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ORIGINAL ARTICLE

Time use and food insecurity in female-headed households in Brazil

Cicero Augusto Silveira Braga*
Lorena Vieira Costa**

In Brazil, female-headed households disproportionately experience food insecurity. However, empirical and theoretical evidence shows that women are better than men at allocating intra-household resources to achieve well-being. In observation of this paradox, the present work studies the process of poverty feminization, and presents a collective decision model to understand the vulnerability situation of women. Specifically, we aimed to observe how time use and food insecurity correlate. We estimated an ordered probit model with Brazilian National Household Sample Survey data. Our studies found that women manage a double burden of both paid and unpaid jobs. This increases their risk of food insecurity, confirming the importance of time allocation in household well-being. Conversely, this effect is inverted when household tasks are shared with another member, specifically the spouse. Single mother households still face several challenges, which require specific policies and studies.

Keywords: Time-use. Food insecurity. Female-headed household.

* Universidade Federal de Viçosa (UFV), Viçosa-MG, Brazil (ciceroaugustosb@gmail.com; https://orcid.org/0000-0002-7035-4926).
** Universidade Federal de Viçosa (UFV), Viçosa-MG, Brazil (lorena.costa@ufv.br; https://orcid.org/0000-0002-0293-9842).

Introduction

Food and nutrition insecurity are phenomena especially present in developing countries. This may be related to low human productivity, insufficient physical and cognitive development and, therefore, socioeconomic vulnerability (BRAGA; COSTA, 2020; KEPPLE, 2014). In Brazil, it is still more predominantly found in households headed by women (22.55%) than in those headed by men (20%) (IBGE, 2014a). However, theoretical and empirical evidence shows that women tend to better allocate resources for intra-household well-being, especially concerning health and food (BANERJEE; DUFLO 2011). Underlying this paradox, there are some characteristics that make female-headed households fundamentally different and more vulnerable in Brazil.

Feminization of poverty is a theory highlighting the particularities of gender vulnerability and household composition. It argues that women experience a relative disadvantage in poverty because they often perform double shifts of work; that is, the execution of paid and unpaid jobs, the latter usually being domestic tasks (MARCOUX, 1998; BARDASI; WODON, 2006). This is especially true in single mother households, which are increasing in number within the Brazilian demography (LIU; ESTEVES; TREVIÑO, 2017).

Related to this, the concept of time poverty considers an individual's available time for rest and leisure, after computing the total working time. According to Bardasi and Wodon (2006), time poverty is fundamentally a female problem. In developed countries, women's increased labor market participation has decreased their time allocated to domestic tasks, while in developing countries, it has only made their total workload increase (HIRATA, 2002).

In this paper, we aim to study the relationship between time constraints faced by women-headed households and food insecurity. Namely, we seek to answer three main questions: (i) Are households headed by women more likely to be food and nutrition insecure? (ii) Is the potential disadvantage of these households associated with the double burden[1] of women? (iii) Does having someone in the household to share domestic tasks with help women overcome food insecurity?

The hypotheses are tested with an ordered probit methodology, considering different levels of food insecurity and nutrition severity. We use household level data drawn from the 2013 National Household Sample Survey. The paper is structured as follows: in section 2, we present the background on time use and food insecurity. Section 3 shows the theoretical background that supports the hypotheses, and the methodology and data. Section 4 discusses the econometric results. Finally, we present conclusions.

[1] For work double burden, we consider individuals that allocate time to paid and unpaid jobs, the latter represented by domestic activities.

Food insecurity and timeuse: a gendered background

Food and nutritional insecurity is a broad issue which reflects a state where individuals cannot regularly and permanently access quality and sufficient food without compromising access to other essential necessities (KEPPLE, 2014). The phenomenon is strictly related to several other vulnerabilities such as poverty, human rights, public policies and gender relations (CONTI, 2009; KEPPLE, 2014).

Indeed, households headed by women are more prone to food insecurity, as measured by such indicators as anthropometric measures, undernourishment, insufficient calorie intake, and by the psychometric scale – the most used measure in Brazil (BRAGA; COSTA, 2020; HACKETT *et al.*, 2008; KEPPLE; SEGALL-CORRÊA, 2011). This relationship is also commonly observed in different countries (MALUF; MENEZES, 2021).

For example, in Bangladesh, Mallick and Rafi (2010) found evidence confirming women's increased vulnerability to food insecurity. However, among traditional groups presenting nontraditional gender roles, women experienced more division of domestic tasks, and more freedom to participate in the paid labor market. Within these communities specifically, no evidence sustained gender differences in food insecurity. Omonona and Agoi (2007) further showed that women heads of household are more likely to accept informal jobs in order to guarantee food security, making them more vulnerable to exogenous shocks. In rural India, for example, birth order and gender in households raising young children lead to an unbalanced resource allocation, with girls unfavored in terms of food security (GUPTA, 1987). Likewise, in Ethiopia, Hadley *et al.* (2008) found a gender bias against teenage girls.

