UNIVERSIDADE FEDERAL DE JUIZ DE FORA

FACULDADE DE ECONOMIA

PROGRAMA DE PÓS-GRADUAÇÃO EM ECONOMIA

THE VALUE OF TIME: ESSAYS ON HOUSEHOLD, LABOR, AND CONSUMPTION

Maria Victoria Garcia Rosa

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Tese apresentada ao Programa de Pós-Graduação em Economia da Universidade Federal de Juiz de Fora, como requisito parcial à obtenção do título de Doutor em Economia.

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Coorientadora: Prof. Dra. Kênia Barreiro de Souza

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“Women are not going to be equal outside the home until men are equal in it.”.

Gloria Steinem

RESUMO

Esta tese visa analisar as desigualdades de gênero na alocação de tarefas domésticas e entender a relação destas desigualdades com disparidades no mercado de trabalho e suas consequências sobre o consumo alimentar. A pesquisa é dividida em três artigos, cada um abordando aspectos distintos das dinâmicas intrafamiliares e seus efeitos sobre o trabalho remunerado, a divisão de tarefas domésticas e o consumo de alimentos. O primeiro ensaio investiga os determinantes da alocação de tempo entre tarefas domésticas e mercado de trabalho para casais brasileiros, com ênfase nas diferenças entre lares patriarcais, igualitários e não tradicionais. Utilizando um modelo de Regressões *Seemingly Unrelated* (SUR) com dados da Pesquisa Nacional por Amostra de Domicílios Contínua (PNADC) entre 2016 e 2019, os resultados indicam que a educação e a presença de crianças e idosos são determinantes importantes para a alocação de tempo, especialmente para mulheres. O estudo sugere que uma adoção mais ampla de práticas igualitárias poderia beneficiar não apenas as mulheres, mas também a economia como um todo, aumentando a participação feminina no mercado de trabalho e estimulando o crescimento econômico. O segundo artigo tem como objetivo analisar a influência das tarefas domésticas no salário dos indivíduos e na diferença salarial de gênero, utilizando a técnica de Variáveis Instrumentais (IV) com dados da Pesquisa Nacional por Amostra de Domicílios Contínua (PNADC) entre 2016 e 2019. Os resultados sugerem que o tempo dedicado às tarefas domésticas tem um impacto negativo nos salários, com as mulheres sendo mais afetadas. Além disso, a participação do parceiro masculino nas tarefas domésticas está associada ao aumento dos salários das mulheres. O terceiro artigo analisa a demanda alimentar das famílias, com foco no impacto do status ocupacional das chefes ou cônjuges sobre o consumo de alimentos. Utilizando a metodologia *Quadratic Almost Ideal Demand System* (QUAIDS) com dados da Pesquisa de Orçamentos Familiares (POF) de 2017-2018, os resultados sugerem que o emprego da mulher influencia as escolhas alimentares das famílias, especialmente de alimentos ultraprocessados, em que a demanda é mais elástica quando a mulher não está empregada. Em geral, os três artigos fortalecem a ideia de que as restrições e a alocação do tempo dentro da família possuem importantes consequências sobre diversas decisões e comportamentos.

Palavras-chave: Alocação de tempo intradomiciliar; Mercado de trabalho; Trabalho feminino; Consumo alimentar.

ABSTRACT

This thesis aims to analyze gender inequalities in the allocation of household chores and to understand the relationship between these inequalities, labor market disparities, and their consequences on food consumption. The research is divided into three articles, each addressing different aspects of intrafamily dynamics and their effects on paid work, the division of domestic labor, and food consumption. The first essay investigates the determinants of time allocation between domestic tasks and labor market activities for Brazilian couples, with an emphasis on differences across patriarchal, egalitarian, and non-traditional households. Using a Seemingly Unrelated Regressions (SUR) model with data from the Continuous National Household Sample Survey (PNADC) between 2016 and 2019, the results indicate that education and the presence of children and elderly individuals are important determinants of time allocation, especially for women. The study suggests that broader adoption of egalitarian practices could benefit not only women but also the economy as a whole by increasing female labor force participation and stimulating economic growth. The second article aims to analyze the influence of household chores on individual wages and on the gender wage gap, using the Instrumental Variables (IV) technique with data from the Continuous National Household Sample Survey (PNADC) between 2016 and 2019. The results suggest that time spent on domestic tasks negatively impacts wages, with women being more affected. Additionally, male partners' participation in domestic tasks is associated with higher wages for women. The third article analyzes household food demand, focusing on the impact of the occupational status of female household heads or spouses on food consumption. Using the Quadratic Almost Ideal Demand System (QUAIDS) methodology with data from the 2017–2018 Household Budget Survey (POF), the results suggest that female employment influences families' food choices—particularly regarding ultra-processed foods, for which demand is more elastic when the woman is not employed. Overall, the three articles reinforce the idea that time constraints and time allocation within families have significant consequences on various decisions and behaviors.

Key-words: Labor; Female labor; Intra-household time allocation; Food consumption.

LISTA DE FIGURAS

LISTA DE TABELAS

LISTA DE ABREVIATURAS E SIGLAS

2SLS Two-Stage Least Squares

AIDS Almost Ideal Demand System

CDF Cumulative Distribution Function

DD Differences in Differences

FDA Accumulated Distribution Function

GII Gender Inequality Index

GMM Generalized Method of Moments

GSD Gross Domestic Product

HB IV Heteroskedasticity-Based Instrumental Variable

IBGE Brazilian Institute of Geography and Statistics

IFGNLS Interated Feasible Generalized Non-Linear Least Squares

IV Instrumental Variables

OECD Organization for Economic Co-operation and Development

PDF Probability Density Function

Piglog *Price-Independent Generalized Logarithmic*

PNADC Continuous National Household Sample Survey

POF Family Budget Survey

QUAIDS Quadratic Almost Ideal Demand System

SUR Seemingly Unrelated Regression

ZCP Zero Consumption Problem

SUMÁRIO

INTRODUCTION

The increase in female labor force participation, which occurred in the last decades, resulted in changes in time allocation within the household. However, even with the greater participation of women in the labor market, research related to the use of time shows that, despite the increase in the male contribution to household chores, household activities are still more attributed to women and they are the main responsible for household chores (BIANCHI et al., 2000; FLORO, 2021).

According to data from the Continuous National Household Sample Survey (PNADC) for 2023, carried out by the Brazilian Institute of Geography and Statistics (IBGE) in Brazil, women spend about twice as much time on household chores as men. The data showed that women spent an average of 21.3 hours per week on household chores, while men spent 11.7 hours (IBGE, 2023).

In addition to this, men's household chores are often considered more "enjoyable" and are associated with sporadic activities, such as minor repairs and car cleaning. On the other hand, women tend to engage in tasks that occur on a daily basis, including cleaning, childcare, and managing meal preparations. This division of labor reflects societal norms and gender roles, where men's contributions to domestic responsibilities are often seen as intermittent and less demanding. At the same time, women bear the brunt of routine and essential tasks (COLTRANE, 2000; FUWA, 2004; LENNON; ROSENFIELD, 1994). This dynamic contributes to a broader discussion on gender equality and the need to challenge stereotypes associated with domestic work.

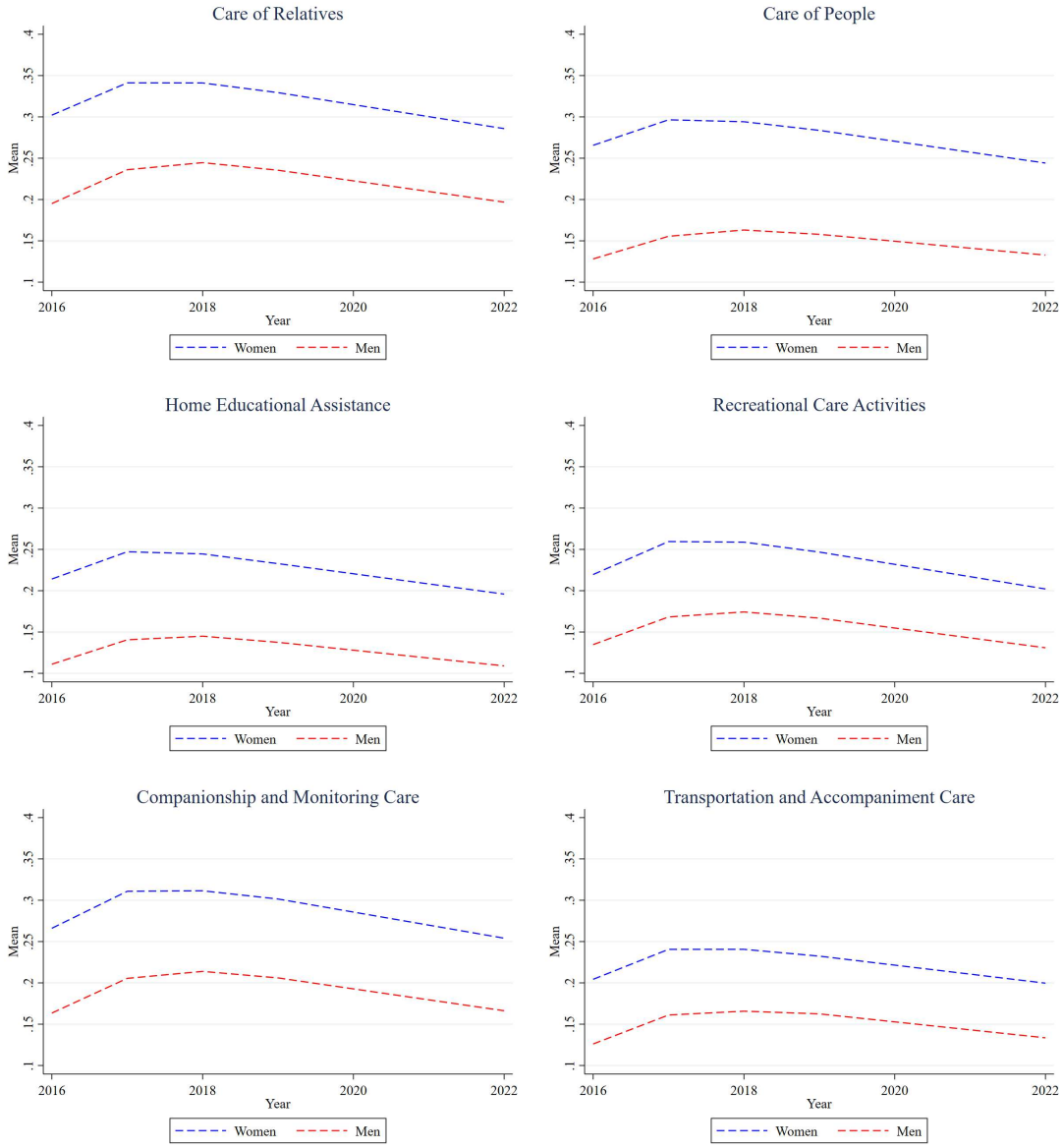
In light of this context, we examine the responses to stylized questions available in the PNADC, covering topics such as cleaning, care-giving, people transportation, and more. Despite the absence of information regarding the specific duration of each activity, these questions yield insights into the average prevalence of men and women engaging in these tasks. Since the stylized questions are binary, capturing only yes or no responses, they offer insight into the proportion of individuals, on average, who participate in these activities.

Figure 1 presents an overview of care-giving activities, shedding light on the distinct levels of engagement between men and women. The data shows a consistent trend where women actively participate in these activities more than their male counterparts. Examining the period from 2016 to 2022[1], it emerges that around 30% of women dedicated their time to tasks such as caring for relatives and individuals, in contrast to the 15% participation rate observed among men. Delving further into activities like educational support, recreational pursuits, companionship, and transportation, the participation rates stand at approximately

[1] Except the years 2020 and 2021, when these questions where removed from the questionary.

25% for women and 15% for men. Notably, there is a decline in the overall number of individuals engaging in these care-giving tasks over time.

Figure 1 – Care Activities

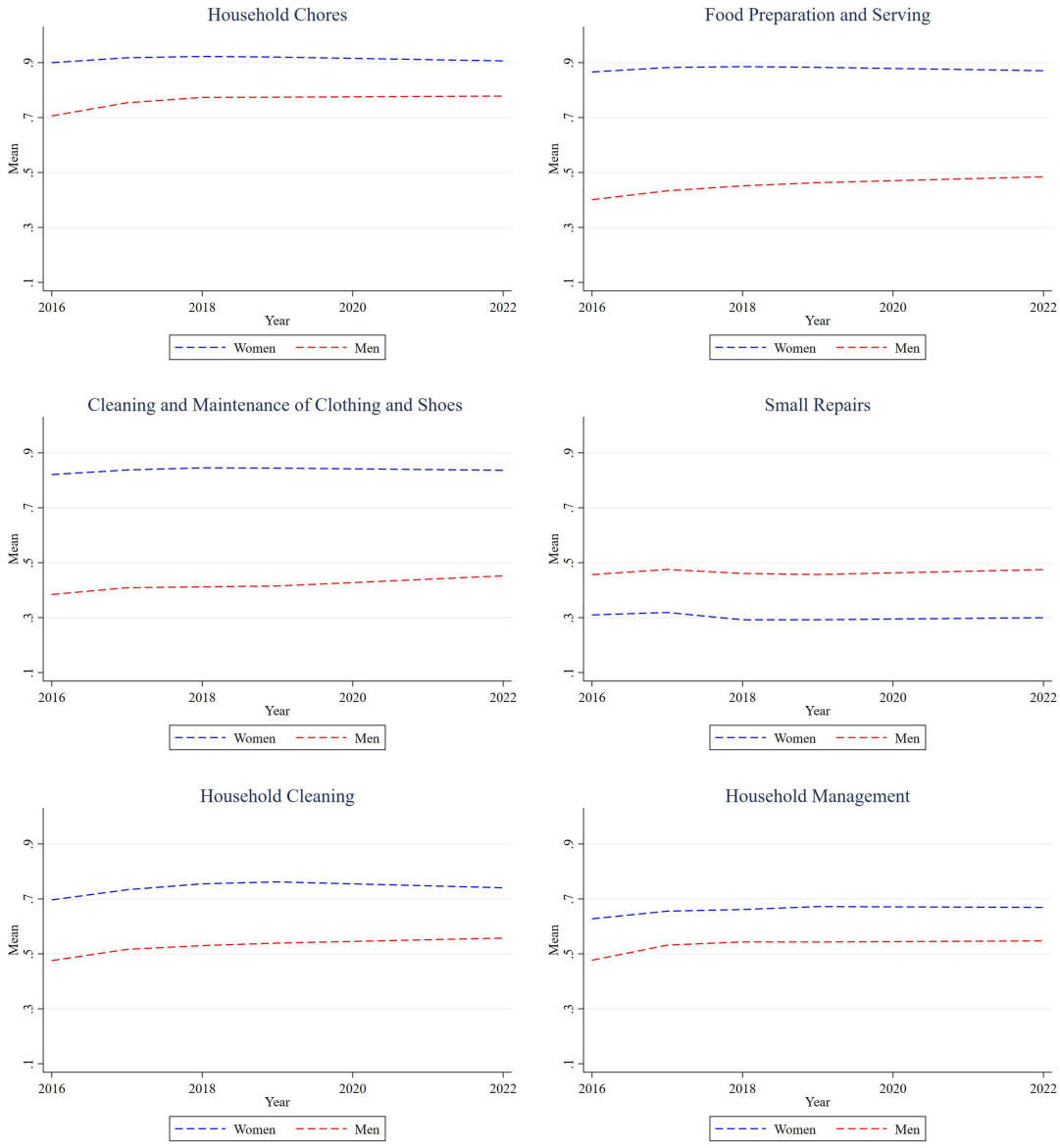


Source: Prepared by the author based on PNADC data, 2016-2022 (IBGE, 2023).

Figure 2 explores domestic tasks, revealing gender disparities in the results. In the domain of household chores, food preparation, and clothes cleaning, 90% of women actively contribute to these activities. In contrast, men exhibit engagement rates of approximately 70% for household chores and 40% for food preparation and clothes cleaning. The gender dynamics continue with house cleaning, where roughly 70% of women participate in this activity, compared to a response rate of around 50% among men. When considering household management, participation levels it's closer, approximately 65% for women and 55% for men. Notably, the activity with higher male participation is small repairs. These findings

show the pattern that men tend to focus more on sporadic tasks, while women deal with the responsibility of daily domestic duties. Different from the care tasks, the amount of people engaging in domestic tasks remains almost the same over the period.

Figure 2 – Household Tasks



Source: Prepared by the author based on PNADC data, 2016-2022 (IBGE, 2023).

This disproportionate assignment of household chores to women has different consequences, including work and consumption. In terms of work, the increase in time devoted to household chores can lead to a reduction in the time spent in the labor market and limit the potential possibility of getting a job, due to the need for more flexible positions (QUEIROZ; ARAGÓN, 2015; PAZELLO; FERNANDES, 2004; FONTOURA et al., 2010; FLORO, 2021). Moreover, greater engagement in more time-intensive domestic activities results in a larger wage penalty (SETTE; COELHO; SILVA, 2023).

Regarding the household consumption pattern, domestic eating activities are mostly performed by women in Brazil, as shown in Figure 2. In this sense, female employment, combined with the low change in the male role in terms of household chores, has significant effects on food consumption at home due to the time restriction that women face. Thus, there may be an increase in the search for fast-prepared foods and ready meals, to minimize the time spent on food preparation (DEVINE et al., 2003; BOER et al., 2004).

Thus, given the consequences related to the allocation of intra-household time, the present thesis aims, from three essays, to explore the determinants and effects of the division of time among Brazilian couples. The first article, Gender Norms and Time Allocation: Insights from Household Analysis, examines how time division between household chores and paid labor is different due to household gender norms. Using an empirical approach, the study demonstrates that even in egalitarian households, women remain disproportionately responsible for domestic tasks, limiting their financial autonomy and potential economic contributions.

The second article, Unequal Burdens, Unequal Pay: Household Chores and the Gender Wage Gap in Brazil, explores the impacts of the unequal division of domestic labor on individual earnings and the wage gap within couples. The results show that the time women dedicate to household chores reduces their wages, while men's involvement in these tasks can positively impact women's earnings, suggesting pathways to reduce wage inequalities.

Finally, the third article, Balancing Work and Food: The Influence of Female Employment on Household Food Consumption, examines how women's occupational status influences household food consumption patterns. The findings suggest that women's employment does not necessarily lead to increased consumption of ready-to-eat foods, challenging traditional assumptions and highlighting the importance of income as a key factor in food consumption decisions.

By connecting these dimensions — time allocation, the labor market, and consumption — this thesis provides a comprehensive analysis of gender inequalities in Brazil, contributing to the debate on public policies aimed at promoting gender equality and inclusive socioeconomic development.

1 GENDER NORMS AND TIME ALLOCATION: INSIGHTS FROM HOUSEHOLD ANALYSIS

RESUMO

O primeiro ensaio investiga os determinantes da alocação de tempo entre tarefas domésticas e mercado de trabalho para casais brasileiros, com ênfase nas diferenças entre lares patriarcais, igualitários e não tradicionais. Utilizando um modelo de Regressões Seemingly Unrelated (SUR) com dados da Pesquisa Nacional por Amostra de Domicílios Contínua (PNADC) entre 2016 e 2019, os resultados indicam que a educação e a presença de crianças e idosos são determinantes importantes para a alocação de tempo, especialmente para mulheres. O estudo sugere que uma adoção mais ampla de práticas igualitárias poderia beneficiar não apenas as mulheres, mas também a economia como um todo, aumentando a participação feminina no mercado de trabalho e estimulando o crescimento econômico.

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Key-words: Labor; Female labor; Intra-household time allocation; Food consumption.

1.1 INTRODUCTION

Until 1950, women carried out activities related to goods production and services almost exclusively within the household. From that decade onward, an exponential increase in female labor force participation began. This change was driven by factors such as increased educational level, reduced fertility, and the urbanization process, among others (BIANCHI et al., 2000; MAIA; LIRA, 2002; GOLDIN, 1990; FERRANT; PESANDO; NOWACKA, 2014a; BROWNING; CHIAPPORI; WEISS, 2014).

The Organization for Economic Cooperation and Development (OECD) notes that analyzing the division between households of domestic chores is an important factor in understanding the inequalities in the labor market (FERRANT; PESANDO; NOWACKA, 2014a). The first family economic models were proposed by Becker (1974, 1991) and were based on the assumption that family members specialize in market or home production based on their individual comparative advantage. Nevertheless, the models overlooked the fact that the division of intrahousehold time may also be related to gender norms, where there is a pattern of what is considered female or male activities (AGARWAL, 1997; PEARSE; CONNELL, 2016; GUISO; ZACCARIA, 2023).

Despite greater participation of women in the workforce, no major changes were observed in the time allocated to household chores, which continue to be carried out more significantly by women (MELO; CONSIDERA; SABBATO, 2007; MACIEL, 2008; DEGRAFF; ANKER, 2015). According to data from the 2023 Continuous National Household Sample Survey (PNADC), conducted by the Brazilian Institute of Geography and Statistics (IBGE) in Brazil, women spend approximately twice as much time on household chores as men. Similar allocations are observed for the United States (BIANCHI et al., 2000; BRINES, 1994; GREENSTEIN, 2000), and 22 other industrialized countries (FUWA, 2004).

Several studies have elucidated the complex dynamics of time allocation within households. They have shown that the presence of children, especially preschool-aged children, can change household dynamics (LUNDBERG, 1988; APPS; REES, 1996; FENGDAN et al., 2016). The effect observed is a high increase in the time allocated to domestic chores by women. Other important factors that affect household time allocation are age, education, wage, and educational differences between spouses (APPS; REES, 1996; DONNI; MOREAU, 2007; FENGDAN et al., 2016).

Gender norms significantly influence decisions about the total workload of men and women within households, often defining activities as either “female” or “male” and thereby promoting a non-egalitarian distribution of time between them (BURDA; HAMERMESH; WEIL, 2013; HILLER; PHILLIBER, 1986; KAMO, 1988; BLAIR; LICHTER, 1991; AGARWAL, 1997;

PEARSE; CONNELL, 2016; BERTRAND, 2020). As highlighted by Agarwal (1997), these norms can affect bargaining over time allocation by restricting the scope of negotiable responsibilities. Consequently, the factors that shape couples' time allocation may vary significantly between households with distinct time distribution patterns. Variables such as comparable incomes between partners, higher education levels, and a weaker influence of traditional gender norms contribute to more egalitarian or nontraditional household task allocation (SEIZ, 2021; AMÁBILE, 2022).

Studies have found that couples who adhere to traditional gender beliefs tend to have the wife performing the majority of domestic tasks. Conversely, couples with more egalitarian ideologies exhibit a more balanced division of labor (GREENSTEIN, 1996; BLAIR; LICHTER, 1991; HILLER; PHILLIBER, 1986; KAMO, 1988; PRESSER, 1994; SANCHEZ, 1994; CARLSON; MCPHERSON; PETTS, 2024). Campaña, Giménez-Nadal e Molina (2018) also finds that, in some Latin American countries (Mexico, Peru, and Ecuador), where gender norms are more egalitarian, there is a higher level of equality in the gendered distribution of total work, considering both paid and unpaid work.

Lee (2024) examines how changing societal attitudes, influenced by media coverage of feminism, alter gender roles in South Korea, revealing that egalitarian attitudes lead women to reduce household labor while enhancing marital satisfaction through shared activities. Meanwhile, Maxwell e Wozny (2021) estimates that gender norms[1] explains up to 40% of time-use gaps and 60% of wage disparities in the U.S., advocating for frameworks that integrate both norms and economic efficiency. Lastly, Chu e Zhang (2023) finds that women's work hours have a stronger positive impact on household economic welfare than men's, underscoring the importance of equitable time management for broader economic benefits.

Despite the extensive literature on the topic, few studies in Brazil have analyzed the relationship between time allocation to household chores and participation in the labor market, and no studies considering gender norms were found. Most have focused on home production or labor market involvement separately. For example, Madalozzo, Martins e Shiratori (2010) identifies family income as a key factor reducing women's time spent on household chores, while studies analyzing time allocation in the labor market focus on factors such as region, educational level, presence of children, differences in spousal age, sex ratios[2], and wages (MACIEL, 2008; FERNANDES; SCORZAFAVE, 2009; GONÇALVES; FILHO, 2015; SILVA; CUNHA, 2020).

[1] The authors define norms as the collectively differences in preferences for time use, differences in preferences for job type, or differences in social expectations about how time is spent at work or home. They define the measured influence of norms about work and home to be the observed gender gap among singles with no children.

[2] The sex ratio in Fernandes e Scorzafave (2009) is defined as the ratio between the total number of men with similar characteristics as the husband and the corresponding total of men and women from a given region.

Taking into account the disparities related to the allocation of time at home and its impacts on aspects of female work, this study aims to analyze the determining factors of this allocation between domestic chores and the labor market, especially seeking to answer if these factors play a different role depending on the distribution of household chores within the home. To achieve this objective, this paper uses PNADC data from 2016 to 2019. The theoretical framework on which this paper is based was developed by Donni e Matteazzi (2018), who developed a collective household model that allows for nonparticipation in the labor market. This framework was chosen since there is a high female unemployment rate in Brazil. It also makes use of the Seemingly Unrelated Regression (SUR) methodology to take into account the correlation between the time-use decisions inside the household.

Brazil provides an interesting case of analysis as it is an upper-middle income developing country with the highest Gross Domestic Product (GSD) in Latin America and a Human Development Index of 0.754 according to the Atlas of Human Development in Brazil (2021). However, despite these favorable indicators, the Gender Inequality Index (GII) for the country is 0.390, ranking 94th among 170 nations (PNUD, 2021). This index analyzes gender inequality considering factors such as health, empowerment, and the labor market, indicating that there are still severe barriers to overcome and emphasizing the importance of studying the various inequalities that occur in the country.

In this context, our contribution to the literature is twofold. First, unlike previous studies that evaluated domestic tasks or participation in the labor market in Brazil, such as Maciel (2008), Fernandes e Scorzafave (2009) and Silva e Cunha (2020), this document emphasizes the relationship between time allocation for household chores and participation in the labor market. Second, we incorporate an analysis of households with different gender norms, acknowledging how time determinants are different between these households and how the distribution of domestic chores reveals different choice patterns inside the household. Households are classified into non-traditional, egalitarian, and patriarchal families. In nontraditional families, women perform fewer domestic chores; in egalitarian families, they handle 40% to 60% of the household tasks; and in patriarchal households, women are responsible for over 60% of domestic chores. Third, our simulation allows us to project a "what if" scenario in which households adopt a more egalitarian approach.

In addition to this introduction, the chapter is composed of the following sections: the literature review, the methodology, the data and sample, the results, and, finally, the final considerations.

1.2 TIME ALLOCATION MODELS

Several models have been developed to analyze intra-household time allocation. In a pioneering way, Becker (1965) and Samuelson (1956) developed the unitary model, in which family members decide on income expenditure, maximizing a single utility function subject to a budget constraint, which corresponds to household income. In this approach, changes in family composition do not change decisions. Furthermore, family utility maximization does not differ from individual utility maximization, thus, family preferences are identical to those of a specific member or a representative family member, for which only the total household income matters and variables such as income are irrelevant, which can lead to allocations that are not Pareto efficient[3] (MCELROY; HORNEY, 1981; VERMEULEN, 2002).

Subsequently, the Becker-Gronau model, proposed by Gronau (1977), as an extension of the Becker (1965) model, adds time as an input in the production of goods and services. Thus, it becomes possible to separate the time spent on household chores from the time spent on leisure. In the Becker-Gronau model, work is the opportunity cost of allocating time to household chores, and the family decides how to allocate time according to the relative productivity of the members. Thus, the allocation of time divided between the couple depends on factors such as human capital, which leads to the specialization of the member with less human capital in domestic tasks, while the member with greater human capital specializes in the labor market (GRONAU, 1977).

However, some works, such as Thomas (1993), Thomas e Chen (1994), Vermeulen (2002) and Angelucci e Attanasio (2013) criticize the unitary model because, according to the authors, the model does not reflect the intra household reality. According to Vermeulen (2002), the unitary model presents methodological problems, since the microeconomic theory suggests that behavior should be treated individually and not in an aggregated way, and empirically, given the difficulty of its application. Regarding the empirical application, the non-work income of household members is aggregated into a single income (income pooling hypothesis) and has no effect on the allocation of family time in the labor market. According to Vermeulen (2002), this restriction is rejected in the studies of Browning et al. (1994) and Lundberg, Pollak e Wales (1997). Another hypothesis assumed in the unitary model is the symmetry of the Slutsky matrix, suggesting that marginal changes in the salary of two individuals in a family have the same effect on the labor supply of each. This hypothesis is also rejected in the work of Browning e Chiappori (1998).

From the various criticisms regarding the simplification of the unitary approach, models that employ the bargaining theory emerged. Manser e Brown (1980) still assumes the family

[3] Pareto efficiency occurs when resources are allocated in such a way that it is not possible to improve someone's situation without worsening someone else's situation (MAS-COLELL et al., 1995).

income grouping but, instead of assuming that there is a domestic utility function, the authors establish some particular bargaining rules, such as the Nash or Kalai-Smorodinsky solutions for the household decision, which result in a Pareto efficient solution. A similar model is proposed by McElroy e Horney (1981). The authors argue that the developed models make empirical testing possible, which is later criticized by Chiappori (1988a).

The models developed from Chiappori (1988b) and Apps e Rees (1988) have two main characteristics: i) they admit that more than one individual is a decision maker, supporting the individualistic principle of microeconomic theory; and ii) do not require a single household well-being index, allowing any change within the household to affect an individual's or household's well-being. Furthermore, they assume that a family's decision-making process results in Pareto efficient outcomes, that is, the leisure hours, and consequently the labor supply, chosen are such that an individual's well-being cannot increase without decreasing the well-being of other family members. Such models were called collective rationality models. Among the contributions of these models, there is the possibility of empirical testing based on the observable behavior of families' labor supply.

Collective rationality models are segmented into different approaches. Strategic models, also known as non-cooperative, are based on the concept of Cournot-Nash equilibrium[4] (LUNDBERG; POLLAK, 1993; LOMMERUD, 1997). That is, individuals have selfish preferences and may fail to reconcile them, leading to results that are not Pareto efficient, which is one of the criticisms of the (HODDINOTT; HADDAD, 1995; CACHEUX, 2005) model.

Another version of the collective model is the separate spheres, presented by Thomas e Chen (1994). In this model, there is a threat point in the household where individuals cooperate for the collective well-being, but if the individual utility level, called fall-back position, falls below the threat point, the individual will leave the household (PHIPPS; BURTON, 1998). Cooperation is based on gender conceptions, in which each member of the household specializes in the provision of specific goods and services. According to Tiefenthaler (1999), in these models, the increase in income from sources other than the salary has an impact on the bargaining power of individuals and, consequently, on the threat points.

Continuing with the contribution to the development of the collective models approach, Browning e Chiappori (1998) develop a model that allows greater generalization concerning the previous ones. The model is an extension of what was proposed in Chiappori (1988b) and Chiappori (1992), with the hypothesis that the family decision process leads to Pareto-efficient results but the process that determines the equilibrium result of the family is not necessarily specified and can be any variable that reflects the home environment, commonly called

[4] In Cournot-Nash equilibrium, family members act to maximize their utility by subjecting themselves to their budget constraint and taking into account the decisions of your partner (DONNI; CHIAPPORI, 2011).

"distribution factors" or "bargaining power". Such variables affect the decision process within the family without affecting preferences or budget constraints. According to the authors, the distribution factor makes it more difficult to obtain a rational preference relationship for the family that satisfies the transitivity and completeness properties. Therefore, the observed consumption and leisure choices must not satisfy the conditions of a negative symmetric and semi-definite Slutsky matrix[5].

Despite the great contribution of the Browning e Chiappori (1998) collective model, the empirical application of the approach requires information regarding the supply of work and leisure of the two spouses, price variations, as well as information on the consumption of goods and services by the family. Thus, the need for such information makes empirical tests concerning the model difficult, especially for Brazil, due to the limitations of the databases.

Other extensions of the collective model were developed to analyze family labor supply decisions. Among them Chiappori, Fortin e Lacroix (2002) and Chiappori e Ekeland (2002) contribute to the inclusion of the consumption of public goods. In addition, Chiappori, Fortin e Lacroix (2002) derives conditions for the determination of a rule for sharing income from sources deriving from non-work between spouses. Donni (2003) and Blundell et al. (2007) consider non-participation in the labor market and non-convex budget sets.

One of the main weaknesses of the collective model is the non-inclusion of time spent in domestic production, therefore, all time not spent in the labor market is considered leisure (APPS; REES, 1997). To fill this gap, Apps e Rees (1997) and Chiappori (1997) develop a collective model that considers labor supply and domestic production. Despite this, the empirical test is again hampered by the need for information on the consumption of goods and services at home.

Subsequently, Donni e Matteazzi (2012) develop a new identification result for the collective labor supply model with domestic production, even when no distribution factor is observable. Thus, the authors are able to generalize the results of Apps e Rees (1997) and Chiappori (1997), which is an important advance in the literature since finding (exogenous) distribution factors is not always possible.

Given the brief review of the theoretical literature on the evolution of home-based work supply models, the theoretical basis used to estimate the work supply and domestic production will be the extension carried out by Donni e Matteazzi (2012). The model was chosen since it allows greater generalization compared to the other models presented. Furthermore, empirical applicability is possible without the need to impose specific properties regarding the individual preferences of household members. The structure of the model is detailed

[5] The negative symmetric and semi-definite Slutsky matrix is necessary for the weak axiom of revealed preference not be violated (MAS-COLELL et al., 1995).

below.

1.2.1 Collective job offer

The model considers a family composed of two people who make decisions about consumption and leisure and two hypotheses are considered: i) Each member of the family is characterized by a specific and selfish utility function that depends on the consumption of good C^i and leisure $T - L^i$, where T denotes the total time endowment and L^I denotes the individual's total labor supply $i's$ (that is, the sum of domestic and market labor supply), with $i = 1.2$. The utility is represented by a strictly quasiconcave, monotonic, and sufficiently smooth function, given by

$$U^i = U^i(C^i, T - L^i, d) \tag{1.1}$$

where d is a vector of socio-demographic factors that may affect individual preferences. ii) The result of the decision process is Pareto optimal, that is, in equilibrium, it is not possible to increase the welfare of one family member without decreasing the welfare of the other family member. This configuration defines the so-called collective approach. This approach can be legitimized by referring to the theory of repeated games under perfect information. As the family is a typical example of such repeated games, it is plausible that an efficient decision-making process can be developed by its members.

1.2.1.1 The model without domestic production

The model considers internal solutions, that is, the total supply of work, leisure, and consumption are positive. If there is no domestic production, the total labor supply L^i coincides with the market labor supply. In addition, all consumption by family members is purchased on the market. If taxation is ignored and the price of consumption is normalized to one, the budget constraint is equal to

$$C^1 + C^2 \leq w_1 L^1 + w_2 L^2 + y \tag{1.2}$$

where L^i denotes the individual's market labor supply i (which coincides with the total labor supply), w are individual wages (determined exogenously by the market) and y is the non-work income (or net expenditure, the two concepts being equivalent when there are no savings). Chiappori (1992) shows that, given efficiency assumptions and selfish preferences, the family decision program can be reduced to a two-stage decision process. In the first stage, non-work income y is shared among family members according to a sharing rule where individual 1 gets $\Phi^1 = \Phi(w_1, w_2, y, d)$ and the individual 2 gets $\Phi^2 = y - \Phi(w_1, w_2, y, d)$. In

the second stage, each individual allocates his income separately to his own consumption and leisure in order to maximize his own utility, subject to an individual budget constraint. Formally, the result is declared as follows.

Lemma 1. The Pareto optimal allocations (C^i, L^i) are solutions of the following decentralized programs

$$\max_{C^i, L^i} U^i(C^i, T - L^i, d) \tag{1.3}$$

subject to

$$C^i \leq w_i L^i + \Phi^i(w_1, w_2, y, d) \tag{1.4}$$

for some functions $\Phi^i(w_1, w_2, y, d)$, where $\sum_i \Phi^i(w_1, w_2, y, d) = y$. The individual market labor supply functions can be written as:

$$L^i = F^i(w_i, \Phi^i(w_1, w_2, y, d), d) \tag{1.5}$$

for some Marshallian labor supply functions $F(\cdot)$.

Proof. This interpretation of the sharing rule derives directly from an application of the second fundamental theorem of welfare economics; See also Chiappori (1992).

The previous lemma has two consequences. From equation (5), it is observed that the wage rate of individual i has only an income effect on the labor supply of member f through the individual's share of non-work income. Furthermore, the sharing functions can be identified genetically up to an additive function of socio-demographic variables of the estimation of the labor supply functions[6].

1.2.1.2 The model with domestic production

In the model with domestic production, it is considered that household members divide their time between leisure, work in the market, and domestic activities. Thus, we have the total working time given by:

$$L^i = t^i + h^i \tag{1.6}$$

where the time dedicated to domestic production by the individual i is denoted by t^i and the time dedicated to work in the market by h^i.

[6] The presentation of this result can be seen in Donni e Matteazzi (2012).

Again, interior solutions are considered, and it is assumed that the spouses work both in the market and at home. In addition, the marketing assumption is made, in which the individual's total consumption i can be divided between consumption purchased in the market and consumption produced at home. The quantity purchased is denoted by x^i and the quantity produced by z^i. Therefore, the total consumption of the individual i is equal to

$$C^i = x^i + z^i \tag{1.7}$$

Finally, the production technology is represented by a strictly concave and smooth function, that is,

$$z^1 + z^2 = Z(t^1 + t^2, d) \tag{1.8}$$

in which technology supposedly depends on the vector of socio-demographic factors. Due to the commercialization assumption, spouses' decisions about production and consumption can be seen as sequential; that is, the family first solves its production problem and maximizes the family profit, and then allocates the non-labor income and the profit obtained in the first stage to consumption, in which each member separately maximizes his own welfare under his own budget and time constraints[7].

1.3 EMPIRICAL REVIEW

In the empirical analysis, while some studies aim to compare the various models of labor supply (VERMEULEN, 2005; FORTIN; LACROIX, 1997), others seek to understand the factors that affect the allocation of time in the labor market and household chores using a specific model (SILVA; CUNHA, 2020; FERNANDES; SCORZAFAVE, 2009; BLOEMEN, 2010; MADALOZZO; MARTINS; SHIRATORI, 2010; LAHGA; MOREAU, 2007).

In the international literature, some works perform labor supply analysis using non-cooperative models, such as Leuthold (1968), Ashworth e Ulph (1981), Bjorn e Vuong (1985), among others. In an analysis for the United States, Bjorn e Vuong (1985) interprets the model in terms of a Stackelberg game, in which the leader is indifferent to the action of the follower. The results obtained suggest that family income and the presence of children reduce the female labor supply. Despite this, Kooreman e Kapteyn (1990) and Kooreman (1994) argue that the identification and estimation of non-cooperative models require additional data to be valid, mainly on the individual preferences of household members.

[7] The formalization of this result can be consulted at Donni e Matteazzi (2012).

Thus, the most empirically analyzed models of labor supply are the collective ones. In her work, Lundberg (1988) analyzes the job offer for married men and women in the United States. With the bargaining model and application of simultaneous equations, the results suggest that the labor supply of childless husbands and wives is not jointly determined in the short term, while families with young children show strong interactions during the working hours decision.

Also for the United States, Killewald e Gough (2010) hypothesizes in his work that the increase in wives' earnings allows them to give up or outsource some, but not all, household tasks. Using the collective approach and a fixed effects model, the results indicate that the time devoted to housework by wives decreases when there are earnings increase. Despite this, when the wife's income is above average, increases in income lead to small reductions in time spent on housework, thus, there is a limit on outsourcing or giving up housework, corroborating the initial hypothesis.

With a generalization of the model of collective rationality to enable non-participation in the labor market, Donni e Matteazzi (2018) analyze the allocation of time at home by couples in the United States, using the maximum-likelihood method, considering the sex ratio[8] as a measure of bargaining power. The results obtained suggest that the total labor supply is rigid, compared to the supply of domestic and market labor. In addition, husbands receive the lion's share of any increase in total net expenses or non-work income.

For Australia, Apps e Rees (1996) extends the collective rationality model of Apps e Rees (1988) and uses the maximum likelihood method to analyze labor supply, domestic production, and the distribution of intra-family well-being of couples. The results suggest that the presence of young children, age, and higher educational level increase the time that women allocate to household chores. Meanwhile, the age and education of the partner decreases the time women allocate to such activities. The work also contributes to highlight the importance of including household chores in the homework offer model.

