.11*** (84.85)	-1240.38*** (271.72)	-517.71** (212.07)
Household wealth						
Second expenditure quintile	254.01*** (91.94)	231.36** (119.10)	-60.50*** (24.6)	-10.18 (21.7)	-56.93 (65.9)	-36.13 (43.07)
Third expenditure quintile	452.44*** (103.01)	279.72** (130.14)	-67.92** (27.83)	-33.57 (23.48)	-83.62 (72.79)	4.61 (46.61)
Fourth expenditure quintile	499.68*** (118.98)	399.65*** (148.3)	-80.33*** (32.49)	-90.79*** (27.25)	-141.55* (84.95)	-177.84*** (55.11)
Fifth expenditure quintile	573.05*** (145.56)	491.07*** (181.59)	-97.83*** (39.79)	-140.3***(34.17)	-363.6*** (105.67)	-93.31 (68.63)
Place of residence						
Urban	869.37*** (98.71)	1283.72*** (122.75)	-138.61*** (27.41)	-188.69*** (23.97)	-1231.46*** (85.95)	-908.72*** (55.46)
Region						
Central	-401.50*** (160.12)	-611.44*** (194.13)	142.23*** (56.73)	-56.34 (49.17)	1020.30*** (350.34)	428.86*** (158.25)
Eastern	-926.08*** (187.6)	-1076.96*** (233.52)	108.45* (61.12)	187.89*** (53.32)	979.85*** (355.9)	471.5*** (163.86)
Northern	-991.29*** (197.70)	-621.76***(243.01)	-24.30 (63.92)	454.18*** (54.82)	717.79** (359.08)	85.66 (166.82)
Western	-708.13*** (181.56)	-711.69*** (226.17)	163.28*** (59.92)	121.43** (52.18)	1427.3*** (353.56)	990.9*** (161.57)
Survey round						
2009-10	-586.47*** (109.03)	-1278.35*** (143.65)	-75.90*** (29.90)	-123.11*** (27.41)	-731.25*** (79.42)	-405.83*** (53.53)
2010-11	-734.53*** (113.38)	-1348.48*** (144.11)	-76.96**(31.95)	-117.33*** (29.09)	-735.99*** (87.64)	-425.57*** (58.23)
2011-12	-740.8*** (115.76)	-1554.9*** (149.46)	-106.38*** (32.73)	-69.94**(29.36)	-577.29*** (87.32)	-276.76*** (57.65)
Constant	888.78*** (307.08)	200.34 (370.44)	-144.38* (88.65)	335.63*** (76.87)	120.52 (396.3)	537.95*** (200.98)
Sigma u	1048.40*** (43.87)	1340.93*** (58.25)	216.71*** (14.81)	201.08*** (12.5)	698.19*** (36.44)	486.42*** (24.06)
Sigma e	1706.33*** (30.32)	1896.97*** (43.49)	426.83*** (9.55)	494.96*** (6.83)	1221.17*** (23.82)	914.48*** (14.52)
Rho	0.27 (0.02)	0.33 (0.02)	0.2 (0.02)	0.14 (0.02)	0.25 (0.02)	0.22 (0.02)
Number of observations	5362	6007	5356	6002	5362	6004

Source: Authors' elaboration, based on UNHS (2005-06; 2009-10; 2010-11; 2011-12. ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard deviation in parentheses.

Moreover, given the relevance of the household net market position, we replicate the analysis by considering if households are net buyers or sellers of food. The sign of the coefficients confirms the main results although, possibly because of the reduced number of observations, the 'within' coefficient for female labour market hours of work loses its significance. However, the results are available upon request.

6. Conclusions

In this study we have explored the effects of soaring food prices on both male and female hours of work in Uganda in order to verify whether there exists a gender dimension to the relationship between hours of work and the price changes in the recent crisis. We have used data at both the individual and household levels from the last three waves of the Uganda National Household Survey panel (2009-10; 2010-11; 2011-12), and focused our analysis on working women and men (where the notion refers to individuals who have given a positive answer to the labour time questions). We have estimated a Hybrid Tobit model with fixed effects, with both between and within predictors, which has the advantage of taking into account correlation between the regressors and unobserved heterogeneity under the assumption of random effects.
Regarding the two staple foods mainly consumed by Ugandan households, matooke and cassava, our results suggest that the change in their prices exacerbated gender inequalities, increasing total female labour time. In detail, we observe that, over time, the increase in paid hours is more pronounced for women than men. On the contrary, time spent on all the other activities appears to decrease. Surprisingly, hours spent on the household farm is negatively associated with price increases (this statement concerns only the between effect) for both working men and women, while for hours of agricultural work we have 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, which is particularly evident for women, who, even though they decrease both their non-labour 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 a net buyer of both matooke and cassava determines a more prominent increase in labour market hours of work for women than for their male counterparts. When teasing out food and non-food expenditure by quintiles, our findings demonstrate a greater increase in paid hours of work for the richest individuals and this is 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 their labour behaviour more in order to meet household needs. To be more precise, while the increase in market hours of work and the consequent decrease in the other labour categories may be seen as a form of female empowerment, after the price increases women work more than before, and in the context of material and time deprivation it is hard to interpret this as an increase in empowerment.

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Table 8: Yearly hours of work of the estimated Hybrid Tobit model, 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)
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)
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)

	Household farming		***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)
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)
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: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12.) ***,**,* significant at 0.01, 0.05 and 0.1 level, respectively. Standard deviation in parentheses.

Table 9: Real price indices for the main staple food consumed in Uganda (expressed in Uganda shillings)

	2009-10	***2010-11***	***2011-12***
Matooke	49.90 (23.54)	39.53 (21.07)	44.11 (23.42)
Cassava	11.18 (6.84)	12.08 (8.43)	20.02 (22.72)
Maize	7.99 (3.63)	15.24 (10.47)	13.63 (5.72)
Cereals	14.12 (3.91)	12.45 (8.19)	20.58 (6.97)
Beans	10.6 (3.91)	5.98 (3.55)	12.74 (4.33)
Fruits & Vegetables	4.86 (1.79)	6.82 (3.56)	7.3 (3.19)

Source: Authors' elaboration, based on UNHS (2009-10; 2010-11; 2011-12).
Standard deviation in parentheses.