Several papers analyzing food insecurity in Brazil found a relationship with individual characteristics such as income, schooling, and race (HOFFMANN, 2008). Regional and urban living also factor into this phenomenon (FACCHINI *et al.*, 2014; YUYAMA *et al.*, 2007; SEGALL-CORRÊA *et al.*, 2008), as do conditional cash transfer programs such as *Bolsa Família* (ANSCHAU; MATSUO; SEGALL-CORRÊA, 2012; CABRAL *et al.*, 2014; ROCHA, 2015). Poverty, absence of assets and residential characteristics (presence of children or elderly and household density) are also relevant to the state of vulnerability (COSTA *et al.*, 2015; LIMA; PAIXÃO; SILVA, 2016; FERREIRA *et al.*, 2014).

Since Brazilian households headed by women are the most vulnerable socially and economically (IBGE, 2014a), empirical evidence shows a positive correlation with dummy variables indicating women household headship and food insecurity. However, gender alone does not address the real reasons that lead these households to such vulnerable situations. It is important to disentangle this correlation, shedding light on what makes women more vulnerable. We claim that households headed by women are at a disadvantage specifically due to women's workload and lack of time.

Gender roles are especially more rigid in developing countries (LIU; ESTEVE; TREVIÑO, 2017), and are usually enforced at a younger age. Given that boys tend to have more incentives for better investments in their own welfare (DUFLO, 2012), girls' early roles

consequentially reflect their future outcomes as women. As Faria and Moreno (2012) and Fernandez (2018) pointed out, and based on the Feminist Economics approach (FERBER; NELSON, 1993), gender analysis must go beyond simple differences between male and female performance. It must find the intrinsic characteristics that lead to so-called gender roles, which diminish opportunities for women and leave them in vulnerable scenarios.

It is important to factor in time use when analyzing differences between men and women, since women tend to have a bigger workload when considering both paid and unpaid jobs. Unpaid labor, usually consisting of domestic activities, is mainly performed by women. An important part of this time is actually dedicated to food preparation and other food security and nutritional demands (FERNANDEZ, 2018). This labor has an invisible economic output; women are doing more work but not profiting from it, and this increases their vulnerability. According to Ferrant, Pesando, and Nowacka (2014), women spend two to ten times as much of their time on unpaid care work compared to men. Time use analysis is the missing link in labor outcome studies concerning the gender gap, and it affects participation, wages, and job quality.

This unbalanced time allocation – one that increases the woman's total workload – also explains different welfare outcomes between men and women, such as poverty rates (ZILANAWALA, 2016; BRADSHAW; CHANT; LINNEKER, 2017), increase in health problems (VÄÄNÄNEN *et al.*, 2005), quality of leisure time (CHATZITHEOCHARI; ARBER, 2012; SAYER, 2005), educational standards (CRAIG, 2006), stress levels (MACDONALD; PHIPPS; LETHBRIDGE, 2005), and so on. Specifically regarding food security, Rao and Raju (2020) studied time use of women workers in rural India, and showed that in peak agricultural seasons, they devoted less time to care work, which negatively affected household nutrition. This is because men spent this time migrating to search for better opportunities, leaving the care and reproductive work to women. In Brazil, the differences in time allocation and women's higher work burden is unequivocal (FONTOURA; ARAÚJO, 2016). Jesus (2018) shows that a woman's time dedicated to unpaid domestic work through all lifetime in 2013 corresponded to 10.4% of national GDP.

Combining both productive and reproductive contributions to the household, men and women contribute very similarly to the economy. However, female-headed households are still at a greater disadvantage compared to male-headed households. Our aim in this work is to contribute to the literature by linking time constraints and the importance of the division of domestic chores to household food security and nutrition.

Theoretical framework

In the mainstream economic literature, time is a main resource allocated between leisure and work. The latter, specifically, can be divided between paid and unpaid work, which is not equally assigned among spouses. To comprehend the behavior and uncover the path that may lead female-headed households to more vulnerable scenarios, we use the class

of collective models.[2] Namely, we adapt the Conjugal Model proposed by Carter and Katz (1997) in light of the Feminist Economics theory (FERBER; NELSON, 1993).

Since the biggest differences in bargaining power derive from economic differences between men and women outside the household, this approach led us to a structural analysis of patriarchal inequalities (FOLBRE, 1986). The model allows us to observe how the division of household tasks and the participation of women in the labor market may help explain food insecurity situations in households. It starts with a household initially formed by male (m) and female (f) spouses (1):

$$\begin{array}{ll} \max U_f(x_f, z \mid \theta) & \max U_m(x_m, z \mid \theta) \\ s.a. & s.a. \\ p_f x_f \leq w_f l_f^w + \theta & p_m x_m \leq w_m l_m^w + \theta \\ z = a_z(l_f^z + \hat{l}_m^z) & z = a_z(l_m^z + \hat{l}_f^z) \\ l_f^z + l_f^w \leq L_f & l_m^z + l_m^w \leq L_m \end{array} \quad (1)$$

Where the utilities of each member (U_f, U_m) are the function of private goods (x_f, x_m) and z is conditional to the time devoted to domestic tasks imposed by the conjugal contract (θ). Each member is restricted to purchasing x private goods by his or her personal income, providing labor in the market, by an exogenous wage rate specific to gender (w_f, w_m); Z is equivalent to household food security and is produced from the time dedication, given a technology linear production function $z = a_z l_z$; L is the sum of individual time allocated to produce $Z(l_f^z + l_m^z)$. Here, l_m^z represents the male labor supply contribution to produce z anticipated by the woman. For each individual (f, m), the problem of maximization obtained in (1) is expressed as a Lagrange function that, for women, is expressed by

$$L_f = U_f\left(x_f, a_z(\hat{l}_m^z + \hat{l}_f^z)\right) + \lambda_f\left(w_f(L_f + l_f^z) + \theta - p_f x_f\right) \quad (2)$$