Using a Generalized Method of Moments (GMM) model , Vermeulen (2005) aims to compare the results of the unitary model and the collective model. Analyzing the determinants of the labor supply of Belgian couples, the results suggest that the unitary model is not suitable for the analysis of the couples labor supply. In turn, the results found for the collective model indicate that being married, compared to cohabitation, implies a substantial increase in the part of the non-work income that goes to the woman. In addition, an increase in the age gap between spouses and in men's non-work income reduces the share of income for women.

In turn, Donni e Moreau (2007) analyzes the determinants of the labor supply of French

[8] The sex ratio in Donni e Matteazzi (2018) is defined for each state, and each age category, as the number of men divided by the total number of men and women.

couples with the approach of the collective rationality model. The results obtained using the GMM method suggest that, considering the effect of the sharing rule, the husband's salary gains influence his own demands, but not the wife's demands, and symmetrically, the wife's salary influences her own demands, but not the husband's demands.

Also using the collective rationality approach and the GMM model, Lahga e Moreau (2007) assess the effects of the transition from cohabitation to marriage on domestic work hours and on the labor market for couples in Germany. The results indicate that marriage increases women's specialization in domestic activities and decreases women's leisure. Furthermore, higher wages reduce female specialization in the domestic sphere, while the presence of young children increases such specialization.

Hendy e Sofer (2009) analyzes the female labor supply in Egypt within a collective structure with the GMM model. The authors use bargaining power variables such as women's participation in the decision-making process, their access to financial resources at home, their mobility, and domestic violence. The results suggest that most measures of bargaining power are significantly related to women's decision to participate in the labor market.

In the study by Bloemen (2010), the analysis is performed separately for individuals in civil marriage and common-law marriage. The estimates made for Holland are theoretically based on the collective rationality model and are made using the maximum likelihood method, suggesting that men in civil marriages have greater bargaining power than men in a stable union. Furthermore, the effect of non-labor income differs according to marital status. An increase in non-employment income is shared between husband and wife in couples in a stable union, while it is attributed to the husband in couples in a civil marriage. This suggests that single women have a better bargaining position than married women.

In turn, Fengdan et al. (2016) investigates the relationship between bargaining power and time allocated to household chores and the labor market, using the collective rationality model approach. With a sample for China, the analysis is conducted using the Seemingly Unrelated Regression (SUR) method. It appears that the presence of young children in the household substantially increases the time spent on household chores by women. In addition, the greater bargaining power of husbands, represented by the educational difference between the spouses, leads to greater dedication of time to the labor market and less time to household chores, while greater bargaining power for women does not affect time spent on household chores.

Among the analyses carried out for Brazil, Tiefenthaler (1999) tests the unitary family decision model, estimating a multinomial logit for the labor supply for men and women. The results indicate that the unitary model is rejected in the informal and autonomous sectors for men and the formal and informal sectors for women. In these cases, own non-wage income

has a significant negative effect on labor supply, while the spouse's non-wage income has no significant effect.

Advancing in the literature, Maciel (2008) uses a collective model approach and analyzes the determinants of intra-family labor supply. The results obtained with a GMM model indicate that factors such as regional differences, schooling, fertility, and labor market characteristics are important for determining the labor supply. In addition, participation in income transfer programs reduces the couples' labor supply.

Also using the collective approach, Fernandes e Scorzafave (2009) assumes variables of the age difference between the spouses and the sex ratio[9] as distributive factors to identify the bargaining power of household members. With this approach, an analysis of the labor supply of Brazilian spouses is carried out and the results indicate that the greater the age difference between the spouses, the lower the monthly job offer for women and the greater the job offer for men. Furthermore, the higher the sex ratio, the greater the labor supply for men.

To analyze the allocation of time in household chores according to the gender of individuals and the bargaining power of couples, Madalozzo, Martins e Shiratori (2010) employs the methods of multiple linear regression and the Oaxaca-Blinder decomposition. The linear regression results show that women's participation in the labor market and their remuneration concerning total family income have a considerable impact on their bargaining power at home, reducing the time allocated to household chores. Regarding the Oaxaca-Blinder results, women dedicate more time to housework and less time to the job market, even when compared to men with similar observable characteristics.

Gonçalves e Filho (2015) analyzes the labor supply of poor families in Brazil, the main objective being to identify, using the differences in differences (DD) method, the impacts of an increase in the minimum wage on the labor supply. The results show that, with the increase in the minimum wage, there is a reduction in the participation of adolescents in the labor market and an increase in the job offers of the household head and spouses. In addition, the difference in education between the spouses, considered as bargaining power, is favorable to the household head. Another result obtained from the work is that, if the household head is male, the head and the adolescent have greater participation in the labor market, which may suggest that the adolescent has greater bargaining power, which contributes to lower participation in the labor market.

In a more recent work, Silva e Cunha (2020) uses a collective model to verify the determinants of the labor supply of couples. The authors verify, using the SUR method, that in recent years there has been an increase in the female labor force participation. Despite this, the male

[9] The sex ratio in Fernandes e Scorzafave (2009) is defined as the ratio between the total of men with the same characteristics as the husband and the corresponding total of men and women in a given region.

labor force participation is still higher than the female one, which suggests, according to the authors, that there is a traditional view of gender, in which the man should be the financial provider of the household, while the woman is responsible for domestic activities. In addition, the presence of children younger than 14 years reduces the time allocated by women in the labor market while increasing the time that men allocate to this activity.

Table 1 summarizes the studies that analyze the allocation of intra-household time, presented in this literature review.

Table 1 – Overview of methodologies, databases, regions, and key findings in time allocation studies

Authors	Methodology	Data base	Country	Distribution factors
Leuthold (1968)	OLS	University of Michigan Survey Research Center's Panel Study on Income Dynamics	United States	-
Bjorn e Vuong (1985)	Maximum likelihood	University of Michigan Survey Research Center's Panel Study on Income Dynamics, 1968 a 1982	United States	-
Lundberg (1988)	Maximum likelihood	Denver Income Maintenance Experimet	United States	-
Kooreman e Kapteyn (1990)	Maximum likelihood	Dutch Labor Mobility Survey, 1982	Netherlands	-
Kooreman (1994)	Maximum likelihood	Dutch Labor Mobility Survey, 1985	Netherlands	-
Apps e Rees (1996)	Maximum likelihood	Australian Bureau of Statistics (ABS) 1985/86	Australia	-
Tiefenthaler (1999)	Multinomial logit	National Statistical Service, 1989	Brazil	-
Vermeulen (2005)	GMM	DNB Household Survey, 1995 a 2003	Belgium	The difference in age, marital status and non-work income of men
Donni e Moreau (2007)	GMM	Panel INSEE, 1994	France	Non-work income and wife's non-wage income
Lahga e Moreau (2007)	GMM	German Socio-Economic Panel, 1984 a 2004	Germany	Marital status
Maciel (2008)	GMM	PNAD, 2014	Brazil	The difference in schooling and age
Fernandes e Scorzafave (2009)	3SLS	PNAD, 2003 a 2007	Brazil	Age difference and sex ratio
Hendy e Sofer (2009)	GMM	Egyptian labor Market and Panel Survey, 2006	Egypt	Age difference
Killewald e Gough (2010)	Fixed effects	Panel Study of Income Dynamics, 1976 a 2003	United States	-

(continue)

(continuation)

Authors	Methodology	Data base	Country	Distribution factors
Madalozzo, Martins e Shiratori (2010)	OLS e Oaxaca-Blinder	PNAD, 2006	Brazil	-
Bloemen (2010)	Maximum likelihood	Socio-economic Panel 1990 a 20001	Netherlands	-
Gonçalves e Filho (2015)	Probit and DD	PNAD, 2012 a 2015	Brazil	Difference in schooling
Fengdan et al. (2016)	SUR	China National Time Use Survey, 2008	China	Difference in schooling and age
Donni e Matteazzi (2018)	Maximum likelihood	Panel Study of Income Dynamics, 2009	United States	Sex ratio
Silva e Cunha (2020)	SUR	Pesquisa Mensal de Emprego, 2002 a 2015	Brazil	-

Source: Prepared by the author (2022).

In order to better understand women's participation in the labor market and the observed pay gap between men and women, it is necessary to incorporate the effects of intra-family divisions of time between men and women. In view of the disparities related to the division of intra-household time allocation and its impacts on aspects of female work, the present work aims to analyze the determinants of couples' time allocation between household chores and the labor market.

1.4 METHODOLOGY

The intrahousehold decision of the couple's labor supply and household chores is supported by the theoretical framework of Donni e Matteazzi (2018), in which the family is composed of two individuals with rational and potentially different preferences. Decisions are made through interactions between the couple, and responses produced are Pareto efficient. Some exogenous factors can affect the family's decision process, named distribution factors by Bourguignon et al. (1993).

In the present work, the distribution factors used are the difference between the couple's years of study, used in works such as Maciel (2008), Gonçalves e Filho (2015) and Fengdan et al. (2016), and the age difference, used in Maciel (2008) and Fernandes e Scorzafave (2009). Differences in the couple's educational level can affect the intrafamily decision-making process but not individual preferences since the individual's educational level itself is an individual choice, but not the spouse's educational level. The difference in education increases with women's education level, thus, it is expected that it will affect women's labor supply in a positive way and men's labor supply negatively. When there is an increase in the educational difference, there is an increase in the bargaining power of women in the household (GONÇALVES; FILHO, 2015; MACIEL, 2008).

In turn, the age difference can be analyzed in terms of the marital market (BERGSTROM; LAM, 1991). The variable increases with the increase in the wife's age compared to her husband, thus, if the woman is older in comparison to her husband, there is a reduction in her bargaining power in the household, since, according to the marriage market, there is a reduction in the opportunity to get out of the marriage (WOOLLEY, 2003; FERNANDES; SCORZAFAVE, 2009).

Considering that there is a simultaneity in the intrafamily decision of labor supply, the estimation of Seemingly Unrelated Regression (SUR) is carried out to verify the determinants of labor supply and time allocation in domestic chores. The SUR model, developed by Zellner (1962), considers that there is a correlation between the equation errors, which implies in our specification that the decisions of one partner have effects on the decisions of the other, even if there is no information available that makes it possible to measure this relationship.

The SUR model can be represented as follows:

$$Y_j = X_j \beta_j + \varepsilon_j \;\; j = 1, 2, ..., k \tag{1.9}$$

where

$$\varepsilon_j = \left[\varepsilon_1^{'}, \varepsilon_2^{'}, ..., \varepsilon_k^{'} \right]$$

and

$$E\left[\varepsilon_j\right] = 0$$

with $E\left[\varepsilon_{jt}\varepsilon_{ls}^{'}\right] = \sigma_{jl}$ if $t = 0$, and 0, otherwise, in addition $E\left[\varepsilon_j \varepsilon_l^{'}\right] = \sigma_{jl} I_T$.

It is assumed that, to estimate Y_j, a total of T observations are used, making it possible to estimate the parameters β_j of k equations, using the set X_j of independent variables. Each equation has Z_k regressors for a total of $Z = \sum_{j=1}^{k} Z_j$. Furthermore, the assumption is also made that the data is well behaved[10] and that the errors (ε_j) are not correlated.

In the present work, four regressions ($k = 4$) are specified to estimate the intrahousehold time allocation according to the representation given by (1.9), two for the time allocated to household chores and two for the time allocated to the labor market.

Some endogeneity issues need to be addressed. For working individuals, hourly wages are computed as the ratio of labor earnings to hours of work. For nonworking individuals, wages are missing and have to be imputed from a wage equation. To reduce potential selection

[10] For more details on well-behaved data, see Greene (2003).

bias, the full sample is used in the application of the Heckman (1979) procedure, after this, the wages of all individuals are predicted. After this, we replace the missing values for the predicted wages. The procedure follows Donni e Matteazzi (2018), and the details are in Appendix A.

1.5 DATA AND SAMPLE

The method chosen to collect time use is determined depending on the survey purpose. Some ways to collect the data are through direct observation, self-reports, or interviews. Each of the instruments used has advantages and disadvantages (DESA, 2004). The database used in the present work is the Continuous National Household Sample Survey (PNADC) of the Brazilian Institute of Geography and Statistics (IBGE), from 2016 to 2019. The PNADC sample is constructed as a rotating panel, where the household is interviewed for one month and leaves the sample for two consecutive months, this procedure is repeated five times. Although the survey is not a time diary, it has stylized questions about the time allocated to household chores and caring for people. Thus, respondents are asked how much time was allocated to household chores or caring for people in the last week. This question was asked only at the time of the last interview for each household. The question regarding time spent on household chores was discontinued during the pandemic period (2020 and 2021) and restarted in 2022. The 2022 and 2023 data follow the same trend as previous years, however, the decision was made to retain the longer data series, allowing for a larger sample size, which justifies the period chosen.

Among the problems generated by this type of questionnaire, stylized questions may underestimate the time women spend caring for children, since people may not classify it as work, or because it is reported only when it is performed as the main activity. Additionally, respondents may have difficulty remembering what they have done during the period mentioned in the question and may overestimate activities that are perceived as socially "good" or acceptable (MATULEVICH; VIOLLAZ, 2019; SUH, 2016; FLORO; MILES, 2003). Another limitation of the PNADC is that each household may have only one respondent, which means that one person could answer the questionnaire for another. Thus, there may be an underreporting of hours for the non-responders. Despite the limitations mentioned, the PNADC is the only database that has information about the time allocated to household chores in Brazil.

We selected couples[11] in which both members were between 20 and 60 years old. The

[11] Only heterosexual couples were considered, identified through self-declaration that the household situation is "Spouse or partner of a different sex." The sample of same-sex couples was not used due to limitations in size.

age range of 20 to 60 was chosen to avoid bias caused by the fact that very young couples may be studying and, therefore, not working in the market. In addition, couples older than 60 years are more likely to be retired and, therefore, are not offering hours of market work. Finally, people who answered that they did not have a job but had a positive wage, who had a job but did not have a wage, and couples who declared zero hours in domestic chores and the labor market were removed from the sample. We also excluded households with more than one family living together, given that the collective model is directed to only two decision-makers[12].

The selection of variables in the model aligns with the literature exploring time allocation between domestic chores and labor market activities within households. Individual characteristics, such as age and educational level, are essential to capture the impact of human capital and life-cycle stages on time allocation decisions. The variables of household composition, including the number of children and the presence of young children can reflect additional time demands (CRAIG; MULLAN, 2011).

The presence of children at home, especially young children, has direct implications for the use of parents' time. This circumstance may create an incentive for women to specialize in household chores, consequently reducing the time they dedicate to the labor market compared to men. Additionally, children are regarded as a form of public good within the household, and these goods are inseparable in couples' utility functions (BLUNDELL; CHIAPPORI; MEGHIR, 2005). To capture such effect, we introduce a dummy variable with a value of one for couples with children aged three years or younger[13].

For your turn, teenagers (especially women) and elderly individuals can represent an additional time demand or can contribute to the activities of household chores, and influence the division of domestic work and participation in the labor market. Income-related variables, such as earnings from work, non-work income, and local female unemployment rates, help to understand the economic incentives driving labor supply decisions, consistent with studies like Vermeulen (2005), Donni e Moreau (2007) and Lundberg e Pollak (1996). Finally, distribution factors, such as age and education differences between spouses, allow for an investigation of how intrahousehold asymmetries shape bargaining dynamics, following the approach of Vermeulen (2005), Maciel (2008), Hendy e Sofer (2009), Gonçalves e Filho (2015) and Fengdan et al. (2016). This model thus captures a wide range of individual, household, and contextual factors that shape time allocation dynamics.

The list of variables used in the model and their descriptions are shown in Table 2.

[12] See details in Table 10 in Appendix A

[13] The age of three years is defined once, since 2013, the mandatory age for registration of children in Basic Education in Brazil is 4 years old, according to Law nº 12.796 and, although is not possible to observe which child is attending school, the age cutoff partially captures this effect.

Table 2 – Variable Definitions for the Couples' Time Allocation Model

Variable	Description
Dependents	
Hours Chores	Hours spent on domestic chores.
Hours Market	Hours spent at the labor market.
Explanatory	
Individual Characteristics	
Age	Individual's age.
Household's head	Dummy equal to 1 if the individual is the household head.
Educational level	Dummies to no instruction*, primary, high school, and undergraduate.
White	Dummy equal to 1 if the individual is white.
Household Characteristics	
Nº of children	Number of children.
Teenager	Dummy equal to 1 for the presence of a teenager in the household.
Teenager Female	Dummy equal to 1 for the presence of a female teenager in the household.
Children ≤ 3	Dummy equal to 1 for the presence of children aged three years old or less in the household.
Elderly	Dummy equal to 1 for the presence of an elderly individual in the household.
Controls	Dummies for urban and rural* areas, North* Northeast, Southeast, South, Midwest, 2016*, 2017, 2018 and 2019.
Income	
Man's Work Income	Income from man's work.
Women's Work Income	Income from women's work.
Work income_i^2	Individual income squared.
Non-Work Income	Income from sources other than work (i.e. cash transfer, retirement.)
Labor Market	
Unemployment Rate	Female unemployment rate by stratum[1].
Distribution factors	
Age Dif.	Age difference between the couple.
Education Dif.	Difference in years of school between the couple.

Note: *Base category. 1 - The stratum is a part of the sample from the database prepared by IBGE. Initially, the census tracts were defined, totaling 214,836 tracts. Based on this list, the primary sampling units (PSUs) were established. The minimum size of the PSUs was at least 60 private permanent households. The tracts were then stratified, meaning they were divided into subpopulations from which independent samples were drawn to obtain the Master Sample (MALAGUTI; ALVES, 2024).
Source: Prepared by the authors (2025).

Table 3 presents the descriptive statistics for the full data. The following can be observed: women spend, on average, significantly more hours on domestic chores (22.54 hours) compared to men (9.43 hours), while men dedicate more time to the labor market (35.07 hours versus 19.57 hours for women). These differences reflect persistent gender disparities in the division of labor within households. In terms of education, women exhibit a slightly higher representation at the undergraduate level (21.19%) compared to men (15.26%). Regarding income, men earn an average of R$14,92 per hour, exceeding the average hourly income of women at R$12,66[14], further illustrating gender inequality in earnings. Households have an average of 1.42 children, and 33.61% of households have a teenager while 2.28% have elderly members.

[14] All income values are expressed in 2019 prices.

Table 3 – Descriptive Statistics for the Couples' Time Allocation Model

Variable	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Dif.
	Men				Women				
Hours Chores[1]	9.4335	8.4162	0	60	22.5487	12.7208	0	60	-13.1151***
Hours Market[2]	35.0779	16.9195	0	60	19.5738	19.9714	0	60	15.5040***
Age	41.8262	9.8473	20	60	38.7779	9.7887	20	60	3.0483***
Household's head	0.7333	0.4421	0	1	0.2666	0.4421	0	1	0.4667***
Primary	0.4599	0.4983	0	1	0.3806	0.4855	0	1	0.0792***
High School	0.3402	0.4738	0	1	0.3790	0.4851	0	1	-0.0387***
Undergraduate	0.1526	0.3596	0	1	0.2119	0.4087	0	1	-0.0593***
White	0.4006	0.4900	0	1	0.4093	0.4917	0	1	-0.0086***
Nº of children	1.4249	1.1473	0	12	1.4249	1.1473	0	12	-
Teenager	0.3361	0.4723	0	1	0.3361	0.4723	0	1	-
Teenager Female	0.1831	0.3868	0	1	0.1831	0.3868	0	1	-
Children≤ 3	0.1912	0.3932	0	1	0.1912	0.3932	0	1	-
Elderly	0.0228	0.1493	0	1	0.0228	0.1493	0	1	-
Work Income	14.9251	22.3752	0,0157	2436.9230	12.6610	14.7669	0.0051	1352.6600	2.2641***
Work Income[2]	723.4096	16503.9700	0,0002	5,938,596	378.3623	5825.2070	0.0000	1,829,689	345.0473***
Non-Work Income	402.6321	2112.5030	0	178243.5000	264.0880	1308.1880	0	111,402.2000	138.5441***
Unemployment Rate	0.0561	0.0349	0	0.3076	0.0561	0.0349	0	0.3076	-
Age Dif.	-3.0483	6.2370	-40	37	-3.0483	6.2370	-40	37	-
Education Dif.	1.0370	3.5765	-16	16	1.0370	3.5765	-16	16	-
Observations	219,796*								

Note: 1: Total hours dedicated to caring for people and/or household chores in the week. 2: Weekly working hours spent on all jobs.*Observations are presented as the number of couples without sample weight.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

The household division according to gender norms is carried out as follows: initially, the total time the household head and the spouse spend on household chores is counted, adding the time each individual in the couple allocates to such activity. Households in which the woman performs up to 40% of domestic activities are considered nontraditional; households in which the woman performs between 40% and 60% of domestic activities are considered egalitarian, and households in which the woman performs more than 60% of domestic activities are considered as patriarchal. According to this classification, approximately 72.49% of the sample comprises patriarchal households, approximately 23.21% of the households are egalitarian, and 4.29% of the households are nontraditional.

This household classification, based on the distribution of domestic work, can contribute to analyze potential shifts in behavioral patterns linked to social norms. By distinguishing between patriarchal, egalitarian, and nontraditional households, it becomes possible to assess how family dynamics and time allocation might evolve in response to changing societal values or policy interventions aimed at promoting gender equity. For instance, the significant prevalence of patriarchal households (72.49%) suggests that traditional gender norms still strongly influence domestic arrangements. However, the existence of egalitarian (23.21%) and nontraditional (4.29%) households highlights emerging variations in family choices. This classification enables the exploration of how families might redistribute domestic responsibilities and labor market participation if they were to adopt more egalitarian practices, thereby contributing to broader discussions on gender equality and social transformation.

Table 4 presents the descriptive statistics by household type according to the gender norms defined above, and it reveals distinct patterns in the distribution of time, income,

and demographic characteristics. In patriarchal households, women dedicate significantly more time to household chores than men (25.43 hours versus 7.01 hours, on average), while nontraditional households show the opposite pattern in the distribution, with men dedicating 15.43 hours and women 5.41 hours. Also, nontraditional households, on mean, spend less total time in domestic chores than patriarchal and egalitarian households. Regarding income, all household types exhibits a similar distribution of work income between genders, where women earn approximately R$3 less than men by hour.

Additionally, the couples' education levels tend to be higher in egalitarian and non-traditional households, as seen in the greater proportion of individuals with undergraduate degrees. Nontraditional households also display a higher average non-work income for men, suggesting that these households might have access to additional resources beyond labor earnings, which can contribute to paying for domestic chores.

Table 4 – Descriptive Statistics by Household Type: Patriarchal, Egalitarian, and Non-Traditional

	Patriarchal		Egalitarian		Nontraditional	
	Mean		Mean		Mean	
Variables	Men	Women	Men	Women	Men	Women
Hours Chores	7.01373	25.4301	15.8799	16.7186	15.4379	5.4163
Hours Market	35.8557	15.7495	33.7517	30.3162	29.1134	26.0668
Age	41.9565	38.8251	41.2313	38.4182	42.8424	39.9250
Household's head	0.7289	0.2710	0.7368	0.2631	0.7894	0.2105
Primary	0.1013	0.4227	0.3455	0.2619	0.4058	0.3108
High School	0.3262	0.3787	0.3814	0.3817	0.3543	0.3678
Undergraduate	0.1201	0.1668	0.2455	0.3382	0.1979	0.2911
White	0.3884	0.3835	0.4557	0.4827	0.4109	0.4465
Nº of children	1.5014	1.5014	1.2239	1.2239	1.2191	1.2191
Teenager	0.3550	0.3550	0.2847	0.2847	0.2941	0.2941
Teenager Female	0.1943	0.1943	0.1530	0.1530	0.1564	0.1564
Children≤3	0.1974	0.1974	0.1800	0.1800	0.1458	0.1458
Elderly	0.0226	0.0226	0.0221	0.0221	0.0293	0.0293
Work income	13.6442	11.5808	18.2672	15.5218	18.4845	15.4328
Work Income^2	589.2760	291.1001	944.6555	614.1181	1792.1010	577.1176
Non-Work Income	333.0033	261.6854	564.9829	260.0801	700.5392	326.3294
Unemployment Rate	0.0559	0.0559	0.0568	0.0568	0.0556	0.0556
Age Dif.	-3.1314	-3.1314	-2.8130	-2.8130	-2.9173	-2.9173
Education Dif.	1.0422	1.0422	1.0037	1.0037	1.1298	1.1298
Observations	159,338	159,338	51,022	51,022	9,436	9,436

Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

1.6 RESULTS AND DISCUSSION

This section presents and analyzes the results of the study, divided into distinct subsections. The results for the full sample can be seen in Table 13 in Appendix A. The first subsection, gender roles, examines households with different gender norms, acknowledging how time determinants are different between these households and how the distribution of domestic chores reveals different choice patterns inside the household. This is followed by

a counterfactual scenario subsection, which explores the potential economic outcomes if all households adopted an egalitarian approach to time allocation. A subsequent section will extend the analysis to single individuals, enabling comparisons between household structures.

1.6.1 Gender Roles

Tables 5 to 7 present the results for couples by household type[15] obtained with the SUR model, and the coefficients, in general, were significant. The main differences between genders and across household types are concentrated on variables directly related to care, i.e., the number of children, children under the age of three years, teenagers, and elderly individuals.

Regarding patriarchal households, an undergraduate degree contributes to a decrease in the amount of time dedicated by women to home production by about 4.10 hours a week and to an increase in the amount of time allocated to the labor market by around 21.59 hours a week. These results corroborate the results obtained in Madalozzo, Martins e Shiratori (2010) for household chores and in Maciel (2008) and Silva e Cunha (2020), where the higher the educational level is, the less time is spent on household chores and more time is spent in the labor market. For men, the higher the educational level, the greater the amount of time dedicated to both activities. This result suggest that increases in men's educational level may contribute to a reduction in disparities related to time allocation in household chores.

Being white reduces the time dedicated to domestic chores and increases the time spent in the labor market for both women and men. With the increase in the number of children, women's work in domestic chores increases, and their time in the labor market decreases. With an increase in the number of children, men also decrease their market labor supply and increase their domestic labor (but approximately 10 times less than women). Additionally, these results are also related to the motherhood penalty, where women adjust their time allocation in the labor market in response to motherhood (KLEVEN; LANDAIS; SØGAARD, 2019).

If the child is a teenager, both men and women can reduce household chores (but not less than the effect of having one child) and increase time in the labor market. When the teenager is a female, women spend less time on domestic chores, but the results for the labor market are not significant. For your turn, men reduces the time spent both in domestic chore and the labor market. This result indicate that the female teenager is probably taking some

[15] To analyze the viability of the model, the error correlation matrix was estimated and the Breusch-Pagan test was performed. The test results, presented in Table 12 in Appendix A, are significant at the 1% level, supporting the suitability of applying the SUR method to all specified models.

responsibility of the household domestic chores.

Concerning the presence of an elderly person in the household, there is a small increase in the amount of time dedicated to domestic chores and a greater reduction in the amount of time devoted to the labor market for the couple. These results may be explained by the fact that people do not consider caring for elderly people as domestic chores. Furthermore, the result also suggests that when an elderly person lives in the household, they are being cared for rather than helping with childcare or with other domestic activity.

Regarding income, an increase in male income reduces the time women spend on domestic chores and the time men spend on both domestic chores and the labor market. Conversely, an increase in female income leads to more time allocated by women to domestic chores and less to the labor market, while men decrease their time spent on domestic chores and increase their labor market participation. This dynamic can be related to Bertrand, Kamenica e Pan (2015) paper, which argues that women who earn more than their husbands often increase, rather than decrease, the amount of time invested in household work due to the utility costs associated with deviating from traditional gender expectations of being a "good wife". Finally, for non-work income, increases result in both women and men spending more time on domestic chores and less time in the labor market.

The female unemployment rate by stratum also significantly contributes to the couple's time allocation. For women, there is an increase in the time allocated to domestic chores and a reduction in the labor market. For men, there is also an increase in the time dedicated to home production and a reduction in the time spent on the labor market. However, the significant differences in the magnitudes of the coefficients suggest significant gender disparities in responses to the economic context.

Table 5 – Time Allocation in Patriarchal Households: SUR Model Results

	Women		Men	
Variables	Chores	Market	Chores	Market
Individual Characteristics				
Age	0.0101**	0.0578***	-0.0374***	-0.1890***
	(0.0040)	(0.0060)	(0.0019)	(0.0048)
Household's head	-0.4300***	1.2500***	0.1370***	0.8270***
	(0.0698)	(0.1030)	(0.0336)	(0.0829)
Primary	0.5520***	3.5610***	0.3310***	5.0530***
	(0.2020)	(0.3170)	(0.0764)	(0.2020)
High School	-0.4420**	9.4380***	0.8470***	7.8020***
	(0.2110)	(0.3290)	(0.0835)	(0.2180)
Undergraduate	-4.1000***	21.5900***	1.0850***	9.359***
	(0.2300)	(0.3570)	(0.0957)	(0.2480)
White	-0.1140*	1.7860***	-0.1790***	1.0720***
	(0.0653)	(0.1030)	(0.0310)	(0.0822)
Household Characteristics				
Nº of children	1.0020***	-0.9680***	0.0540***	-0.0936**
	(0.0350)	(0.0517)	(0.0168)	(0.0415)
Teenager	-0.9700***	2.5460***	-0.3660***	1.0670***
	(0.0950)	(0.1400)	(0.0457)	(0.1130)
Teenager Female	-0.6860***	0.2360	-0.2670***	-0.2430*
	(0.1050)	(0.1550)	(0.0504)	(0.1240)
Children≤3	3.8410***	-4.2310***	1.5820***	0.0569
	(0.0923)	(0.1360)	(0.0445)	(0.1100)
Elderly	0.5640***	-3.5240***	0.3640***	-3.8880***
	(0.2150)	(0.3170)	(0.1030)	(0.2550)
Income				
Man's Work Income	-0.0195***	0.0167***	-0.0111***	-0.0232***
	(0.0015)	(0.0022)	(0.0009)	(0.0025)
Women's Work Income	0.0477***	-0.4420***	-0.0009	0.0404***
	(0.0035)	(0.0054)	(0.0013)	(0.0033)
Work income^2	-8.18e-05***	0.0006***	6.13e-06***	1.53e-05***
	(7.86e-06)	(1.25e-05)	(1.32e-06)	(3.55e-06)
Non Work Income	7.45e-05***	-0.0005***	2.16e-05***	-0.0009***
	(1.20e-05)	(1.77e-05)	(5.78e-06)	(1.43e-05)
Labor Market				
Unemployment Rate	4.7910***	-34.8800***	4.9140***	-9.2550***
	(0.9680)	(1.4300)	(0.4660)	(1.1500)
Distribution factors				
Education Dif.	-0.0308***	0.0569***	0.0053	0.1760***
	(0.0096)	(0.0143)	(0.0048)	(0.0120)
Age Dif.	-0.0235***	0.0743***	-0.0309***	-0.0886***
	(0.0054)	(0.0080)	(0.0026)	(0.0066)
Constant	22.2400***	6.0940***	7.1900***	34.4600***
	(0.3000)	(0.4540)	(0.1350)	(0.3400)
Controls	Yes	Yes	Yes	Yes
Observations	159,338	159,338	159,338	159,338
R^2	0.053	0.146	0.036	0.124

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Observations represented in number of couples, with sample expansion.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

Moving to egalitarian households, we can see important changes compared to patriarchal households. The number of children has a smaller relationship with women's domestic

work and market labor hours, while for men, the number of children still leads to an increase in household chores. This effect is significantly higher than in traditional households, suggesting a more balanced distribution of caregiving responsibilities.

The education level explains a smaller portion of the time allocated by both men and women. Higher education remains associated with reduced domestic work and increased market labor for women, and now, also for men. Among individual characteristics, an increase in education level plays a key role in raising the time men dedicate to domestic chores. However, this pattern is not observed in egalitarian households, where it actually contributes to a decrease. Unlike traditional households, the effect of the female unemployment rate on women's domestic work is smaller, while its influence on men's labor market participation is more evident. This dynamic highlights the importance of contextual variables in shaping intrahousehold time allocation within egalitarian households.

The presence of at least one child under the age of three remains significant, but with similar effects on domestic production for men and women, increasing domestic labor hours by approximately 3 hours a week for both women and men. However, the reduction in the labor market is still greater for women. Interestingly, for couples with teenage children, the reduction in household chores and the increase in labor market participation are higher, emphasizing the role of teenagers in contributing to household tasks. Concerning the presence of an elderly person in the household, there is a higher increase in the amount of time dedicated to domestic chores, when compared to patriarchal households and a reduction in the amount of time devoted to the labor market for the couple.

Regarding income, an increase in male income reduces the time women spend on domestic chores and increases time spent on the labor market, for men, it decreases time spent on both domestic chores and the labor market. Conversely, an increase in female income leads to a decrease in time allocated by women to domestic chores and to the labor market, while men decrease their time spent on domestic chores and increase their labor market participation. This dynamic differs from the patriarchal households, suggesting that in a more egalitarian context, women may not feel the pressure to perform a role. Finally, for non-work income, increases result in both women and men spending more time on domestic chores and less time in the labor market.

Table 6 – Time Allocation in Egalitarian Households: SUR Model Results

	Women		Men	
Variables	Chores	Market	Chores	Market
Individual Characteristics				
Age	0.0180***	-0.0930***	0.0195***	-0.2500***
	(0.0055)	(0.0093)	(0.0052)	(0.0091)
Household's head	0.2560**	1.1020***	-0.3310***	0.5850***
	(0.1020)	(0.1680)	(0.0966)	(0.1660)
Primary	-0.1520	7.8710***	-0.1610	3.5030***
	(0.1450)	(0.6740)	(0.1160)	(0.5570)
High School	-0.3740**	13.4000***	-0.2380*	7.2710***
	(0.1600)	(0.6810)	(0.1330)	(0.5710)
Undergraduate	-0.6670***	17.4400***	-0.3930***	9.5360***
	(0.1750)	(0.6990)	(0.1500)	(0.6010)
White	-0.0929***	1.4350***	-0.0832***	1.2820***
	(0.0334)	(0.1610)	(0.0316)	(0.1590)
Household Characteristics				
Nº of children	0.9830***	-0.4990***	0.9200***	-0.3080***
	(0.0553)	(0.0911)	(0.0522)	(0.0901)
Teenager	-1.1690***	1.9970***	-1.2060***	1.5250***
	(0.1510)	(0.2480)	(0.1430)	(0.2460)
Teenager Female	-0.3500**	-0.0910	-0.2930*	0.2630
	(0.1700)	(0.2790)	(0.1610)	(0.2760)
Children≤3	3.2720***	-2.6130***	2.9920***	-0.4600**
	(0.1340)	(0.2190)	(0.1260)	(0.2170)
Elderly	1.3470***	-6.0390***	1.2030***	-5.8230***
	(0.3250)	(0.5330)	(0.3070)	(0.5280)
Income				
Man's Work Income	-0.0293***	0.0258***	-0.0293***	-0.0164***
	(0.0020)	(0.0034)	(0.0020)	(0.0048)
Women's Work Income	-0.0186***	-0.1380***	-0.0169***	0.0341***
	(0.0027)	(0.0061)	(0.0024)	(0.0044)
Work income^2	1.51e-06	0.0001***	1.95e-06	2.99e-05***
	(2.75e-06)	(1.43e-05)	(2.09e-06)	(1.14e-05)
Non Work Income	4.52e-05***	-0.0004***	4.77e-05***	-0.0006***
	(1.14e-05)	(1.87e-05)	(1.08e-05)	(1.86e-05)
Labor Market				
Unemployment Rate	7.4230***	-25.5800***	7.3400***	-17.5600***
	(1.4710)	(2.4150)	(1.3890)	(2.3930)
Distribution factors				
Education Dif.	-0.0110	0.0152	0.2660***	-0.0382***
	(0.0146)	(0.0256)	(0.0258)	(0.0139)
Age Dif.	-0.0271***	0.1160***	-0.1350***	-0.0036
	(0.0080)	(0.0132)	(0.0133)	(0.0077)
Constant	15.1700***	14.1100***	14.3600***	34.4800***
	(0.3610)	(0.8510)	(0.3410)	(0.7750)
Controls	Yes	Yes	Yes	Yes
Observations	51,022	51,022	51,022	51,022
R^2	0.049	0.120	0.046	0.102

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Observations represented in number of couples, with sample expansion.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

For nontraditional households, higher education levels have a consistent impact across genders, reducing time spent on domestic work while increasing market labor for women and

men. The female unemployment rate is still important to shift female time allocation, with an increase in time spent on domestic chores and a decrease in time spent in the labor market. For men, the unemployment rate is not important to change the time dedicated to domestic chores, while it increases the time allocated to the labor market.

The number of children is not significant for women's domestic work hours, while it increases the time spent on the labor market. For men, the presence of children continues to increase their time in household chores, and there is no effect on the labor market. This is a significant difference when compared to the results of both patriarchal and egalitarian households, suggesting that behavior regarding care differs between egalitarian and non-traditional families.

The presence of young children under three years is related to an increase in time spent on domestic chores, but is not significant for women's market labor participation. For your turn, it contributes to an increase in the time men spend on domestic chores and a decrease in the time dedicated to the labor market. Teenage children, particularly girls, still influence household dynamics, reducing the time women allocate to housework and increasing time allocated into the labor market. Concerning the presence of an elderly person in the household, the results suggests an increase in time assigned to domestic chores and a reduction in time invested in the labor market. For men, there is a decrease in time spend on the labor market.

About the income variables, an increase in male income reduces the time women spend on domestic chores. For men, it decreases time spent on both domestic chores and the labor market. In contrast, an increase in female income leads to a decrease in time allocated by women to domestic chores and to an increase in time devoted to the labor market, while men decrease their time spent on domestic chores and in the labor market. Finally, for non-work income, increases result in women spending more time on domestic chores and less time in the labor market, while the opposite happens for men.

Table 7 – Time Allocation in Non-Traditional Households: SUR Model Results

	Women		Men	
Variables	Chores	Market	Chores	Market
Individual Characteristics				
Age	-0.0806***	-0.1650***	-0.0530***	-0.0736***
	(0.0175)	(0.0251)	(0.0079)	(0.0243)
Household's head	2.9850***	0.4950	-0.8430***	1.2290***
	(0.3450)	(0.4920)	(0.1560)	(0.4670)
Primary	-0.9870*	2.5810**	0.3590	5.9040***
	(0.5830)	(1.1490)	(0.2990)	(1.2790)
High School	-1.7910***	3.3580***	0.4440	14.7000***
	(0.6480)	(1.2040)	(0.3220)	(1.3100)
Undergraduate	-2.7430***	4.9960***	0.4960	24.0700***
	(0.7300)	(1.3160)	(0.3550)	(1.4000)
White	-0.0896	1.6260***	0.1480	0.8360**
	(0.2130)	(0.4310)	(0.0957)	(0.4190)
Household Characteristics				
Nº of children	0.2630	0.4200*	0.2310***	-0.1790
	(0.1650)	(0.2350)	(0.0744)	(0.2240)
Teenager	-0.5220	-1.2550*	-0.0722	2.8660***
	(0.4610)	(0.6570)	(0.2080)	(0.6250)
Teenager Female	-2.4820***	3.1370***	-0.9710***	-0.1330
	(0.5180)	(0.7380)	(0.2340)	(0.7010)
Children≤3	4.4330***	-0.1190	2.0700***	-4.8740***
	(0.4640)	(0.6600)	(0.2090)	(0.6280)
Elderly	3.1390***	-4.7590***	-0.0760	-3.6030***
	(0.8860)	(1.2620)	(0.3990)	(1.2000)
Income				
Man's Work Income	-0.0311***	0.0094	-0.0042***	-0.0154***
	(0.0046)	(0.0090)	(0.0011)	(0.0033)
Women's Work Income	-0.0442***	0.0675***	-0.0357***	-0.387***
	(0.0080)	(0.0122)	(0.0060)	(0.0251)
Work income^2	9.03e-06***	-1.49e-06	8.65e-05***	0.0024***
	(1.87e-06)	(3.96e-06)	(3.33e-05)	(0.0001)
Non Work Income	0.0001***	-0.0007***	-0.0001**	6.29e-05***
	(3.67e-05)	(5.23e-05)	(4.97e-05)	(1.65e-05)
Labor Market				
Unemployment Rate	34.9200***	-43.9000***	7.2950	16.9800***
	(4.4810)	(6.3860)	(6.076)0	(2.0200)
Distribution factors				
Education Dif.	-0.2530***	0.0980**	-0.1290**	0.0855***
	(0.0651)	(0.0446)	(0.0613)	(0.0199)
Age Dif.	-0.0311	-0.0840***	0.0556*	0.00832
	(0.0350)	(0.0245)	(0.0330)	(0.0110)
Constant	35.2200***	12.3700***	9.9850***	4.4800***
	(1.8260)	(1.1750)	(1.8050)	(0.5330)
Controls	Yes	Yes	Yes	Yes
Observations	9,436	9,436	9,436	9,436
R^2	0.076	0.092	0.158	0.074

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Observations represented in number of couples, with sample expansion.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

1.6.1.1 Counterfactual Scenario

Gender differences in time allocation can impact both individual and household well-being, underscoring the importance of examining these decisions (KAHNEMAN; KRUEGER, 2006; GIMENEZ-NADAL; SEVILLA, 2014). One possible effect of the unpaid work burden on women is its negative impact on their labor supply, which can, in turn, lead to worse educational and economic outcomes (ANTONOPOULOS; HIRWAY, 2010). However, unpaid work provides essential services to households and contributes to family welfare.