Where λ is the shadow-price of the income controlled by the woman. Admitting interior solutions, the first order conditions can be rewritten as (2.a – 2.c):

$$\lambda_f = \frac{\partial U_f / \partial x_f}{p_f} \quad (2.a)$$

$$\left(\frac{\partial U_f}{\partial_z}\right) a_z = \lambda_f w_f \quad (2.b)$$

$$w_f(L_f - l_f^z) + \theta - p_f x_f = 0 \quad (2.c)$$

Condition 2.b indicates that women will allocate total labor supply to produce Z until the returns of marginal utility equals the opportunity cost of labor. That is, for a woman who has low levels of income and consumption of x_f, such marginal utility is high and, from 2.a, λ will be high. This solution supports the concept that women would supply less of her work to maintain food security (Z), since they will have to assign more time to more profitable

[2] Collective models consider that individual preferences in a household are different and *per capita* indicators cannot be simply aggregated in an individual budget constraint, admitting the possibility of unequal distribution of household resources. For this discussion, see Alderman *et al.* (1995) and Bourguignon and Chiappori (1994).

activities (paid work), even if w_f is low. In this case, it is seen that positive cash transfers to the woman could increase her consumption levels and reduce the shadow price, allowing the maximization of labor supply to produce Z.

It must be noted that sharing domestic tasks with a male spouse (θ) is an incentive to modify autonomous decisions of time allocation in the household. In single mother households, this is one more limitation, since θ does not exist. All the work to produce Z is, therefore, up to the woman, leading to a more vulnerable position. Therefore, this model suggests that the unequal allocation of intra-household resources is important to analyze policies, because its pattern is mutable and economically endogenous, thus constructed with a gender bias. Furthermore, it shows how labor decisions (also built in family patterns and gender roles), such as the sharing of domestic tasks, can influence household food insecurity.

Empirical strategy

In this paper, we follow the main measure of food insecurity used in Brazil, the Brazilian Scale of Food Insecurity (EBIA), originally proposed by the USDA (COLEMAN-JENSEN; GREGORY; SINGH, 2014) and adapted to Brazil. These data are collected by the *Pesquisa Nacional de Amostra Domiciliar* (PNAD), a household level survey, carried out yearly in the country. EBIA is a supplementary survey inside PNAD last implemented in 2013.

The EBIA is based on 14 "yes or no" questions that lead to different levels of food insecurity perception in the household. These levels are summarized in four categories, such as Food Security and Nutrition (FSN), Low Food Insecurity (LFI), Moderate Food Insecurity (MFI) and Severe Food Insecurity (SFI), both in households with and without residents under 18 years old, as shown in Table 1.

TABLE 1
Levels, cut-offs and description of food security classifications

Food insecurity situation	Cut-off points		Description
	With residents under 18 years old	Without residents under 18 years old	
Food Security and Nutrition (FSN)	0	0	The family/household has regular and permanent access to quality food in sufficient quantity without compromising access to other essential needs.
Low Food Insecurity (LFI)	1-5	1-3	Concern or uncertainty about access to food in the future; inadequate quality of food resulting from strategies aimed at not compromising the quantity of food.
Moderate Food Insecurity (MFI)	6-9	4-5	Quantitative food reduction among adults and/or disruption in feeding patterns resulting from lack of food among adults.
Severe Food Insecurity (SFI)	10-14	6-8	Quantitative reduction of food among children and/or disruption of food patterns resulting from lack of food among children; hunger (when someone does not eat all day due to lack of money to buy food).

Source: IBGE (2014b).

Most empirical studies that analyze food insecurity using EBIA[3] tend to focus on two conditions: the households would either be considered secure (within the food security and low food insecurity categories) or insecure (moderate food insecurity and severe food insecurity). However, categorizing its different levels provide a broader analysis of the characteristics that lead to a transition between the different degrees of vulnerability. Thus, in this paper we consider the four categories and use an econometric model where the dependent variable, the observed food insecurity (Y), assumes categorical and ordinal values (from 1 to 4). When the latent variable – that represents the unobserved situation of food insecurity (Y^*) – crosses the threshold, the household goes through different levels of observed food insecurity, which can be considered, as suggested in Table 1, as low, moderate or severe.

Then, supposing that the unobserved latent variable (Y^*) follows a linear regression model $Y_i^* = x_i'\beta + u_i$, the likelihood of observing a particular situation of food insecurity (Y) is given by the likelihood of Y^* being in a range defined by the threshold. Assuming a normal distribution of the residual term u_i, the estimation by maximum likelihood leads to an ordered probit model. Since the dependent variable refers to categories, the effects of the explanatory variables provide the probability of occurrence of the event, given the variations of Y[4].