Therefore, if the state's role in subsidizing care work remains unchanged, the focus should shift to redistributing unpaid work between men and women rather than reducing it. This redistribution would involve men taking on more household responsibilities when women engage in the labor market. This point is crucial because a reduction in overall unpaid work might not necessarily require changes in gender norms, whereas redistribution almost certainly would, which justifies a focus on the relationship between gender norms and total time worked (CAMPAÑA; GIMÉNEZ-NADAL; MOLINA, 2018).

What if all households adopted an egalitarian behavior? The parameters of the egalitarian model were used to forecast the time couples would spend on domestic chores and in the labor market. These estimates were subsequently compared to the predictions from the general model and are presented in Table 8. In a hypothetical scenario in which all households follow egalitarian practices, women would potentially decrease the time allocated to home production by approximately 26%, while men might increase their contribution by approximately 69%. In terms of participation in the labor market, women's engagement increased by approximately 42%, while men might reduce their involvement by only approximately 10%.

Examining the potential impact of these changes on the overall wage mass, the revised estimated hours were calculated and multiplied by the respective hourly wages. The findings suggest that the total male wage mass could decrease by approximately 5%, while the female wage mass might increase by approximately 40%. Ultimately, this shift could lead to a collective increase in the total wage mass, reaching close to 9%.

Thus, the results suggest that transitioning toward a more egalitarian division of household chores presents promising prospects not only for gender equality but also for the economy. A potential decrease in women's time spent on home production, combined with a potential increase in men's involvement in domestic chores, represents an important change in traditional gender roles. This new configuration would allow women to increase their participation in the workforce, enabling greater economic independence and expanding opportunities for career growth.

From an economic perspective, the expected increase in female wage mass can boost

economic activity. While the redistribution of time between genders might marginally affect male wage mass, the overall collective rise in total wage mass promises a substantial increase in income circulation within the economy and may stimulate consumption and investment.

Table 8 – Counterfactual Wage Mass Scenario: Egalitarian Household Behavior (in R$ billions)

	Men	Women	Total	Variation
General Model	67,19	33,57	100,75	0.00%
Patriarchal	69,90	25,52	95,42	-5.29%
Egalitarian	63,65	46,70	110,35	9.53%
Non Traditional	55,80	49,13	104,93	4.15%

Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

1.6.2 Singles

One heterogeneity check was to estimate the model for single women and men[16], so that the time devoted to home production and the labor market are assumed to be correlated only for the same individual, therefore, it is not been influenced by the partners choices or preferences. The results in Table 9 show that the maternity penalty is again greater for women. Here, having an undergraduate level reduces the time women spend on domestic chores and increases the time spent on the labor market. For men, there is an increase in time allocated to domestic chores and a decrease in time assigned to the labor market.

Single mothers spend nearly 1.50 hours more on domestic chores per child, an additional 5.06 hours if at least one child is under three. At the same time, they reduce their hours in the labor market, but less than they increase in domestic chores (implying they are giving up leisure time). A female teenager in the household contributes to a decrease in time spent on domestic chores and an increase in time employed in the labor market, suggesting that this girl may contribute to housework.

On the other hand, single fathers spend nearly 0.46 hours more on domestic chores per child and 1.70 hours if there is a teenager in the household. The results for domestic chores are not significant if at least one child is under three or a female teenager. Children also reduce men's hours devoted to the labor market, but only by 0.46 hours a week. Additionally, suppose that a single man has an elderly individual in the household. In that case, his time devoted to domestic chores is reduced by 4.39 hours, while for women, there is an increase in domestic chores by approximately 1.71 hours. This result may indicate that single fathers may have more support than single mothers.

[16] We define single women and men as those who do not have a partner living at their household.

Table 9 – Time Allocation in Single's Households: SUR Model Results

	Women		Men	
Variables	Chores	Market	Chores	Market
Individual Characteristics				
Age	0.0533***	-0.1270***	-0.1420***	0.0860***
	(0.0050)	(0.0079)	(0.0089)	(0.0046)
Primary	0.2660	4.5890***	5.3170***	0.1410
	(0.2600)	(0.4040)	(0.4330)	(0.2230)
High School	-0.4030	11.3300***	8.5950***	0.0727
	(0.2650)	(0.4120)	(0.4570)	(0.2350)
Undergraduate	-3.2650***	17.5200***	9.8180***	-0.7660***
	(0.2800)	(0.4350)	(0.4960)	(0.2550)
White	0.0100	0.8660***	0.1830	-0.0773
	(0.1020)	(0.1580)	(0.1990)	(0.1030)
Household Characteristics				
Nº of children	1.5000***	-0.8630***	0.4630**	0.4020***
	(0.0529)	(0.0823)	(0.2020)	(0.1040)
Teenager	-0.2300	2.0530***	1.7050***	0.4710*
	(0.1520)	(0.2360)	(0.5300)	(0.2730)
Teenager Female	-1.5060***	0.5840**	0.8180	-1.9320***
	(0.1700)	(0.2640)	(0.6680)	(0.3440)
Children≤3	5.0660***	-5.4350***	-0.4780	5.8020***
	(0.2010)	(0.3120)	(1.2980)	(0.6670)
Elderly	1.7120***	-5.1060***	-4.3960***	-0.6650***
	(0.1940)	(0.3020)	(0.3130)	(0.1610)
Income				
Work income	-0.0300***	-0.1030***	0.0048	-0.0456***
	(0.0027)	(0.0042)	(0.0048)	(0.0025)
Work income^2	4.66e-06***	1.74e-05***	2.03e-05***	1.57e-05***
	(6.99e-07)	(1.09e-06)	(3.50e-06)	(1.80e-06)
Non Work Income	0.0003***	-0.0016***	-0.0009***	9.64e-05***
	(1.71e-05)	(2.66e-05)	(2.80e-05)	(1.44e-05)
Labor Market				
Unemployment Rate	5.6300***	-33.0900***	-17.3900***	7.1170***
	(1.4100)	(2.1950)	(2.7760)	(1.4280)
Constant	15.6600***	19.7100***	34.6100***	9.1890***
	(0.4280)	(0.6670)	(0.6970)	(0.3590)
Controls	Yes	Yes	Yes	Yes
Observations	64,049	64,049	39,336	39,336
R^2	0.078	0.180	0.086	0.037

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Observations represented in number of couples, with sample expansion.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

1.7 CONCLUDING REMARKS

This article aimed to analyze the determinants of intrahousehold time allocation between household chores and the labor market for Brazilian couples, based on household types according to the division of time spent on domestic chores. The results obtained with the SUR model suggest, for patriarchal households, that factors such as education and the presence of children in the household (especially young children) are the main determinants of women's time allocation. An increase in schooling contributes to a reduction in the time

spent doing household chores and an increase in the time spent in the labor market, while the presence of young children in the home has the opposite effect. For men, the presence of young children has a smaller impact on the time dedicated to household chores, while factors such as education and region of residence are relevant for determining the allocation of time for home production.

Different attitudes toward gender norms are reflected in time allocation as patriarchal, egalitarian, or nontraditional. The main differences between genders and across household types are concentrated on variables directly related to care, i.e., number of children, children under the age of three years, teenagers, and elderly individuals. For patriarchal households, women spend more time on household production and reduce their labor market participation with an increasing number of children, whereas men show marginal changes in either domain. Egalitarian and nontraditional households, on the other hand, exhibit a more balanced distribution of domestic responsibilities, with men contributing more to household chores. However, the time men allocate to the labor market shows only modest reductions, reflecting structural norms and economic priorities.

In a hypothetical scenario where all households adopt egalitarian behaviors, the potential benefits are substantial. Women could decrease their time in home production by approximately 26% while increasing their participation in the labor market by 42%. Men, conversely, could increase their involvement in household chores by 69%, with only a 10% reduction in labor market participation. These changes would not only contribute to individual well-being and gender equity but also stimulate broader economic gains. Our estimates suggest that the total wage mass could rise by 9%, driven by a 40% increase in women's wage mass and only a 5% decline in men's.

The ongoing gender revolution, although it has contributed to a significant increase in the presence of women in the workforce, remains incomplete. This is because, despite notable advances toward equality in the workplace (although there are still many inequalities to be overcome), women continue to assume a disproportionate share of domestic responsibilities.

The greater attribution of household chores to women has several consequences, whether in terms of health, such as greater perceived stress and fatigue (EEK; AXMON, 2015), in terms of work, with a small female labor force participation (MELO; CONSIDERA; SABBATO, 2007) or even in the macroeconomic sphere, since talent may be wasted, which may limit the country's economic growth (HSIEH et al., 2019). Thus, the gender-based division of labor contributes to the perpetuation of women's disadvantage to structural and cultural forces that are mutually reinforcing at different levels (CHAFETZ, 1988).

Our results show that if all households adopted more egalitarian practices, the benefits would extend not only to women but also to the economy. A potential reduction in women's

time spent on domestic work, combined with greater involvement of men in household chores, represents a significant shift in traditional gender roles. While this new configuration is not an ideal scenario, as the behavior of more egalitarian families remains influenced by gender stereotypes related to caregiving, it still demonstrates considerable benefits. It would enable women to increase their workforce participation, fostering greater economic independence and opening up opportunities for career advancement. Additionally, it would boost overall wage mass, stimulating consumption and investment.

APPENDIX A

Sample Building

Table 10 – Step-by-Step Process of PNADC Sample Construction for the SUR Model

		Observations		Loss	
		Absolute	%	Absolute	%
		(1)	(2)	(3)	(4)
	Total observations of PNADC	1,764,845	100%		
Step 1	Households with only one family	1,313,103	74.45%	451,742	25,55%
Step 2	Above 18 and below 60 years old	760,535	43.09%	552,568	31.36%
Step 3	Declare being in a relationship with a different gender	759,613	43.03%	922	0.06%
Step 4	Household heads or spouse	627,722	35.55%	131,891	7.48%
Step 5	Individuals with consistent work hours and earnings	616,405	34.92%	11,317	0.41%
Step 6	Individuals who work up to 60 hours a week	605,428	34.30%	10,977	0.62%
Setp 7	Individuals who do up to 60 hours a week of domestic chores	600,106	34,00%	5,322	0.92%
Setp 8	Individuals with positive earnings after wages procedure	599,711	33,98%	395	0.02%
Step 9	Households with couples*	444,222	25.17%	155,489	8.81%
Step 10	Reshape*[1]	222,111	25.17%	0	0%
Step 11	Households where market work hours + domestic chores >0*	221,826	25.13%	285	0.04%
Step 12	Households where at least one spouse is employed*	219,796	24.90%	2,030	0.23%

Note: Procedures done only for couples estimation. 1: the reshape procedure is used to restructure the data to consolidate individual information by household so, there is no sample loss.
Source: Elaborated by the authors based on PNADC (IBGE, 2020) from 2012 to 2019.

Constructing the wages

As it is not possible to observe the wages of individuals who are not employed, the Heckman (1979) procedure is used to correct for sample selection bias. The procedure was performed in two stages. First, with a probit model, labor force participation is estimated.

The dependent variable assumes a value equal to one if the individual participates in the labor force and zero if not, and is then regressed from:

$$y_i^* = \beta_i X_i + \mu_i \tag{1.10}$$

where X_i is a vector of explanatory variables, namely age, educational level, race, region, number of children, presence of children younger than three years old, stratum unemployment rate, and the interview year. The latent probability of the individual being in the labor force y_i is not observed. The following is observed for the binary dependent variable y, such that:

$$y_i = 1 \; if \; y_i^* > 0 \; and, \tag{1.11}$$

$$y_i = 0 \; if \; y_i^* \leq 0 \tag{1.12}$$

By estimating the parameters β_i and μ_i, it is possible to construct λ, which is called the inverse of the Mills ratio, through:

$$\lambda = \frac{\phi\left(\frac{\beta X_i}{\sigma_\mu}\right)}{\Phi\left(\frac{\beta X_i}{\sigma_\mu}\right)} \tag{1.13}$$

where ϕ is the probability density function and Φ is the cumulative distribution function for the normal distribution. The inverse of the Mills ratio, λ, is included in the wage equation.

The wage equation is then calculated using:

$$w_i = \delta\lambda Z_i + \varepsilon_i \tag{1.14}$$

where w_i represents the wage and Z_i represents the vector of explanatory variables, given by educational level, race, region number of children, presence of children younger than three years old, stratum unemployment rate, and interview year. δ_i corresponds to the parameter set, and ε_i is the error vector.

Results

Table 11 – Heckman and Wage Equation Estimates for the Time Allocation Study

	Heckman procedure	Wage equation
Variables	LFP	Hourly Wage
Age	-0.0185***	1.1690***
	(0.0002)	(0.0343)
Primary	0.2660***	-16.6300***
	(0.0112)	(0.6210)
High School	0.5020***	-24.7300***
	(0.0117)	(0.9970)
Undergraduate	0.8740***	-20.0300***
	(0.0130)	(1.4100)
Black	0.0251***	-5.2100***
	(0.0056)	(0.1290)
Nº of children	-0.0168***	1.0220***
	(0.0022)	(0.0672)
Children≤3	-0.2460***	12.7300***
	(0.0075)	(0.4510)
Unemployment Rate	0.7240***	-42.6400***
	(0.0732)	(2.4110)
Mills	-	-112.6000***
	-	(3.7390)
Constant	0.9690***	37.9300***
	(0.0199)	(1.1860)
Controls	Yes	Yes
Observations	600,103	408,994
R^2	0.0540	0.176

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Observations represented with sample expansion.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

Breusch-Pagan test results

Table 12 – Breusch-Pagan LM Diagonal Covariance Matrix Test (SUR)

Model	Lagrange Multiplier Test	Degrees of freedom	P-Value >Chi2(6)
General Model	4.365e+04	6	0.000
Patriarchal Households	3.727e+04	6	0.000
Egalitarian Households	5.006e+04	6	0.000
Non Traditional Households	6541.21801	6	0.000
Single Men	816.30468	1	0.000
Single Women	4141.31957	1	0.000

Note: $H0$: Run OLS; $H1$: Run SUR.
Source: Research results based on PNAD data, 2016-20109.

Agreggate Results

The results for our complete sample and for patriarchal households are quite similar (which is expected since most of the families are patriarchal). Table 13 presents the results obtained with the SUR model and the coefficients, in general, were significant.

Table 13 – Time Allocation in the Full Sample: SUR Model Results

	Women		Men	
Variables	Chores	Market	Chores	Market
Individual Caracteristics				
Age	0.0111***	-0.0141***	-0.0310***	-0.1580***
	(0.0040)	(0.0053)	(0.0024)	(0.0044)
Household's head	0.1030	0.9630***	0.3390***	0.4790***
	(0.0704)	(0.0921)	(0.0435)	(0.0777)
Incomplete Primary	1.2050***	3.5030***	0.0682	3.7730***
	(0.2290)	(0.3110)	(0.1120)	(0.2110)
Primary	0.6090**	7.1300***	0.7150***	5.9150***
	(0.2470)	(0.3340)	(0.1260)	(0.2350)
Incomplete High School	0.3330	7.7590***	0.9970***	5.8920***
	(0.2600)	(0.3520)	(0.1370)	(0.2550)
High School	-0.6610***	11.8500***	1.3450***	6.8490***
	(0.2370)	(0.3190)	(0.1210)	(0.2240)
Incomplete Undergraduate	-2.4600***	14.6200***	2.0810***	6.7730***
	(0.2750)	(0.3710)	(0.1520)	(0.2830)
Undergraduate	-5.5170***	23.9000***	1.8990***	8.7750***
	(0.2540)	(0.3410)	(0.1360)	(0.2510)
White	-0.1810***	1.2730***	-0.5250***	1.4860***
	(0.0667)	(0.0906)	(0.0405)	(0.0762)
Household Caracteristics				
Nº of children	1.6270***	-1.2920***	0.0156	0.0875**
	(0.0360)	(0.0471)	(0.0222)	(0.0396)
Teenager	-1.2320***	2.3280***	-0.7630***	1.0780***
	(0.0977)	(0.1280)	(0.0603)	(0.1080)
Teenager Female	-0.8770***	0.4150***	-0.3350***	0.0023
	(0.1080)	(0.1420)	(0.0669)	(0.1200)
Children≤3	5.8500***	-4.7450***	2.3170***	-0.1320
	(0.0913)	(0.1200)	(0.0564)	(0.1010)
Elderly	0.9590***	-3.9130***	1.0240***	-4.4620***
	(0.2230)	(0.2920)	(0.1380)	(0.2460)
Income				
Men's Work income	-0.0155***	0.0052***	-0.0204***	-0.0327***
	(0.0015)	(0.0019)	(0.0012)	(0.0022)
Women's Work income	0.0306***	-0.3070***	-0.0007	0.0352***
	(0.0032)	(0.0043)	(0.0014)	(0.0026)
Work income^2	-8.73e-05***	0.0005***	1.28e-05***	2.99e-05***
	(8.80e-06)	(1.20e-05)	(1.93e-06)	(3.65e-06)
Non Work Income	4.41e-05***	-0.0004***	9.52e-05***	-0.0007***
	(1.02e-05)	(1.34e-05)	(6.32e-06)	(1.13e-05)
Labor Market				
Unemployment Rate	8.6560***	-41.0700***	3.6440***	-12.09*00**
	(1.0090)	(1.3220)	(0.6230)	(1.1140)
Distribution Factors				
Education Dif.	0.0349***	-0.0841***	0.0754***	0.1890***
	(0.0101)	(0.0133)	(0.0065)	(0.0117)
Age Dif.	-0.0150***	0.0957***	-0.0206***	-0.0830***
	(0.0054)	(0.0071)	(0.0034)	(0.0061)
Constant	18.8700***	10.0800***	8.9480***	35.0200***
	(0.3170)	(0.4220)	(0.1810)	(0.3280)
Controls	Yes	Yes	Yes	Yes
Observations	224,047	224,047	224,047	224,047
R^2	0.079	0.154	0.035	0.079

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Observations are represented as the number of couples, with sample expansion.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2022).

2 UNEQUAL BURDENS, UNEQUAL PAY: HOUSEHOLD CHORES AND THE GENDER WAGE GAP IN BRAZIL

RESUMO

O segundo artigo tem como objetivo analisar a influência das tarefas domésticas no salário dos indivíduos e na diferença salarial de gênero, utilizando a técnica de Variáveis Instrumentais (IV) com dados da Pesquisa Nacional por Amostra de Domicílios Contínua (PNADC) entre 2016 e 2019. Os resultados sugerem que o tempo dedicado às tarefas domésticas tem um impacto negativo nos salários, com as mulheres sendo mais afetadas. Além disso, a participação do parceiro masculino nas tarefas domésticas está associada ao aumento dos salários das mulheres.

Palavras-chave: Mecado de Trabalho; Afazeres Domésticos; Salários.

ABSTRACT

The second article aims to analyze the influence of household chores on individual wages and on the gender wage gap, using the Instrumental Variables (IV) technique with data from the Continuous National Household Sample Survey (PNADC) between 2016 and 2019. The results suggest that time spent on domestic tasks negatively impacts wages, with women being more affected. Additionally, male partners' participation in domestic tasks is associated with higher wages for women.

Key-words: Labor; Domestic Chores; Wage.

2.1 INTRODUCTION

Despite recent changes in the division of labor between men and women in the workforce and at home, heterosexual couples still exhibit a trend where women specialize in domestic duties (ARTIS; PAVALKO, 2003; KAN; SULLIVAN; GERSHUNY, 2011; BLAU; KAHN, 2017). The time division between paid and unpaid work among heterosexual couples has various socioeconomic implications. These include disadvantages for female labor force participation and lower wages (BLAU; KAHN, 2017), which can affect financial independence and the possibility of retirement, and can also have aggregate effects of under-utilization of women's workforce (HSIEH et al., 2019).

Different theories explain the relationship between domestic chores and labor market results. According to Becker (1985), the negative impact of household chores on wages arises from the limitation on individual energy. The more energy expended on household chores, the less energy is available to invest in the labor market, reducing productivity and consequently lowering wages. Furthermore, dedicating more time to household chores leads to a decreased availability of time to participate in the labor market and training programs (BAXTER, 1992). Consequently, there is an increased demand for lower-skilled and more flexible employment opportunities, which tend to offer lower compensation.

On the other hand, within the household dynamic, an increase in the partner's time allocation to household chores diminishes the individual's need to dedicate as much time to such tasks. This, in turn, increases the availability of energy to be directed towards the labor market (BONKE; GUPTA; SMITH, 2004). In addition, it gives more time to engage in work that requires higher professional availability, thereby fostering beneficial outcomes in terms of career advancement and income growth.

Besides this, the time allocation divided between the couple depends on factors such as human capital, which leads to the specialization of the member with less human capital or smaller wages in domestic tasks, while the member with greater human capital or higher wages specializes in the labor market (GRONAU, 1977). The specialization theory does not incorporate the gender perspective and overlooks the necessity of policies aimed at fostering a more equitable distribution of household labor as fundamental for achieving a fairer society (BLOM; COOKE, 2023).

In contrast to this model, gender theorists assert that the division of housework encloses more than just rational time allocation. Among these factors are gender identities, roles, and status hierarchies (BERK, 2012; WEST; ZIMMERMAN, 1987; RIDGEWAY; CORRELL, 2004). This explains why women typically undertake more domestic responsibilities than men, even when they spend similar hours in the labor market. Moreover, women often bear the primary

responsibility for the mental organization of household tasks, even when their partners contribute more hours (DAMINGER, 2019). In addition to this, Bertrand (2020) argues that gender stereotypes are beliefs about what men and women should do. This makes men and women adjust their actions and make decisions based on these beliefs. Besides this, Akerlof e Kranton (2000) argues that prescriptions dictate that "men" should not do "women's work" in the home and "men" should earn more than their wives, which contributes to the unequal division of housework.

According to the Organization for Economic Cooperation and Development (OECD), the unequal division of household chores within the household can be a factor that contributes to explaining the gender differences observed in labor market outcomes (FERRANT; PESANDO; NOWACKA, 2014b). Furthermore, Matteazzi e Scherer (2021) contends that women tend to face more substantial wage penalties for routine domestic work compared to their male counterparts.

Several studies have analyzed the negative relationship between household chores and wages (BAXTER, 1992; BONKE; GUPTA; SMITH, 2004; BRYAN; SEVILLA-SANZ, 2011; CARLSON; LYNCH, 2017; COOKE; HOOK, 2018; COVERMAN, 1983; HERSCH; STRATTON, 1997; HERSCH, 2009; KEITH; MALONE, 2005; MCALLISTER, 1990; MCLENNAN, 2000). Although just a few of them take into account the effects of the partner's household time on the individual wage (JACOBSEN; RAYACK, 1996; STROH; BRETT, 1996; BRYAN; SEVILLA-SANZ, 2011; HERSCH; STRATTON, 1997; HERSCH, 2009; KEITH; MALONE, 2005; MATTEAZZI; SCHERER, 2021).

Additionally, it should be noted that specialization among partners may prove to be more advantageous for high-wage couples. This can be attributed to the high cost of living, which renders it challenging for low-wage couples to sustain themselves solely on one income. Furthermore, for low-wage earners, outsourcing domestic tasks is often unfeasible, resulting in a heavier burden of housework. Additionally, low-wage workers tend to have more traditional ideas about women's and men's paid and unpaid work (KAN, 2008; USDANSKY, 2011).

Hence, the objective of this study is to examine the impact of individual and partner household chores on individual wages in Brazil. Furthermore, the study aims to assess how the division of household tasks within a household influences wages. Specifically, our analysis focuses on individual wages and the wage differentials between partners (the intra-couple wage gap). A similar analysis is conducted by Matteazzi e Scherer (2021) for the United States, Germany, and Italy.

For Brazil, Sette, Coelho e Silva (2023) analyzes how individual time spent on housework can contribute to the gender wage gap. However, there is currently no analysis in the Brazilian context related to the partners' time spent on domestic chores. To fulfill the stated

objectives, this study employs the Instrumental Variables (IV) approach. The dataset used is the Continuous National Household Sample Survey (PNADC) of the Brazilian Institute of Geography and Statistics (IBGE), spanning from 2016 to 2019.

To address potential endogeneity in the estimation of housework hours on wages, we employ an instrumental variable based on the proportion of hours spent on domestic chores within the stratum. The stratum is a part of the sample from the database prepared by IBGE. Initially, the census tracts were defined, totaling 214,836 tracts. Based on this list, the primary sampling units (PSUs) were established. The minimum size of the PSUs was at least 60 private permanent households. The tracts were then stratified, meaning they were divided into subpopulations from which independent samples were drawn to obtain the Master Sample (MALAGUTI; ALVES, 2024). Table 26 in Appendix B presents the number of stratum by Federal Units.

The domestic chore proportion is calculated as the total hours spent on domestic chores by women (or men) divided by the sum of hours spent on domestic chores by both partners in a household. The choice of this instrument is motivated by the argument that local gender norms can influence individual behavior, discussed in papers such as Akerlof e Kranton (2000) and Bertrand (2020). Women, for example, may feel pressured to perform more domestic work when surrounded by women who allocate a significant portion of their time to such activities (BERTRAND, 2020). The exogeneity of this instrument relies on the assumption that local gender norms, reflected in the average behavior within the stratum, affect individual housework decisions but do not directly impact wages, except through their influence on housework allocation. This makes the instrument a valid proxy to capture the variation in individual housework hours driven by social norms rather than by unobserved factors potentially correlated with wages.

While the study by Sette, Coelho e Silva (2023) explores the relationship between domestic work and gender wage gap in Brazil, this research advances the literature by employing an instrumental variable to address endogeneity issues in the relationship between hours spent on housework and wages. Furthermore, it distinguishes between the effects of domestic chores performed by the individual and those performed by their partner, offering a more detailed perspective on intrafamily dynamics.

In addition to this introduction, the chapter is composed of the following sections: the literature review, the methodology, the data and sample, the results, and, finally, the final considerations.

2.2 THEORITICAL FRAMEWORK

This section briefly summarizes Becker (1985) theory, where he demonstrates the relationship between household labor time and market effort.

Individuals maximize a utility function composed of commodities

$$U = U(Z) \tag{2.1}$$

where Z presents a vector of commodities produced through a function that incorporates both effective time and market goods (x)

$$Z = Z(x, \hat{t}) \tag{2.2}$$

where the effective time is $\hat{t}_i = w_i(e_i)\, t_i$, and i is a household activity. Effective time is determined by the productivity in each home production activity (w_i), which, in turn, depends on the effort exerted per hour on that activity (e_i).

Individuals are subject to limitations on their income, time, and effort. The budget and time constraints follow standard assumptions. Total available energy is considered finite and is distributed between household and market activities.

To maximize utility, the marginal utility of time spent in either market or home production must equal the marginal cost of both time and effort. By specifying Cobb-Douglas functional forms for the effective home time function and the wage function, Becker (1985) illustrates that effort in any activity depends on the marginal utility of time and effort, as well as the effort intensity of those activities. It is important to note that effort intensities are fixed parameters, as are the marginal utility of time and effort. Consequently, the ratio of effort per hour between any two activities remains constant.

The energy constraint assumes that each individual has a fixed amount of energy, which is fully utilized in efforts dedicated to either household or market activities. Following Becker's framework, activities are categorized into three groups: household labor, market work, and leisure. The energy constraint, expressed with its optimal values, is formalized as:

$$E = e_h^* t_h^* + e_l^* t_l^* + e_m^* y_m^* \tag{2.3}$$

It is further assumed that both household labor and market work are more effort-intensive than leisure. Given that the effort per hour ratio between any two activities is fixed, the following relationships apply:

$$e_h = \alpha_1 e_m,\ e_l = \alpha_2 e_m,\ \alpha_1 > 0,\ \alpha_2 < 1,\ \alpha_1 > \alpha_2 \tag{2.4}$$

Here, e_h represents the effort per hour of household labor, e_m the effort per hour of market work, and e_l the effort per hour of leisure. By applying both the time and energy constraints, the following expression is derived:

$$e_m^* = \frac{E}{\alpha_1 t_h^* + \alpha_2 (T - t_m^* - t_h^*) + t_m^*} \tag{2.5}$$

Taking the total derivative of this optimal condition allows for an examination of the relationship between changes in two variables e_m and t_h. The resulting total derivative is:

$$\partial e_m^* = \frac{-e_m^*}{\alpha_1 t_h^* + \alpha_2 t_l^* + t + m^*} \left[(\alpha_1 - \alpha_2) \partial t_h^* + (1 - \alpha_2) \partial t_m^* \right] \tag{2.6}$$

Becker assumes that ∂t_m, and obtains the result that, if ∂t_h is positive, ∂e_m will be negative[1].

Building on Becker's assumption of constant t_m, an increase in hours dedicated to household labor reduces the effort per hour of market work if the replaced activity is less effort-intensive than household labor. Since household labor is typically more effort-intensive than leisure, allocating more hours to household tasks at the expense of leisure reduces the effort devoted to market work, leading to lower wages. In the case of couples, if one partner specializes in household tasks, the other gains additional time and energy to dedicate to market work, potentially increasing their productivity and earnings.

2.3 EMPIRICAL LITERATURE

Some papers have investigated the relationship between domestic work and wages. Most of them have found a negative relationship for both men and women, but with a higher decrease in female wages (HERSCH; STRATTON, 1997; KEITH; MALONE, 2005; BAXTER, 1992; SETTE; COELHO; SILVA, 2023). The findings of Coverman (1983), for the United States, align with these studies. The author argued that gender inequality in the division of domestic labor perpetuates disparities in the labor market. Women with high earnings potential but limited access to domestic support are particularly disadvantaged.

Also for the United States, Hersch e Stratton (1997) showed that housework time exerts a negative effect on wages, with women experiencing significantly greater penalties than men. On the other hand, McLennan (2000) only observed a negative and significant impact of

[1] $(\alpha_1 - \alpha_2) > 0$; $(1 - \alpha_2) > 0$ by equation 2.4.

household labor on the wages of white married women. The author contended that household labor differences alone do not account for the persistent gender wage gap.

Further evidence for the United States is found at Keith e Malone (2005) paper, which indicated that housework time adversely affects married women's wages while having an indeterminate effect on married men's wages. The impact of housework was particularly significant for women in childbearing stages, with each additional hour reducing wages by 0.1–0.4% for younger and middle-aged women.

Hersch (2009) examined the relationship across various occupations in the United States and found a persistent negative association between time spent on daily housework activities and wages. Once again, the effect was stronger for women than men. This trend was further explored by Carlson e Lynch (2017), who found that, for women, earnings negatively affected time spent in routine housework, and time spent in routine housework also negatively affected personal earnings. For your turn, only the latter was observed for husbands.

Finally, Cooke e Hook (2018) highlighted that, for women, reduced time spent on routine housework at the higher end of the wage distribution predicted smaller penalties, whereas men at the top of their wage distribution incurred the largest penalties for increased housework time.

Studies conducted in Australia reveal similar dynamics regarding the relationship between domestic labor and wages. McAllister (1990) found that for both men and women, time spent on household chores leads to a reduction in wages. However, women working part-time did not experience wage reductions associated with time spent on housework. The authors suggest this result might be due to differences in the nature of part-time work or its compatibility with domestic responsibilities.

Similarly, Baxter (1992) highlighted that domestic labor responsibilities significantly reduce women's earnings. However, they found no clear evidence that the number of hours women spend on housework directly affects their wages. Additionally, the study observed that married men tend to earn higher wages than single men, a result attributed to the domestic support provided by wives, which enables greater engagement in paid work. For women, however, marriage was associated with a decline in earnings, reflecting the unequal economic impacts of domestic roles.

Research from European countries also highlights the impacts of housework on wages. In Denmark, Bonke, Gupta e Smith (2004) found that housework negatively affects women's wages while having a positive effect on men's wages, except at the higher end of the conditional wage distribution.

In Britain, Bryan e Sevilla-Sanz (2011) observed that housework negatively impacts

the wages of both men and women working full-time, regardless of marital status. Among women working part-time, only single women experience a housework penalty, indicating that some part-time jobs are more compatible with domestic responsibilities. The study also found evidence suggesting that the housework penalty is more pronounced when children are present, underscoring the influence of caregiving responsibilities on wage outcomes.

In Germany, Fendel (2021) identified significant negative effects of housework on wages for migrant women and native-born individuals. Migrant men, however, experienced significantly smaller or negligible effects. The study noted that migrant women tend to spend more time on housework than native-born women, leading to larger wage penalties.

In Brazil, research on the relationship between housework and wages is scarce, with only two studies addressing this issue directly. Manganelli et al. (2012) demonstrated that housework influences wages negatively, particularly at the top of the wage distribution. More recently, Sette, Coelho e Silva (2023) found a negative association between physically demanding housework and labor income for both men and women, with women experiencing a larger penalty. Using income decomposition techniques, the study revealed that accounting for housework reduces both observed and unobserved wage differentials.

Research examining the influence of a partner's domestic labor on wages is limited, but existing studies provide important insights. In the United States, Jacobsen e Rayack (1996) and Stroh e Brett (1996) found that men benefit economically from having non-working wives, experiencing advantages in wages or career progression. Similarly, Brines (1993) explored the relationship between husbands' housework and their wives' labor, though no evidence has been identified linking husbands' housework contributions to their wives' wages.

Expanding to other countries, Matteazzi e Scherer (2021) showed that women's housework generally supports men's wage growth, while women do not appear to derive similar benefits from their partners' domestic contributions. This pattern was consistent in the United States, Italy, and Germany and applied both to the overall wage gap and the within-couple gap.

In England, Blom e Cooke (2023) found that women face wage penalties for taking on larger shares of housework, while only elite men benefit economically from their partners' specialization in domestic labor. Notably, men's wages were unaffected by performing more routine housework, and the study suggested that partnered men could significantly increase their housework contributions without compromising their earnings.

Table 14 presents a summary from the literature review. This study contributes to the existing literature by examining the relationship between individual housework and the domestic contributions of a partner on wages, with a specific focus on Brazil. Unlike previous

research, which has not addressed cross-partner effects for this country, this work fills an important gap by incorporating the partner's role into the analysis.

Table 14 – Overview of Methodologies, Databases, Regions in Housework and Wage Studies

Authors	Methodology	Data base	Country
Coverman (1983)	OLS	Quality of Employment Survey, 1997	United States
McAllister (1990)	Multivariate Analysis	Australian National Social Science Survey, 1984/85	Australia
Baxter (1992)	2SLS	Comparative Project on Class Structure and Class Consciousness, 1986	Australia
Brines (1993)	OLS	Panel Study of Income Dynamics, 1985	United States
Jacobsen e Rayack (1996)	OLS	Panel Study of Income Dynamics, 1984-1989	Unites States
Stroh e Brett (1996)	OLS	Fortune 500 corporations, 1987/1988	United States
Hersch e Stratton (1997)	IV	Panel Study of Income Dynamics, 1979-1987	United States
McLennan (2000)	OLS	National Longitudinal Study of Young Women and Young Men, 1968-1988	United States
Bonke, Gupta e Smith (2004)	Quantile Regressions	Danish TUS, 1987	Denmark
Keith e Malone (2005)	OLS	Panel Study of Income Dynamics, 1979-1987	Unites States
Hersch (2009)	OLS	American Time Use Survey 2003-2006	United States
Manganelli et al. (2012)	Quantile Regressions	PNAD, 2009	Brazil
Bryan e Sevilla-Sanz (2011)	Fixed effects	British Household Panel Survey, 1992-2004	Britain
Carlson e Lynch (2017)	Structural equation models	National Survey of Families and Households, 1987/88 and 1992/94	United States
Cooke e Hook (2018)	Unconditional quantile regression	American Time Use Survey, 2010-2015	United States
Fendel (2021)	OLS	German Socio-Economic Panel, 1995-2017	Germany
Matteazzi e Scherer (2021)	IV and Oaxaca-Blinder	Panel Study of Income Dynamics, 2009 and European Union Statistics on Income and Living Conditions, 2010	United States, Germany and Italy
Sette, Coelho e Silva (2023)	Oaxaca-Blinder	PNAD, 2019	Brazil
Blom e Cooke (2024)	Unconditional Quantile Regression	British Household Panel Survey, 1991-2021	Britain

Source: Prepared by the authors (2025).

2.4 DATA

The data used in this study is the Continuous National Household Sample Survey (PNADC) conducted by the Brazilian Institute of Geography and Statistics (IBGE) from 2016 to 2019. The PNADC sample follows a rotating panel design, where households are interviewed for one month and then exit the sample for two consecutive months; this process is repeated five times. While the survey is not a time diary, it includes stylized inquiries regarding time allocation for household chores and caregiving responsibilities. Consequently, respondents are queried about the amount of time dedicated to household chores or caregiving activities in the past week. The question regarding time spent on household chores was discontinued during the pandemic period (2020 and 2021) and restarted in 2022. The 2022 and 2023 data follow the same trend as previous years; however, the decision was made to retain the longer data series, allowing for a larger sample size, which justifies the period chosen.

We focused on heterosexual couples wherein both partners were aged between 20 and 60 years old and were employed. This age bracket was selected to mitigate potential biases stemming from very young couples who might still be in education and thus not yet active in the job market. Similarly, couples aged over 60 are more likely to be retired and hence not contributing to the labor force. Individuals who reported not having a job but received a positive wage, those who were employed but did not receive a wage, and respondents who claimed to spend over 70 hours per week on domestic chores, over 60 hours in the labor market, or less than 5 hours in the labor market were excluded from the analysis. Finally, we excluded households with more than one family living together[2]. The analyses are carried out for families with and without children to verify the robustness of the results.

The list of variables used in the model and their descriptions are shown in Table 15.

[2] See details of data building in Table 27.

Table 15 – Variable Definitions for the Housework and Wage Study

Variable	Description
Dependents	
Hourly Wage	Wage by worked hours.
Explanatory	
Domestic Chores$_i$	Time spent in domestic chores by individual i.
Domestic Chores$_i^2$	Squared time spent in domestic chores by individual i.
Domestic Chores$_p$	Time spent in domestic chores by the partner p.
Domestic Chores$_p^2$	Squared time spent in domestic chores by the partner p.
Children	Dummies for the presence of children aged between 0 and 5, 6 and 12, and 13 and 18 years old.
Black	Dummy equal to 1 if the individual is black.
Educational level	Dummies to incomplete elementary*, elementary, incomplete high school, high school, incomplete undergraduate, and undergraduate.
Occupation	Dummies for occupation: 0=Other occupation*; 1=Elementary occupations and skilled agricultural workers; 2=Managers; 3=Professionals; 4=Associate professionals; 5=Clerks; 6=Service, shop and market sales workers; 7=Craft-workers; Plant and machine operators.
Sector	Dummies for activity sector: 0=Other sector*; 1=Arts, activities of extraterritorial bodies and other services; 2=Agriculture, mining, manufacturing, electricity, gas and water supply; 3=Construction, wholesale and retail trade, and transportation; 4=Accommodation and food services; 5=Information and communication, financial and insurance activities; 6=Real estate, professional and administrative services; 7=Public administration, education and human health services. 8=Domestic work.
Controls	Dummies for urban and rural* areas, North*, Northeast, Southeast, South, Midwest, 2016*, 2017, 2018, and 2019.

Note: *Base category.
Source: Prepared by the authors (2025).

Table 16 presents the descriptive statistics. It can be observed that the mean hourly wage is by about R$17[3]. The individual and partner's time spent on domestic chores is around 14 hours a week. Most of the sample has completed high school, is working in elementary occupations, and skilled agricultural workers, service, shop, and market sales workers; the predominant sector is construction, wholesale and retail trade, and transportation. Finally, more than 91% live in urban areas and about 46% in the Southeast.

[3] All income values are expressed in 2019 prices.

Table 16 – Descriptive Statistics for the Housework and Wages Study

Variable	Mean	SD	Min.	Max.
Hourly Wage	17.3133	22.2427	0.0696	811.5961
Domestic Chores$_i$	14.7582	11.1417	0	70
Domestic Chores$_i^2$	341.9420	524.5532	0	4900
Domestic Chores$_p$	14.7582	11.1417	0	70
Domestic Chores$_p^2$	341.9420	524.5532	0	4900
Children 13 to 18	0.9751	0.9452	0	9
Children 6 to 12	0.3969	0.6159	0	5
Children 0 to 5	0.2809	0.5145	0	4
Black	0.4944	0.4999	0	1
Incomplete Elementary	0.1977	0.3982	0	1
Elementary	0.0846	0.2783	0	1
Incomplete High School	0.0539	0.2258	0	1
High School	0.3533	0.4780	0	1
Incomplete Undergraduate	0.0491	0.2162	0	1
Undergraduate	0.2491	0.4325	0	1
Occupation[a]				
1	0.1837	0.3873	0	1
2	0.0494	0.2169	0	1
3	0.1366	0.3434	0	1
4	0.0864	0.2810	0	1
5	0.0742	0.2622	0	1
6	0.2257	0.4180	0	1
7	0.2185	0.4132	0	1
Sector[b]				
1	0.0524	0.2229	0	1
2	0.1969	0.3977	0	1
3	0.3078	0.4615	0	1
4	0.0499	0.2178	0	1
5	0.0310	0.1733	0	1
6	0.0853	0.2793	0	1
7	0.2071	0.4052	0	1
8	0.0690	0.2535	0	1
Urban Area	0.9129	0.2819	0	1
Northeast	0.1982	0.3986	0	1
Southeast	0.4624	0.4985	0	1
South	0.1883	0.3909	0	1
Mid-West	0.0903	0.2867	0	1
Mills	0.4871	0.2341	0.0583	4.1313
2017	0.2485	0.4321	0	1
2018	0.2538	0.4352	0	1
2019	0.2537	0.4351	0	1
Observations	206,750			

Notes: (a): Occupation: 1=Elementary occupations and skilled agricultural workers; 2=Managers; 3=Professionals; 4=Associate professionals; 5=Clerks; 6=Service, shop and market sales workers; 7=Craftworkers; Plant and machine operators. (b) Sector of the economic activity: 1= Arts, activities of extraterritorial bodies and other services; 2=Agriculture, mining, manufacturing, electricity, gas and water supply; 3=Construction, wholesale and retail trade, and transportation; 4=Accommodation and food services; 5=Information and communication, financial and insurance activities; 6=Real estate, professional and administrative services; 7=Public administration, education and human health services. 8= Domestic work.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020)

Table 17 presents the descriptive statistics by gender. In terms of hourly wages, men earn around R$19 while women earn about R$15, resulting in a gap of R$3. Considering domestic chores, men spend about 10 hours a week, while women spend about 19 hours a week. In this way, women spend almost twice the time on housework compared to their partners. Considering educational level, whereas 20% of men have completed a graduate, 29% of women have reached this educational level. Related to occupation, 35% of men are craft-workers, plant and machine operators, while 27% of women are service, shop, and market sales workers. Finally, we have 40% of men in construction, wholesale and retail trade, and transportation, and 28% of women in public administration, education, and human health services.

Table 17 – Descriptive Statistics by Gender for the Housework and Wages Study

Variable	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Dif.
	Men				Women				
Hourly Wage	19.2300	24.8442	0.1000	715	15.3965	19.1024	0.0696	811.5961	3.2779***
Domestic Chores$_i$	10.2222	8.5678	0	70	19.2941	11.5637	0	70	-9.2127***
Domestic Chores$_i^2$	177.9026	329.1358	0	4900	505.9815	623.0296	0	4900	-327.2910***
Domestic Chores$_p$	19.2941	11.5637	0	70	10.2222	8.5678	0	70	9.2127***
Domestic Chores$_p^2$	505.9815	623.0296	0	4900	177.9026	329.1358	0	4900	327.2918***
Children 13 to 18	0.9751	0.9452	0	9	0.9751	0.9452	0	9	-
Children 6 to 12	0.3969	0.6159	0	5	0.3969	0.6159	0	5	-
Children 0 to 5	0.2809	0.5145	0	4	0.2809	0.5145	0	4	-
Black	0.5035	0.4999	0	1	0.4854	0.4997	0	1	0.0164***
Incomplete Elementary	0.2355	0.4243	0	1	0.1598	0.3664	0	1	0.0757***
Elementary	0.0944	0.2925	0	1	0.0748	0.2631	0	1	0.0196***
Incomplete High School	0.0574	0.2326	0	1	0.0504	0.2188	0	1	0.0070***
High School	0.3477	0.4762	0	1	0.3588	0.4796	0	1	-0.0110***
Incomplete Undergraduate	0.0465	0.2106	0	1	0.0517	0.2215	0	1	-0.0052***
Undergraduate	0.2030	0.40225	0	1	0.2953	0.4562	0	1	-0.0923***
Occupation[a]									
1	0.1496	0.3567	0	1	0.2179	0.4128	0	1	-0.0683***
2	0.0575	0.2328	0	1	0.0414	0.1993	0	1	0.0161***
3	0.0941	0.2920	0	1	0.1791	0.3834	0	1	-0.0850***
4	0.0880	0.2834	0	1	0.0848	0.2786	0	1	0.0032***
5	0.0465	0.2106	0	1	0.1020	0.3027	0	1	-0.0555***
6	0.1763	0.3811	0	1	0.2751	0.4465	0	1	-0.0988***
7	0.3543	0.4783	0	1	0.0826	0.2752	0	1	-0.2717***
Sector[b]									
1	0.0358	0.1858	0	1	0.0690	0.2535	0	1	-0.0332***
2	0.2521	0.4342	0	1	0.1417	0.3488	0	1	0.1104***
3	0.4087	0.4916	0	1	0.2068	0.4050	0	1	0.2019***
4	0.0376	0.1904	0	1	0.0622	0.2415	0	1	-0.0246***
5	0.0354	0.1847	0	1	0.0266	0.1610	0	1	0.0088***
6	0.0925	0.2898	0	1	0.0781	0.2683	0	1	0.0144***
7	0.1295	0.3358	0	1	0.2847	0.4512	0	1	-0.1552***
8	0.0078	0.0880	0	1	0.1303	0.3366	0	1	-0.1225***
Urban Area	0.9129	0.2819	0	1	0.9129	0.2819	0	1	-
Northeast	0.1982	0.3986	0	1	0.1982	0.3986	0	1	-
Southeast	0.4624	0.4985	0	1	0.4624	0.4985	0	1	-
South	0.1883	0.3909	0	1	0.1883	0.3909	0	1	-
Mid-West	0.0903	0.2867	0	1	0.0903	0.2867	0	1	-
Mills	-	-	-	-	0.4871	0.2341	0.0583	4.1313	-
2017	0.2485	0.4321	0	1	0.2485	0.4321	0	1	-
2018	0.2538	0.4352	0	1	0.2538	0.4352	0	1	-
2019	0.2537	0.4351	0	1	0.2537	0.4351	0	1	-

Notes: (a): Occupation: 1=Elementary occupations and skilled agricultural workers; 2=Managers; 3=Professionals; 4=Associate professionals; 5=Clerks; 6=Service, shop and market sales workers; 7=Craftworkers; Plant and machine operators. (b) Sector of the economic activity: 1=Arts, activities of extraterritorial bodies and other services; 2=Agriculture, mining, manufacturing, electricity, gas and water supply; 3=Construction, wholesale and retail trade, and transportation; 4=Accommodation and food services; 5=Information and communication, financial and insurance activities; 6=Real estate, professional and administrative services; 7=Public administration, education and human health services. 8= Domestic work.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020)

2.5 METHODOLOGY

According to Becker (1985), individuals with higher productivity tend to specialize in the labor market, dedicating less time to housework, which can make housework endogenous to the wage equation. To address potential endogeneity in the estimation of housework hours on wages, we employ an instrumental variable based on the proportion of hours spent on domestic chores within the stratum. This proportion is calculated as the total hours spent on domestic chores by women (or men) divided by the sum of hours spent on domestic

chores by both partners in a household. The choice of this instrument is motivated by the argument that local gender norms can influence individual behavior. Women, for example, may feel pressured to perform more domestic work when surrounded by women who allocate a significant portion of their time to such activities (BERTRAND, 2020). The exogeneity of this instrument relies on the assumption that local gender norms, reflected in the average behavior within the stratum, affect individual housework decisions but do not directly impact wages, except through their influence on housework allocation. This makes the instrument a valid proxy to capture the variation in individual housework hours driven by social norms rather than by unobserved factors potentially correlated with wages.

2.5.1 Instrumental Variables

Domestic work was instrumentalized from the proportion of domestic chores by stratum, calculated as the total hours spent on domestic chores by women (or men) divided by the sum of hours spent on domestic chores by both partners in a household. Additionally, to confirm the robustness of the instrumental variable estimates, a heteroscedasticity-based instrumental variable was performed (LEWBEL, 2012).

Let y_i denote the outcome variable of interest, the hourly wage of individual i for individual wage analysis, and the wage gap in the within-couple wage gap analysis. The difference between the male and female wages gives the wage gap. Y_i denotes the interest variables (the hourly wage of individual i for individual wages analysis and the wage gap in the within couple wage gap analysis), X_i denotes K_1 additional observed control variables and Z_i denote the instrumental variable. These are all observed for individuals $i = 1, \ldots, N$. Also, let β and γ be unknown parameter vectors, Φ and Π be matrices of unknown parameters, β' denote the transpose of β, and ε_i and V_i are error terms. Assuming that these variables are linearly related, the instrumental variables approach can be represented by these two equations:

$$Y_i = \Phi X_i + \Pi Z_i + V_i \tag{2.7}$$

$$y_i = \beta^{'} Y_i + \gamma^{'} X_i + \varepsilon_i \tag{2.8}$$

In the first level, equation (2.7), Y_i is explained by the instruments, denoted by Z_i, which are constructed using the total hours spent on domestic chores by women divided by the sum of hours spent on domestic chores by both partners in a household, for the female wage equation and the total hours spent on domestic chores by men divided by the sum of hours spent on domestic chores by both partners in a household, for the male wage equation.

Additionally, the control variables, represented by X_i, include the squared time spent by the individual partner on domestic chores, the partner's time spent on domestic chores, the number of children in different age groups (0–5 years, 6–12 years, and 13–18 years), race, educational level, occupation, sector of economic activity, region, and year dummies. In the second level, equation (2.8), the estimated Y_i is used as an explanatory variable for y_i. Both levels constitute a Two-Stage Least Squares (2SLS) estimation procedure.

2.6 RESULTS

This section presents the results for the OLS and HB IV[4]. The OLS estimates provide valid estimates of the econometric models only if the observed determinations of wages are uncorrelated with the unobserved determinations of domestic chores. Since this condition probably does not hold, the OLS results should be disregarded as primarily descriptive.

First, we present the results for the full sample, then there are the results for couples who both work in full-time jobs, couples with children, and childless couples. In the selected sample, 40.51% of women were unemployed or out of the labor force, while only 10.28% of men were in this situation. The Heckman (1979) correction is used to reduce the sample selection bias caused by the high level of female non-participation in the labor market, and the mill's ratio was included among the explanatory variables[5].

2.6.1 Full Sample

The results presented in Table 18 highlight the relationship between individual and partner household chores with wages of men and women. The models of Ordinary Least Squares (OLS) and the Robust Method of Instrumental Variables (HB IV)[6] were estimated separately by gender.

The validity of the instrumental variable is confirmed by the results of the first-stage F-test, which indicate a strong relationship between the instrument and the endogenous variable. Specifically, the F-statistic is 25,818.5 for the wage equation of women and 29,376.6 for the wage equation of men. These values are well above the commonly accepted threshold of 10, which is used to rule out weak instrument concerns. Thus, the instrument exhibits sufficient explanatory power, reinforcing its suitability for addressing potential endogeneity in the model.

[4] The IV results are presented in Appendix B.

[5] The Heckman procedure details and the estimation results are presented in Appendix B.

[6] The estimation of Instrumental Variables (IV) was also conducted, and the results are similar to the ones obtained with the HB IV. These results are available upon request to the corresponding author.

An increase in time dedicated to household chores is associated with a reduction in wages for both men and women. This effect is particularly pronounced for women, with a potential decrease of up to R$0.11 in hourly wages when using the HB IV method. In contrast, the reduction for men is smaller, reaching up to R$0.04. To provide context, in 2019, the Brazilian minimum wage was R$998, translating to an hourly wage of approximately R$6.23 for a full-time worker (40 hours per week). This implies that an additional hour spent on domestic chores corresponds to a wage reduction of approximately 1.86% for women and 0.79% for men.

These results are consistent with the literature that suggests that housework reduces individual wages, and that this reduction is higher for women (HERSCH; STRATTON, 1997; KEITH; MALONE, 2005; BAXTER, 1992; SETTE; COELHO; SILVA, 2023). One potential explanation for the variance in results is that tasks typically deemed non-routine, such as minor repairs and gardening, which are more commonly performed by men, may not significantly impact the wages of either men or women (COOKE; HOOK, 2018; HERSCH, 2009). Furthermore, some studies suggest that routine tasks, such as house cleaning—predominantly undertaken by women—have a higher impact on employment outcomes. The adverse effect of each additional hour spent on these tasks is observed to be more pronounced for women than for men, aligning with findings from previous literature (BRYAN; SEVILLA-SANZ, 2011; CARLSON; LYNCH, 2017; COOKE; HOOK, 2018; HERSCH, 2009; HERSCH; STRATTON, 1997; KILLEWALD; GARCÍA-MANGLANO, 2016; KÜHHIRT; LUDWIG, 2012; MATTEAZZI; SCHERER, 2021; POLLMANN-SCHULT, 2011).

In contrast, the findings suggest that a partner's engagement in household chores contributes to an increase in the female individual's wage and to a decrease in the male individual's wage. This result is the opposite of what was obtained in Jacobsen e Rayack (1996), Stroh e Brett (1996) and Matteazzi e Scherer (2021), which suggests that men benefit from their partner's housework. Blom e Cooke (2023), for your turn, finds that only elite men benefit economically from their partners' specialization in domestic labor, which can be a further investigation.

Even though the results support the OECD's suggestion that unequal sharing of household chores may help explain gender disparities in labor market outcomes (FERRANT; PESANDO; NOWACKA, 2014b). Hence, the results indicate that fostering men to take on more domestic responsibilities could be a viable strategy for narrowing the gender wage gap.

Regarding the age range of children in the household, it is noted that for children between 13 and 18 years old, there is an increase in women's and men's hourly wages. This outcome can be explained by the fact that teenagers in this age group can assist with household chores, allowing the parents to pursue better jobs. The presence of children aged between

6 and 12 years reduces women's hourly wages and increases men's hourly wages.

Concerning the presence of children aged between 0 and 5 years, there is a decrease in women's hourly wages, and the results for men are not significant. This finding suggests that when there are young children in the household, women tend to prioritize caregiving responsibilities over their careers, while men take on the role of the primary breadwinner. As expected, being black reduces women's and men's wages. The higher the educational level, the higher the hourly wage for both men and women. However, the wage increase due to educational level is more pronounced for women than for men.

Table 18 – Effects of Individuals' and Partners' Housework Hours on Hourly Wages: OLS and HB IV Estimates

	Women		Men	
	OLS	HB IV	OLS	HB IV
Domestic Chores$_i$	-0.081***	-0.1160***	-0.0577***	-0.0497***
	(0.0070)	(0.0117)	(0.0122)	(0.0160)
Domestic Chores$_p$	0.0314***	0.0515***	-0.0905***	-0.0929***
	(0.0089)	(0.0104)	(0.0089)	(0.0102)
Children 13 to 18	0.9610***	0.9820***	0.5430***	0.5470***
	(0.1510)	(0.1510)	(0.1990)	(0.1990)
Children 6 to 12	-1.4780***	-1.4670***	0.5010*	0.4980*
	(0.2510)	(0.2520)	(0.2710)	(0.2710)
Children 0 to 5	-7.7860***	-7.7260***	-0.2240	-0.2420
	(0.5150)	(0.5160)	(0.2820)	(0.2810)
Black	-1.8210***	-1.8150***	-3.7720***	-3.7730***
	(0.1500)	(0.1500)	(0.1830)	(0.1830)
Incomplete Elementary	9.1200***	9.1690***	-0.0567	-0.0619
	(0.6790)	(0.6820)	(0.2840)	(0.2840)
Elementary	16.5200***	16.5400***	0.6690**	0.6570**
	(1.0480)	(1.0520)	(0.3100)	(0.3110)
Incomplete High School	18.1600***	18.1700***	0.9260***	0.9120***
	(1.1580)	(1.1620)	(0.3260)	(0.3260)
High School	24.9100***	24.9200***	1.9790***	1.9610***
	(1.5020)	(1.5070)	(0.3080)	(0.3090)
Incomplete Undergraduate	32.1400***	32.1300***	5.1090***	5.0650***
	(1.8560)	(1.8620)	(0.5550)	(0.5560)
Undergraduate	49.9300***	49.8900***	18.7500***	18.7200***
	(2.3460)	(2.3530)	(0.5210)	(0.5200)
Mills	49.6500***	49.6900***	-	-
	(2.9360)	(2.9470)	-	-
Constant	-39.3400***	-39.0100***	13.8500***	13.8400***
	(9.9500)	(9.9450)	(2.0480)	(2.0510)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,375	103,336	103,375	103,319
F-test	-	25818.5		29376.6
R^2	0.341	0.340	0.324	0.324

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

The within-couple wage gap is calculated as the male wage minus the female wage. Table 19 presents the findings regarding the wage gap within couples. Shea's partial R-squared is a measure used to assess the explanatory power of IVs in models with multiple endogenous regressors. Unlike the traditional R-squared or F-statistic, which evaluate the overall strength of instruments, Shea's statistic focuses on the independent contribution of each instrument to the endogenous variable after accounting for correlations among the instruments. Higher values of Shea's partial R-squared indicate that the instrument is strong and relevant for the associated endogenous variable.

In the context of this study, Shea's partial R-squared for women's housework hours is 0.0238, while for men's housework hours, it is 0.0794. These values suggest that, together, these instruments explain a modest proportion of the variation in housework hours, particularly for women, where the explanatory power is notably lower. Although the F-statistics for the salary equations confirm the validity of the instrument for estimating wages when used separately, the relatively low Shea's partial R-squared values raise concerns about its strength in explaining the variation in the wage gap when used together.

The results indicate that changes in women's or men's time spent on domestic tasks are not significant to change the couple wage gap. This lack of significance may be partially attributed to the instrument's limited explanatory power in the wage gap equation, as suggested by the relatively low Shea's partial R-squared values. For your turn, the presence of children aged between 13 and 18 years old contributes to an increase in the wage gap. On the other hand, the age and educational difference, and being black, reduces the gap.

Table 19 – Effects of individuals' and their partners' housework hours on Within-Couple Wage Gap: OLS and HB IV Estimates

	OLS	HB IV
Domestic Chores$_f$	-0.0066	0.0379
	(0.0085)	(0.0916)
Domestic Chores$_m$	-0.0653***	-0.0732
	(0.0115)	(0.0657)
Children 13 to 18	0.4580***	0.4420**
	(0.1650)	(0.1720)
Children 6 to 12	-0.1580	-0.1970
	(0.2560)	(0.3320)
Children 0 to 5	-0.5760**	-0.7150
	(0.2410)	(0.6120)
Age Difference	-0.2000***	-0.1990***
	(0.0140)	(0.0140)
Educational Difference	-0.3140***	-0.3140***
	(0.0192)	(0.0195)
Black$_f$	-0.7140***	-0.7280***
	(0.1700)	(0.1720)
Black$_m$	-1.0020***	-0.9990***
	(0.1740)	(0.1790)
Constant	0.8560	0.3770
	(4.0680)	(4.4340)
Regional Controls	Yes	Yes
Occupation Controls	Yes	Yes
Sector Controls	Yes	Yes
Year Controls	Yes	Yes
Observations	103,375	103,282
Shea's partial R^2_f	-	0.0162
Shea's partial R^2_m	-	0.0599
R^2	0.0840	0.0840

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Shea's partial R^2_f is for female domestic chores;
Shea's partial R^2_m is for male domestic chores.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020)

2.6.2 Heterogeneity

Analyzing heterogeneity is important to better understand how the relationship between domestic work and wages varies across different household contexts. Distinct dynamics may emerge depending on factors such as the presence of children or the employment conditions of partners, as these elements significantly shape household labor allocation and bargaining power. For instance, couples with children often face additional childcare responsibilities, which could deepen gender disparities in both domestic work and labor market outcomes. Similarly, couples where both partners work full-time (40 hours per week) might exhibit different patterns of time allocation and wage determination compared to those with more flexible work arrangements. By examining these subgroups—couples with children, couples without children, and those where both partners have full-time employment—this subsection

aims to provide an analysis of how wage determinants (specially housework) differ depending on the household context.

2.6.2.1 Full-time employment

The first heterogeneity analysis is conducted only for people who work at least 40 hours a week. This test aims to determine if the effects persist when considering couples in this subset, who consequently have limited flexibility to increase their time in the labor market, despite any increase in their partner's time spent on domestic tasks.

The results in Table 20 show that the instrumental variable is valid, considering the results of the first-stage F-test, which indicate a strong relationship between the instrument and the endogenous variable. The F-statistic is 25,818.5 for the wage equation of women and 44.3341 for the wage equation of men. These values are well above the commonly accepted threshold of 10, which is used to rule out weak instrument concerns.

The influences of individual and partner household chores on the wages of men and women working in full-time jobs. An increase in time dedicated to household chores corresponds to a decrease in wages for both men and women. Moreover, this effect is more pronounced for women, with an estimated reduction of up to R$0.11 in hourly wages. A very similar result is obtained for the general model. Conversely, for men, the result is not significant. In contrast, the findings suggest that a partner's engagement in household chores contributes to an increase in the female individual's wage by about R$0.05. For your turn, when women increase their time spent on domestic chores, there is no effect on men's wages.

Regarding the age range of children in the household, it is noted that for children between 13 and 18 years old, there is an increase in women's and men's hourly wages. The presence of children aged between 6 and 12 years reduces women's hourly wages, while for men, the results indicate an increase in hourly wages in the SUR results. Concerning the presence of children aged between 0 and 5 years, there is a decrease in women's hourly wages, and the results are not significant for men.

As in the full sample, being black contributes to a reduction in both women's and men's wages. Related to the educational level, an increase leads to a wage increase for women. Although for men, only an incomplete undergraduate degree or above contributes to a wage increase.

Table 20 – Effects of Individuals' and Their Partners' Housework Hours on Hourly Wages: Full-Time Employed – OLS and HB IV Estimates

	Women		Men	
	OLS	HB IV	OLS	HB IV
Domestic Chores$_i$	-0.1260***	-0.1160***	-0.0695***	0.0906
	(0.0091)	(0.0117)	(0.0128)	(0.0486)
Domestic Chores$_p$	0.0707***	0.0515***	-0.0712***	-0.1360
	(0.0103)	(0.0104)	(0.0094)	(0.1550)
Children 13 to 18	1.0190***	0.9820***	0.6610***	0.6510
	(0.1950)	(0.1510)	(0.2190)	(0.4380)
Children 6 to 12	-1.5280***	-1.4670***	0.3220	0.2570
	(0.3070)	(0.2520)	(0.2860)	(0.6160)
Children 0 to 5	-7.7670***	-7.7260***	-0.3210	-0.5230
	(0.6690)	(0.5160)	(0.2970)	(1.1130)
Black	-1.7820***	-1.8150***	-3.8010***	-3.8320***
	(0.1760)	(0.1500)	(0.1840)	(0.2590)
Incomplete Elementary	8.6490***	9.1690***	-0.3670	-0.0818
	(0.8830)	(0.6820)	(0.3150)	(0.2920)
Elementary	15.6700***	16.5400***	0.3520	0.5300
	(1.3660)	(1.0520)	(0.3380)	(0.4980)
Incomplete High School	17.4400***	18.1700***	0.5170	0.6980
	(1.5180)	(1.1620)	(0.3490)	(0.7620)
High School	24.0200***	24.9200***	1.5350***	1.7080**
	(1.9810)	(1.5070)	(0.3350)	(0.7790)
Incomplete Undergraduate	30.9500***	32.1300***	4.6890***	4.8140***
	(2.4390)	(1.8620)	(0.5810)	(1.1320)
Undergraduate	48.2700***	49.8900***	17.8700***	18.4500***
	(3.1080)	(2.3530)	(0.5450)	(1.0470)
Mills	49.4800***	49.6900***	-	-
	(3.9610)	(2.9470)	-	-
Constant	-46.0900***	-39.0100***	13.2900***	13.6600***
	(4.9430)	(9.9450)	(2.1150)	(2.5050)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	69,135	103,336	88,572	100,803
F-test		25818.5		44.3341
R^2	0.3850	0.3400	0.3450	0.3230

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Table 21 presents the findings regarding the wage gap within couples where both are full-time employed. Once more, Shea's partial R-squared indicates that the instrumental variables have a small potential to explain domestic chores. The results suggest that neither an increase in women's nor men's time spent on domestic tasks is associated with a change in the wage gap. In terms of age disparities, a narrower wage gap is noticed when men are older than women. Similarly, a diminished wage gap is evident when there are greater educational differences in favor of men. Furthermore, being black is linked to a narrower wage gap.

Table 21 – Effects of Individuals' and Their Partners' Housework Hours on Within-Couple Wage Gap: Full-Time Employed – OLS and HB IV Estimates

	OLS	HB IV
Domestic Chores$_f$	0.0536***	0.1040
	(0.0108)	(0.1160)
Domestic Chores$_m$	-0.1040***	-0.1100
	(0.0131)	(0.0723)
Children 13 to 18	0.4590**	0.4450*
	(0.2240)	(0.2340)
Children 6 to 12	-0.1090	-0.1520
	(0.2900)	(0.3860)
Children 0 to 5	-0.5620*	-0.7160
	(0.2890)	(0.7290)
Age Difference	-0.1860***	-0.1860***
	(0.0152)	(0.0153)
Educational Difference	-0.3340***	-0.3330***
	(0.0217)	(0.0219)
Black$_f$	-0.6580***	-0.6720***
	(0.1880)	(0.1920)
Black$_m$	-1.1140***	-1.1210***
	(0.1910)	(0.2050)
Constant	2.2330	1.5000
	(1.9440)	(3.2780)
Regional Controls	Yes	Yes
Occupation Controls	Yes	Yes
Sector Controls	Yes	Yes
Year Controls	Yes	Yes
Observations	62,610	62,540
Shea's partial R^2_f	-	0.0189
Shea's partial R^2_m	-	0.0872
R^2	0.0900	0.0890

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Shea's partial R^2_f is for female domestic chores;
Shea's partial R^2_m is for male domestic chores.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020)

2.6.2.2 Couples with children

The presence of children in a household often introduces additional time constraints and redistributes domestic responsibilities between partners. Since childcare responsibilities are likely related to other household chores, analyzing couples with children can provide insights into how the division of labor in these households influences wages. This subgroup allows us to account for the influence of child-related domestic tasks on the allocation of housework hours and their effects on labor market outcomes.

The results in Table 22 suggest that the instrumental variable is valid. The F-statistic is 16,958.1 for the wage equation of women and 28.079 for the wage equation of men. These values are well above the commonly accepted threshold of 10, which is used to rule out weak

instrument concerns.

An increase in time dedicated to household chores corresponds to a decrease in wages for women. This decrease is around R$0.11, similar to the full sample model. For men, the results are not significant. In contrast, the findings suggest that a partner's engagement in household chores contributes to an increase in the female individual's wage by about R$0.06, one cent higher than for the full sample model. For your turn, when women increase their time spent on domestic chores, there is no effect on men's wages.

Regarding the age range of children in the household, it is noted that for children between 13 and 18 years old, there is an increase in women's and men's hourly wages. The presence of children aged between 6 and 12 and between 0 to 4 years reduces women's hourly wages, while for men, the results are not significant. As in the full sample, being black contributes to a reduction in both women's and men's wages. Related to the educational level, an increase leads to a wage increase for women. Although for men, only an incomplete undergraduate degree or above contributes to a wage increase.

Table 22 – Effects of Individuals' and Their Partners' Housework Hours on Hourly Wages: Couples with Children – OLS and HB IV Estimates

	Women		Men	
	OLS	HB IV	OLS	HB IV
Domestic Chores$_i$	-0.0719***	-0.1110***	-0.0274**	0.1380
	(0.0081)	(0.0135)	(0.0139)	(0.6120)
Domestic Chores$_p$	0.0426***	0.0656***	-0.1060***	-0.1600
	(0.0109)	(0.0119)	(0.0104)	(0.2010)
Children 13 to 18	0.4680***	0.4680***	0.4500*	0.5340
	(0.1680)	(0.1680)	(0.2440)	(0.5650)
Children 6 to 12	-1.7320***	-1.7180***	0.4330	0.1760
	(0.3230)	(0.3230)	(0.2690)	(0.7370)
Children 0 to 5	-9.0110***	-8.9420***	-0.4560	-0.7820
	(0.9340)	(0.9340)	(0.2850)	(1.3360)
Black	-2.0240***	-2.0100***	-3.9690***	-3.9950***
	(0.2060)	(0.2060)	(0.2350)	(0.2970)
Incomplete Elementary	10.5000***	10.5300***	-0.1370	-0.0994
	(1.2590)	(1.2620)	(0.3740)	(0.3840)
Elementary	18.5600***	18.5600***	0.5560	0.4440
	(1.9830)	(1.9860)	(0.4080)	(0.6190)
Incomplete High School	20.0800***	20.0700***	0.8210**	0.6430
	(2.1540)	(2.1560)	(0.4160)	(0.8320)
High School	27.4900***	27.4700***	1.7860***	1.5650
	(2.8240)	(2.8280)	(0.4030)	(0.9660)
Incomplete Undergraduate	35.1000***	35.0700***	4.6470***	4.3160***
	(3.4450)	(3.4490)	(0.6240)	(1.4650)
Undergraduate	55.3900***	55.3100***	19.8600***	19.5900***
	(4.4510)	(4.4550)	(0.6790)	(1.4280)
Mills	56.3100***	56.2700***	-	-
	(5.6780)	(5.6850)	-	-
Constant	-56.8600***	-56.4400***	14.0700***	13.9100***
	(6.9000)	(6.9100)	(3.6790)	(4.2090)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	68,137	68,118	68,137	66,434
F-test		16958.1		28.079
R^2	0.3540	0.3530	0.3380	0.3360

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Table 23 presents the findings regarding the wage gap within couples with children. Once more, the results suggest a small explanatory power of the instrumental variable and that neither an increase in women's nor men's time spent on domestic tasks is associated with a change in the wage gap. In terms of age disparities, a narrower wage gap is noticed when men are older than women. Similarly, a diminished wage gap is evident when there are greater educational differences in favor of men. Furthermore, being black is linked to a narrower wage gap.

Table 23 – Effects of Individuals' and Their Partners' Housework Hours on Within-Couple Wage Gap: Couples with Children – OLS and HB IV Estimates

	OLS	HB IV
Domestic Chores$_f$	-0.0194*	-0.0431
	(0.0101)	(0.0885)
Domestic Chores$_m$	-0.0541***	-0.0959
	(0.0137)	(0.0604)
Children 13 to 18	0.4070**	0.3490
	(0.1920)	(0.2250)
Children 6 to 12	-0.1660	-0.0691
	(0.2530)	(0.3220)
Children 0 to 5	-0.6460***	-0.4240
	(0.2460)	(0.5690)
Age Difference	-0.1810***	-0.1810***
	(0.0183)	(0.0183)
Educational Difference	-0.2910***	-0.2930***
	(0.0242)	(0.0243)
Black$_f$	-0.6610***	-0.6590***
	(0.2120)	(0.2150)
Black$_m$	-1.0530***	-1.0290***
	(0.2190)	(0.2210)
Constant	2.9610	3.6280
	(2.2170)	(2.6760)
Regional Controls	Yes	Yes
Occupation Controls	Yes	Yes
Sector Controls	Yes	Yes
Year Controls	Yes	Yes
Observations	68,137	68,089
Shea's partial R^2_f	-	0.0136
Shea's partial R^2_m	-	0.0544
R^2	0.0880	0.0870

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Shea's partial R^2_f is for female domestic chores;
Shea's partial R^2_m is for male domestic chores.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020)

2.6.2.3 Childless

Many times, the time spent caring for children is not considered a household chore by parents. Since the PNADC data does not have a specific question about time spent on this type of activity, it may lead to an underreporting of the total time spent on housework. To check the consistency of the results, we consider a subsample of childless couples.

The results presented in Table 24 demonstrate that the instrumental variable is valid, with a value of 9,302.23 for women and 18.5839 for man, both results above the threshold of 10. Besides this, the effects of individual and partner household chores on the wages of childless men and women are examined. The findings for the childless sample are quite similar to those of the general sample. An increase in the time spent on domestic chores contributes to

a decrease of up to R$0.14 in women's hourly wages. For men, this reduction can reach up to R$0.13 in hourly wages. This result is higher than for all the other subsamples.

In contrast, the findings indicate that a partner's involvement in household chores has no relationship with individual wages. As anticipated, higher levels of education correspond to higher hourly wages for both genders. Nevertheless, the wage boost linked to educational attainment is more significant for women than for men. The IV results suggest that the educational effects are stronger for childless couples, both for women and men.

Table 24 – Effects of Childless Individuals' and Their Partners' Housework Hours on Hourly Wages – OLS and HB IV Estimates

	Women		Men	
	OLS	HB IV	OLS	HB IV
Domestic Chores$_i$	-0.1130***	-0.1480***	-0.1420***	0.1060
	(0.0144)	(0.0222)	(0.0244)	(0.7390)
Domestic Chores$_p$	-0.0118	0.0057	-0.0670***	-0.1340
	(0.0152)	(0.0201)	(0.0181)	(0.2110)
Black	-1.3400***	-1.3420***	-3.3370***	-3.5210***
	(0.2290)	(0.2280)	(0.2860)	(0.4880)
Incomplete Elementary	7.4770***	7.5490***	0.2450	0.0732
	(0.6630)	(0.6660)	(0.4340)	(0.4710)
Elementary	13.9300***	13.9800***	1.1140**	0.7900
	(0.9320)	(0.9370)	(0.4730)	(0.8460)
Incomplete High School	15.8600***	15.9100***	1.6080***	1.0190
	(1.0590)	(1.0650)	(0.5390)	(1.6220)
High School	21.5300***	21.5800***	2.6420***	2.0710*
	(1.2930)	(1.3000)	(0.4800)	(1.2470)
Incomplete Undergraduate	28.2600***	28.2900***	6.2380***	5.7250***
	(1.6420)	(1.6500)	(1.0380)	(1.6670)
Undergraduate	42.3900***	42.4100***	17.1200***	16.5600***
	(1.9530)	(1.9610)	(0.8360)	(1.4060)
Mills	41.0800***	41.2600***	-	-
	(2.3540)	(2.3850)	-	-
Constant	-8.4430	-8.1520	13.9000***	13.2300***
	(23.6200)	(23.5500)	(2.0270)	(3.1580)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	35,238	35,218	35,238	34,369
F-test		9302.23		18.5839
R^2	0.3260	0.3250	0.3040	0.3010

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Table 25 presents the findings regarding the wage gap within couples for childless partners. The results indicate that instrumental variables are not powerful in explaining time spent on domestic chores and that changes in domestic chores do not influence the wage gap. Regarding age differences, a smaller wage gap is observed when men are older than

women. Similarly, a smaller wage gap is seen with greater educational disparities in favor of men. Additionally, if the woman or man is black, there is a smaller wage gap.

Table 25 – Effects of Childless Individuals' and Their Partners' Housework Hours on Within-Couple Wage Gap – OLS and HB IV Estimates

	OLS	HB IV
Domestic Chores$_f$	0.0205	0.1610
	(0.0160)	(0.1710)
Domestic Chores$_m$	-0.0943***	-0.0474
	(0.0208)	(0.1290)
Age Difference	-0.2380***	-0.2380***
	(0.0214)	(0.0214)
Educational Difference	-0.3520***	-0.3480***
	(0.0316)	(0.0323)
Black$_f$	-0.8200***	-0.8290***
	(0.2820)	(0.2830)
Black$_m$	-0.8530***	-0.8790***
	(0.2790)	(0.2930)
Constant	-4.8400	-7.8270
	(9.2840)	(10.0100)
Regional Controls	Yes	Yes
Occupation Controls	Yes	Yes
Sector Controls	Yes	Yes
Year Controls	Yes	Yes
Observations	35,238	35,193
Shea's partial R^2_f		0.0225
Shea's partial R^2_m		0.0782
R^2	0.0830	0.0780

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%; OLS: ordinary least squares; HB IV: heteroskedasticity-based instrumental variable.
Shea's partial R^2_f is for female domestic chores;
Shea's partial R^2_m is for male domestic chores.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020)

2.7 CONCLUDING REMARKS

This article aimed to analyze the influence of individual and partner household chores on wages and the gender wage gap. To fulfill the stated objectives, this study employs the Instrumental Variables (IV) approach. The dataset used is the Continuous National Household Sample Survey (PNADC) spanning from 2016 to 2019.

To address potential endogeneity in the estimation of housework hours on wages, we employ an instrumental variable based on the proportion of hours spent on domestic chores within the stratum. This proportion is calculated as the total hours spent on domestic chores by women (or men) divided by the sum of hours spent on domestic chores by both partners in a household. The results suggest that the instrumental variable is valid for the wages equations.

One limitation of the study is that the data does not provide information about specific household tasks. This could be a crucial control factor, as the literature indicates that tasks predominantly performed by females, such as cleaning and caregiving, are penalized more than tasks predominantly performed by males, such as small repairs (HERSCH; STRATTON, 2002; NOONAN, 2001). Additionally, the format of the PNADC data does not allow for the control of fixed effects.

The results indicate that each individual's housework contributes to a reduction in their own wages, with the impact being greater for women than for men. This finding holds consistently across all samples analyzed in the study. Conversely, a partner's involvement in domestic chores is associated with an increase in women's wages and a decrease in men's wages in the full sample. For households where both partners are employed full-time, whether they have children, changes in women's time spent on domestic chores do not affect men's wages. However, when men increase their time spent on housework, there is a corresponding rise in women's wages. This outcome aligns with the findings of Blom e Cooke (2023), which suggest that only elite men economically benefit from their partners' specialization in domestic labor. This could be an interesting path for further investigation in the Brazilian context.

Regarding the within-couple wage gap, the instrumental variable has limited explanatory power for the time spent on domestic chores. This limitation may help explain why the results indicate that neither the individual's nor the partner's domestic chores significantly affect the wage gap. This could be because we are using the proportion of time spent by men and women simultaneously in this model, since we do not share the sample by gender when analyzing the within wage gap. Besides this, the instrument reflects social norms, while the wage gap is more likely influenced by couple-specific choices not captured by the model, such as occupational preferences and decisions related to the marriage market. Additionally, some studies suggest that individuals tend to marry others with similar income levels (COSTA et al., 2011; PEREIRA; SANTOS, 2017).

The findings of this study highlight the influence of the division of domestic labor on the labor market. The disproportionate impact of housework on women's wages emphasizes the need to assign women a more equitable share of unpaid labor. Policies aimed at promoting gender equality in both the workplace and the home are essential to reduce the economic penalty associated with traditional gender roles. For instance, public policies that incentivize shared domestic responsibilities, such as paid parental leave for both parents and subsidized childcare, could alleviate the burden on women and foster a more equitable distribution of housework.

However, while the government can promote such services, it is essential that men

assume greater responsibility for domestic chores to ensure that these policies effectively contribute to balancing the division of labor within households. Additionally, raising awareness about the economic value of unpaid labor and its implications for career advancement could challenge entrenched norms and encourage cultural shifts toward more balanced partnerships within households. These steps are important not only for reducing gender disparities in wages but also for promoting economic and social equality.

The results also suggest that the gender-neutral economic model is not entirely consistent with the empirical results, as the penalty for domestic chores is higher for women. Another implication is that gender inequalities within the household are socially reproduced in the labor market, and a shift toward more equitable gender roles could help reduce gender income inequalities, as suggested by the OECD (FERRANT; PESANDO; NOWACKA, 2014b).

APPENDIX B

Federal Units Stratum

Table 26 – Number of stratum by Brazilian Federal Units

Federal Unit	Number of Stratums
Rondônia	11
Acre	4
Amazonas	16
Roraima	5
Pará	19
Amapá	7
Tocantins	8
Maranhão	25
Piauí	17
Ceará	30
Rio Grande do Norte	12
Paraíba	18
Pernambuco	24
Alagoas	13
Sergipe	10
Bahia	42
Minas Gerais	49
Espírito Santo	15
Rio de Janeiro	37
São Paulo	53
Paraná	35
Santa Catarina	26
Rio Grande do Sul	35
Mato Grosso do Sul	13
Mato Grosso	18
Goiás	25
Distrito Federal	8

Source: Prepared by the authors, based on PNADC (IBGE, 2020) from 2012 to 2019.