Our estimations are based on the following specification:

$$Y_i = \alpha_i + \beta_1 WomenHead_i + \beta_2 DoubleBurden_i + \beta_3 TasksDivision_1 + \beta_4 TasksDivisionWSpouse_i + \beta_5 X_i' + \varepsilon_i \quad (3)$$

For all i households, Y is the dependent variable and assumes 0 in the case of food security, 1 for low food insecurity, 2 for moderate food insecurity and 3 for severe food insecurity. *WomenHead* indicates if the household is headed by a woman, *DoubleBurden* if the woman head of household engages in both paid and unpaid jobs, $TasksDivision_i$ if domestic chores are divided in the household[5] and, lastly, $TasksDivisionWSpouse_i$ is a dummy variable that indicates if the male spouse declares that he performs domestic chores. X_i' is a vector of observable control variables (described in Table 2) and ε is the residual term.

Equation (3) was estimated by one main variable of interest at a time, in order to shed light on how the gender of the household head correlates with their jobs, and how the presence or absence of a male spouse with whom to share domestic tasks affects this burden. With this exercise, we were able to verify the overall effect of the gender of the household head, controlling for the variables that represent the time available to the women. In order to consider households headed by single women with children, we specified another equation:

[3] See Hoffmann (2008), Oliveira *et al.* (2010), and Panigassi *et al.* (2008) for examples.

[4] That said, the coefficients could still be interpreted by the signal of their respective parameters, which will indicate if the regressor increases or decreases the latent variable.

[5] Dummy if household tasks are performed by someone else.

$$Y_i = \alpha + \beta_1 WomenHead + \beta_2 DoubleBurden + \beta_4 SingleMother + \beta_5 X_i' + \varepsilon_i \quad (4)$$

Where *SingleMother* is a dummy for variables composed with mother and child(ren) and everything else as an equation (3).

For comparison purposes, we added to the equations a set of covariates divided into three main blocks: a) head of household characteristics; b) household characteristics; c) stratified *per capita* income. All control variables are listed in Table 2. The most complete specification includes controls that are potentially endogenous. Our main variables of interest might also be endogenous. Even though sex is exogenous to the individual, as head of household (or declaring oneself as such) may sometimes be a choice, as affected by marriage, divorce, living alone or position in a family. If this is the case, it is possible that unobservable characteristics simultaneously correlate to household headship and vulnerability to food insecurity.

According to Liu, Esteve and Treviño (2017), a female empowerment process that, along with a demographic transition, can explain the rise in women-headed households. This process, which is unmeasured, can also explain not only the household's food security status, but also the decision of women to declare themselves as the head of their household. Let q be a set of unobserved variables:

$$q = \rho_0 + \rho_1 WomenHead + \upsilon_i \quad (5)$$

Omitting q, which is relevant unobservable characteristics from the estimations, make β_1 a biased parameter, since it omits the real effect of gender on food insecurity. From the omitted variable bias formula, we can represent the real interest effect as:

$$\beta_1 = \gamma_1 + \rho_1 \gamma_2 \quad (6)$$

Where γ_1 is the causal effect of households headed by women on food insecurity, ρ_1 is the effect of a woman-headed household over the vector of unobserved variables q, and γ_2 is the effect of vector q over food insecurity. On one hand, it is expected that a female-headed household associates positively with the variables unobserved in $q(\rho_1 > 0)$. On the other hand, female empowerment and other unobservable variables are linked to decision-making by women, as well as their bargaining power at home. Considering that women are the ones that best allocate intra-household resources (DUFLO, 2012), empowerment is negatively associated with food insecurity ($\alpha 2 < 0$).

That said, even though we do not claim a causal interpretation of gender parameters, we assume they are underestimated. Although we are not establishing causal effects, our parameters reflect the correlations of women-headed households and their time use structure. The "head of household" position is based on each individual's perception of other members' roles in the household, and its perception is ruled by culture, belief and experiences. Causal effects of woman heads can only be established from objective measures and controlled methodology, which is impossible given the available data. Table 2 shows the variables considered in the estimations.

TABLE 2
Variables and description

	Variables	Description
Dependent variable	Food insecurity	Categorical variable: 0 if food security; 1 if low food insecurity; 2 if moderate food insecurity and, 3 if severe food insecurity
Exogenous variables		
Interest variables	Female head of household	*Dummy*: 1 if the person of reference is a woman, 0 otherwise
	Double burdens	*Dummy*: 1 when the woman does paid and unpaid work6, 0 otherwise
	Share of domestic tasks	*Dummy*: 1 if the domestic work was done by more than one person in the household, 0 otherwise
	Domestic tasks done by spouses	*Dummy*: 1 when the domestic work was done by the spouse, 0 otherwise
	Single mother	*Dummy*: 1 if the household is composed of a mother and children, without a spouse, 0 otherwise
	Working woman head of household	*Dummy*: 1 when the woman head of household is in the labor market, 0 otherwise
Head of household characteristics	Race	*Dummy*: 1 if the person of reference is black (*pretos ou pardos*), 0 otherwise
	Education	Years of study
	Elderly	*Dummy*: 1 when the head of household is more than 60 years old, 0 otherwise
	Less than 5 years old	*Dummy*: 1 when there are children less than 5 years old in the household, 0 otherwise
	More than 5 and less than 18 years old	*Dummy*: 1 for the presence of dwellers between 5 and 18 years old, 0 otherwise
	Per capita income	Dummies for *per capita* income in terms of minimum wage (m.w.): • less than ¼ • between ¼ and ½ • between ½ and 1 • between 1 and 2 • between 2 and 5 • more than 5
	Household density	Number of dwellers per bedroom
	Rural	*Dummy*: 1 for rural households, 0 otherwise
	Access to drinking water	*Dummy* 1 for the presence of piped water 0 otherwise
	Electricity	*Dummy*: 1 for the presence of electricity in the household, 0 otherwise
	Sanitation	*Dummy*: 1 for the presence of indoor plumbing, 0 otherwise

Source: IBGE (2014a).