Sample Building

Table 27 – Step-by-Step Process of PNADC Sample Construction for the Housework and Wages Analysis

		Observations		Loss	
		Absolute	%	Absolute	%
		(1)	(2)	(3)	(4)
	Total observations of PNADC	1,764,845	100%		
Step 1	Individuals with age between 20 a 60 years old	994,239	56.33%	770,606	43.66%
Step 2	Household with only one family	760,535	43.09%	233,704	0.56%
Step 3	Individual who are household heads or spouses	628,644	35.62%	131,891	7.46%
Step 4	Individuals who perform up to 70 hours per week of household chores	626,070	35.47%	2,5740	0.14%
Step 5	Individuals with consistent work hours and earnings	614,785	34.83%	11,285	0.63%
Setp 6	Households with heterossexual couples	463,026	26.23%	44,428	8.59%
Step 7	Households where both individuals spend at least and up to 60 hours at the labor market	206,750	11.71%	256,276	14.51%
Step 8	Reshape[1]	103,375	11.71%	0	0%

Note: 1: The reshape procedure is used to restructure the data to consolidate individual information by household, used on the wage gap estimation. Therefore, there is no sample loss.
Source: Elaborated by the authors based on PNADC (IBGE, 2020) from 2012 to 2019.

Heckman

In the selected sample, 40.51% of women were unemployed or out of the labor force while only 10.28% of men were in this situation. The Heckman (1979) correction is used to reduce the sample selection bias caused by the high level of female non-participation in the labor market. The Heckman (1979) selection equation estimates the probability of being employed. In the selection equation, the dependent variable assumes a value equal to one if the woman is employed and equal to zero if not. The dependent variable y_i^* represents labor market participation and is then regressed from:

$$y_i^* = \beta_i X_i + \mu_i \tag{2.9}$$

where X_i is a vector of explanatory variables, in which there is a latent probability that the woman is employed. The latent probability y_i is not observed. What is observed is the binary dependent variable y, such that:

$$y_i = 1 \; if \; y_i^* > 0 \; and, \tag{2.10}$$

$$y_i = 0 \; if \; y_i^* \leq 0 \tag{2.11}$$

The equation yielded is calculated using:

$$w_i = \delta Z_i + \varepsilon_i \; e \tag{2.12}$$

where w_i represents the wage, Z_i represents the vector of explanatory variables that determine the wage, δ_i corresponds to the parameter set, and ε_i is the error vector.

Assuming that:

$$\mu_i \sim N(0, \sigma), \tag{2.13}$$

$$\varepsilon_i \sim N(0, 1), \tag{2.14}$$

$$corr(\mu_i, \varepsilon_i) = \rho \tag{2.15}$$

So, if $\rho \neq 0$, the sample used in the earnings equation is random, and the use of standard regression techniques results in biased estimates. By estimating the parameters β_i and μ_i, it is possible to construct λ, which is called the inverse of Mills ratio, through:

$$\lambda = \frac{\phi\left(\frac{\beta X_i}{\sigma_\mu}\right)}{\Phi\left(\frac{\beta X_i}{\sigma_\mu}\right)} \tag{2.16}$$

so ϕ is the probability density function and Φ is the cumulative distribution function for the normal distribution. The inverse of the Mills ratio, λ, is included in the Ordinary Least Squares, and Instrumental Variables methods. Thus, consistent estimators are obtained for the population parameters and the problem of sample selectivity is corrected. From the results, one can then predict the expected values for the hourly wage that would be expected in the absence of selection bias.

Heckman Correction Results for the Housework and Wages Analysis

Table 28 – Heckman

Variables	LFP
Age_i	-0.0037***
	(0.0007)
Age_p	-0.0106***
	(0.0007)
Children 13 to 18	0.0502***
	(0.0075)
Children 6 to 12	-0.1300***
	(0.0103)
Children 0 to 5	-0.4300***
	(0.0107)
Incomplete $Primary_i$	0.1810***
	(0.0309)
$Primary_i$	0.3700***
	(0.0332)
Incomplete $High\ School_i$	0.3870***
	(0.0348)
$High\ School_i$	0.6370***
	(0.0319)
Incomplete $Undergraduate_i$	0.8760***
	(0.0385)
$Undergraduate_i$	1.4030***
	(0.0347)
Incomplete $Primary_p$	0.1550***
	(0.0244)
$Primary_p$	0.2010***
	(0.0275)
Incomplete $High\ School_p$	0.2650***
	(0.0298)
$High\ School_p$	0.2130***
	(0.0259)
Incomplete $Undergraduate_p$	0.2210***
	(0.0360)
$Undergraduate_p$	0.1150***
	(0.0302)
Black	0.0147
	(0.0095)
$Wage_p$	-0.0029***
	(0.0002)
Non-Work Income	-2.37e-05***
	(6.59e-06)
Constant	0.1240***
	(0.0456)
Year Controls	Yes
Regional Controls	Yes
Observations	195,404

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Observations represented with sample expansion. i represents individuals' characteristics; p represents partners' characteristics.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020)

Instrumental Variable Results

Table 29 – Effects of individuals' and their partners' housework hours on hourly wages - First Stage IV Results, Full Sample and Full Time Workers Sample

	Full sample		Full Time	
	Women	Men	Women	Men
Domestic Chores Proportion	54.4148***	36.7027***	48.5576***	-1.0621***
	(0.3387)	(0.0826)	(0.3725)	(0.1740)
Domestic Chores$_p$	1.2247***	0.4877***	1.1606***	0.3160***
	(0.0066)	(0.0013)	(0.0067)	(0.0053)
13 to 18	-0.0162	-0.1054***	-0.0134	-0.8632***
	(0.0585)	(0.0244)	(0.0677)	(0.0629)
6 to 12	0.4811***	0.1788***	0.3925***	1.1455***
	(0.0787)	(0.0331)	(0.0915)	(0.0874)
0 to 5	1.1816***	0.4888***	1.0721***	2.1812***
	(0.1019)	(0.0344)	(0.1110)	(0.0987)
Black	0.0675	0.1108***	0.1220*	0.3963***
	(0.0683)	(0.0307)	(0.0724)	(0.0817)
Incomplete Elementary	0.9878***	-0.2882***	1.0802**	0.0217
	(0.3603)	(0.0953)	(0.4426)	(0.2445)
Elementary	1.0063***	-0.2106**	1.0978**	0.7198***
	(0.3794)	(0.1024)	(0.4580)	(0.2590)
Incomplete High School	0.7779**	-0.1979*	0.7318	1.3469***
	(0.3930)	(0.1088)	(0.4706)	(0.2812)
High School	0.7790**	-0.1303	0.7718*	1.3922***
	(0.3894)	(0.0970)	(0.4664)	(0.2471)
Incomplete Graduate	0.7720*	-0.0977	0.5534	2.0284***
	(0.4261)	(0.1167)	(0.5038)	(0.2966)
Graduate	0.5241	-0.2249**	0.0609	1.7333***
	(0.4412)	(0.1061)	(0.5156)	(0.2688)
Mills	0.1251	-	-0.5730	-
	(0.3402)	-	(0.3694)	-
Constant	-32.1569***	-10.8855***	-26.3316***	4.1220***
	(1.1645)	(0.8461)	(1.4630)	(1.4343)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,336	103,319	69,106	86,393
F-test	25818.5	197288	16990.2	37.2451
R^2	0.6536	0.7324	0.6810	0.2274

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020).

Table 30 – Effects of individuals' and their partners' housework hours on hourly wages - Second Stage IV Results, Full Sample and Full Time Workers Sample

	Full sample		Full Time	
	Women	Men	Women	Men
Domestic Chores$_i$	-0.1160***	-0.0497***	-0.1160***	0.0906
	(0.0117)	(0.0160)	(0.0117)	(0.0486)
Domestic Chores$_p$	0.0515***	-0.0929***	0.0515***	-0.1360
	(0.0104)	(0.0102)	(0.0104)	(0.0155)
13 to 18	0.9820***	0.5470***	0.9820***	0.6510
	(0.1510)	(0.1990)	(0.1510)	(0.0438)
6 to 12	-1.4670***	0.4980*	-1.4670***	0.2570
	(0.2520)	(0.2710)	(0.2520)	(0.0616)
0 to 5	-7.7260***	-0.2420	-7.7260***	-0.5230
	(0.5160)	(0.2810)	(0.5160)	(1.1130)
Black	-1.8150***	-3.7730***	-1.8150***	-3.8320***
	(0.1500)	(0.1830)	(0.1500)	(0.2590)
Incomplete Elementary	9.1690***	-0.0619	9.1690***	-0.0818
	(0.6820)	(0.2840)	(0.6820)	(0.2920)
Elementary	16.5400***	0.6570**	16.5400***	0.5300
	(1.0520)	(0.3110)	(1.0520)	(0.0498)
Incomplete High School	18.1700***	0.9120***	18.1700***	0.6980
	(1.1620)	(0.3260)	(1.1620)	(0.0762)
High School	24.9200***	1.9610***	24.9200***	1.7080**
	(1.5070)	(0.3090)	(1.5070)	(0.0779)
Incomplete Graduate	32.1300***	5.0650***	32.1300***	4.8140***
	(1.8620)	(0.5560)	(1.8620)	(1.1320)
Graduate	49.8900***	18.7200***	49.8900***	18.4500***
	(2.3530)	(0.5200)	(2.3530)	(1.0470)
Mills	49.6900***	-	49.6900***	-
	(2.9470)	-	(2.9470)	-
Constant	-39.0100***	13.8400***	-39.0100***	13.6600***
	(9.9450)	(2.0510)	(9.9450)	(2.5050)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,336	103,319	103,336	100,803
F-test	25818.5	29376.6	25818.5	44.3341
R^2	0.3400	0.3240	0.3400	0.3230

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020).

Table 31 – Effects of individuals' and their partners' housework hours on hourly wages - First Stage IV Results, Couples with and Without Children Samples

	With Children		Childless	
	Women	Men	Women	Men
Domestic Chores Proportion	58.2024***	-1.1460***	47.9683***	-1.0379***
	(0.4470)	(0.2163)	(0.4974)	(0.2408)
Domestic Chores$_p$	1.2403***	0.3310***	1.2019***	0.2828***
	(0.0080)	(0.0061)	(0.0114)	(0.0075)
13 to 18	-0.2619***	-0.8758***	-	-
	(0.0716)	(0.0743)	-	-
6 to 12	0.5662***	1.1523***	-	-
	(0.0795)	(0.0832)	-	-
0 to 5	1.2969***	2.1384***	-	-
	(0.1072)	(0.0938)	-	-
Black	0.1435	0.3135***	-0.0573	0.5035***
	(0.0876)	(0.1010)	(0.1037)	(0.1157)
Incomplete Elementary	0.7455*	0.0068	1.4654**	0.1664
	(0.4154)	(0.2716)	(0.6305)	(0.3216)
Elementary	0.9814**	0.7423**	1.2201*	0.9118**
	(0.4353)	(0.2911)	(0.6741)	(0.3547)
Incomplete High School	0.6120	1.1615***	1.3432*	2.0162***
	(0.4464)	(0.3069)	(0.7235)	(0.4462)
High School	0.6809	1.3977***	1.2465*	1.5160***
	(0.4449)	(0.2777)	(0.7040)	(0.3269)
Incomplete Graduate	0.7061	2.1285***	1.2449	1.8795***
	(0.4916)	(0.3453)	(0.7734)	(0.3963)
Graduate	0.4144	1.9900***	1.2962	1.4646***
	(0.5092)	(0.3108)	(0.8092)	(0.3540)
Mills	-0.3181	-	2.0805***	-
	(0.3943)	-	(0.6679)	-
Constant	-35.4839***	3.9303*	-27.2752***	3.9801*
	(1.4044)	(2.1829)	(1.9233)	(2.0839)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	68,118	66,434	35,218	34,369
F-test	16958.1	28.079	9302.23	18.5839
R^2	0.6585	0.2458	0.6293	0.1568

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020).

Table 32 – Effects of individuals' and their partners' housework hours on hourly wages - Second Stage IV Results, Couples with and without children samples

	With Children		Childless	
	Women	Men	Women	Men
Domestic Chores$_i$	-0.1110***	0.1380	-0.1480***	0.1060
	(0.0135)	(0.6120)	(0.0222)	(0.7390)
Domestic Chores$_p$	0.0656***	-0.1600	0.0057	-0.1340
	(0.0119)	(0.2010)	(0.0201)	(0.2110)
13 to 18	0.4680***	0.5340	-	-
	(0.1680)	(0.5650)	-	-
6 to 12	-1.7180***	0.1760	-	-
	(0.3230)	(0.7370)	-	-
0 to 5	-8.9420***	-0.7820	-	-
	(0.9340)	(1.3360)	-	-
Black	-2.0100***	-3.9950***	-1.3420***	-3.5210***
	(0.2060)	(0.2970)	(0.2280)	(0.4880)
Incomplete Elementary	10.5300***	-0.0994	7.5490***	0.0732
	(1.2620)	(0.3840)	(0.6660)	(0.4710)
Elementary	18.5600***	0.4440	13.9800***	0.7900
	(1.9860)	(0.6190)	(0.9370)	(0.8460)
Incomplete High School	20.0700***	0.6430	15.9100***	1.0190
	(2.1560)	(0.8320)	(1.0650)	(1.6220)
High School	27.4700***	1.5650	21.5800***	2.0710*
	(2.8280)	(0.9660)	(1.3000)	(1.2470)
Incomplete Graduate	35.0700***	4.3160***	28.2900***	5.7250***
	(3.4490)	(1.4650)	(1.6500)	(1.6670)
Graduate	55.3100***	19.5900***	42.4100***	16.5600***
	(4.4550)	(1.4280)	(1.9610)	(1.4060)
Mills	56.2700***	-	41.2600***	-
	(5.6850)	-	(2.3850)	-
Constant	-56.4400***	13.9100***	-8.1520	13.2300***
	(6.9100)	(4.2090)	(23.5500)	(3.1580)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	68,118	66,434	35,218	34,369
F-test	16958.1	28.079	9302.23	18.5839
R^2	0.3530	0.3360	0.3250	0.3010

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. (–): not controlled for.
Source: Survey results based on PNAD data, 2016-2019 (IBGE, 2020).

Table 33 – Within-couple wage gap - First Stage IV results, Full Sample and Full Time Workers Sample

	Full Sample		Full Time	
Instrumented	Hrs Fem	Hrs Masc	Hrs Fem	Hrs Masc
Domestic Chores$_f$	-27.0065***	0.7284	-24.4361***	0.9881
	(0.8895)	(0.5819)	(1.0319)	(0.6977)
Domestic Chores$_m$	-7.2521***	-28.3649***	-8.4029***	-27.5572***
	(0.9124)	(0.5896)	(1.0632)	(0.7042)
13 to 18	-0.2393***	-0.1703***	-0.2201*	-0.2089***
	(0.0864)	(0.0504)	(0.1121)	(0.0699)
6 to 12	1.6126***	0.9372***	1.5050***	0.9931***
	(0.1190)	(0.0734)	(0.1530)	(0.0986)
0 to 5	4.2561***	2.5431***	4.0290***	2.6916***
	(0.1349)	(0.0864)	(0.1666)	(0.1172)
Age Difference	-0.0048	0.0053	0.0022	0.0057
	(0.0078)	(0.0048)	(0.0097)	(0.0062)
Educational Difference	-0.0187	-0.0055	-0.0110	-0.0023
	(0.0147)	(0.0086)	(0.0188)	(0.0117)
Black$_f$	0.1460	0.0469	0.1811	0.0497
	(0.1142)	(0.0744)	(0.1406)	(0.0971)
Black$_m$	0.2170*	0.2497***	0.3248**	0.3491***
	(0.1171)	(0.0774)	(0.1450)	(0.1016)
Constant	28.3708***	27.5071***	31.3604***	28.4055***
	(2.9641)	(2.0668)	(3.4363)	(2.6374)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,282	103,282	62,540	62,540
Shea's partial R^2	0.0166	0.0604	0.0197	0.0879
R^2	0.1549	0.3789	0.1246	0.3521

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Shea's partial R^2_f is for female domestic chores; R^2_m is for male domestic chores.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Table 34 – Within-couple wage gap - First Stage IV results, , Couples With and Without Children Samples

	With Children		Childless	
Instrumented	Hrs Fem	Hrs Masc	Hrs Fem	Hrs Masc
Domestic Chores$_f$	-28.6664***	0.1842	-25.0323***	0.7042
	(1.1646)	(0.7641)	(1.3232)	(0.8544)
Domestic Chores$_m$	-8.1662***	-30.8181***	-6.8958***	-25.2941***
	(1.1917)	(0.7799)	(1.3641)	(0.8585)
13 to 18	-0.9381***	-0.5321***	-	-
	(0.1078)	(0.0638)	-	-
6 to 12	1.6517***	0.8972***	-	-
	(0.1185)	(0.0732)	-	-
0 to 5	4.1168***	2.3521***	-	-
	(0.1341)	(0.0855)	-	-
Age Difference	-0.0064	0.0043	-0.0011	0.0049
	(0.0101)	(0.0062)	(0.0117)	(0.0070)
Educational Difference	-0.0194	-0.0101	-0.0251	0.0015
	(0.0188)	(0.0111)	(0.0228)	(0.0130)
Black$_f$	0.2516*	0.0519	-0.0228	0.0713
	(0.1483)	(0.0981)	(0.1694)	(0.1049)
Black$_m$	0.1925	0.2930***	0.2502	0.1819*
	(0.1533)	(0.1031)	(0.1703)	(0.1058)
Constant	26.8370***	29.0245***	32.4955***	26.9417***
	(4.4213)	(3.2368)	(4.0171)	(2.5981)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	68,089	68,089	35,193	35,193
Shea's partial R^2	0.0143	0.0551	0.0238	0.0794
R^2	0.1306	0.3809	0.1692	0.3823

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Shea's partial R^2_f is for female domestic chores; R^2_m is for male domestic chores.

Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Table 35 – Within-couple wage gap - Second Stage IV results

	Full Sample	Full time	With Children	Childless
Domestic Chores$_f$	0.0379	0.1040	-0.0431	0.1610
	(0.0916)	(0.1160)	(0.0885)	(0.1710)
Domestic Chores$_m$	-0.0732	-0.1100	-0.0959	-0.0474
	(0.0657)	(0.0723)	(0.0604)	(0.1290)
13 to 18	0.4420**	0.4450*	0.3490	-
	(0.1720)	(0.2340)	(0.2250)	-
6 to 12	-0.1970	-0.1520	-0.0691	-
	(0.3320)	(0.3860)	(0.3220)	-
0 to 5	-0.7150	-0.7160	-0.4240	-
	(0.6120)	(0.7290)	(0.5690)	-
Age Difference	-0.1990***	-0.1860***	-0.1810***	-0.2380***
	(0.0140)	(0.0153)	(0.0183)	(0.0214)
Educational Difference	-0.3140***	-0.3330***	-0.2930***	-0.3480***
	(0.0195)	(0.0219)	(0.0243)	(0.0323)
Black$_f$	-0.7280***	-0.6720***	-0.6590***	-0.8290***
	(0.1720)	(0.1920)	(0.2150)	(0.2830)
Black$_m$	-0.9990***	-1.1210***	-1.0290***	-0.8790***
	(0.1790)	(0.2050)	(0.2210)	(0.2930)
Constant	0.3770	1.5000	3.6280	-7.8270
	(4.4340)	(3.2780)	(2.6760)	(10.0100)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,282	62,540	68,089	35,193
Shea's partial R^2_f	0.0162	0.0189	0.0136	0.0225
Shea's partial R^2_m	0.0599	0.0872	0.0544	0.0782
R^2	0.0840	0.0890	0.0870	0.0780

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Shea's partial R^2_f is for female domestic chores; R^2_m is for male domestic chores.
Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Heteroskedastic Based Instrumental Variable First Stage Results

Table 36 – Effects of individuals' and their partners' housework hours on hourly wages - First Stage HB IV Results, Full Sample and Full Time Workers Sample

	Full sample		**Full Time**	
	Women	Men	Women	Men
prop_afazeres_m	54.4148***	54.4148***	48.5576***	-1.0621***
	(0.3387)	(0.3387)	(0.3725)	(0.1740)
Domestic Chores$_p$	1.2247***	1.2247***	1.1606***	0.3159***
	(0.0066)	(0.0066)	(0.0067)	(0.0053)
13 to 18	-0.0162	-0.0162	-0.0134	-0.8632***
	(0.0585)	(0.0585)	(0.0677)	(0.0629)
6 to 12	0.4811***	0.4811***	0.3925***	1.1455***
	(0.0787)	(0.0787)	(0.0915)	(0.0874)
0 to 5	1.1816***	1.1816***	1.0721***	2.1812***
	(0.1019)	(0.1019)	(0.1110)	(0.0987)
Black	0.0675	0.0675	0.1220*	0.3963***
	(0.0683)	(0.0683)	(0.0724)	(0.0817)
Incomplete Elementary	0.9878***	0.9878***	1.0802**	0.0217
	(0.3603)	(0.3603)	(0.4426)	(0.2445)
Elementary	1.0063***	1.0063***	1.0978**	0.7198***
	(0.3794)	(0.3794)	(0.4580)	(0.2590)
Incomplete High School	0.7779**	0.7779**	0.7318	1.3469***
	(0.3930)	(0.3930)	(0.4706)	(0.2812)
High School	0.7790**	0.7790**	0.7718*	1.3922***
	(0.3894)	(0.3894)	(0.4664)	(0.2471)
Incomplete Graduate	0.7720*	0.7720*	0.5534	2.0284***
	(0.4261)	(0.4261)	(0.5038)	(0.2966)
Graduate	0.5241	0.5241	0.0609	1.7333***
	(0.4412)	(0.4412)	(0.5156)	(0.2688)
Mills	0.1251	0.1251	-0.5730	-
	(0.3402)	(0.3402)	(0.3694)	-
Constant	-32.1569***	-32.1569***	-26.3316***	4.1220***
	(1.1645)	(1.1645)	(1.4630)	(1.4343)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,336	103,319	69,106	86,393
F-test	25818.5	29376.6	16990.2	37.2451
R^2	0.6536	0.7352	0.6810	0.2274

Table 37 – Effects of individuals' and their partners' housework hours on hourly wages - First Stage HB IV Results, Couples With and Without Children Samples

	With Children		**Childless**	
	Women	Men	Women	Men
prop_afazeres_m	58.2024***	-1.1460***	47.9683***	-1.0379***
	(0.4470)	(0.2163)	(0.4974)	(0.2408)
Domestic Chores$_p$	1.2403***	0.3310***	1.2019***	0.2828***
	(0.0080)	(0.0061)	(0.0114)	(0.0075)
13 to 18	-0.2619***	-0.8758***	-	-
	(0.0716)	(0.0743)	-	-
6 to 12	0.5662***	1.1523***	-	-
	(0.0795)	(0.0832)	-	-
0 to 5	1.2969***	2.1384***	-	-
	(0.1072)	(0.0938)	-	-
Black	0.1435	0.3135**	-0.0573	0.5035***
	(0.0876)	(0.1010)	(0.1037)	(0.1157)
Incomplete Elementary	0.7455*	0.0068	1.4654**	0.1664
	(0.4154)	(0.2716)	(0.6305)	(0.3216)
Elementary	0.9814**	0.7423**	1.2201*	0.9118**
	(0.4353)	(0.2911)	(0.6741)	(0.3547)
Incomplete High School	0.6120	1.1615***	1.3432*	2.0162***
	(0.4464)	(0.3069)	(0.7235)	(0.4462)
High School	0.6809	1.3977***	1.2465*	1.5160***
	(0.4449)	(0.2777)	(0.7040)	(0.3269)
Incomplete Graduate	0.7061	2.1285***	1.2449	1.8795***
	(0.4916)	(0.3453)	(0.7734)	(0.3963)
Graduate	0.4144	1.9900***	1.2962	1.4646***
	(0.5092)	(0.3108)	(0.8092)	(0.3540)
Mills	-0.3181	-	2.0805***	-
	(0.3943)	-	(0.6679)	-
Constant	-35.4839***	3.9303*	-27.2751***	3.9801*
	(1.4044)	(2.1829)	(1.9233)	(2.0839)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	68,118	66,434	35,218	34,369
F-test	16958.1	44.3341	9302.23	18.5839
R^2	0.6585	0.2267	0.6293	0.1568

Table 38 – Within-couple Wage Gap - HB IV First Stage Results, Full Sample and Full Time Workers Sample

	Full Sample		Full Time	
Instrumented	Hrs Fem	Hrs Masc	Hrs Fem	Hrs Masc
Domestic Chores$_f$	-27.0065***	0.7284	-24.4361***	0.9881
	(0.8895)	(0.5819)	(1.0319)	(0.6977)
Domestic Chores$_m$	-7.2521***	-28.3649***	-8.4029***	-27.5572***
	(0.9124)	(0.5896)	(1.0632)	(0.7042)
13 to 18	-0.2393***	-0.1703***	-0.2201*	-0.2089***
	(0.0864)	(0.0504)	(0.1121)	(0.0699)
6 to 12	1.6126***	0.9372***	1.5050***	0.9931***
	(0.1190)	(0.0734)	(0.1530)	(0.0986)
0 to 5	4.2561***	2.5431***	4.0290***	2.6916***
	(0.1349)	(0.0864)	(0.1666)	(0.1172)
Age Difference	-0.0048	0.0053	0.0022	0.0057
	(0.0078)	(0.0048)	(0.0097)	(0.0062)
Educational Difference	-0.0187	-0.0055	-0.0110	-0.0023
	(0.0147)	(0.0086)	(0.0188)	(0.0117)
Black$_f$	0.1460	0.0469	0.1811	0.0497
	(0.1142)	(0.0744)	(0.1406)	(0.0971)
Black$_m$	0.2170*	0.2497***	0.3248**	0.3491***
	(0.1171)	(0.0774)	(0.1450)	(0.1016)
Constant	28.3708***	27.5071***	31.3604***	28.4055***
	(2.9641)	(2.0668)	(3.4363)	(2.6374)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	103,282	103,282	62,540	62,540
Shea's partial R^2	0.0166	0.0604	0.0197	0.0879
R^2	0.1549	0.3789	0.1246	0.3521

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Shea's partial R^2_f is for female domestic chores; R^2_m is for male domestic chores.

Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

Table 39 – Within-couple Wage Gap - HB IV First Stage Results, Couples with and without children samples

	With Children		Childless	
Instrumented	Hrs Fem	Hrs Masc	Hrs Fem	Hrs Masc
Domestic Chores$_f$	-28.6664***	0.1842	-25.0323***	0.7042
	(1.1646)	(0.7641)	(1.3232)	(0.8544)
Domestic Chores$_m$	-8.1662***	-30.8181***	-6.8958***	-25.2941***
	(1.1917)	(0.7799)	(1.3641)	(0.8585)
13 to 18	-0.9381***	-0.5321***	-	-
	(0.1078)	(0.0638)	-	-
6 to 12	1.6517***	0.8972***	-	-
	(0.1185)	(0.0732)	-	-
0 to 5	4.1168***	2.3521***	-	-
	(0.1341)	(0.0855)	-	-
Age Difference	-0.0064	0.0043	-0.0011	0.0049
	(0.0101)	(0.0062)	(0.0117)	(0.0070)
Educational Difference	-0.0194	-0.0101	-0.0251	0.0015
	(0.0188)	(0.0111)	(0.0228)	(0.0130)
Black$_f$	0.2516*	0.0519	-0.0228	0.0713
	(0.1483)	(0.0981)	(0.1694)	(0.1049)
Black$_m$	0.1925	0.2930***	0.2502	0.1819
	(0.1533)	(0.1031)	(0.1703)	(0.1058)
Constant	26.8370***	29.0245***	32.4955***	26.9417***
	(4.4213)	(3.2368)	(4.0171)	(2.5981)
Regional Controls	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes
Sector Controls	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	68,089	68,089	35,193	35,193
Shea's partial R^2	0.0143	0.0551	0.0238	0.0794
R^2	0.1306	0.3809	0.1692	0.3823

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%. Shea's partial R^2_f is for female domestic chores; R^2_m is for male domestic chores.

Source: Survey results based on PNADC data, 2016-2019 (IBGE, 2020).

3 BALANCING WORK AND FOOD: THE INFLUENCE OF FEMALE EMPLOYMENT ON HOUSEHOLD FOOD CONSUMPTION

RESUMO

O terceiro artigo analisa a demanda alimentar das famílias, com foco no impacto do status ocupacional das chefes ou cônjuges sobre o consumo de alimentos. Utilizando a metodologia *Quadratic Almost Ideal Demand System* (QUAIDS) com dados da Pesquisa de Orçamentos Familiares (POF) de 2017-2018, os resultados sugerem que o emprego da mulher influencia as escolhas alimentares das famílias, especialmente de alimentos ultraprocessados, em que a demanda é mais elástica quando a mulher não está empregada. Em geral, os três artigos fortalecem a ideia de que as restrições e a alocação do tempo dentro da família possuem importantes consequências sobre diversas decisões e comportamentos.

Palavras-chave: Emprego feminino; Consumo Alimentar; *Quadratic Almost Ideal Demand System.*

ABSTRACT

The third article analyzes household food demand, focusing on the impact of the occupational status of female household heads or spouses on food consumption. Using the Quadratic Almost Ideal Demand System (QUAIDS) methodology with data from the 2017–2018 Household Budget Survey (POF), the results suggest that female employment influences families' food choices, particularly regarding ultra-processed foods, for which demand is more elastic when the woman is not employed. Overall, the three articles reinforce the idea that time constraints and time allocation within families have significant consequences on various decisions and behaviors.

Key-words: Female Employment; Food Consumption; Quadratic Almost Ideal Demand System.

3.1 INTRODUCTION

The rise in female labor force participation in recent decades has led to a decrease in the time available for household chores. Social norms, often rooted in gender segregation, contribute to a disproportionate burden of these tasks falling on women, including childcare and homemaking (DEGRAFF; ANKER, 2015). Despite women having less time for these activities, there has been little change in the male role in performing household chores (MELO; CONSIDERA; SABBATO, 2007; PINHEIRO; MEDEIROS, 2016).

While domestic chores are essential, they are often undervalued and primarily performed by women. In Brazil, data from the Continuous National Household Sample Survey (PNADC) in 2023 showed that women spent an average of 21.3 hours per week on household chores, while men spent 11.7 hours. Men's domestic activities, such as gardening and car care, are often sporadic, whereas women are primarily responsible for daily tasks such as cleaning, cooking, and caring for others (COLTRANE, 2000; FUWA, 2004; LENNON; ROSENFIELD, 1994).

When a woman is employed, it can lead to changes in the family's eating habits. This is because food preparation is a central element of domestic work, which women predominantly carry out. Even when they are employed full-time, women often remain the central figure in purchasing, caring for, and preparing food (THOMPSON, 1994; CHARLES; KERR, 1988; MOISIO; ARNOULD; PRICE, 2004). As a result, eating practices are heavily influenced by their decisions. This labor division is reinforced by traditional stereotypes that associate caregiving with women's natural role (GROSSI; SCHENDEILWEIN; MASSA, 2013; BACKETT, 1992; COVENEY, 2000).

Due to time constraints, eating habits can change, leading to a tendency to minimize efforts spent on meal preparation by opting for fast-prepared foods. This trend is especially prevalent in households where both men and women are employed (DEVINE et al., 2003; VERLEGH; CANDEL, 1999; CANDEL, 2001; DUXBURY; LYONS; HIGGINS, 2007; BAUER et al., 2012; CAWLEY; LIU, 2012; MONSIVAIS; AGGARWAL; DREWNOWSKI, 2014; JABS; DEVINE, 2006; SENAUER, 2001; BIANCHI et al., 2000; BLISARD et al., 2002; GUTHRIE; LIN; FRAZAO, 2002). The preference for ready-to-eat or quick-to-prepare foods, including ultra processed and processed foods, is also noticeable in families with higher incomes (BOER et al., 2004). Additionally, urbanization, changes in food prices, educational level, and the number of hours worked by the household head are factors linked to changes in eating habits (REGMI et al., 2001; PARK; JR, 1997).

The rise in ready-to-eat meal consumption poses health risks, as an inadequate diet can lead to obesity, diabetes, heart disease, cancer, and other illnesses (SCHLINDWEIN; KASSOUF,

2007b). Moreover, since eating habits are often passed down from one generation to the next, unhealthy diets observed in parents are often seen in their children and adolescents. When young individuals are obese, they are more likely to become obese adults and face a higher risk of developing diseases (MONTEIRO; VICTORA; BARROS, 2004; MAGAREY et al., 2003).

Despite the potential health risks associated with changes in eating habits, female employment can lead to an increase in total family income. This increase in purchasing power can influence food decisions, which could lead to increased consumption of fresh and higher quality foods (DARMON; DREWNOWSKI, 2008).

Given the importance of this topic, researchers have started to analyze the factors influencing food consumption. Socioeconomic factors such as household income, maternal education, and the full-time employment status of the female household head or spouse have significant impacts on household food intake, as seen in other studies about Brazil (LEVY et al., 2010; ARAÚJO et al., 2010; NUNES; FIGUEIROA; ALVES, 2007; SCHLINDWEIN; KASSOUF, 2007a; SCHLINDWEIN; KASSOUF, 2007b; BERTASSO, 2006).

Given this context, the achievement of success in the labor market is often associated with distancing from caregiving activities, which reinforces gender stereotypes. In this regard, the present study aims to estimate household food demand by analyzing the effect of female employment on household food consumption of ultra processed, processed, *In Natura*, ingredients, and other foods. To conduct this analysis, data from the 2017-2018 Family Budget Survey (POF) and the Quadratic Almost Ideal Demand System (QUAIDS) method are used.

The food groups are defined according to the Dietary Guide for the Brazilian Population (SAÚDE, 2014): Ultra-processed are ready-to-consume industrial formulations made with ingredients with unfamiliar names and not used at home (carboxymethylcellulose, inverted sugar, maltodextrin, fructose, corn syrup, flavorings, emulsifiers, thickeners, sweeteners, among others), as instant noodles and chocolates; Processed are made with *In Natura* or minimally processed foods and culinary ingredients, as canned vegetables and cheese; *In Natura* are those obtained directly from plants or animals, such as leaves and fruits or eggs and milk, and acquired for consumption without having undergone any alteration after leaving nature; Ingredients are extracted from *In Natura* foods or directly from nature and used as seasonings, for cooking foods, and for culinary preparations, as sugar and salt.

The paper aims to contribute to the literature by incorporating an analysis of simultaneous demand equations for the relationship between female employment and family eating habits, using the QUAIDS model. This analysis is scarce in the Brazilian literature, which predominantly focuses on analyzing the demand for specific foods by income level (REZENDE; COELHO; TRAVASSOS, 2022; WAGNER; COELHO; TRAVASSOS, 2022; SILVA; COELHO, 2015; FERREIRA; COELHO, 2017; TRAVASSOS; COELHO, 2017; ZANIN; BACCHI; ALMEIDA, 2019).

The following sections deal with the literature review, the database, the methodological approach, the results obtained, and final considerations.

3.2 ALLOCATION OF TIME THEORY

According to traditional theory, households maximize utility functions of the form

$$U = U(y_1, y_2, ..., y_n) \tag{3.1}$$

subject to the constraint

$$\sum p_i^{'} y_i = I = W + V \tag{3.2}$$

where y_i are goods purchased on the market, $p_i^{'}$ are their prices, I is money income, W is wage and V is other income.

Becker (1965) incorporated non-working time at the household utility function. Then, households combine time and market goods to produce commodities that enter their utility function. These commodities are represented by the function:

$$Z_i = f_i(x_i, T_i) \tag{3.3}$$

where x_i is a vector of market goods and T_i a vector of time inputs used to produce the ith commodity.

Households now use a production function f_i to combine time and market goods in order to produce commodities Z_i. They then select the optimal combination of these commodities by maximizing a utility function

$$U = U(Z_i, ..., Z_m) \equiv U(f_1, ..., f_m) \equiv U(x_1, ..., x_m; T_1, ..., T_m) \tag{3.4}$$

subject to a budget constrain

$$g(Z_i, ..., Z_m) = Z \tag{3.5}$$

where g is an expenditure function of Z_i and Z represents the limit of available resources.

Assuming that the utility function in equation (3.4) is maximized subject to distinct constraints on the expenditure of market goods and time, as well as the production functions defined in equation (3.3). The constraint for goods can be expressed as

$$\sum_{1}^{m} p_i x_i = I = V + T_w \bar{w} \tag{3.6}$$

where p_i represents a vector of unit prices for x_i, T is a vector indicating the hours spent at the labor market, and w_v is a vector denoting earnings per unit of T_w. The time constraints can be expressed as

$$\sum_{1}^{m} T_i = T_c = T - T_w \tag{3.7}$$

where T_c represents a vector of total time spent on consumption, and T denotes a vector of total time available. The production functions in equation (3.3) can be equivalently expressed as

$$\left.\begin{aligned} T_i &\equiv t_i Z_i \\ x_i &\equiv b_i Z_i \end{aligned}\right\} \tag{3.8}$$

where t_i is a vector representing the time input per unit of Z_i, and b_i is a corresponding vector for market goods.

Then, the household needs to maximize the utility function (3.4) subject to the constraints (3.6) and (3.7) and to the production relations (3.8). However, (3.6) is not independent of (3.7) because time can be converted into goods by allocating less time to consumption and more to work. Therefore, substituting T_w in (3.6) with its equivalent from (3.7) yields a single constraint

$$\sum p_i x_i + \sum T_i \bar{w} = V + T\bar{w} \tag{3.9}$$

Using (3.8), (3.9) can be written as

$$\sum (p_i b_i + t_i \bar{w}) Z_i = V + T\bar{w} \tag{3.10}$$

with

$$\left.\begin{aligned} \pi_i &\equiv p_i b_i + t_i \bar{w} \\ S' &\equiv V + T\bar{w} \end{aligned}\right\} \tag{3.11}$$

The full price of a unit of Z_i (π_i) is the sum of the prices of goods and the time used per unit of Z_i. In other words, the total cost of consumption includes both direct and indirect prices. Then, a meal prepared at home is not simply the result of purchased food (market inputs) but also of the time spent on its preparation (time input), for example.

3.3 EMPIRICAL LITERATURE

Women's employment leads to a division of time between the labor market and unpaid domestic work and time constraints can lead to changes in family habits. Given that food preparation demands a large part of the time allocated to housework, female employment can have a direct impact on household food decisions. This occurs because women are identified as the main responsible for choosing and preparing food consumed at home, reflecting gender stereotypes in consumption habits (PINHEIRO, 2005; REDMAN, 1980).

The reduction in time available for food preparation can lead to an increase in the demand for ready-to-eat or pre-cooked foods, which results in a substitution of time-intensive foods for time-saving foods, such as processed foods (LAMBERT et al., 2005; SENAUER; SAHN; ALDERMAN, 1986). Furthermore, there may be an increase in the consumption of meals away from home (REDMAN, 1980). In addition to women's employment, other factors that are linked to changes in eating habits are increased income, urbanization, availability of food, prices, years of study and hours worked by the household head (REGMI et al., 2001; PARK; JR, 1997).

In an analysis for the United States, Devine et al. (2009) finds that parents with long working hours are more related to buy take-out and restaurant meals. Also for the United States, Datar, Nicosia e Shier (2014) finds that children whose mothers work more consume more unhealthy foods, like soda and fast food, and less healthy foods, as fruits, vegetables and milk. For your turn, the results of Bauer et al. (2012) suggest that full-time mothers reported fewer encouragement of healthy eating by their adolescents, lower fruit and vegetable intake, and less time spent on food preparation, compared to part-time and non-employed mothers.

In a study for Germany, Thiele e Weiss (2003), based on regressions estimated in Ordinary Least Squares (OLS), found that the variety of foods[1] consumed in households is positively related to income and the number of children aged between 7 and 13 years, but negatively related to the variable that indicates that the head of the family works full time. For Norway, the results of Djupegot et al. (2017) suggest that the lack of parental time leads to an increase in the consumption of ultra-processed foods and fast food.

In turn, the results of Oostenbach et al. (2022) in a study for Australia suggest that the longer the individual spends in the labor market and commuting, the greater the chances of consuming food away from home and the lower the probability of consumption of foods such as fruits and vegetables. Despite this, the work of Brown e Presseau (2018) suggests that being an unemployed woman is negatively associated with healthy eating habits.

[1] The variety of foods is measured using the logarithm of two indices: the Berry Index, which measures the share of the product in total expenditure on food, and the entropy index, which gives greater weight to smaller commodities in the consumption basket.