[6] The unpaid work is represented by domestic tasks such as cleaning, cooking, ironing and washing clothes, washing dishes, guiding domestic workers, and taking care of children or other residents (IBGE, 2013).

Results

Food insecurity and Brazilian households

Table 3 shows that 77% of Brazilian households were food secure in 2013.[7] However, approximately 15 million households[8] still faced some type of food insecurity, more frequently in the low intensity (14.7%), followed by 4.6% in moderate and 3.23% in severe food insecurity situations.

TABLE 3
Food insecurity situation of Brazilian households
Brazil – 2013

EBIA	Number of households	Percentage (%)	Cumulative (%)
Food Security (FS)	50,551,428	77.45	77.45
Low Food Insecurity (LFI)	9,621,364	14.74	92.19
Moderate Food Insecurity (MFI)	2,988,014	4.58	96.77
Severe Food Insecurity (SFI)	2,110,162	3.23	100.00
Total	**65,270,968**	**100.00**	

Source: IBGE (2014b).

This prevalence should be different as household heterogeneities are explored. In order to highlight this issue and other differences according to the gender of the head of household, Table 4 presents sample characteristics divided by households headed by women and men. As presented in Table 4, 25.34% of households headed by women were categorized as having some form of food insecurity, whereas this percentage was 20.85% for male-headed households.

Households headed by women have the highest incidence of food insecurity in all categories (severe (4%), moderate (5%) and low (16%) compared to those headed by men (3%, 4% and 13% respectively)). A significant percentage of women heads of household are single mothers (40%), so they alone are responsible for household maintenance. Moreover, the work burden is worse for women: 44% of them performed both paid and unpaid jobs, compared to 25% of men.

Men only shared domestic work with their spouses in 13.62% of the households. As showed by Pinheiro and Medeiros (2016), the polarization of domestic activities remains independently of social classes and is intrinsically a cultural phenomenon. It must be noted that the variable only captures the effects of the division and not the total burden of work. According to IBGE, in 2013 the average weekly hours dedicated to domestic chores were 4.9h by men, while 21.7h for women. It states that, even though the division exists in the household, women still dedicate a way more to such activities than men.

[7] In 2009, latest data collected, 70% of the households showed FSN, while 18.7%, 6.5% and 5% showed LFI, MFI and GFI respectively (IBGE, 2014a).

[8] Considering the weighted sample.

TABLE 4
Descriptive statistics of Brazilian household composition according to the gender of household head
Brazil – 2013

Variables	Women head of household	Men head of household
EBIA (%)		
FIN	74.66	79.14
LFI	16.04	13.95
MFI	5.39	4.08
SFI	3.91	2.82
Single mother (1) (%)	39.78	0.00
Double burden (%)	44.00	25.18
Male spouse makes domestic tasks (%)	13.62	-
Average income (%)		
0 – 1/4 minimum wage	13.64	12.23
1/4 – 1/2 minimum wage	14.32	13.34
1/2 – 1 minimum wage	28.66	26.89
1 – 2 minimum wage	25.47	27.11
› 2 minimum wage	17.91	20.4
Schooling (average years of study)	8.43	7.50
Black (%)	55.91	55.79
Elderly (%)	30.56	23.11
Children (%)		
‹5 years old	12.05	18.15
Between 5 and 18 years old	35.12	24.06
Average household density	1.63	1.97
Rural (%)	21.83	78.17
Water (%)	96.22	93.95
Electricity (%)	99.55	99.31
Sewer (%)	68.02	60.12

Source: IBGE (2014b).
(1) The PNAD data does not consider households composed only by father and children, nor determine paternal relations to observe the "single father" households.

Even though women heads of household have higher levels of education (women study for 8.43 years on average, *versus* 7.5 years for men), they are predominantly located in the lower income strata. In black households, elderly women are more frequently found as heads of household (30.5%) than elderly men (23.11%). Finally, rural households were predominately headed by men (78%), which reflects a more structured gender bias in rural areas.

Taken as a whole, descriptive data show that female-headed households are still in a more vulnerable food security situation. However, as previously shown, there is a paradox, since, in households headed by women, schooling background and presence of assets (water, electricity, etc.) are equivalent or higher compared to male-headed households. It reinforces the need to investigate possible structural causes that expose households headed by women to food insecurity, and to present worse performances in other wellbeing measures.

Gender factors associated with food and nutrition insecurity

In this section, we present how the household head's gender and time allocation, including double burdens and domestic task division, affects food insecurity. Table 5 shows 5 different alternative specifications based on equation (1) – columns (1) to (4) – and equation (2) – column (5) –, without additional controls.