The results of Miller et al. (2016) shows that there is little difference in food consumption between households where women do not work, work part-time or full-time in Australia. On the other hand, Li et al. (2012) finds that, for Western Australia, having a mother that stays at home in early to middle childhood is associated with better diet quality in adolescence.

In an analysis of Japanese married women, Oono et al. (2021) found results indicating that increased hours spent in paid work contribute to a less healthy diet. There is a reduction in the consumption of vegetables, potatoes, soy products, seaweed, protein, fiber and mineral vitamins. Besides this, Mori et al. (2021) suggests that longer maternal working hours are significantly associated with higher intake of white rice and lower intake of confectioneries.

For the Brazilian case, Bertasso (2006), using data from the 1995/1996 POF, classifies traditional foods as those consumed at home and which require some time to prepare, while foods that are easy and quick to prepare are classified as modern. The results found indicated that in households where women work, there is a higher frequency of modern foods consumption and eating away from home.

In their work, Schlindwein e Kassouf (2007b) perform an analysis with data from the POF 2002/2003 and find, through Heckman's two-stage procedure, that the opportunity cost of women's time and years of schooling negatively affect the consumption of foods such as rice, beans, cassava, meats and wheat flour and positively affect the consumption of ready-to-eat foods, yogurts, soft drinks, juices and eating away from home.

Thus, it can be observed that female labor force participation and full-time work can be related to a change in household eating habits. The consumption increase of ready meals and eating away from home can be harmful to the population's health, as they increase the chances of obesity, diabetes, blood pressure, heart problems, and cancer, among others (SCHLINDWEIN; KASSOUF, 2007a; RUEL; HADDAD; GARRETT, 1999).

Although the results suggest that maternal employment, in general, reduces the time allocated to food preparation, it is essential to highlight that women's empowerment —such as having decision-making power over healthcare and household purchases, as well as their employment status— is important to improve child health and nutrition (ABREHA; ZEREYESUS, 2021; BLIZNASHKA et al., 2021; HECKERT; OLNEY; RUEL, 2019). Moreover, women's empowerment is also strongly linked to their own improved nutritional status (HINDIN, 2000; MALAPIT et al., 2015; MALAPIT; QUISUMBING, 2015).

Additionally, it is important to emphasize that women tend to take on a disproportionate share of household tasks compared to men (SOARES, 2019). This unequal distribution of domestic responsibilities not only have impact on food consumption but it also increases the burden on women, limits their time and energy for other pursuits, such as professional

development, leisure, and self-care.

Engaging men in maternal and child health and nutrition can improve outcomes for both women and children. By fostering greater involvement, men can contribute to better dietary intake of micro nutrients, which is essential for maternal and child health (NGUYEN et al., 2018). Additionally, research has shown that male engagement positively influences the quality of child diets, as fathers' involvement can lead to more balanced and diverse family meals (GALVIN et al., 2023). Moreover, empowering men to participate in parenting programs can enhance their understanding of caregiving responsibilities, promote shared decision-making, and reduce gender-based disparities in child nutrition and development (GALVIN et al., 2023).

Table 40 presents a summary from the literature review. Given the importance of the topic, the present chapter aims to analyze the relationship of women's employment with the consumption of food at home. The chapter contributes to the literature by employing a QUAIDS model to analyze if female employment is significant to change household food consumption pattern.

Table 40 – Summary of methodologies, database, and regions of food consumption analyses

Authors	Methodology	Data base	Country
Senauer, Sahn e Alderman (1986)	OLS	Labor force and socioeconomic survey, 1980/81	Sri Lanka
Thiele e Weiss (2003)	OLS	Consumer Panel Research Data	Germany
Lambert et al. (2005)	Descriptive and exploratory analysis	National Institute of Statistics and Economic Studies	France
Bertasso (2006)	Heckman	POF, 1995/1996	Brazil
Schlindwein e Kassouf (2007b)	Probit and OLS	POF, 2002/2003	Brazil
Devine et al. (2009)	Two-tailed chi-square and Fisher exact tests	Telephone survey	United States
Bauer et al. (2012)	Descriptive statistics	Project F-EAT, 2010	United States
Li et al. (2012)	OLS	Western Australian Pregnancy Cohort, 2003-2006	Australia
Datar, Nicosia e Shier (2014)	OLS	Early Childhood Longitudinal Study	United States
Miller et al. (2016)	Chi-squared test	Australian National Nutrition and Physical Activity Survey, 2011/12	Australia
Djupegot et al. (2017)	Logit	Interview	Norway
Brown e Presseau (2018)	Random effects maximum likelihood	Household Income and Labour Dynamics of Australia, 2007 and 2009	Australia
Oono et al. (2021)	OLS	Health Diary Study 2, 2013	Japan
Mori et al. (2021)	Descriptive statistics	Interview	Japan
Oostenbach et al. (2022)	Mixed and fixed effect models	Household, Income and Labour Dynamics	Australia

Source: Prepared by the authors (2025).

3.4 DATA BASE

The analysis of Brazilian households' food consumption patterns is carried out using data from the 2017-2018 Family Budget Survey (POF), conducted by the Brazilian Institute of Geography and Statistics (IBGE). This survey is conducted every five years with the aim of measuring the consumption structures, expenditures, and incomes of households, as well as the perception of living conditions of the population, according to the characteristics of households and individuals. In addition, POF data is used to establish new weighting structures for the price indices that make up the National Consumer Price Index System of IBGE and other institutions.

The survey is conducted through sampling. It investigates private permanent households, with representativeness by Federative Unit (UF) for both urban and rural areas. The 2017-2018 POF was carried out from July 2017 to July 2018. In each household, the basic research unit—consumption unit (CU)—is identified, which includes a single resident or a group of residents who share the same food source or housing expenses (IBGE, 2017).

The questionnaire collects information about the household and its residents, including housing conditions and family composition—such as relationships among members (household reference person or head), gender, age, and education level. The collective expense diary records household-wide purchases related to food, hygiene, and cleaning. Meanwhile, the individual expense questionnaire gathers data on credit availability, health plans or insurance, and all types of expenses categorized as personal or individual use.

The food groups are defined according to the Dietary Guide for the Brazilian Population (SAÚDE, 2014): Ultra-processed are ready-to-consume industrial formulations made with ingredients with unfamiliar names and not used at home (carboxymethylcellulose, inverted sugar, maltodextrin, fructose, corn syrup, flavorings, emulsifiers, thickeners, sweeteners, among others), as instant noodles and chocolates; Processed are made with *In Natura* or minimally processed foods and culinary ingredients, as canned vegetables and cheese; *In Natura* are those obtained directly from plants or animals, such as leaves and fruits or eggs and milk, and acquired for consumption without having undergone any alteration after leaving nature; Ingredients are extracted from *In Natura* foods or directly from nature and used as seasonings, for cooking foods, and for culinary preparations, as sugar and salt. The list of foods comprising each group is provided in Appendix C. Table 41 describes the variables used in the estimations.

Table 41 – Variables' Description - Food Consumption Analyses

Variable	Description
Expenditure $Share_i$	Share of expenditure on good i.
$Price_i$	Price of good i.
Age	Household head's age.
Age_sqr	Household head's age squared.
Female	Dummy equal to 1 if the household head is female.
Black	Dummy equal to 1 if the individual is black or brown.
Female Employed	Dummy equals one if the female household chief or chief's wife is employed.
Full time	Dummy equals one if the female household chief or chief's wife is full time employed.
Spouse	Dummy equals one if the spouse resides in the household.
Children	Dummies equals one if there are children up to 6 years old and between 6 and 12 years old in the household.
Elderly	Dummy equal to one if there are elderly people, over 60 years old, in the household.
Educational Level	Dummies equal to 1 if the household head has between 11 and 14 years of schooling, and if the household head has 15 or more years of schooling.

Source: Prepared by the author (2025).

Table 42 presents the descriptive statistics of the database. The average total expenditure on food is approximately R$145. Most food expenditures are with other foods, while the lowest expenditures are with ingredients. The groups with the highest prices per kilo are other foods, while ingredients have the lowest prices. The average age of the household head is 49 years, with 41% being female, 57% black or mixed race, 95% employed, and 8% having a high school education. About 75% of the women, heads, or spouses, were employed. Most families do not have children at home, and 20% of the household have an elderly person.

Table 42 – Descriptive Statistics - Food Consumption Analyses

Variable	Mean	Std. Dev.	Min	Max
Expenditure share with Ultra-Processed	0.0763	0.1208	0	1
Expenditure share with Processed	0.0835	0.1769	0	1
Expenditure share with *In Natura*	0.1871	0.2082	0	1
Expenditure share with Ingredients	0.0121	0.0378	0	1
Expenditure share with Other Foods	0.6407	0.2654	0	1
Ultra-Processed price	42.5652	33.1995	0.0013	319.3770
Processed price	28.5352	18.0403	0.0054	154.0085
In Natura price	34.4613	27.8683	0.0181	254.1084
Ingredients price	8.6236	4.7700	0.0043	69.8225
Other Foods price	98.3333	95.7931	0.0055	825.9493
Age	49.7476	15.9294	12	101
Age_sqr	2728.5680	1673.7870	144	10201
Female	0.4133	0.4924	0	1
Black	0.6300	0.4828	0	1
Female Employed	0.7433	0.4368	0	1
Full-Time	0.3849	0.4865	0	1
Income	2442.1840	4161.5390	0	241408
Spouse	0.6246	0.4846	0	2
Children 0 to 6	0.0687	0.2530	0	1
Children 6 to 12	0.0667	0.2495	0	1
Elderly	0.1954	0.3965	0	1
Middle Educational Level	0.2666	0.4421	0	1
High Educational Level	0.0580	0.2339	0	1
Observations	46,865			

Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.5 EMPIRICAL STRATEGY

This chapter presents the methodology employed to estimate the demand system and its elasticities. It discusses the econometric procedures and the model used for the estimations, addressing key aspects such as adjustments for sociodemographic factors, handling zero consumption, addressing endogeneity issues related to total expenditures and prices, and the estimation of expenditure share equations and elasticities within the adjusted QUAIDS framework.

3.5.1 Demand System

The analyze is performed using the QUAIDS model developed by Banks, Blundell e Lewbel (1997) using the *Almost Ideal Demand System* (AIDS) model by Deaton e Muellbauer (1980). The AIDS model relates the share of expenditure on a particular good to prices and total expenditure, representing consumer preferences. Nevertheless, when the analyze is performed with a high level of disaggregation of goods, there is a high probability of non-linearity of Engel's curves[2] (BANKS; BLUNDELL; LEWBEL, 1997; BLUNDELL; ROBIN, 1999).

[2] Represents the variation in household expenditures with a given good according to the family income (DEATON; MUELLBAUER, 1980).

This situation may occur since at high levels of detail, several households do not consume certain goods, producing Engel curves that require quadratic terms in the logarithm of total expenditure, which is not possible to incorporate into the AIDS model. Thus, the QUAIDS model, based on a modified version of Roy's Theorem[3], allows the relation of the logarithm of expenditure to the good to have nonlinearity by incorporating its quadratic term into the equation. This change makes it possible to consider non-linear Engel curves, allowing a good to be a luxury for some levels of expenditure and necessary for other levels of expenditure.

The QUAIDS model starts from the generalization of preferences of the type *Price-Independent Generalized Logarithmic* (Piglog) that present indirect utility functions that are linear in the logarithm of expenditure, according to the equation:

$$ln\ V = \left[\frac{ln\ m - ln\ a(p)^{-1}}{b(p)}\right] + \lambda(p)^{-1} \tag{3.12}$$

where $ln\ V$ is the Naperian logarithm of the indirect utility function V; $ln\ m$ is the logarithm of the total expense; $a(p)$ and $b(p)$ are functions of the price vector p; the term $\left[\frac{ln\ m - ln\ a(p)^{-1}}{b(p)}\right]$ is the indirect utility function of a Piglog demand system ; and λ zero degree differentiable and homogeneous function in prices p[4] model. The term $b(p)$ is a price aggregator of the type Cobb-Douglas:

$$b(p) = \prod_{i=1}^{n} p_i^{\beta i} \tag{3.13}$$

In turn, the term $ln\ a(p)$[5] It is given by:

$$ln\ a(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i ln p_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} ln p_i ln p_j \tag{3.14}$$

The term $\lambda(p)$, which in the case of the AIDS models is equal to zero, in the QUAIDS model is given by:

$$\lambda(p) = \sum_{j=1}^{n} \lambda_i ln p_i \tag{3.15}$$

[3] Roy's Theorem shows that the Marshallian demand for good i is the negative of the ratio between its partial derivatives concerning price and expenditure (DEATON; MUELLBAUER, 1980).

[4] The indirect utility function of QUAIDS is: $u^* = \left[\frac{ln(y) - \alpha_0 - \sum_k \alpha_k ln(p_k) - \frac{1}{2}\sum_k \gamma^*_{kj} ln(p_k) ln(p_j)}{\beta_0 \prod_k p_k^{\beta_k}}\right]^{-1} + \lambda(p)^{-1}$. Where $\lambda(p) = \sum_{i=1}^{M} \lambda_i ln(p_i)$ and $\sum_i \lambda_i = 0$. Being different from AIDS models due to λp. When λp is independent of prices, it is equivalent to the Piglog class, which includes the AIDS (BANKS; BLUNDELL; LEWBEL, 1997).

[5] The term α_0, according to Banks, Blundell e Lewbel (1997), is defined by the minimum value of the total expenditure $ln\ m$.

where $\sum_{j=1}^{n} \lambda_i = 0$.

From the substitutions of these equations and the application of Roy's identity in the indirect utility function, the share of expenditure with the i-th good of the system is obtained:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln \left[\frac{m}{a(p)} \right] + \frac{\lambda_i}{b(p)} \ln^2 \left[\frac{m}{a(p)} \right]^2 \tag{3.16}$$

where $i = 1, ..., n$ are the goods considered in the demand system; w_i is the share of expenditure of the h-th family with good i, being a function of prices (own price and prices of other goods in the system) and total income. The parameters estimated from this equation are used to calculate the elasticities of demand in relation to prices and income.

To ensure consistency with the theory of demand, some conditions are imposed (and tested) under the coefficients of the QUAIDS model (additivity, homogeneity, symmetry, and negativity). Additivity is guaranteed if:

$$\sum_{i=1}^{n} \alpha_i = 1; \sum_{i=1}^{n} \gamma_{ij} = 0; \sum_{i=1}^{n} \beta_i = 0; \sum_{i=1}^{n} \lambda_i = 0 \tag{3.17}$$

In turn, homogeneity is guaranteed if:

$$\sum_{i=1}^{n} \gamma_{ij} = 0 \tag{3.18}$$

Finally, symmetry is ensured if:

$$\gamma_{ij} = \gamma_{ji} \tag{3.19}$$

In addition to income and prices, factors such as education, household location, and family composition are also factors that have an impact on the decision to consume food. The omission of these variables can result in biased estimates (SCHLINDWEIN; KASSOUF, 2007a; SCHLINDWEIN; KASSOUF, 2007b; POLLAK; WALES, 1981; RAY, 1983)

The sociodemographic factors were incorporated into the QUAIDS model by Poi (2002), using the method proposed by Ray (1983), where Z represents a vector of sociodemographic characteristics. The adjusted expenditure function for the Z vector is given by:

$$e(p, Z, u) = m_0(p, Z, u) \times e^R(p, u) \tag{3.20}$$

where $e^R(p, u)$ is the expenditure function in the reference household and $m_0(p, Z, u) = \bar{m}_0(Z) \times \phi(p, Z, u)$ is a scale factor of the sociodemographic characteristics of the household.

The first term of the scale factor scales the expenditure response concerning changes in the Z vector, regardless of changes in the consumption pattern. The second term controls changes in relative prices and the current consumption pattern. When introducing these demographic variables into the QUAIDS model, equation (3.16) is changed to:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} ln p_j + (\beta_i + \eta_i^{'} Z) ln \left[\frac{m}{\bar{m}_0(Z) a(p)} \right] + \frac{\lambda_i}{b(p) c(p,Z)} ln \left[\frac{m}{\bar{m}_0(Z) a(p)} \right]^2 \quad (3.21)$$

where $c(p,Z) = \prod_{i=1}^{n} p_i^{\eta_i^{'} Z}$ is a vector-weighted price aggregator sociodemographic variables; $\bar{m}_0(Z) = 1 + \rho^{'} Z$ is the sociodemographic scaling factor, with ρ being the parameter vector of the effects of sociodemographic characteristics on total expenditure to be estimated; η is the adjustment for relative changes in expenditure on each good i the additivity condition requires that $\sum_{i=1}^{n} \eta_i = 0$.

To calculate the price and expenditure elasticities based on the QUAIDS model, one must derive the system of equations expressed in (3.21) about expenditure (income) and prices, that is, concerning $ln\ m$ and $ln\ p_j$. It is obtained like this:

$$\mu_i \equiv \frac{\partial w_i}{\partial ln\ m} = \beta_i + \eta_i^{'} Z + \frac{2\lambda_i}{b(p) c(p,Z)} ln \left[\frac{m}{\bar{m}_o(Z) a(p)} \right] \quad (3.22)$$

$$\mu_{ij} \equiv \frac{\partial w_i}{\partial ln\ p_j} = \gamma_{ij} - \mu_i \left(\alpha_i + \sum_k \gamma_{jk} ln p_k \right) - \frac{\lambda_i (\beta_j + \eta_j^{'} Z)}{b(p) c(p,Z)} ln \left[\frac{m}{\bar{m}_0(Z) a(p)} \right]^2 \quad (3.23)$$

Which results in the elasticity of expenditure: $e_i \left(\frac{\mu_i}{w_i} \right) + 1$; and uncompensated (Marshallian) price elasticity: $e_{ij}^u = \frac{\mu_{ij}}{w_i} - \delta_{ij}$, where δ_{ij} is the Kronecker delta, which takes the value equal to unity when $i = j$ and zero otherwise. The Slutsky equation $e_{ij}^c = e_{ij}^u + e_i w_j$ is used to calculate the set of compensated elasticities $\left(e_{ij}^c \right)$.

3.5.2 The zero consumption problem

One of the challenges in estimating demand equations is the Zero Consumption Problem (ZCP), which arises when some households do not consume certain goods during the research period. The main causes of the ZCP include permanent zero consumption, where a family does not consume a good for non-economic reasons; the possibility that the family did not acquire the good during the research period, despite having the habit of doing so, which is common with non-perishable foods; and the family's decision not to consume the good as an optimal solution, considering the price and budget constraints (TAFERE et al., 2010).

The ZCP imposes a series of restrictions on the econometric methods that can be used for estimating demand equations because biased and inconsistent estimates can result. To deal with this problem, the correction suggested by Shonkwiler e Yen (1999) is used, in which a two-stage estimation is performed[6].

In the first stage, the multivariate probit model is used to find the probability that the household consumes food groups simultaneously, using sociodemographic variables, since such variables can affect the family's purchase decisions (SCHLINDWEIN; KASSOUF, 2007a; SILVA; COELHO, 2014; POLLAK; WALES, 1981; RAY, 1983). The second stage considers the estimation of the demand system.

Thus, to correct the censored expenditure values, a probit model is estimated in the first stage for all groups within the demand system simultaneously. The dependent variable (d_{ik}) indicates household consumption for each food group and equals one if the household has a positive expenditure on the i-th good $d_{ih} = 1$ if the household had a positive expenditure on the i-th good $w_{ih} > 0$ and zero otherwise ($d_{ih} = 0$ if $w_{ih} = 0$). The specification of the multivariate probit model is provided by Almeida e Júnior (2017):

$$d_{ik}^{*} = z_{ik}\alpha i + v_{ik} \tag{3.24}$$

$$\begin{pmatrix} h_{k1} \\ \vdots \\ h_{kn} \end{pmatrix} \sim N \left[\begin{pmatrix} 0 \\ \vdots \\ 0 \end{pmatrix} \right] \begin{pmatrix} 1 & r_{12} & \cdots & r_{1n} \\ \vdots & \cdots & \cdots & \vdots \\ r_{n1} & r_{n2} & \cdots & 1 \end{pmatrix} \tag{3.25}$$

where $d_{hi} = 1$ if $d_{hi}^{*} > 0$; $d_{hi} = 0$ otherwise. z_{ik} is the vector of explanatory variables that can influence household consumption decisions; α is the vector of parameters estimated through the probit, which assume a multivariate normal functional form. The standardized error term, v_{ik} is the random error, and r measures the correlation between the stochastic error terms in the system. For $r \neq 0$, it indicates that household consumption decisions are not made independently (ZANIN; BACCHI; ALMEIDA, 2019).

In the second stage, we have:

$$y_{ik}^{*} = f(c_{ik}, \beta_i) + \varepsilon_{ik} \tag{3.26}$$

$$y_{ik} = d_{ik} y_{ik}^{*}, \ (i = 1, ..., m; \ k = 1, ..., K)$$

[6] The correction process applied only corrects the existence of zero consumption as a corner solution, that is, for potential consumers.

where y_{ik}^{*} is a latent variable that represents the consumed quantity of the i-th product; y_{ik} is an observed dependent variable that represents the amount consumed with the i-th product; $f(c_{ik}, \beta_i)$ is the demand function; c_{ik} is the vector of exogenous variables; β_i is the parameter vector and ε_{ik} is the random error.

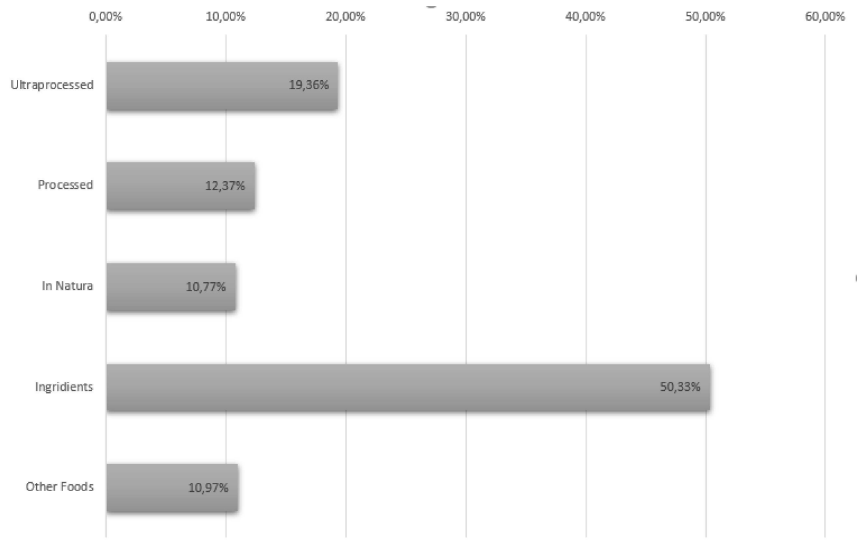
The error terms v_{ik} and ε_{ik} are assumed to be distributed as a bivariate normal with $Cov = (v_{ik},\ \varepsilon_{ik}) = \delta_i$, for each i. From the estimates of the probit, for each good (i) and for each family (h), the cumulative distribution function (CDF), $\varphi_{hi} = \Phi(\theta_{i}^{i} G_{hi})$ and the probability density function (PDF), $\varphi hi = \varphi(\theta_{i}^{i} G_{hi})$, which are incorporated into the QUAIDS model corrected for zero consumption:

$$W_{hi} = \Phi(\hat{\theta}_{i}^{i} G_{hi})\, \hat{w}_{hi} + \hat{\tau}_i \varphi(\hat{\theta}_{i}^{i} G_{hi}) \tag{3.27}$$

where W_{hi} is the observed value of household expenditure on good i, and w_{hi} is the latent value of this expenditure, which is determined by the QUAIDS model. The τ_i parameter captures the covariance between the error term in the QUAIDS model and the error term of the multivariate probit for consumption decisions.

For the data in hand, Figure 3 presents the percentage of households with zero consumption in each group. Since ingredients are easily sortable foods (such as salt, oil, sugar, among others), their purchase frequency is lower, as shown in the Figure. In our sample, approximately 50% of households did not consume this food group. Conversely, only 10% of households did not consume *In Natura* products, which are more perishable.

Figure 3 – Proportion of households with zero expenditures by food categories, 2017-2018



Source: Survey results based on ata from POF 2017-2018 (IBGE, 2020).

3.5.3 The problem of the endogeneity of total expenditures

Correction for the endogeneity of total expenditures is also performed. Such endogeneity may be caused by the fact that the decision to spend on food can occur simultaneously with the decision on total expenditure. Thus, it is not possible to consider that food expenditure is exogenous. To correct for endogeneity, a reduced form regression was performed, suggested by Blundell e Robin (1999), in which the total expenditure on the analyzed food groups is estimated concerning the total expenditure, including the vector of household characteristics in the estimation. The residuals of this estimation are used as an explanatory variable in the demand equation together with total expenditure. The estimation can be represented by:

$$ln\ m_h = a_0 + \Lambda^{'} Z_h + \Lambda^{'} ln\ p_h + e_y ln\ Y_h + v_h \tag{3.28}$$

where: Z and p are, respectively, the vectors of sociodemographic variables and prices of goods in the system; Y_h is the total household income and e_y is the income elasticity of constrained expenditure, or total household expenditure, on food (m_h).

3.5.4 The problem of price endogeneity

Another problem that must be fixed is related to prices. Household surveys only provide information on total expenditure and on the quantity of products consumed. Thus, households that do not consume a particular product do not have information on the price of that product, making estimations impossible. In the present work, for consumers who do not consume the goods, state averages of prices for each product were used, as recommended by Yen e Huang (2002).

In addition, a procedure for the endogeneity of prices is also performed, arising from the fact that prices are obtained by the quantity consumed of the good over the value paid for such good. As these values are not exogenous, their use may compromise the estimations as they incorporate factors such as the quality of the good (COX; WOHLGENANT, 1986; DEATON; MUELLBAUER, 1980). This is because consumers with higher incomes tend to consume better quality products, thus, the unit prices generated tend to be positively correlated with income.

To correct this problem, the methodology proposed by Cox e Wohlgenant (1986) was used, in which estimation is performed with the difference between the prices observed for each family and the average price per region. Subsequently, the new prices are calculated through the sum of the average prices by region and the residual obtained in the regression. This procedure aims to distinguish the price variability that is attributed to product quality differentials.

3.5.5 Estimation of expenditure share equations and elasticities in the adjusted QUAIDS model

The expenditure share equations of the QUAIDS model adjusted for sociodemographic factors, according to Poi (2012), are adapted to take into account the corrections to circumvent the problem of zero consumption and endogeneity of total expenditure, described in the previous subsections. However, these corrections mean that the condition of additivity, recommended by the theory of demand, is not guaranteed. Thus, the alternative proposed by Yen, Lin e Smallwood (2003) is to treat the nth good of the system as a residual good, with $W_{hm} = 1 - \sum_{i=1}^{n-1} W_{hi}$. The good of least interest in the research was chosen as the residual good (other foods group). Based on this restriction, and the others imposed on the QUAIDS model, the parameters are estimated and the elasticities of interest for the residual good can be calculated. Thus, the adapted equations to be estimated are described by:

$$w_{hi} = \Phi_{hi}\alpha_i + \sum_{j=1}^{10} \gamma_{ij} ln(p_{hj}) + (\beta_i + \eta_i^{'} Z_h) ln\left(\frac{m_h}{\zeta(p,Z)}\right) + \left(\frac{\lambda_i}{b(p)c(p,Z)}\right)\left[ln\left(\frac{m_h}{\zeta(p,Z)}\right)\right]^2 + \tau_{hi}\varphi_{hi} + \jmath_{hi} \tag{3.29}$$

with $i = n-1, \zeta(p,Z) = \bar{m}_0(Z) \times a_h(p)$; $\epsilon_{hi} = \vartheta_i \upsilon_h + \nu_{hi}$.

Due to the nonlinearity of the QUAIDS model, the equations are estimated by a Seemingly Unrelated Regression (SUR). For that, the interated feasible generalized nonlinear least squares (IFGNLS) method is applied, which is similar to the maximum likelihood estimations. The programming of these adjustments to obtain the parameters was carried out by adapting the *function evaluator program*, proposed by Poi (2002) and Poi (2008) and used by Almeida e Júnior (2017) and Zanin, Bacchi e Almeida (2019) for the case of POF.

From the estimated parameters, the elasticities are matched to the model adaptations, according to Zheng e Henneberry (2010). Thus, we have the elasticity of expenditure given by $E_i = e_i \times \Phi_i$ and the price elasticity of uncompensated demand given by $E_{ij}^u = \frac{\mu_{ij}}{W_i} \times \Phi_i + \varphi_i \times \pi_{ij}\left(1 - \frac{\tau_i}{W_i}\right)$. The parameter π_{ij} is associated with the price of the jth good in the first stage (multivariate probit); The price elasticity of compensated demand, by the Slutsky equation, is given by: $E_{ij}^c = E_{ij}^u + W_j + E_i$.

3.6 RESULTS

The presentation of the results follows a structure that allows us to understand the differences in the patterns of food consumption based on the estimated elasticity of the demand. Due to the nonlinear functional form of the demand system, model interpretations

should be made through the elasticity parameters, as suggested by Banks, Blundell e Lewbel (1997)[7]. First, we present the elasticities for the full sample, without distinguishing between households with employed and unemployed women. Next, we conduct a detailed analysis of the elasticities, considering different household characteristics such as marital status and the presence of children. It is important to highlight that these analyses were performed as post-estimations of the QUAIDS model applied to the full sample. In other words, the sample was not subdivided before estimating the model.

Additionally, we performed a new estimation of the QUAIDS model, considering only households formed by couples. This specific model allowed for a new analysis of elasticities, including the differentiation between households in which the woman is employed or not. Thus, we present two distinct approaches to assessing the impact of female employment on food consumption: (i) an analysis based on post-estimations of the full sample model and (ii) an analysis based on post-estimations of the model exclusively for couples.

3.6.1 Elasticities – Full Sample

Tables 43 and 44 present the price elasticities of Marshallian (or uncompensated) and Hicksian (or compensated) demands for the food groups for the full sample. The main diagonal represents the demand conditions of the product in relation to its own price, while the off-diagonal coefficients represent the demand relationship of a product correlated with the price of another[8].

In turn, the off-diagonal elements represent how a variation in the price of the *j-th* good affects the demand for the *i-th* good. Thus, through cross-price elasticities, it is possible to classify products as gross complements when an increase in the price of good *j* reduces the quantity demanded of good *i*, or as gross substitutes when this price increase for good *j* leads to an increase in the quantity demanded of good *i*.

The price elasticities of the products themselves, arranged on the main diagonal, are negative in both the Marshallian and Hicksian demand, as suggested by microeconomic theory. By the Marshallian matrix, presented in Table 43, it can be observed that there is an elastic price demand for ultra-processed and ingredients food groups. This means that an increase in the price of items from these groups would lead to a reduction in the quantity demanded of these items at a rate greater than the price increase. For their part, processed, *In Natura*, and other foods have an inelastic price demand. In other words, an increase in the

[7] The results for the QUAIDS model are presented at Appendix B.

[8] The elasticity matrices follow the form $E = \begin{pmatrix} e_{11} & e_{12} & \cdots & e_{1i} \\ e_{21} & e_{22} & \cdots & e_{2i} \\ \vdots & \vdots & \ddots & \vdots \\ e_{i1} & e_{i2} & \cdots & e_{ii} \end{pmatrix}$

price of items from these groups would result in a decrease in the quantity demanded that is proportionally smaller than the price rise.

Ultra-processed foods exhibit the highest elasticity among the elastic categories (-1.1692), demonstrating that households are more sensitive to price changes in this category. For your turn, processed foods has own-price elasticities of -0.3659, indicating that households are less sensitive to price changes in this category.

The cross-price elasticities provide additional insight into substitution and complementarity relationships between food groups. The highlights are the positive elasticity between ultra-processed foods and processed foods (0.1679), between processed foods and ingredients (0.0940), and between *In Natura* foods and processed foods (0.2163), suggesting a substitutive relationship; when the price of ultra-processed foods increases, households tend to shift consumption toward processed foods. Similarly, a price increase in processed foods leads to higher consumption of ingredients and a price increase in *In Natura* foods leads to a higher consumption of processed foods. Conversely, certain complementarity effects are evident in the data. For example, a price increase in processed foods, and in *In Natura* foods reduces the consumption of other foods (-0.0434 and -0.0188, respectively), suggesting that these categories are often consumed together.

Table 43 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Full Sample

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1692***	0.1679***	0.0057	0.0545***	-0.0014
	(0.0191)	(0.0150)	(0.0044)	(0.0181)	(0.0016)
Processed	0.0558***	-0.3659***	0.0385***	0.0940***	-0.0434***
	(0.0102)	(0.0225)	(0.0051)	(0.0194)	(0.0023)
In Natura	0.0371***	0.2163***	-0.9589***	-0.0202	-0.0188***
	(0.0103)	(0.0177)	(0.0128)	(0.0157)	(0.0025)
Ingredients	0.0112***	0.0414***	-0.0025	-1.2769***	0.0006
	(0.0040)	(0.0050)	(0.0016)	(0.0686)	(0.0005)
Other foods	0.1820***	0.3418***	0.0108	0.1296***	-1.0279***
	(0.0121)	(0.0399)	(0.0098)	(0.0230)	(0.0049)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 44 presents the compensated price elasticities (Hicksian demands) for food groups in Brazil. These elasticities reflect consumer responses to price changes, assuming their utility level remains constant, as purchasing power is adjusted. The results show that ultra-processed and ingredients exhibit elastic demand, with own-price elasticities of -1.0999 and -1.2636, respectively. While ultra-processed foods are close to the elastic threshold, indicating moderate price sensitivity, processed foods show lower responsiveness to price changes, with elasticity of -0.3354. This suggests that households are less likely to adjust their consumption

of processed items despite price variations. For *In Natura* foods, the own-price elasticity is -0.7780, confirming an inelastic demand, as price increases result in proportionally smaller decreases in demand. Lastly, the category of other foods demonstrates relatively low own-price elasticity (-0.3218), reinforcing its inelastic nature.

Cross-price elasticities suggest that price increases in ultra-processed foods lead to higher consumption of other categories, particularly processed foods (0.1056), and ingredients (0.1358), suggesting their potential substitutability. Similarly, a rise in the price of processed foods increases the demand for ultra-processed foods (0.1349), *In Natura* foods (0.1195) and ingredients (0.1624). Lastly, a price increases in *In Natura* foods leads to a similar increase in consumption in all the other group foods.

Table 44 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Full Sample

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.0999***	0.1056***	0.0858***	0.1358***	0.0878***
	(0.0193)	(0.0142)	(0.0045)	(0.0178)	(0.0016)
Processed	0.1349***	–0.3354***	0.1195***	0.1624***	0.0451***
	(0.0099)	(0.0223)	(0.0052)	(0.0288)	(0.0028)
In Natura	0.2043***	0.1617***	–0.7780***	0.1812***	0.1754***
	(0.0098)	(0.0154)	(0.0128)	(0.0161)	(0.0026)
Ingredients	0.0217***	0.0391***	0.0087***	–1.2636***	0.0136***
	(0.0040)	(0.0050)	(0.0016)	(0.0686)	(0.0005)
Other foods	0.7391***	0.0289	0.5641***	0.7842***	–0.3218***
	(0.0113)	(0.0207)	(0.0093)	(0.0414)	(0.0047)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 45 show the uncompensated (or Marshallian) price elasticities of demand for households where the woman is not employed. The results indicate that ultra-processed foods, ingredients, and other foods are price-elastic, meaning their demand is highly responsive to price changes. However, an unexpected result emerges for processed foods, which exhibit a positive own-price elasticity of 2.5526, a characteristic of a Giffen good. This implies that an increase in the price of processed foods leads to an increase in their consumption, a finding that contradicts standard economic theory. This result may be explained by data issues such as measurement errors, omitted variable bias, or unobserved heterogeneity in consumption patterns. Further research could investigate these factors to determine whether this result reflects data peculiarities.

The analysis of cross-price elasticities indicates that ultra-processed foods act as a substitute for processed foods (0.5499), and other foods (0.0163). This result suggests that an increase in ultra-processed foods price would lead to a change in consumption, mainly for processed foods. For your turn, an increase in prince of processed foods would lead to a substitution for ultra-processed foods (0.0786), and *In Natura* foods (0.0215).

Table 45 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - - Full Sample, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.2908***	0.5499***	0.0064	0.0552	0.0163***
	(0.0338)	(0.0580)	(0.0038)	(0.0407)	(0.0026)
Processed	0.0786***	2.5526***	0.0215***	0.0628	-0.0319***
	(0.0128)	(0.1076)	(0.0046)	(0.0555)	(0.0028)
In Natura	0.0646***	0.5425***	–0.9405***	0.2402**	-0.0170***
	(0.0130)	(0.0668)	(0.0108)	(0.0818)	(0.0037)
Ingredients	0.0110**	0.1518***	-0.0021	–1.6711***	0.0004
	(0.0045)	(0.0204)	(0.0014)	(0.4831)	(0.0008)
Other foods	0.2164***	0.8230***	-0.0092	0.4486***	–1.0808***
	(0.0174)	(0.1253)	(0.0089)	(0.1400)	(0.0066)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 46 displays the compensated price elasticities for households where the woman is not employed. The results indicate that ultra-processed, processed, and ingredients are elastic goods, with own-price elasticities of -1.2191, -2.5872, and -1.6577, respectively. Notably, processed foods exhibit the highest elasticity in absolute terms, meaning that a price increase in this category leads to a substantial reduction in its consumption. Conversely, *In Natura* foods and other foods show inelastic demand, with own-price elasticities of -0.7557 and -0.3853, indicating that price changes in these categories have a smaller effect on consumption.

For instance, an increase in the price of ultra-processed foods leads to higher consumption of other foods (0.7893), suggesting that households may substitute ultra-processed foods with these options when prices rise. On the other hand, a price increase in processed foods results in a substantial decrease in the consumption of other foods (-2.6236), pointing to a strong complementarity between these two categories.

Table 46 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - - Full Sample, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.2191***	0.1714***	0.2365***	0.0219***	0.7893***
	(0.0339)	(0.0127)	(0.0127)	(0.0045)	(0.0194)
Processed	0.1052***	–2.5872***	–0.1715***	0.1026***	–2.6236***
	(0.0551)	(0.1073)	(0.0617)	(0.0203)	(0.0980)
In Natura	0.0832***	0.1053***	–0.7557***	0.0083***	0.5590***
	(0.0038)	(0.0045)	(0.0107)	(0.0014)	(0.0077)
Ingredients	0.1233***	0.0626	0.4406***	–1.6577***	1.0313***
	(0.0519)	(0.1333)	(0.0917)	(0.4830)	(0.2198)
Other foods	0.1049***	0.0730***	0.1938***	0.0136***	–0.3853***
	(0.0026)	(0.0031)	(0.0036)	(0.0008)	(0.0068)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 47 provides an overview of the elasticities of uncompensated (or Marshallian) demands for households where the women is employed. The results indicate that ultra-

processed foods, processed foods, ingredients, and other foods exhibit price-elastic demand. In households where the woman is employed, the own-price elasticity of ultra-processed foods is -1.1275, indicating a highly elastic demand but, smaller when compared to households where the women is not employed.

Additionally, ultra-processed foods act as substitutes for processed foods in both cases, but the substitution effect appears weaker when the woman is employed (0.0369) compared to when she is not (0.5499). This suggests that non-employed women's households are more likely to replace processed foods with ultra-processed alternatives when prices rises.

For *In Natura* foods, the own-price elasticity is similar for employed women's households (-0.9652) compared to non-employed ones (-0.9405). In employed women's households, processed foods are a weak substitute for ultra-processed foods (0.0369) while it was a strong substitute in households where the women is not employed (0.5499). Overall, the findings suggest that employment status have a small influence on price sensitivity when considering the uncompensated elasticity.

Table 47 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 -- Full Sample, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1275***	0.0369***	0.0055	0.0543	–0.0074***
	(0.0181)	(0.0025)	(0.0047)	(0.0339)	(0.0018)
Processed	0.0479***	–1.3659***	0.0444***	0.1047***	–0.0473***
	(0.0097)	(0.0216)	(0.0057)	(0.0321)	(0.0029)
In Natura	0.0277***	0.1046***	–0.9652***	–0.1094***	–0.0194***
	(0.0098)	(0.0054)	(0.0165)	(0.0344)	(0.0027)
Ingredients	0.0113***	0.0036***	–0.0026	–1.1418***	0.0007
	(0.0039)	(0.0008)	(0.0017)	(0.1117)	(0.0005)
Other foods	0.1703***	0.1770***	0.0176	0.0203	–1.0098***
	(0.0120)	(0.0171)	(0.0118)	(0.0414)	(0.0061)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 48 show the compensated price elasticities for households where the woman is employed. The results indicate that ultra-processed, processed, and ingredients are elastic goods, with own-price elasticities of -1.0591, -1.3368, and -1.1286, respectively, though the elasticities are smaller compared to households where the woman is not employed. Conversely, *In Natura* foods and other foods have inelastic demands, with own-price elasticities of -0.7857 and -0.3001, respectively.