TABLE 5
Gender and time use associated to FIN in Brazilian households
Brazil – 2013

Variables	(1)	(2)	(3)	(4)	(5)
Women head of the household	0.150***	0.183***	0.0892***	0.0887***	0.0976***
	(0.00034)	(0.00040)	(0.00047)	(0.00047)	(0.00046)
Double journey	-	0.0769***	-0.114***	-0.110***	0.0883***
		(0.00053)	(0.00054)	(0.00054)	(0.00054)
Share of domestic tasks	-	-	0.221***	0.258***	-
			(0.00053)	(0.00053)	
Male spouse makes domestic tasks	-	-	-	-0.144***	-
				(0.00083)	
Single mother	-	-	-	-	0.214***
					(0.00053)
Number of observations	65,270,968				

Source: Results of the research. Dependent variable assumes value 0 for FS, 1 for LFI, 2 for MFI and 3 for SFI.
Note: * p<0.05; ** p<0.01; *** p<0.001. Standard errors in parenthesis.

Regarding column (1), the results show that households headed by women were more likely to face severe food insecurity. This situation is worsened when they face a double burden (column 2), that is, both paid and unpaid work at home. However, the effect is softened when controlled for the division of domestic work, especially when shared with the spouse (columns 3 – 4). The marginal effects obtained by all five specifications above for the woman headed households are shown in Table 6, for all levels of food insecurity.[9]

TABLE 6
Marginal effects of the woman as head of household for the food insecurity and nutritional situation of Brazilian households
Brazil – 2013

Variables	(1)	(2)	(3)	(4)	(5)
FSN	-0.04544***	-0.05573***	-0.02691***	-0.02676***	-0.02949***
	(0.0001)	(0.0004)	(0.0001)	(0.0001)	(0.0001)
LFI	0.02314***	0.02829***	0.01383***	0.01376***	0.01514***
	(0.0001)	(0.0001)	(0.0007)	(0.0007)	(0.0007)
MFI	0.01119***	0.01374***	0.00661***	0.00657***	0.00725***
	(0.0003)	(0.0006)	(0.0004)	(0.0004)	(0.0003)
SFI	0.01112***	0.01369***	0.00648***	0.00643***	0.0071***
	(0.0001)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Number of observations: 65,270,968					

Source: Own elaboration.
Note: *** p<0.001. Standard errors in parenthesis.

[9] The covariates marginal effects are available for consult under request for the authors.

Estimation 1 shows that households headed by women have 4.5 percentage points (p.p.) fewer chances of being food secure, and are 2.3pp., 1.1p.p. and 1.1 p.p. more likely to experience low, moderate and severe food insecurity, respectively. When we included the double burden (column 2) and tasks division (3), the fact that the household is headed by a woman presented a smaller negative effect on the chances of food security (-2.7 p.p.). The probability of severe food insecurity is also reduced to 0.6 p.p. These results suggest that the labor structure (both paid and unpaid) completed by women and the characteristics of their households affect household food insecurity, and not the gender of the household head alone. That said, when controlled by managing a double burden, households headed by women are less likely to face food insecurity (columns 2 and 5), confirming the hypothesis derived from the theoretical model regarding time use. Thus, it is reasonable to suggest that when time allocation in the household is balanced between spouses, individuals in woman headed households tend to be better off in terms of food security.

These results are in line with assumptions of time poverty and Feminist Economics theories. According to Medeiros and Pinheiro (2018), if men and women in Brazil proportionally divided their time devoted to both paid and unpaid activities, women's total workday would be, on average, reduced by one quarter. Moreover, since household chores are not profitable, they are usually ignored as "real work" and, therefore, are not computed as an economic activity. Given that women are primarily responsible for such activities, their full workload is underestimated, generating a two -way vulnerability path: less time for leisure and wellbeing, and disqualification and devaluation of their work. A key result in this discussion is the inclusion of the division of domestic tasks to our models.

Columns 3 and 5 show that when such activities are not performed exclusively by the women head of household, the gender effect on food insecurity is actually negative, that is, households headed by women are less prone to face food insecurity. It suggests that when time constraints are more flexible for women, the household tends to be in a better position. Specifically, when the male spouse completes domestic work (column 4), not only the effect of double burden is lessened, but also the relative disadvantage of household headed by women is reduced.

Therefore, our results suggest that household vulnerability in terms of food insecurity might not be strictly related to women's participation in the labor market, but due to the time constraints they face through the accumulation of tasks. Indeed, being in the labor market is beneficial to these households (columns 3 – 4) when the household structure allows women to allocate their time between work and leisure adequately. Our results are consistent with Soares (2008), which states that a primary explanation of gender inequality in Brazil is the polarization of time use and the excessive time burden on women when performing both paid and unpaid work.

Moreover, there are also several households with only women and children, an increasingly common configuration in Brazilian demographics, especially in more vulnerable groups, as studied by Sorj (2004). According to Castro (1999), it is common that these

households have already faced a divorce, leaving women responsible for the household and childcare but with fewer resources available. Time constraints associated with historical gender roles restrict these women from investing in their own careers, leading to more precarious and informal jobs. The negative relationship between food security and single mother households is especially consistent with the findings in developing countries, which highly correlate low income levels with household structure (MCINTYRE *et al.*, 2002, 2003; COLEMAN-JENSEN; GREGORY; SINGH, 2014).

In Table 7 we present the influence of all covariates on food insecurity with five different specifications. Although we include controls that are potentially endogenous, they shed light on the mechanisms underlying the effects of interest. They also verify how the coefficients change as these controls were added.

The controls were first added in three blocks: column 2 includes individual characteristics of the household head, column 3 has household characteristics and column 4 includes income stratification. Overall, we show that individual covariates increase the effects associated with food insecurity in households headed by women, but *per capita* income controls (based on the highest income range) reduce this coefficient.

Column 6 shows that households headed by black people are more likely to face severe food insecurity. This result is consistent with the literature and reflects the portrayal of poverty in Brazil. According to IPEA (2017), historical inequalities faced by the Brazilian black population leads them to a situation of greater vulnerability. Indeed, our data show that households headed by black people have, on average, disadvantages in terms of schooling, average income *per capita* and presence of durable goods such as a refrigerator and stove, for example.

Schooling background also contributes to reducing food insecurity, since more educated individuals tend to have better income, and guarantee food standards in the household quantitatively and qualitatively. Indeed, when controlled for educational covariates, gender effects are greater (since, on average, women are more educated than men). According to the Gender Gap Index (WORLD ECONOMIC FORUM, 2017), although Brazil is among the group of countries that achieved educational gender equality, the country ranks 83rd in economic participation and 110th in political empowerment of women. That is, even though women study more, there are huge equality gaps of inclusion in the economic and productive sphere.

Households headed by the elderly also have greater chances of food security, which can be explained by a more stable environment. Elderly individuals are less exposed to exogenous shocks such as unemployment, despite having social security revenues (ROSA *et al.*, 2012). With social security universalization and improvement of living conditions, according to Camarano (2003), elderly women are the most responsible for household well-being. Moreover, the household bargaining process between men and women is altered by the presence of children (CEBALLOS; ROBLES, 2014). However, as we show in column (6), the presence of children under five increases the chances of food insecurity. In such cases, women are especially required to dedicate time to domestic tasks, increasing their

workload. On the other hand, with older children and adolescents, the opposite is true, since at this point the children require relatively less of women, as stated by Leone, Maia, and Baltar (2010).

TABLE 7
Factors associated with food and nutritional insecurity for Brazilian households
Brazil – 2013

Variables	(3)	(6)	(7)	(8)	(9)
Women head of household	0.0892***	0.145***	0.244***	0.0678***	0.153***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Double journey	-0.114***	-0.0355***	-0.104***	0.0108***	0.0357***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
Share of domestic tasks	0.221***	0.184***	0.119***	0.113***	0.0781***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Race	-	0.381***	-	-	0.254***
		(0.0002)			(0.0002)
Education	-	-0.0731***	-	-	-0.0389***
		(-1789.58)			(0.0000)
Elderly		-0.315***	-	-	-0.132***
		(0.0002)			(0.0002)
‹ 5 years old		0.261***	-	-	-0.00528***
		(0.0002)			(0.0003)
› 5 years old | ‹ 18 years old		-0.0300***	-	-	-0.0124***
		(0.0002)			(0.0002)
Home density		-	0.234***	-	0.103***
			(0.0001)		(0.0001)
Rural		-	0.00352***	-	-0.150***
			(0.0004)		(0.0003)
Water		-	-0.575***	-	-0.404***
			(0.0004)		(0.0004)
Electricity		-	-0.410***	-	-0.359***
			(0.0012)		(0.0012)
Sewer		-	-0.477***	-	-0.297***
			(0.0002)		(0.0002)
Income 1		-	-	1.442***	1.019***
				(0.0004)	(0.0005)
Income 2		-	-	1.406***	0.945***
				(0.0004)	(0.0005)
Income 3		-	-	0.984***	0.648***
				(0.0004)	(0.0004)
Income 4		-	-	0.541***	0.343***
				(0.0004)	(0.0004)
Number of observations		65,270,968			

Source: Own elaboration.
Note: * p<0.05; ** p<0.01; *** p<0.001. Z statistics in parenthesis.

Regarding household structure (7), the results are consistent with Hoffmann (2008), and show that higher household density increases the chances of food insecurity, while

provision of services such as water, electricity and sanitation reduces this probability. Moreover, rural households are more prone to food insecurity, given their higher poverty levels and lack of infrastructure.

The inclusion of income controls in column (8) does not change the female head effect presented in column 5 (no controls included). However, a fundamental difference is that performing double working hours increases the household's chances of food insecurity, apart from reducing the negative coefficient of woman as the head of household. Therefore, it seems that although double burdens increase household overall income, its contribution is limited since it restricts leisure time. Naturally, higher income strata households tend to be less vulnerable, reinforcing that time spent on paid activities is important for the household if the tasks are reconciled among the other members, especially the male spouses (as seen in 4).

Although the inclusion of income does not alter gendered effects, other covariates are changed and confirm our arguments regarding gender roles in Brazil. Specifically, we see that children effects are basically null, and that rural living makes a household more vulnerable to food insecurity. In rural areas, women have the particular burden to produce for self-consumption – which is often invisible in the mainstream literature – and this production determines food security in rural households, since they are part of reproductive and productive aspects of rural life (WINDFUHR; JONSÉN, 2005).

Final remarks

The relationship between gender and household well-being is generally not unequivocal. On one hand, empirical evidence indicates that households headed by women are more likely to experience food insecurity. On the other hand, theoretical models and gender studies show that women tend to allocate household resources better for the benefit of the household.