An increase in the price of ultra-processed foods results in higher consumption of processed foods (0.1058) and ingredients (0.1401), indicating substitution effects. Similarly, a price increase in processed foods leads to higher consumption of ultra-processed foods (0.1224) and *In Natura* foods (0.1243), reinforcing their substitutive relationship. For *In Natura*

foods, a price increase results in higher consumption of ultra-processed foods (0.1933) and processed foods (0.2759), suggesting that these categories are considered viable alternatives.

These results highlight that price elasticity for most categories is lower than in households where the woman is not employed. This indicates that households where women is employed is less sensitive to price changes. This result may be more related to income factors than to time constraints, since it occurs for all food groups, except for *In Natura*, where there is a small difference, since the elasticity is -0.7857 for employed households compared to -0.7557 not employed.

Table 48 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - - Full Sample, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.0591***	0.1058***	0.0867***	0.1401***	0.0819***
	(0.0183)	(0.0022)	(0.0050)	(0.0335)	(0.0018)
Processed	0.1224***	–1.3368***	0.1243***	0.1966***	0.0356***
	(0.0094)	(0.0214)	(0.0060)	(0.0381)	(0.0034)
In Natura	0.1933***	0.2759***	–0.7857***	0.0923***	0.1691***
	(0.0093)	(0.0053)	(0.0164)	(0.0330)	(0.0031)
Ingredients	0.0216***	0.0174***	0.0088***	–1.1286***	0.0136***
	(0.0039)	(0.0007)	(0.0017)	(0.1118)	(0.0005)
Other foods	0.7218***	0.9378***	0.5659***	0.6996***	–0.3001***
	(0.0111)	(0.0156)	(0.0117)	(0.0462)	(0.0060)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 49 highlight key differences in food consumption patterns based on the employment status of women in the household. Ultra-processed foods are consistently classified as normal goods across all household types, with expenditure elasticities of 0.9201 in non-employed households and 0.8704 in employed households.

On the other hand, in households where the woman is employed, processed foods are classified as a superior good, with elasticity of 1.0437. However, in households where the woman is not employed, processed foods act as an inferior good, exhibiting a highly negative elasticity of -4.6197. This suggests that as income rises, these households drastically reduce their consumption of processed foods.

In Natura foods are consistently classified as normal goods, with expenditure elasticities remaining relatively stable across all household groups (ranging from 0.9002 to 0.9239). This stability suggests that households increase their consumption of fresh foods as income increases, regardless of employment status.

While ingredients are classified as superior goods in the full sample (1.0189), and in employed households (1.0718), it is a normal good in non-employed households (0.8643), indicating a weaker response to income changes. Finally, other foods are classified as superior

goods across all household types. Overall, these results reveal important differences in how income affects food consumption depending on employment status, especially for processed foods.

Table 49 – Expenditure elasticity - Full sample

Food Group	Complete Sample	Employed	Not Employed
Ultra-processed	0.8831***	0.8704***	0.9201***
	(0.0086)	(0.0091)	(0.0124)
Processed	-0.4014***	1.0437***	-4.6197***
	(0.0458)	(0.0255)	(0.1619)
In Natura	0.9063***	0.9002***	0.9239***
	(0.0077)	(0.0095)	(0.0081)
Ingredients	1.0189***	1.0718***	0.8643***
	(0.0535)	(0.0246)	(0.2253)
Other foods	1.0908***	1.0832***	1.1130***
	(0.0037)	(0.0045)	(0.0035)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.1.1 Couples Sample

Analyzing couples' households is important to understand how food consumption decisions are influenced by family dynamics. Couples may exhibit different consumption patterns, as food choices and eating habits are often shared and influenced by factors such as the division of household labor, joint family income, and the management of time between professional and domestic responsibilities. Furthermore, including couples allows for investigating how female employment impacts food consumption decisions in a collective consumption setting, considering potential differences in demand elasticities between employed and unemployed women.

Table 50 presents the uncompensated (or Marshallian) price elasticities of demand for couples' households where the woman is not employed. The results indicate that ultra-processed foods, ingredients, and other foods are price-elastic, meaning their demand is highly responsive to price changes. The highest elasticity is observed for ingredients (-2.1126). For your turn, processed foods and *In Natura* exhibit a relatively low own-price elasticity of -0.4353, and -0.8007. This indicates that the demand for this groups is less sensitive to price changes compared to other food categories.

Ultra-processed foods act as substitutes for processed foods, with a cross-price elasticity of 0.1176, and for ingredients, with an elasticity of 0.1294. However, they exhibit a small positive cross-price elasticity with other foods (0.0243), suggesting limited substitution effects. Processed foods show substitution effects with ultra-processed foods (0.0747) and *In Natura* foods (0.1470), but they appear to be complementary to other foods, as indicated by a negative cross-price elasticity of -0.04019.

In Natura foods exhibit substitution effects with ingredients (0.6028), indicating that households may shift between these categories in response to price changes. Additionally, they serve as substitutes for processed foods (0.1470) and ultra-processed foods (0.0624), reinforcing the idea that fresh foods compete with more processed alternatives.

Table 50 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	-1.3409***	0.1176***	-0.0122***	0.1294	0.0243***
	(0.0474)	(0.0138)	(0.0031)	(0.0820)	(0.0039)
Processed	0.0747***	-0.4353***	-0.0292***	-0.0044	-0.04019***
	(0.0136)	(0.0310)	(0.0041)	(0.1697)	(0.0032)
In Natura	0.0624***	0.1470***	-0.8007***	0.6028***	0.0040
	(0.0143)	(0.0144)	(0.0113)	(0.1697)	(0.0062)
Ingredients	0.0110***	0.0369***	-0.0007	-2.1126***	0.0001
	(0.0048)	(0.0054)	(0.0010)	(0.7592)	(0.0009)
Other foods	0.2327***	0.1218***	-0.0271***	0.8953***	-1.1046***
	(0.0224)	(0.0179)	(0.0078)	(0.2820)	(0.0102)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 51 presents the compensated (or Hicksian) price elasticities of demand for couples' households where the woman is not employed. The findings suggest that ultra-processed foods and ingredients are price-elastic, with own-price elasticities of -1.2717 and -2.0996, respectively. This suggests that households in this group are highly responsive to price fluctuations in these categories, reducing their consumption significantly when prices increase. In contrast, processed foods (-0.4041), *In Natura* foods (-0.6182), and other foods (-0.4010) exhibit inelastic demand, meaning that price changes have a relatively smaller impact on their consumption.

The analysis of cross-price elasticities reveals that ultra-processed foods serve as substitutes for processed foods (0.1166), *In Natura* foods (0.0614), and other foods (0.1085). This suggests that when the price of ultra-processed foods rises, households tend to shift towards these alternatives. Processed foods also act as substitutes for *In Natura* foods (0.0450) and other foods (0.0743), but their substitution effects are relatively weak overall. Another finding is the substitution effect between *In Natura* foods and ingredients (0.7123), suggesting that households adjust their consumption between these two categories when relative prices change.

Table 51 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Couples, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.2717***	0.1166***	0.0614***	0.1002	0.1085***
	(0.0472)	(0.0139)	(0.0030)	(0.1092)	(0.0038)
Processed	0.1796***	–0.4041***	0.0450***	–0.0574	0.0743***
	(0.0145)	(0.0293)	(0.0047)	(0.1957)	(0.0044)
In Natura	0.2440***	0.1919***	–0.6182***	0.7123***	0.2050***
	(0.0154)	(0.0149)	(0.0112)	(0.1816)	(0.0058)
Ingredients	0.0220***	0.0343***	0.0094***	–2.0996***	0.0133***
	(0.0048)	(0.0054)	(0.0011)	(0.7593)	(0.0010)
Other foods	0.8260***	0.0612***	0.5024***	1.3445***	–0.4010***
	(0.0275)	(0.0218)	(0.0081)	(0.3174)	(0.0106)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 52 displays the uncompensated (or Marshallian) price elasticities of demand for couples' households where the woman is employed. The analysis reveals that ultra-processed foods, processed foods, *In Natura* foods, and ingredients exhibit elastic demand, with the highest elasticity for processed foods (-1.5699). In contrast, other foods display inelastic demand (-0.9593).

Comparing these findings to households where the woman is not employed, the demand for ultra-processed foods is more elastic in not employed households (-1.3409) compared to employed households (-1.1797). For your turn, processed foods exhibit an opposite pattern: they are more elastic in employed households (-1.5699) compared to not employed households (-0.4353). For *In Natura* foods, demand is elastic in employed households (-1.0094) but inelastic in not employed households (-0.8007).

Cross-price elasticities also reveal that in employed households, ultra-processed and processed foods act as substitutes for other foods (0.1999 and 0.1989, respectively). Overall, households where the woman is not employed tend to exhibit greater price elasticity for ultra-processed foods and ingredients. In contrast, employed households are more elastic in their demand for processed and *In Natura* foods, which may reflect differences in dietary habits and time availability for meal preparation.

Table 52 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	-1.1797**	0.0537***	0.0408***	0.0113***	0.1999***
	(0.0222)	(0.0104)	(0.0109)	(0.0041)	(0.0136)
Processed	0.0016	-1.5699***	0.0527***	-0.0061**	0.1989***
	(0.0057)	(0.0250)	(0.0082)	(0.0023)	(0.0227)
In Natura	0.0155***	0.0365***	-1.0094***	-0.0032	0.0375***
	(0.0052)	(0.0059)	(0.0161)	(0.0020)	(0.0116)
Ingredients	0.0533	0.0999***	-0.1371***	-1.0752***	-0.0044
	(0.0387)	(0.0375)	(0.0412)	(0.1435)	(0.0520)
Other foods	-0.0201***	-0.0575***	-0.0316***	0.0008	-0.9593***
	(0.0022)	(0.0036)	(0.0024)	(0.0006)	(0.0076)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

For your turn, Table 53 provides an overview of compensated elasticities results for couples' households where the women is employed. In employed households, ultra-processed (-1.1131), processed (-1.5443), and ingredients (-1.0621) are price-elastic, while *In Natura* (-0.8323) and other foods (-0.2420) are inelastic. Compared to non-employed households, processed foods are significantly more elastic. On the other hand, not employed households show higher price sensitivity for ultra-processed foods (-1.2717).

Cross-price elasticities highlight that in not employed households, other foods are a strong substitute to ultra-processed (0.7539), processed (1.1736), and *In Natura* (0.5966). These findings indicate that employment status influences food demand elasticity and substitution patterns for couples' households.

Table 53 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Couples, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1131***	0.1349***	0.2037***	0.0216***	0.7529***
	(0.0224)	(0.0103)	(0.0105)	(0.0041)	(0.0127)
Processed	0.0895***	–1.5443***	0.2699***	0.0113***	1.1736***
	(0.0051)	(0.0248)	(0.0076)	(0.0022)	(0.0194)
In Natura	0.0946***	0.1334***	–0.8323***	0.0077***	0.5966***
	(0.0055)	(0.0064)	(0.0160)	(0.0020)	(0.0111)
Ingredients	0.1369***	0.1936***	0.0602***	–1.0621***	0.6714***
	(0.0383)	(0.0454)	(0.0399)	(0.1436)	(0.0591)
Other foods	0.0673***	0.0105**	0.1505***	0.0137***	–0.2420***
	(0.0021)	(0.0043)	(0.0035)	(0.0006)	(0.0076)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Finally, the results in Table 54 present the expenditure elasticities for couples' households where the women is employed and for households where the women is not employed. Ultra-processed foods remain as a normal good in both groups, with slightly higher elasticity

in non-employed households (0.9600) compared to employed ones (0.8738). This suggests that not employed households allocate a larger share of additional income to these products.

In employed households, processed foods are classified as a superior good (1.3227), meaning that as income rises, demand for processed foods increases significantly. In contrast, in not employed households, processed foods have no significance. *In Natura* foods are also classified as normal goods, with a slightly higher elasticity in employed households (0.9230) than in non-employed ones (0.8702).

In general,al, the results indica that the employment status influences the way households adjust their food consumption as income changes. Employed households tend to increase their spending on processed foods and ingredients, while non-employed households show a stronger preference for ultra-processed and other foods when their financial situation improves.

Table 54 – Expenditure elasticity - Couples

Food Group	Employed	Not Employed
Ultra-processed	0.8738***	0.9600***
	(0.0096)	(0.0183)
Processed	1.3227***	0.0119
	(0.0359)	(0.0332)
In Natura	0.9230***	0.8702***
	(0.0105)	(0.0092)
Ingredients	1.0636***	0.4894
	(0.0325)	(0.3054)
Other foods	1.0677***	1.1164***
	(0.0060)	(0.0052)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.1.2 Childless Couples

Analyzing childless couples is important because, without the additional financial and time constraints that children introduce, childless couples can exhibit more flexibility in their consumption choices, and their food choices are less likely to be influenced by the needs and preferences of children.

Table 55 summarizes the uncompensated price elasticities for childless couples' households where the woman is not employed. The results show that ultra-processed foods, ingredients, and other foods are price-elastic. Ultra-processed foods have a high own-price elasticity (-1.5890), indicating that households reduce their consumption substantially when prices increase. They act as substitutes for processed foods (0.1615) and ingredients (0.0515), and as complementary for *In Natura* foods.

Processed foods show a substitution effect with ultra-processed foods (0.1177) and ingredients (0.0881), but they appear complementary to *In Natura* foods (-0.1026) and other foods (-0.0377), suggesting that price changes in these categories may influence processed food consumption. *In Natura* foods have a inelastic own-price elasticity (-0.5728). They are substitutes for processed foods (0.1782), and ultra-processed foods (0.0762) and are complementarity with ingredients (-0.0366).

Table 55 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Childless Couples, Not Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.5890***	0.1615***	–0.0356***	0.0515***	0.0283***
	(0.0681)	(0.0191)	(0.0054)	(0.0161)	(0.0045)
Processed	0.1177***	–0.1708***	–0.1026***	0.0881***	–0.0377***
	(0.0190)	(0.0406)	(0.0098)	(0.0159)	(0.0038)
In Natura	0.0762***	0.1782***	–0.5728***	–0.0366***	0.0147**
	(0.0163)	(0.0199)	(0.0363)	(0.0137)	(0.0073)
Ingredients	0.0121**	0.0480***	0.0018	–1.1772***	0.0003
	(0.0059)	(0.0072)	(0.0010)	(0.0379)	(0.0011)
Other foods	0.3045***	0.1571***	–0.1316***	0.0660***	–1.1090***
	(0.0300)	(0.0323)	(0.0198)	(0.0199)	(0.0118)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 56 presents the compensated price elasticities for childless couples' households where the woman is not employed. The data suggest that ultra-processed foods (-1.5173), processed foods (-1.1331), and ingredients (-1.1642) are price-elastic. In contrast, *In Natura* foods (-0.3858) and other foods (-0.4182) are price-inelastic, suggesting that their consumption is more stable despite price changes.

The analysis of cross-price elasticities demonstrate that ultra-processed foods serve as substitutes for processed foods (0.1269), ingredients (0.1237), and other foods (0.1111), indicating that households shift towards these alternatives when ultra-processed food prices rise. Similarly, processed foods act as substitutes for ingredients (0.1457) and other foods (0.0834), but their are complementary to *In Natura* foods (-0.0503).

In Natura foods show positive substitution effects with processed foods (0.1761), ingredients (0.1655), and other foods (0.2113), indicating flexibility in household food choices within this category. In summary, these results suggest that ultra-processed, processed, and ingredient categories are the most sensitive to price changes, while *In Natura* and other foods remain relatively stable in household consumption.

Table 56 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Childless Couples, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.5173***	0.1269***	0.0293***	0.1237***	0.1111***
	(0.0676)	(0.0189)	(0.0058)	(0.0168)	(0.0044)
Processed	0.2449***	–1.1331***	–0.0503***	0.1457***	0.0834***
	(0.0191)	(0.0385)	(0.0116)	(0.0272)	(0.0049)
In Natura	0.2931***	0.1761***	–0.3858***	0.1655***	0.2113***
	(0.0200)	(0.0202)	(0.0365)	(0.0145)	(0.0066)
Ingredients	0.0250***	0.0406***	0.0124***	–1.1642***	0.0125***
	(0.0059)	(0.0071)	(0.0010)	(0.0379)	(0.0010)
Other foods	0.9543***	–0.2106***	0.3944***	0.7293***	–0.4182***
	(0.0402)	(0.0306)	(0.0238)	(0.0226)	(0.0123)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 57 presents the uncompensated price elasticities for childless couples' households where the woman is employed. These findings highlight that ultra-processed foods, *In Natura*, and other foods are price-elastic, meaning their demand is highly responsive to price changes. In contrast, processed foods, and ingredients are price-inelastic.

Ultra-processed foods have a lower own-price elasticity in employed households (-1.1844) compared to non-employed households (-1.5890). This suggests that when the woman is employed, households are less sensitive to price changes for this category. Additionally, ultra-processed foods in employed households show substitution effects with processed foods (0.0624), *In Natura* (0.0318) and ingredients (0.0117).

Processed foods exhibit greater price sensitivity in employed households (-0.8299) than in non-employed households (-0.1708), suggesting that price changes have a stronger influence on demand when the woman is employed. Furthermore, processed foods in employed households act as substitutes for *In Natura* foods (0.1316) and ultra-processed foods (0.0779).

In Natura foods show a significant difference in price sensitivity between the two groups. In employed households, they are price-elastic (-1.0359), while in non-employed households, their demand is inelastic (-0.5728). This indicates that employed households are more responsive to price variations in fresh foods.

Overall, employed households tend to have lower elasticities for ultra-processed foods and ingredients but higher elasticities for *In Natura* and processed foods. These differences likely reflect variations in food purchasing habits and consumption behavior between the two groups.

Table 57 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Childless Couples, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1844***	0.0624***	0.0318***	0.0117***	0.2221***
	(0.0204)	(0.0108)	(0.0102)	(0.0042)	(0.0135)
Processed	0.0779***	–0.8299***	0.1316***	0.0208***	0.0739***
	(0.0082)	(0.0187)	(0.0084)	(0.0032)	(0.0095)
In Natura	0.0245***	0.0322***	–1.0359***	–0.0042**	0.0104
	(0.0054)	(0.0056)	(0.0158)	(0.0019)	(0.0101)
Ingredients	0.0362	0.0814	–0.2292***	–0.8636***	–0.1445**
	(0.0481)	(0.0559)	(0.0556)	(0.2061)	(0.0715)
Other foods	0.0033	–0.0315***	–0.0444***	0.0004	–1.0234***
	(0.0021)	(0.0024)	(0.0030)	(0.0005)	(0.0089)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 58 presents the compensated price elasticities for childless couples' households where the woman is employed. The evidence points that only ultra-processed foods (-1.1157) are price-elastic, meaning their demand is highly sensitive to price variations. In contrast, in non-employed households, ultra-processed (-1.5173), processed (-1.1331), and ingredients (-1.1642) are price-elastic. This suggests that when the woman is employed, households exhibit a reduced sensitivity to price changes.

The cross-price elasticities highlight important shifts in substitution patterns. In employed households, ultra-processed, and processed foods serve as substitutes for all the other group foods. For your turn, *In Natura* foods serve as substitutes for ultra-processed foods (0.1420), processed foods (0.2330), and other foods (0.1664).

Overall, the comparison suggests that households where the woman is employed exhibit lower price sensitivity across most food categories, except for ultra-processed foods. This may reflect differences in household routines, time constraints, and food purchasing behaviors associated with employment.

Table 58 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Childless Couples, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1157***	0.1163***	0.0969***	0.1247***	0.0878***
	(0.0206)	(0.0083)	(0.0054)	(0.0475)	(0.0018)
Processed	0.1420***	–0.7985***	0.1388***	0.1835***	0.0488***
	(0.0104)	(0.0177)	(0.0060)	(0.0654)	(0.0073)
In Natura	0.2013***	0.2330***	–0.8556***	–0.0188	0.1664***
	(0.0101)	(0.0086)	(0.0156)	(0.0530)	(0.0026)
Ingredients	0.0220***	0.0270***	0.0068***	–0.8506***	0.0139***
	(0.0042)	(0.0032)	(0.0019)	(0.2062)	(0.0005)
Other foods	0.7504***	0.4222***	0.6131***	0.5612***	–0.3169***
	(0.0123)	(0.0126)	(0.0105)	(0.0838)	(0.0089)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 59 summarizes the expenditure elasticities for childless couples, differentiating between households where the woman is employed and those where she is not. In households where the woman is employed, ultra-processed (0.8564), processed (0.5257), and *In Natura* foods (0.9729) are classified as normal goods, meaning their consumption increases with rising income, but at a decreasing rate. In contrast, ingredients (1.1197) and other foods (1.0957) are superior goods, suggesting that these categories see a higher increase in demand as income grows.

For households where the woman is not employed, ultra-processed foods (1.0784) and other foods (1.0081) are considered superior goods, while *In Natura* foods (0.8406) remain normal goods. However, processed foods (-0.3740) are classified as an inferior good, meaning that as household income increases, demand for processed foods declines. This suggests that households where the women is not employed reduce their spending on processed foods when financial conditions improve.

Overall, the results suggest that employment status influences how households prioritize food consumption with increasing income. Employed households allocate more of their additional income toward ingredients and other foods, whereas non-employed households show a stronger preference for ultra-processed and other foods, while reducing their consumption of processed foods as income grows.

Table 59 – Expenditure elasticity - Childless couples

Food Group	Employed	Not Employed
Ultra-processed	0.8564***	1.0784***
	(0.0103)	(0.0285)
Processed	0.5257***	-0.3740***
	(0.0164)	(0.0486)
In Natura	0.9729***	0.8406***
	(0.0076)	(0.0161)
Ingredients	1.1197***	1.0081
	(0.0863)	(0.0313)
Other foods	1.0957***	1.0081***
	(0.0061)	(0.0065)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.1.3 Couples with children

Couples with children faces constraints and priorities that influence their food consumption patterns. The presence of children often leads to different financial and time management dynamics, as households may accommodate the needs of younger family members, which can affect the types of food purchased and consumed. Additionally, the employment

status of mothers in these households may have a stronger impact on food consumption decisions due to the balancing of work, childcare, and household responsibilities.

Table 60 presents the uncompensated price elasticities for households with couples with children where the woman is not employed. The results reveal that ultra-processed foods, ingredients and other foods are price-elastic, with own-price elasticities of -1.2463, -2.4698, and -1.1031, respectively. This suggests that households significantly reduce their consumption of these categories in response to price increases. Besides, ultra-processed foods act as substitutes for processed foods (0.1009) and other foods (0.0228).

On the other hand, processed foods exhibit an inelastic own-price elasticity of -0.5364. They show substitution effects with ultra-processed foods (0.0583) but appear complementary to other foods (-0.0412). For your turn, *In Natura* foods have an own-price elasticity of -0.8878, demonstrating a higher sensitivity to price changes while remaining inelastic. They are substitutes for ultra-processed (0.0572), and processed foods (0.1351) and complementary with ingredients (0.8469).

Table 60 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples with children, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.2463***	0.1009***	–0.0034	0.1592	0.0228***
	(0.0421)	(0.0119)	(0.0038)	(0.1182)	(0.0037)
Processed	0.0583***	–0.5364***	–0.0013	–0.0398	–0.0412***
	(0.0119)	(0.0286)	(0.0044)	(0.2364)	(0.0033)
In Natura	0.0572***	0.1351***	–0.8878***	0.8469***	–0.0001
	(0.0140)	(0.0124)	(0.0137)	(0.2356)	(0.0060)
Ingredients	0.0106**	0.0327***	–0.0018	–2.4698**	0.0001
	(0.0044)	(0.0048)	(0.0013)	(1.0530)	(0.0010)
Other foods	0.2053***	0.1084***	0.0127	1.2120***	–1.1031***
	(0.0209)	(0.0145)	(0.0124)	(0.3870)	(0.0101)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 61 show the compensated price elasticities for couples with children where the woman is not employed. The results reveal that ultra-processed foods (-1.1780) and ingredients (-2.4566) are price-elastic, indicating significant sensitivity of demand to price variations. In contrast, processed foods (-0.5075), *In Natura* foods (-0.7069), and other foods (-0.3944) are inelastic, suggesting more stable consumption in response to price changes.

Regarding cross-price elasticities, ultra-processed foods show positive substitution effects with processed foods (0.1126), *In Natura* foods (0.0736), and other foods (0.1075), indicating that households may switch to these categories when ultra-processed food prices increase. Processed foods also exhibit substitution effects, particularly with *In Natura* foods (0.0814) and other foods (0.0708). For your turn, *In Natura* foods display significant sub-

stitution effects with ultra-processed foods (0.2253), processed foods (0.1980), ingredients (0.9211), and other foods (0.2026).

Table 61 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Couples with children, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1780***	0.1126***	0.0736***	0.0913	0.1075***
	(0.0419)	(0.0120)	(0.0038)	(0.1534)	(0.0037)
Processed	0.1547***	–0.5075***	0.0814***	–0.1350	0.0708***
	(0.0133)	(0.0270)	(0.0051)	(0.2731)	(0.0045)
In Natura	0.2253***	0.1980***	–0.7069***	0.9211***	0.2026***
	(0.0142)	(0.0129)	(0.0135)	(0.2529)	(0.0056)
Ingredients	0.0209***	0.0319***	0.0082***	–2.4566**	0.0136***
	(0.0044)	(0.0047)	(0.0013)	(1.0531)	(0.0010)
Other foods	0.7771***	0.1650***	0.5436***	1.5793***	–0.3944***
	(0.0243)	(0.0195)	(0.0100)	(0.4391)	(0.0104)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 62 presents the uncompensated price elasticities for households with children where the woman is employed. The results indicate that ultra-processed foods, *In Natura*, and ingredients are price-elastic. Concerning ultra-processed foods, it has a lower own-price elasticity in employed households (-1.1778) compared to non-employed households. This suggests that when the woman is employed, households are less sensitive to price changes for this category. Additionally, ultra-processed foods in employed households exhibit substitution effects with processed foods (0.0500), *In Natura* (0.0447), ingredients (0.0112), and other foods (0.1906).

Processed foods show a significantly higher own-price elasticity in employed households (-1.8822) compared to non-employed households (-0.5364), suggesting that price changes exert a stronger influence on their demand when the woman is employed. Furthermore, processed foods in employed households act as substitutes for other foods (0.1906) while it is complementary of ultra-processed foods (-0.0305), and ingredients (-0.0175).

About *In Natura* foods, it exhibits a close behavior between the two groups. In employed households, they are inelastic (-0.9983). Besides this, they act as a substitute for ultra-processed, processed, and other foods. Overall, employed households tend to have lower elasticities for ultra-processed foods and ingredients but higher elasticities for

Table 62 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples with children, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1778***	0.0500***	0.0447***	0.0112***	0.1906***
	(0.0247)	(0.0104)	(0.0114)	(0.0041)	(0.0146)
Processed	–0.0305***	–1.8822***	0.0195	–0.0175***	0.2517***
	(0.0112)	(0.0335)	(0.0138)	(0.0046)	(0.0326)
In Natura	0.0118**	0.0384***	–0.9983***	–0.0028	0.0490***
	(0.0054)	(0.0063)	(0.0181)	(0.0021)	(0.0133)
Ingredients	0.0606	0.1077***	–0.0984***	–1.1645***	0.0546
	(0.0350)	(0.0311)	(0.0359)	(0.1258)	(0.0456)
Other foods	–0.0301***	–0.0685***	–0.0262***	0.0011	–0.9323***
	(0.0029)	(0.0050)	(0.0027)	(0.0008)	(0.0092)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 63 presents the compensated price elasticities (Hicksian elasticities) for couples' households with children where the woman is employed. The outcomes indicate that ultra-processed foods (-1.1119), processed foods (-1.8590), and ingredients (-1.1513) are price-elastic, meaning their demand is highly sensitive to price variations. In contrast, *In Natura*, and other foods are price-inelastic, suggesting lower sensitivity to price changes.

The cross-price elasticities reveals that ultra-processed foods serve as substitutes for processed foods (0.0782), *In Natura* foods (0.0936), ingredients (0.1421), and other foods (0.0587). Similarly, processed foods act as substitutes for ultra-processed (0.1319), *In Natura* (0.1312), and ingredients (0.1978). Finally, *In Natura* foods exhibit substitution relationships, particularly with processed foods (0.2854), ultra-processed foods (0.2047), and other foods (0.1438).

Overall, the comparison suggests that households with employed women exhibit lower price sensitivity for ultra-processed foods, ingredients, and other foods. This may reflect differences in household routines, time availability, and food purchasing behaviors associated with employment.

Table 63 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Couples with children, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1119***	0.0782***	0.0936***	0.1421***	0.0587***
	(0.0248)	(0.0103)	(0.0058)	(0.0348)	(0.0028)
Processed	0.1319***	–1.8590***	0.1312***	0.1978***	–0.0057
	(0.0104)	(0.0334)	(0.0069)	(0.0417)	(0.0050)
In Natura	0.2047***	0.2854***	–0.8225***	0.0935***	0.1438***
	(0.0109)	(0.0124)	(0.0179)	(0.0349)	(0.0047)
Ingredients	0.0214***	0.0048	0.0081***	–1.1513***	0.0136***
	(0.0041)	(0.0044)	(0.0021)	(0.1258)	(0.0008)
Other foods	0.7540***	1.4906***	0.5896***	0.7178***	–0.2104***
	(0.0140)	(0.0280)	(0.0125)	(0.0529)	(0.0092)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 64 provides an overview of the expenditure elasticities for couples with children, distinguishing between households where the woman is employed and those where she is not. In households where the woman is employed, ultra-processed (0.8812), and *In Natura* (0.9019) are classified as normal goods, indicating that their consumption increases with rising income but at a decreasing rate. Processed foods (1.6589), ingredients (1.0399), and other foods (1.0559) are classified as superior goods, meaning these categories experience a higher increase in demand as income grows. Notably, processed foods exhibit the highest elasticity among this group, signaling their strong association with higher income levels.

For households where the woman is not employed, ultra-processed foods (0.9148), processed foods (0.1593), *In Natura* (0.8814), and ingredients (0.2915) are considered normal goods. On the other hand, other foods (1.1213) stand out as a superior good, reflecting the highest elasticity in this group. In summary, the results highlight differences in food expenditure patterns depending on the woman's employment status. Employed households allocate more of their additional income toward processed foods and ingredients, while non-employed households show a stronger preference for ultra-processed and other foods.

Table 64 – Expenditure elasticity - Couples with children

Food Group	Employed	Not Employed
Ultra-processed	0.8812***	0.9148***
	(0.0100)	(0.0163)
Processed	1.6589***	0.1593***
	(0.0521)	(0.0289)
In Natura	0.9019***	0.8814***
	(0.0128)	(0.0101)
Ingredients	1.0399***	0.2915
	(0.0386)	(0.4218)
Other foods	1.0559***	1.1213***
	(0.0074)	(0.0051)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.1.4 Singles

Individuals living alone may exhibit distinct consumption behaviors compared to those in family units. Single individuals have more autonomy in their food choices, as they are solely responsible for their preferences and dietary needs, which can lead to different spending patterns. Additionally, the employment status of single women may have a more direct impact on their food consumption, given that they are not sharing household responsibilities with others.

Table 70 exhibits the uncompensated price elasticities for singles' households without employed women in Brazil. The analysis suggests that ultra-processed foods (-1.2679), processed foods (-3.9138), and ingredients (-1.4700) are highly price-elastic, indicating that their consumption is significantly affected by price variations. Besides this, *In Natura* foods (-1.0041) and other foods (-1.0699) are also price-elastic, but in smaller magnitude.

Regarding cross-price elasticities, ultra-processed foods display substitution effects with processed foods (0.7469), *In Natura* foods (0.0149), and other foods (0.0126). For your turn, processed foods exhibit substitution effects with ultra-processed foods (0.0804), *In Natura* foods (0.0446), and ingredients (0.0934). Finally, *In Natura* foods show substitution with ultra-processed foods (0.0656), and processed foods (0.7226). On the other hand, it is complementary with other foods (-0.0266).

Table 65 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Singles, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.2679***	0.7469***	0.0149***	0.0214	0.0126***
	(0.0313)	(0.0783)	(0.0046)	(0.0300)	(0.0024)
Processed	0.0804***	–3.9138***	0.0446***	0.0934***	–0.0281***
	(0.0128)	(0.1501)	(0.0060)	(0.0206)	(0.0031)
In Natura	0.0656***	0.7226***	–1.0041***	0.0749	-0.0266***
	(0.0128)	(0.0912)	(0.0140)	(0.0481)	(0.0033)
Ingredients	0.0110**	0.2042***	–0.0027*	–1.4700***	0.0005
	(0.0044)	(0.0272)	(0.0016)	(0.4175)	(0.0007)
Other foods	0.2089***	1.1425***	–0.0010	0.2451***	–1.0699***
	(0.0170)	(0.1769)	(0.0106)	(0.0907)	(0.0064)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 66 presents the matrix of compensated (Hicksian) price elasticities for households of childless couples where the woman is not employed. The evidence points that ultra-processed foods exhibit a high own-price elasticity (-1.1951), classifying them as price-elastic. Additionally, ultra-processed foods are substitutes for *In Natura* (0.0932), ingredients (0.1338), and other foods (0.1033), though the substitution effects are relatively modest.

Moreover, the outcomes demonstrate that processed foods is inelastic (-0.7722). They act as substitutes for ultra-processed (0.1676), *In Natura* (0.1327), and other foods (0.0724). *In Natura* foods are also price-inelastic (-0.8184). These foods serve as substitutes for ultra-processed (0.2330), ingredients (0.3168), and other foods (0.1887). For your turn, it is complementary with processed foods (-0.3371).

Table 66 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Singles, Not Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1951***	0.1000	0.0932***	0.1338***	0.1033***
	(0.0315)	(0.0741)	(0.0046)	(0.0353)	(0.0024)
Processed	0.1676***	–0.7722***	0.1327***	0.1172	0.0724***
	(0.0125)	(0.1498)	(0.0056)	(0.1354)	(0.0030)
In Natura	0.2330***	–0.3371***	–0.8184***	0.3168***	0.1887***
	(0.0121)	(0.0837)	(0.0139)	(0.0572)	(0.0034)
Ingredients	0.0219***	0.1338***	0.0078***	–1.4564***	0.0137***
	(0.0044)	(0.0271)	(0.0016)	(0.4173)	(0.0007)
Other foods	0.7726***	–0.3847***	0.5847***	0.8886***	–0.3781***
	(0.0182)	(0.1371)	(0.0096)	(0.2014)	(0.0065)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 67 provides an overview of the matrix of uncompensated (Marshallian) price elasticities for singles' households where the woman is employed. The results show that ultra-

processed foods have a price elasticity of -0.9855, indicating that their demand is inelastic but less sensitive to price changes compared to households where the women is not employed.

Processed foods, *In Natura*, and ingredients, with an elasticity of -0.8105, -0.8447, and -1.3230 respectively, show a smaller elasticity when compared to not employed households, meaning that households where the women is employed are less responsive to price fluctuations in these categories. Other foods, however, show price-elastic demand (-1.1471), suggesting a higher sensitivity to price variations in this category when compared to not employed households.

When examining cross-price elasticities, ultra-processed foods act as substitutes for processed foods (0.1329), ingredients (0.0569), and other foods (0.0273). For your turn, it acts as a complementary good for *In Natura* (-0.0220). Regarding processed foods, it serves as substitutes for *In Natura* foods (0.0657), and ingredients (0.1178), and as complementary for other foods (-0.0195), with the highest substitution effect observed for ingredients. Lastly, *In Natura* foods show the higher substitution effects with processed foods (0.2457).

In summary, the price elasticities and substitution effects suggest that households where the woman is employed exhibit a different pattern of food consumption compared to those where she is not employed. Specifically, ultra-processed foods, processed foods, *In Natura* foods, and ingredients are more price-sensitive in not employed households.

Table 67 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Singles, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.9855***	0.1329***	–0.0220***	0.0569***	0.0273***
	(0.0144)	(0.0133)	(0.0047)	(0.0214)	(0.0035)
Processed	0.0322***	–0.8105***	0.0657***	0.1178***	–0.0195***
	(0.0079)	(0.0352)	(0.0070)	(0.0204)	(0.0039)
In Natura	–0.0083	0.2457***	–0.8447***	–0.0337*	0.0137**
	(0.0076)	(0.0145)	(0.0352)	(0.0190)	(0.0059)
Ingredients	0.0110***	0.0299***	–0.0009	–1.3230***	0.0000
	(0.0032)	(0.0049)	(0.0013)	(0.0447)	(0.0010)
Other foods	0.0896***	0.1171***	–0.0366	0.0875***	–1.1471***
	(0.0112)	(0.0150)	(0.0238)	(0.0220)	(0.0104)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 68 presents the matrix of compensated (Hicksian) price elasticities for singles' households where the woman is employed. The results show that ultra-processed foods have a price elasticity of -0.9121, indicating that their demand is inelastic, while it was elastic for not employed households. Processed foods in employed households have an elasticity of -0.7722, which is also inelastic, and this is similar to non-employed households. Concerning *In Natura* foods, the group is inelastic (-0.6587).

The cross-price elasticities shows that ultra-processed foods serve as substitutes for processed foods (0.1499), *In Natura* foods (0.0650), ingredients (0.1488), and other foods (0.1215). Processed foods exhibit a similar pattern, serving as substitutes for *In Natura* foods (0.0995), ingredients (0.2049), and other foods (0.1037). *In Natura* foods also act as substitutes for ultra-processed foods (0.1650), processed foods (0.2923), and other foods (0.2197). The strongest substitution effects are observed between *In Natura* foods and processed foods, as well as between *In Natura* foods and other foods. Overall, the comparison indicates that households where the woman is employed exhibit lower price sensitivity across most food categories, except for other foods.

Table 68 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Singles, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.9121***	0.1499***	0.0650***	0.1488***	0.1215***
	(0.0145)	(0.0132)	(0.0054)	(0.0216)	(0.0036)
Processed	0.0884***	–0.7722***	0.0995***	0.2049***	0.1037***
	(0.0096)	(0.0343)	(0.0097)	(0.0255)	(0.0046)
In Natura	0.1650***	0.2923***	–0.6587***	0.1796***	0.2197***
	(0.0074)	(0.0144)	(0.0354)	(0.0178)	(0.0055)
Ingredients	0.0215***	0.0337***	0.0118***	–1.3096***	0.0132***
	(0.0032)	(0.0050)	(0.0013)	(0.0448)	(0.0010)
Other foods	0.6373***	0.2962***	0.4823***	0.7763***	–0.4582***
	(0.0112)	(0.0299)	(0.0254)	(0.0265)	(0.0106)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 69 presents the expenditure elasticities for single-person households, distinguishing between those where the women is employed and those where she is not. For employed women, ultra-processed foods (0.8610), processed foods (0.2849), and *In Natura* foods (0.8384) are classified as normal goods. This indicates that as income increases, the consumption of these food categories also rises. In contrast, ingredients (1.0944) and other foods (1.1255) are superior goods for employed individuals, meaning that their consumption increases more significantly as income grows.

For those who are not employed, ultra-processed foods (0.9020) and *In Natura* foods (0.9484) are also considered normal goods. However, processed foods have an expenditure elasticity of -6.7298, which classifies them as an inferior good. This negative elasticity indicates that as income grows, demand for processed foods sharply declines, suggesting that individuals in non-employed households move away from processed foods in favor of other food categories when their financial situation improves.

Overall, the results highlight that employment status influences food consumption patterns in relation to income. Employed women tend to allocate more of their additional income toward ingredients and other foods. On the other hand, non-employed women show

a preference for other foods, while reducing their consumption of processed foods as their income increases.

Table 69 – Expenditure elasticity - Singles

Food Group	Employed	Not Employed
Ultra-processed	0.8610***	0.9020***
	(0.0097)	(0.0118)
Processed	0.2849***	-6.7298***
	(0.0280)	(0.2275)
In Natura	0.8384***	0.9484***
	(0.0166)	(0.0091)
Ingredients	1.0944***	1.0351
	(0.0370)	(0.2759)
Other foods	1.1255***	1.1115***
	(0.0052)	(0.0035)

Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.1.5 Childless Singles

Childless singles may have more disposable income and flexibility in their spending decisions. Table 70 presents the uncompensated price elasticities for childless singles' households where the woman is not employed. The findings show that ultra-processed foods (-1.1113), *In Natura* (-1.0102), ingredients (-1.5081), and other foods (-1.0808) are price-elastic, indicating that their consumption is highly responsive to price changes. In contrast, processed foods are price-inelastic.