Although the literature has considered differences with regard to chances of food insecurity by gender, there is a lack of evidence on the role of time variables in this context. In an effort to address this gap in the literature, we hypothesized that female-headed households are at a disadvantage in terms of time, and that this is the main channel through which the prevalence of food insecurity is higher in their households. In order to test this hypothesis, we explored the effects on Brazilian household food insecurity of a) being in a woman-headed household, b) the female head's double-burden of work, and c) sharing household tasks with a spouse.

This theme is especially important in Brazil, which is a country still facing aggravated socioeconomic vulnerabilities for female-headed households. Although food security has increased in the last decade, recent years show that specific groups, such as women, black people and the impoverished, are even more susceptible to exogenous shocks. This led to us to investigate intrinsic characteristics that may lead these groups to such vulnerable status, and how to help soften such effects.

To address this issue, we use household data and estimated different ordered probit models, allowing comparisons for different levels of food insecurity and gender relations. Our findings indicate that households headed by women actually have a greater chance of facing severe food insecurity. However, a portion of this effect is due to their work and household structure, based on gender roles. We show the importance of a balanced division of time and household tasks, especially between spouses.

Taken together, our results show that: i) households headed by women are more likely to present food insecurity; ii) a great part of this effect is due to time constraints faced by women and the lack of work division between women and men; iii) single mothers have even more severe constraints, and therefore are more likely to have more severe levels of food insecurity.

These results are restricted to heterosexual couples and, therefore, are limited for this household setting. It must be noted that, in Brazil, a great number of households are formed by different family arrangements such as extended families, and same-sex couples, for example. From the theoretical model, we see that the resources – related to food security and also the time – allocation could present a different gendered logic in the household. We suggest further research to investigate these specificities.

Therefore, we say that female empowerment should not be limited to women's insertion into the labor market, or access to basic rights such as education. Gender roles and biased structures are still predominant in woman-headed households, and destroying these patterns is imperative to guaranteeing equal opportunities to achieve well-being. Policies for equitable development must consider such particularities, as well as the pluriactive forms that families can constitute, such as single motherhood and homoaffective households, for example.

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About the authors

Cicero Braga has a Ph.D. in Applied Economics by Universidade Federal de Viçosa and works at the World Bank.

Lorena Vieira Costa has a Ph.D. in Applied Economics by Universidade Federal de Viçosa and is a professor at the same institution.

Contact address

Cicero Braga
Departamento de Economia Rural
Avenida Purdue, s/n, campus universitário, edifício Edson Potsch Magalhães, prédio anexo, 1º andar, sala 105
36570-900 – Viçosa-MG, Brazil

Lorena Vieira Costa
Departamento de Economia Rural
Avenida Purdue, s/n, campus universitário, edifício Edson Potsch Magalhães, prédio anexo, 1º andar, sala 105
36570-900 – Viçosa-MG, Brazil

Resumo

Uso do tempo e insegurança alimentar em domicílios chefiados por mulheres no Brasil

No Brasil, os domicílios chefiados por mulheres sofrem desproporcionalmente com a insegurança alimentar. Entretanto, as evidências empíricas e teóricas mostram que as mulheres alocam melhor do que os homens os recursos intradomiciliares para o bem-estar. Dado este paradoxo, o presente trabalho aborda o processo de feminização da pobreza e apresenta o modelo de decisão coletiva para entender a situação de maior vulnerabilidade feminina. Especificamente, objetiva-se observar como o uso do tempo e a insegurança alimentar se correlacionam. Para isso, estima-se um modelo *probit* ordenado usando os dados da PNAD. Os resultados mostram que as mulheres são as que mais se dedicam para realização de jornadas duplas de trabalho, o que aumenta o risco de insegurança alimentar, confirmando a importância da alocação de tempo para o bem-estar domiciliar. Inversamente, este efeito é contrário quando as tarefas do domicílio são divididas com outros membros, especialmente o esposo. Domicílios monoparentais, ainda, encaram diversos desafios, que requerem políticas e estudos específicos.

Palavras-chave: Uso do tempo. Insegurança alimentar. Domicílios chefiados por mulheres.

Resumen

Uso del tiempo e inseguridad alimentaria en hogares con jefatura femenina en Brasil

En Brasil, los hogares con jefatura femenina experimentan inseguridad alimentaria de manera desproporcionada. Sin embargo, las evidencias empíricas y teóricas muestran que las mujeres asignan mejor que los hombres los recursos dentro del hogar para lograr bienestar. En relación con esta paradoja, el presente trabajo estudia el proceso de feminización de la pobreza y

presenta un modelo de decisión colectiva para comprender la situación de vulnerabilidad de la mujer. Específicamente, nuestro objetivo es observar cómo se correlacionan el uso del tiempo y la inseguridad alimentaria. Estimamos un modelo *probit* ordenado con datos de la Encuesta Nacional de Hogares de Brasil. Los resultados muestran que las mujeres manejan una doble carga de trabajos remunerados y no remunerados, lo que aumenta su riesgo de inseguridad alimentaria y confirma la importancia de la asignación de tiempo en el bienestar del hogar. Por el contrario, este efecto se invierte cuando las tareas del hogar se dividen con otro miembro, en concreto, el cónyuge. Los hogares de madres solas aún enfrentan varios desafíos que requieren políticas y estudios específicos.

Palabras clave: Uso del tiempo. Inseguridad alimentaria. Hogares con jefatura femenina.

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