Regarding the cross-price elasticities, ultra-processed foods are substitutes for processed foods (0.0634), *In Natura* foods (0.0147), and other foods (0.0152). Processed foods show substitution effects with ultra-processed foods (0.0570), *In Natura*, and ingredients (0.1971). For your turn, it acts as complementary for other foods (-0.0213). *In Natura* foods exhibit substitution effects with processed foods (0.1181) and are complementary with ingredients (-0.1845), and other foods (-0.0252).

Table 70 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Childless Singles, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1113***	0.0634***	0.0147***	0.0908	0.0152***
	(0.0239)	(0.0056)	(0.0055)	(0.0643)	(0.0028)
Processed	0.0570***	–0.9915***	0.0577***	0.1971***	–0.0213***
	(0.0101)	(0.0227)	(0.0080)	(0.0627)	(0.0038)
In Natura	0.0071	0.1181***	–1.0102***	–0.1845**	–0.0252***
	(0.0097)	(0.0063)	(0.0200)	(0.0759)	(0.0039)
Ingredients	0.0105***	0.0163***	–0.0038**	–1.5081***	0.0005
	(0.0036)	(0.0021)	(0.0017)	(0.1688)	(0.0007)
Other foods	0.1796***	0.1347***	–0.0229*	–0.0773	–1.0808***
	(0.0152)	(0.0111)	(0.0123)	(0.1309)	(0.0080)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 71 show the compensated price elasticities for childless singles' households where the woman is not employed. The results highlight that ultra-processed foods, and ingredients are price-elastic. Ultra-processed foods have a own-price elasticity of -1.0372, and they act as weak substitutes for processed foods (0.1136), *In Natura* (0.0951), ingredients (0.2179), and other foods (0.1069).

The cross-price elasticities points that ultra-processed foods have the higher substitution effect with processed foods (0.1136). On the other hand, processed foods have a substitution effect with ultra-processed foods (0.1340), *In Natura* (0.1451), ingredients (0.4220), and other foods (0.0833). For your turn, *In Natura* foods exhibit a own-price elasticity of -0.8228, and are substitutes for ultra-processed foods (0.1886), processed foods (0.2404), and other foods (0.1927).

Table 71 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Childless Singles, Not Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.0372***	0.1136***	0.0951***	0.2179***	0.1069***
	(0.0240)	(0.0059)	(0.0055)	(0.0573)	(0.0028)
Processed	0.1340***	–0.9510***	0.1451***	0.4220***	0.0833***
	(0.0100)	(0.0212)	(0.0073)	(0.0512)	(0.0037)
In Natura	0.1886***	0.2404***	–0.8228***	0.0816	0.1927***
	(0.0095)	(0.0071)	(0.0200)	(0.0670)	(0.0040)
Ingredients	0.0204***	0.0236***	0.0068***	–1.4947***	0.0133***
	(0.0036)	(0.0021)	(0.0017)	(0.1690)	(0.0007)
Other foods	0.6942***	0.5734***	0.5757***	0.7731***	–0.3962***
	(0.0144)	(0.0133)	(0.0132)	(0.0872)	(0.0082)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 72 presents the uncompensated price elasticities for childless singles' households where the woman is employed. The analysis suggests that ultra-processed foods (-0.8147) and processed foods (-0.8003) are price-inelastic, while ultra-processed foods was elastic in not employed households. Ingredients (-1.4780) and other foods (-1.1945) are price-elastic, indicating that households are more responsive to price variations in these categories.

Cross-price elasticities reveal that ultra-processed foods act as substitutes for processed foods (0.0988), ingredients (0.0712), and other foods (0.0376). On the other hand, it is complementary to *In Natura* foods (-0.1172). Processed foods serve as substitutes for *In Natura* foods (0.0282) and ingredients (0.1392). In contrast, *In Natura* foods acts as complementary to ultra-processed foods (-0.0574), and as substitute to processed (0.1684), and other foods (0.0374).

Table 72 – Matrix of price elasticities of uncompensated or Marshallian demands in Brazil, 2017-2018 - Childless Singles, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.8147***	0.0988***	–0.1172***	0.0712***	0.0376***
	(0.0277)	(0.0101)	(0.0119)	(0.0200)	(0.0045)
Processed	0.0088	–0.8003***	0.0282***	0.1392***	–0.0078
	(0.0069)	(0.0257)	(0.0040)	(0.0208)	(0.0053)
In Natura	–0.0574***	0.1684***	0.0802	0.0048	0.0374***
	(0.0093)	(0.0104)	(0.0802)	(0.0194)	(0.0082)
Ingredients	0.0113***	0.0259***	0.0074**	–1.4780***	–0.0001
	(0.0025)	(0.0038)	(0.0032)	(0.0604)	(0.0012)
Other foods	–0.0061	0.1443***	–0.4627***	0.1463***	–1.1945***
	(0.0198)	(0.0138)	(0.0507)	(0.0282)	(0.0146)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 78 displays the compensated price elasticities for childless singles' households where the woman is employed. The The data suggest that ultra-processed foods (-0.7391), processed foods (-0.7562), and other foods (-0.5164) are price-inelastic, while ultra-processed foods was elastic in not employed households. In contrast, ingredients (-1.4647) are price-elastic. Notably, *In Natura* foods display a positive own-price elasticity (0.2691), which contradicts standard microeconomic theory and suggests the presence of a Giffen good. The identification of *In Natura* foods as a potential Giffen good—where demand increases as price rises—raises questions about the economic behavior of employed households. This phenomenon could stem from data limitations, income effects, or specific consumption patterns, and further investigation is warranted.

Cross-price elasticities reveal that ultra-processed and processed foods act as substitutes for most other categories, as seen in their positive cross-price elasticities with ingredients (0.1650 and 0.2439, respectively) and other foods (0.1342 and 0.1306, respectively). *In Natura* foods also exhibit substitution effects, particularly with processed foods (0.2394) and ingredients (0.2230).

Table 73 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Childless Singles, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.7391***	0.1282***	–0.0694***	0.1650***	0.1342***
	(0.0277)	(0.0102)	(0.0134)	(0.0215)	(0.0048)
Processed	0.0419***	–0.7562***	–0.1417***	0.2439***	0.1306***
	(0.0147)	(0.0245)	(0.0209)	(0.0276)	(0.0069)
In Natura	0.1252***	0.2394***	0.2691***	0.2230***	0.2391***
	(0.0093)	(0.0110)	(0.0803)	(0.0177)	(0.0074)
Ingredients	0.0218***	0.0297***	0.0201***	–1.4647***	0.0126***
	(0.0025)	(0.0038)	(0.0031)	(0.0604)	(0.0012)
Other foods	0.5502***	0.3588***	–0.0781	0.8327***	-0.5164***
	(0.0193)	(0.0158)	(0.0573)	(0.0335)	(0.0149)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 74 presents the expenditure elasticities for single households without children, comparing those where the women is employed to those where she is not. In employed households, ultra-processed (0.8580), processed (0.3628), and *In Natura* foods (0.4642) are classified as normal goods. In contrast, ingredients (1.1163) and other foods (1.1273) are superior goods.

For non-employed households, ultra-processed foods (0.8570), processed foods (0.6589), and *In Natura* foods (0.9643) are also classified as normal goods, while ingredients (1.4820) and other foods (1.1115) are superior goods. For not employed households, there is a higher expenditure elasticity for processed foods, *In Natura*, and ingredients when compared to employed households.

Table 74 – Expenditure elasticity - Childless Singles

Food Group	Employed	Not Employed
Ultra-processed	0.8580***	0.8570***
	(0.0131)	(0.0119)
Processed	0.3628***	0.6589***
	(0.0205)	(0.0177)
In Natura	0.4642***	0.9643***
	(0.0376)	(0.0096)
Ingredients	1.1163***	1.4820
	(0.0707)	(0.1401)
Other foods	1.1273***	1.1115***
	(0.0074)	(0.0042)

Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.1.6 Singles with children

Single mothers often have to balance work, child-rearing responsibilities, and financial constraints, which can affect their food choices and spending behavior. This demographic typically has a lower disposable income compared to dual-income households. Furthermore, single mothers' employment status is likely to have a strong impact on household consumption, as changes in income and work hours can directly influence their food demand.

In Table 75 there is the uncompensated price elasticities for singles' households with children where the woman is not employed. The results indicate that ultra-processed foods, *In Natura*, ingredients, and other foods are price-elastic, meaning their demand is highly sensitive to price changes. Ultra-processed foods have a high own-price elasticity (-1.2679), and act as substitutes for processed foods (0.7469), *In Natura* foods (0.0149), and other foods (0.0126).

Processed foods exhibit a positive own-price elasticity (3.9138), indicating a Giffen good. They also function as substitutes for ultra-processed foods (0.0804), *In Natura* foods (0.0446), and ingredients (0.0934), while showing a complementarity with other foods (-0.0281). *In*

Natura foods have an own-price elasticity of -1.0041, suggesting a moderate sensitivity to price changes. They act as substitutes for ultra-processed foods (0.0656), processed foods (0.7226), and as complementary to other foods (-0.0266).

Table 75 – Matrix of price elasticities of uncompensated or Marshalian demands in Brazil, 2017-2018 - Singles with children, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.2679***	0.7469***	0.0149***	0.0214	0.0126***
	(0.0313)	(0.0783)	(0.0046)	(0.0300)	(0.0024)
Processed	0.0804***	3.9138***	0.0446***	0.0934***	–0.0281***
	(0.0128)	(0.1501)	(0.0060)	(0.0206)	(0.0031)
In Natura	0.0656***	0.7226***	–1.0041***	0.0749	–0.0266***
	(0.0128)	(0.0912)	(0.0140)	(0.0481)	(0.0033)
Ingredients	0.0110**	0.2042***	–0.0027*	–1.4700***	0.0005
	(0.0044)	(0.0272)	(0.0016)	(0.4175)	(0.0007)
Other foods	0.2089***	1.1425***	–0.0010	0.2451***	–1.0699***
	(0.0170)	(0.1769)	(0.0106)	(0.0907)	(0.0064)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 76 presents the compensated price elasticities for singles' households with children where the woman is not employed. The results indicate that ultra-processed foods (-1.1951), processed foods (-3.9500), and ingredients (-1.4564) are price-elastic. Conversely, *In Natura* (-0.8184), and other foods (-0.3781) are price inelastic.

The cross-price elasticities suggests that ultra-processed foods act as substitutes for *In Natura* foods (0.0932), ingredients (0.1338), and other foods (0.1033). Processed foods exhibit substitution effects for processed foods (0.1676), *In Natura* (0.1327), and other foods (0.0724). *In Natura* foods show positive substitution effects with ultra-processed foods (0.2330), ingredients (0.3168), and other foods (0.1887), suggesting some flexibility in household food choices within this category. For your turn, it is complementary to processed foods (-0.3371).

Table 76 – Matrix of price elasticities of compensated or Hicksian demands in Brazil, 2017-2018 - Singles with children, Not Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1951***	0.1000	0.0932***	0.1338***	0.1033***
	(0.0315)	(0.0741)	(0.0046)	(0.0353)	(0.0024)
Processed	0.1676***	–3.9500***	0.1327***	0.1172	0.0724***
	(0.0125)	(0.1498)	(0.0056)	(0.1354)	(0.0030)
In Natura	0.2330***	–0.3371***	–0.8184***	0.3168***	0.1887***
	(0.0121)	(0.0837)	(0.0139)	(0.0572)	(0.0034)
Ingredients	0.0219***	0.1338***	0.0078***	–1.4564***	0.0137***
	(0.0044)	(0.0271)	(0.0016)	(0.4173)	(0.0007)
Other foods	0.7726***	–3.8467***	0.5847***	0.8886***	–0.3781***
	(0.0182)	(0.1371)	(0.0096)	(0.2014)	(0.0065)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 77 displays the uncompensated price elasticities for singles' households with children where the woman is employed. The results indicate that ultra-processed foods (-0.9855), processed foods (-0.8105), and *In Natura* foods (-0.8447) are price inelastic, in contrast with the not employed results, where these groups were elastic. For your turn, ingredients (-1.3230), and other foods (-1.1471) are price elastic, meaning their demand is more responsive to price variations.

Additionally, cross-price elasticities indicate that ultra-processed foods act as substitutes for processed foods (0.1329), ingredients (0.0569), and other foods (0.0273), though they show a slight complementarity with *In Natura* foods (-0.0220). Processed foods serve as substitutes for ultra-processed foods (0.0322), *In Natura* foods (0.0657), and ingredients (0.1178), while showing complementarity with other foods (-0.0195). *In Natura* foods exhibit substitution effects with processed foods (0.2457), and other foods (0.0137) indicating that households adjust their consumption of these categories based on price variations. However, they show complementarity with ingredients (-0.0337).

Table 77 – Matrix of price elasticities of uncompensated or Marshalian demands in Brazil, 2017-2018 - Singles with children, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.9855***	0.1329***	–0.0220***	0.0569***	0.0273***
	(0.0144)	(0.0133)	(0.0047)	(0.0214)	(0.0035)
Processed	0.0322***	–0.8105***	0.0657***	0.1178***	–0.0195***
	(0.0079)	(0.0352)	(0.0070)	(0.0204)	(0.0039)
In Natura	–0.0083	0.2457***	–0.8447***	–0.0337*	0.0137**
	(0.0076)	(0.0145)	(0.0352)	(0.0190)	(0.0059)
Ingredients	0.0110***	0.0299***	–0.0009	–1.3230***	0.0000
	(0.0032)	(0.0049)	(0.0013)	(0.0447)	(0.0010)
Other foods	0.0896***	0.1171***	–0.0366	0.0875***	–1.1471***
	(0.0112)	(0.0150)	(0.0238)	(0.0220)	(0.0104)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The compensated price elasticity results for singles' households with children where the woman is employed, presented in Table 78, reveal that only ingredients (-1.3096) are price-elastic, meaning their demand remains highly sensitive to price changes. In contrast, in non-employed households, ultra-processed, processed, and ingredients were all price-elastic. Overall, the results reinforce the idea that households where the woman is employed exhibit lower price sensitivity across most food categories, except for other foods.

Regarding cross-price elasticities, ultra-processed foods act as substitutes for processed (0.1499), *In Natura* (0.0650), ingredients (0.1488), and other foods (0.1216). Similarly, processed foods are substitutes for all other food categories, with particularly strong substitution effects for ingredients (0.2049). *In Natura* foods exhibit substitution effects with ultra-processed foods (0.1650), processed foods (0.2923), ingredients (0.1796), and other foods

(0.2197).

Table 78 – Matrix of price elasticities of compensated or Hicksin demands in Brazil, 2017-2018 - Singles with children, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.9121***	0.1499***	0.0650***	0.1488***	0.1216***
	(0.0145)	(0.0132)	(0.0054)	(0.0216)	(0.0036)
Processed	0.0884***	–0.7722***	0.0995***	0.2049***	0.1037***
	(0.0096)	(0.0343)	(0.0097)	(0.0255)	(0.0046)
In Natura	0.1650***	0.2923***	–0.6587***	0.1796***	0.2197***
	(0.0074)	(0.0144)	(0.0354)	(0.0178)	(0.0055)
Ingredients	0.0215***	0.0337***	0.0118***	–1.3096***	0.0132***
	(0.0032)	(0.0050)	(0.0013)	(0.0448)	(0.0010)
Other foods	0.6373***	0.2962***	0.4823***	0.7763***	–0.4582***
	(0.0112)	(0.0299)	(0.0254)	(0.0265)	(0.0106)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 79 presents the expenditure elasticities for single households with children, differentiating between those where the women is employed and those where she is not. For employed women, ultra-processed (0.8610), processed (0.2849), and *In Natura* (0.8384) are classified as normal goods, indicating that their consumption increases as income rises. Ingredients (1.0944), and other foods (1.1255) stand out as superior goods, meaning that demand for this category grows more proportionally with income.

For non-employed women, ultra-processed (0.9608) and *In Natura* (0.9275) foods remain normal goods, with similar expenditure elasticities to their employed counterparts. However, processed foods (-16.4126) present a negative elasticity, identifying them as an inferior good. This suggests that as income increases, non-employed individuals significantly reduce their consumption of processed foods, possibly substituting them for other categories. Other foods (1.1114) also remain a superior good, showing a strong increase in demand as income rises.

Overall, the results indicate that women employment status influences food expenditure patterns. While both groups exhibit similar preferences for ultra-processed and *In Natura* foods, the negative elasticity of processed foods in non-employed households suggests a strong shift in consumption patterns as income changes.

Table 79 – Expenditure elasticity - Singles with children

Food Group	Employed	Not Employed
Ultra-processed	0.8610***	0.9608***
	(0.0097)	(0.0168)
Processed	0.2849***	-16.4126***
	(0.0280)	(0.5173)
In Natura	0.8384***	0.9275***
	(0.0166)	(0.0128)
Ingredients	1.0944***	0.4495
	(0.0370)	(0.5316)
Other foods	1.1255***	1.1114***
	(0.0052)	(0.0034)

Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.6.2 Elasticities – Couples

This section examines the elasticities considering only households with couples, since the division of labor, caregiving responsibilities, and resource allocation may differ when considering only couples' households. The results for the QUAIDS model for this subsample are presented in Appendix C.

Tables 80 and 81 shows the price elasticities of Hicksian and Marshallian demands for the food groups for the couples sample. The own-price elasticities, located on the main diagonal, are negative in both Marshallian and Hicksian demands, again consistent with microeconomic theory.

Table 80 presents the uncompensated price elasticities for couples' households in Brazil. Ultra-processed foods have a high own-price elasticity (-1.2300), suggesting that households substantially reduce their consumption when prices rise. They are substitutes for processed foods (0.1339), *In Natura* foods (0.0409), ingredients (0.0125), and other foods (0.1824).

Processed foods, on the other hand, have a relatively lower own-price elasticity (-0.2229), indicating that demand is inelastic due to price changes. They act as substitutes for ultra-processed (0.0736), *In Natura* foods (0.1977), ingredients (0.0415), and other foods (0.0561). *In Natura* foods exhibit an inelastic own-price elasticity of (-0.5284), meaning. They are substitutes for ultra-processed foods (0.1120), processed foods (0.1726), and ingredients (0.0034). On the other hand, it is a substitute for other foods (-0.0928).

Overall, while ultra-processed foods and ingredients show the highest price sensitivity, processed and other foods exhibit more inelastic demand, as in the full sample result. Although, except for the ultra-processed foods, all the other elasticities are smaller then for the full sample.

Table 80 – Price elasticities matrix of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	-1.2300***	0.1339***	0.0409***	0.0125***	0.1824***
	(0.0258)	(0.0200)	(0.0134)	(0.0048)	(0.0141)
Processed	0.0736***	-0.2229***	0.1977***	0.0415***	0.0561***
	(0.0130)	(0.0284)	(0.0207)	(0.0080)	(0.0240)
In Natura	0.1120***	0.1726***	-0.5284***	0.0034***	-0.0928***
	(0.0071)	(0.0078)	(0.0616)	(0.0024)	(0.0342)
Ingredients	0.1417***	0.1745***	0.1538***	-1.1686***	-1.0451***
	(0.0218)	(0.0210)	(0.0198)	(0.0884)	(0.0036)
Other foods	0.0913***	0.0526***	0.1753***	0.0136***	-0.3329***
	(0.0013)	(0.0020)	(0.0021)	(0.0006)	(0.0033)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The results in Table 81 show the compensated price elasticities (Hicksian elasticities) for couples' households in Brazil. The results indicate that ultra-processed foods (-1.1593), processed foods (-1.4356), *In Natura* (-1.0213), and ingredients (-1.2173) are price-elastic, meaning their demand is highly responsive to price changes. In contrast, other foods (-0.3506) are price-inelastic, suggesting greater stability in consumption despite price fluctuations. Except for ingredients, the elasticities are higher when compared to the full sample.

Regarding cross-price elasticities, ultra-processed foods show substitution effects with processed foods (0.1284), *In Natura* (0.0206), ingredients (0.1617), and other foods (0.0951). Processed foods also act as substitutes for ultra-processed foods (0.1564), *In Natura* (0.2122), ingredients (0.0538), and other foods (0.7001). *In Natura* foods show substitution effects with ultra-processed foods (0.2189), processed foods (0.1603), ingredients (0.0811), and other foods (0.1811).

Table 81 – Price elasticities matrix of compensated or Hicksian demands in Brazil, 2017-2018 - Couples

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1593***	0.1284***	0.0206**	0.1617***	0.0951***
	(0.0262)	(0.0195)	(0.0086)	(0.0361)	(0.0017)
Processed	0.1564***	–1.4356***	0.2122***	0.0538***	0.7001***
	(0.0127)	(0.0214)	(0.0342)	(0.0023)	(0.0515)
In Natura	0.2189***	0.1603***	–1.0213***	0.0811**	0.1811***
	(0.0129)	(0.0196)	(0.0616)	(0.0376)	(0.0025)
Ingredients	0.0235***	0.0379***	0.0142***	–1.2173***	0.7663***
	(0.0048)	(0.0079)	(0.0024)	(0.0477)	(0.0287)
Other foods	0.7605***	-0.1325***	0.3175***	0.7001***	–0.3506***
	(0.0141)	(0.0249)	(0.0445)	(0.0515)	(0.0041)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 82 displays the uncompensated (Marshallian) price elasticities of demand for couples' households where the woman is not employed. The results indicate that ultra-processed (-1.0600), processed (-0.9611), ingredients (-1.1135), and other foods (-1.0770) are

price-elastic, meaning that their demand is highly responsive to price changes. Comparing to the full sample results, except for *In Natura*, the elasticities are smaller.

The analysis of cross-price elasticities reveals that ultra-processed foods act as a substitute for processed foods (0.0527), ingredients (0.0644), and other foods (0.0143). For your turn, processed foods act as a substitute for ultra-processed foods (0.0482), *In Natura* foods (0.0228), and ingredients (0.0974). Additionally, processed foods also exhibit a complementary relationship with other foods (-0.0357), suggesting that an increase in the price of one leads to a decrease in the consumption of the other. Finally, *In Natura* act as substitute for processed foods (0.0931) and as complementary to ingredients (-0.1122), and other foods (-0.0173).

Table 82 – Price elasticities matrix of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	-1.0600***	0.0527***	0.0078	0.0644**	0.0143***
	(0.0264)	(0.0057)	(0.0060)	(0.0328)	(0.0041)
Processed	0.0482***	-0.9611***	0.0228***	0.0974***	-0.0357***
	(0.0113)	(0.0287)	(0.0074)	(0.0330)	(0.0045)
In Natura	0.0081	0.0931***	-0.9716***	-0.1122***	-0.0173***
	(0.0107)	(0.0068)	(0.0204)	(0.0326)	(0.0058)
Ingredients	0.0118***	0.0100***	-0.0061***	-1.1135***	-0.0011
	(0.0040)	(0.0019)	(0.0019)	(0.0807)	(0.0010)
Other foods	0.1290***	0.0707***	-0.0294**	0.0248	-1.0770***
	(0.0135)	(0.0108)	(0.0142)	(0.0417)	(0.0110)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

In Table 83, it is shown the compensated (Hicksian) price elasticities of demand for couples' households where the woman is not employed. The results indicate that ultra-processed foods (-0.9866), processed foods (-0.9255), *In Natura* (-0.7814), and other foods (-0.3894) show inelastic behavior, meaning that their consumption is less affected by price changes. Notably, the demand for other foods is the least responsive to price fluctuations. For your turn, ingredients (-1.1002) are price-elastic.

Cross-price elasticities reveal that ultra-processed foods are replaced by processed foods (0.1063), *In Natura* (0.0866), ingredients (0.1527), and other foods (0.1057) when their prices increase. Processed foods are substitutes for ultra-processed foods (0.1195), *In Natura* (0.1209), ingredients (0.1871), and other foods (0.0751). *In Natura* foods are substitutes for ultra-processed foods (0.1816), processed foods (0.2304), ingredients (0.0943), and other foods (0.1963).

Table 83 – Price elasticities matrix of compensated or Hicksian demands in Brazil, 2017-2018 - Couples, Not employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–0.9866***	0.1063***	0.0866***	0.1527***	0.1057***
	(0.0260)	(0.0060)	(0.0059)	(0.0323)	(0.0040)
Processed	0.1195***	–0.9255***	0.1209***	0.1871***	0.0751***
	(0.0108)	(0.0268)	(0.0070)	(0.0337)	(0.0048)
In Natura	0.1816***	0.2304***	–0.7814***	0.0943***	0.1963***
	(0.0109)	(0.0077)	(0.0202)	(0.0314)	(0.0055)
Ingredients	0.0224***	0.0194***	0.0051***	–1.1002***	0.0123***
	(0.0040)	(0.0020)	(0.0019)	(0.0807)	(0.0010)
Other foods	0.6631***	0.5694***	0.5688***	0.6661***	–0.3894***
	(0.0162)	(0.0176)	(0.0136)	(0.0459)	(0.0113)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

The analysis of Table 84, which presents the uncompensated (Marshallian) price elasticities for couples' households where the woman is employed. Regarding ultra-processed foods, it remains elastic. However, the demand for ultra-processed foods is more elastic in households where the woman is employed (-1.2549) compared to those where she is not employed. This suggests that households with employed women are more responsive to price changes in this category.

Considering processed foods, it is inelastic for both households. Although, when the women is employed, the elasticity is smaller then for households when the women is not employed, being -0.1146 and -0.9611, respectively. Similarly, for *In Natura* foods, the own-price elasticity is lower in households with employed women (-0.4634) than in those where the woman is not employed.

Regarding substitution patterns, ultra-processed foods act as substitutes for processed foods (0.1459), ingredients (0.0678), and other foods (0.0037). On the other hand, it acts as complementary to *In Natura* foods (-0.0257). Considering processed foods, there is a substitution effect with ultra-processed foods (0.0773), *In Natura* (0.0351), and ingredients (0.1073), while it is complementary to other foods (-0.0370). Additionally, the results show that *In Natura* are substitutes for ultra-processed foods (0.0457), processed foods (0.2130), and complementary to ingredients (-0.1398), and other foods (-0.0288).

Table 84 – Price elasticities matrix of uncompensated or Marshallian demands in Brazil, 2017-2018 - Couples, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	-1.2549***	0.1459***	-0.0257***	0.0678***	0.0037**
	(0.0278)	(0.0222)	(0.0073)	(0.0375)	(0.0017)
Processed	0.0773***	-0.1146***	0.0351***	0.1073***	-0.0370***
	(0.0134)	(0.0319)	(0.0050)	(0.0349)	(0.0020)
In Natura	0.0457***	0.2130***	-0.4634***	-0.1398***	-0.0288***
	(0.0140)	(0.0230)	(0.0706)	(0.0398)	(0.0028)
Ingredients	0.0127**	0.0462***	0.0048	-1.1767***	-1.0404***
	(0.0049)	(0.0089)	(0.0029)	(0.0907)	(0.0037)
Other foods	0.1903***	0.0540**	-0.1021***	-0.0242	-1.0404***
	(0.0148)	(0.0269)	(0.0391)	(0.0516)	(0.0037)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 85 provides an overview of the compensated (Hicksian) price elasticities for couples' households where the woman is employed. The results indicate that ultra-processed foods, processed foods, ingredients, and other foods exhibit price-elastic demand. In households where the woman is employed, the own-price elasticity of ultra-processed foods is -1.1846. This suggests that price changes significantly influence the consumption of ultra-processed foods in these households. Similarly, processed foods show the highest own-price elasticity (-1.4356), indicating that households with employed women are highly responsive to price variations in this category.

Regarding substitution patterns, ultra-processed foods act as substitutes for processed foods (0.1316) and ingredients (0.1631), suggesting that households replace these food categories when prices fluctuate. Processed foods are substitutes for *In Natura* foods (0.2122) and other foods (0.7001), highlighting their importance in household food choices. Likewise, *In Natura* foods are substitutes for processed foods (0.1501) and ingredients (0.0792), while ingredients also act as substitutes for processed foods (0.0406) and *In Natura* foods (0.0155).

Table 85 – Price elasticities matrix of compensated or Hicksian demands in Brazil, 2017-2018 - Couples, Employed

	Ultra-processed	Processed	*In Natura*	Ingredients	Other foods
Ultra-processed	–1.1846***	0.1316***	0.0109	0.1631***	0.0935***
	(0.0282)	(0.0217)	(0.0097)	(0.0368)	(0.0016)
Processed	0.1618***	–1.4356***	0.2122***	0.0538***	0.7001***
	(0.0131)	(0.0316)	(0.0342)	(0.0023)	(0.0515)
In Natura	0.2244***	0.1501***	–1.0213***	0.0792**	0.1811***
	(0.0135)	(0.0218)	(0.0706)	(0.0386)	(0.0025)
Ingredients	0.0236***	0.0406***	0.0155***	–1.2173***	0.7663***
	(0.0049)	(0.0088)	(0.0028)	(0.0908)	(0.0287)
Other foods	0.7747***	-0.2354***	0.2807***	0.7051***	–0.3506***
	(0.0151)	(0.0282)	(0.0510)	(0.0528)	(0.0041)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

Table 86 summarizes the expenditure elasticities for different food groups among couples, distinguishing between households where the woman is employed and those where she is not. Ultra-processed foods are classified as normal goods across all household types, with expenditure elasticities of 0.9205 in the full sample, 0.9290 in employed women's households, and 0.8628 in non-employed women's households. The slightly higher elasticity in employed households suggests that convenience may play a role in their food choices.

Processed foods exhibit a contrasting pattern: while they are classified as a normal good in households where the woman is not employed (0.7346), they act as inferior goods in both the full sample (-0.2064) and among employed households (-0.3444). This indicates that, in households where the woman is employed, an increase in income leads to a reduction in the consumption of processed foods.

In Natura foods are normal goods in all household types, but their expenditure elasticity varies. The highest elasticity is found in non-employed women's households (0.9765), suggesting that these households increase their consumption of fresh foods at a higher rate as income rises compared to employed women's households (0.5513).

Ingredients are classified as superior goods in all cases, with the highest elasticity observed in employed households (1.1656), followed by the full sample (1.1494) and non-employed households (1.0390). Finally, other foods are consistently superior goods across all household types, with minimal variation in elasticity values.

In summary, the results highlight differences in how income affects food consumption depending on the employment status of women. The distinction is particularly notable for processed foods, which act as a superior good in non-employed women's households but as an inferior good in employed households, and for *In Natura* foods, which are more responsive to income changes in non-employed households.

Table 86 – Expenditure elasticity - Couples

Food Group	Complete Sample	Employed	Not Employed
Ultra-processed	0.9205***	0.9290***	0.8628***
	(0.0103)	(0.0107)	(0.0147)
Processed	-0.2064***	-0.3444***	0.7346***
	(0.0376)	(0.0431)	(0.0225)
In Natura	0.6057***	0.5513***	0.9765***
	(0.0326)	(0.0371)	(0.0109)
Ingredients	1.1494***	1.1656***	1.0390***
	(0.0262)	(0.0277)	(0.0366)
Other foods	1.1043***	1.1024***	1.1168***
	(0.0031)	(0.0032)	(0.0065)

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020).

3.7 CONCLUDING REMARKS

This paper aimed to estimate household food demand by analyzing the effect of the occupational status of female household heads or spouses on food consumption. For this analysis, data from the 2017-2018 Family Budget Survey (POF) were used, and the Quadratic Almost Ideal Demand System (QUAIDS) method was applied.

Overall, the model proved suitable for estimating food demand, as the parameters capturing the non-linearity of total expenditure were significant in most equations. Additionally, economic and sociodemographic variables are important in explaining household food expenditure.

Particularly, the results indicate some differences in the demand for processed and ultra-processed foods between households where the woman is employed versus not employed. In all household arrangements, the demand for ultra-processed foods is more elastic when the woman is not employed, for both uncompensated and compensated demands. Conversely, the demand for *In Natura* foods is more elastic in the full sample and in households with couples where the woman is employed, again for both uncompensated and compensated demands. This result may be related to time constraints faced by employed women.

Although these differences highlight the role of female employment in shaping food demand, an important finding is that ultra-processed foods tend to be elastic in most household types. This suggests that policies aimed at increasing the price of such products could be effective in reducing their consumption. Meanwhile, *In Natura* foods exhibit inelastic demand across all models, even in households where the woman is employed, indicating that price-based policies alone may not be sufficient to boost their consumption.

Another notable result is that, in some household types (childless couples, singles, and single parents), processed foods are considered an inferior good when the woman is not employed. This finding suggests that income increase may decrease the consumption of this food group.

One key aspect to consider is the relationship between food demand and time constraints faced by working women. The results suggest that when women are employed, household food choices may shift due to the time available for food preparation and shopping. The lower elasticity of ultra-processed foods in these households could indicate a trade-off between convenience and healthier options, as time constraints may lead to greater reliance on ready-to-eat products.

As a next step, we intend to refine these estimations by accounting for the time women dedicate to the labor market and how it influences household food choices. As labor market hours are not available in POF, this step requires its estimation, going beyond the scope of

the current thesis. Additionally, expanding the analysis to include food consumed outside the home would also contribute to a more comprehensive understanding of food demand in Brazil.

APPENDIX C

Food Groups Composition

Table 87 – Composition of the food groups used in the estimation

Ultra-processed
Instant cereal powder, Chocolate porridge, Corn flakes, Corn breakfast cereal, Lactose flour, Instant noodles, Instant pasta, Nutritional supplement of any flavor, Industrialized ice cream of any flavor, Industrialized popsicle of any flavor, Stick ice cream, Chewing gum, Candy, Caramel (candy), Drops, Lozenges, Lollipop, Chewing gum, Jellybeans, Coconut candy, Gummy candy, Fruit-flavored candy, Chocolate bar, Cocoa powder of any brand, Ovomaltine, Ovomaltine powder, Chocolate-flavored powder, Chocolate drink, Chocolate bonbon of any brand, Truffle, Mousse, Gelatin (mocotó jelly), Gelatin of any flavor, Artificial sweetener, Meringue, Marshmallow, Pudding of any flavor, Flan, Marshmallow-like dessert (Maria Mole), Egg yolk dessert (Baba de Moça), Coconut sweet.
Processed
Fruit preserves of any flavor, Crystallized fruit of any flavor, Eggplant in brine, Canned vegetables, Canned sardines, Canned tuna, Canned radish, Cheese, Bread, Dinner roll, Dried meat, Bacon (toucinho).
In Natura
Rice, Corn, Wheat Grain, Peanuts (in Grain) (Raw), Peas in Grain, Beans, Flaxseed, Andu, Chickpeas, Lentils, Soybeans in Grain, Pumpkin Seeds, Quirera, Quinoa, Chia, Sunflower Seeds, Vegetables, Nuts, Almonds, Fruits, Meat.
Ingredients
Demerara Sugar, Demerara, Brown Sugar, Sugar, Salt, Butter with or without Salt, Butter in Jar, Olive Oil, Soybean Oil, Corn Oil, Sunflower Oil, Coconut Oil.

Source: Prepared by the authors (2025).

Multivariate Probit Results

Table 88 – Multivariate Probit Results

	Ultra Processed	Processed	In Natura	Ingredients	Other Foods
ln_p_i	-0.5380***	-0.5100***	-0.4730***	-0.6050***	-0.5690***
	(0.0081)	(0.0092)	(0.0062)	(0.0209)	(0.0060)
Income	0.0000***	0.0000***	0.0000	0.0000	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Urban	0.2060***	0.5010***	-0.0222	-0.0443***	0.0370***
	(0.0135)	(0.0139)	(0.0138)	(0.0154)	(0.0140)
Northeast	0.1750***	0.3460***	0.1160***	-0.1120***	0.0990***
	(0.0182)	(0.0183)	(0.0185)	(0.0201)	(0.0193)
South	0.5710***	0.1170***	-0.0187	-0.1400***	0.1900***
	(0.0231)	(0.0225)	(0.0229)	(0.0254)	(0.0236)
Southeast	0.2900***	0.3820***	-0.2150***	-0.1150***	-0.1610***
	(0.0197)	(0.0197)	(0.0195)	(0.0222)	(0.0202)
Mid West	0.1140***	0.0384*	-0.1200***	-0.2640***	-0.1430***
	(0.0223)	(0.0224)	(0.0223)	(0.0255)	(0.0228)
High Educational Level	0.2170***	0.0631**	0.1050***	-0.2040***	0.1020***
	(0.0301)	(0.0282)	(0.0295)	(0.0352)	(0.0307)
Middle Educational Level	0.1540***	0.1510***	0.0929***	-0.0703***	0.1030***
	(0.0143)	(0.0144)	(0.0144)	(0.0166)	(0.0149)
Black	-0.0809***	-0.0725***	-0.0430***	-0.0026	-0.0365***
	(0.0128)	(0.0129)	(0.0129)	(0.0148)	(0.0132)
Female	0.0174	0.0345***	0.0347***	0.0171	0.0180
	(0.0130)	(0.0131)	(0.0131)	(0.0151)	(0.0135)
Age	-0.0036*	0.0179***	0.0178***	0.0085***	0.0100***
	(0.0021)	(0.0021)	(0.0021)	(0.0025)	(0.0022)
Age_sqr	0.0000	-0.0001***	-0.0001***	-0.0001**	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Employed	0.1190***	0.0349	0.1550***	0.0782***	0.1500***
	(0.0254)	(0.0258)	(0.0254)	(0.0293)	(0.0265)
Children 0 to 6	0.0500**	0.0621***	0.0737***	0.0594**	0.0673***
	(0.0232)	(0.0233)	(0.0235)	(0.0264)	(0.0239)
Children 6 to 12	0.0761***	0.1100***	0.0835***	0.1430***	0.0968***
	(0.0240)	(0.0242)	(0.0246)	(0.0267)	(0.0257)
Teenagers	0.1050***	0.1070***	0.0199	0.0607**	0.0470**
	(0.0216)	(0.0219)	(0.0219)	(0.0241)	(0.0223)
Elderly	-0.0575***	-0.0791***	-0.0042	-0.0788***	-0.0207
	(0.0186)	(0.0188)	(0.0188)	(0.0214)	(0.0196)
Spouse	0.1450***	0.1890***	0.2150***	0.1230***	0.1420***
	(0.0131)	(0.0134)	(0.0132)	(0.0156)	(0.0135)
Constant	1.4030***	0.3640***	1.1680***	0.0872	2.4880***
	(0.0675)	(0.0695)	(0.0644)	(0.0852)	(0.0680)
Observations	52,203	52,203	52,203	52,203	52,203

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020)

QUAIDS Results

Table 89 – QUAIDS - Full sample

	Ultra-processed	Processed	*In Natura*	Ingredients	Other Foods
α	0.107***	0.261***	0.265***	-0.00822***	0.3747***
	(0.00602)	(0.00647)	(0.00818)	(0.00242)	(0.0121)
β	-0.00565	-0.0848***	-0.00558	0.0106***	0.0853***
	(0.00394)	(0.00380)	(0.00557)	(0.00144)	(0.0086)
γ_{i1}	0.00668***	-0.00189***	-0.00517***	0.000756***	-0.0003
	(0.000836)	(0.000666)	(0.000530)	(0.000236)	(0.0007)
γ_{i2}	-0.00189***	0.0244***	-0.00668***	0.00220***	-0.0180***
	(0.000666)	(0.00121)	(0.000887)	(0.000262)	(0.0015)
γ_{i3}	-0.00517***	-0.00668***	0.0397***	-0.000364*	-0.0275***
	(0.000530)	(0.000887)	(0.00138)	(0.000209)	(0.0013)
γ_{i4}	0.000756***	0.00220***	-0.000364*	-0.00334***	0.0007**
	(0.000236)	(0.000262)	(0.000209)	(0.000373)	(0.0002)
λ	-0.00240***	0.00636***	-0.00454***	-0.00186***	0.0024
	(0.000724)	(0.000724)	(0.00107)	(0.000254)	(0.0016)
η(Age)	-0.00238***	-0.00366***	-0.00706***	-0.000263	-0.00507***
	(0.000210)	(0.000556)	(0.000602)	(0.000193)	(0.000535)
η(Age_sqr)	1.99e-05***	3.16e-05***	6.00e-05***	1.86e-06	4.22e-05***
	(2.06e-06)	(6.11e-06)	(6.19e-06)	(1.69e-06)	(5.18e-06)
η(Female)	-0.00107	0.00669	-0.00497	0.00177*	-0.00340
	(0.00213)	(0.00580)	(0.00639)	(0.00103)	(0.00525)
η(Black)	-0.00598***	-0.00640	-0.0104*	0.000287	-0.0121***
	(0.00179)	(0.00462)	(0.00542)	(0.000728)	(0.00452)
η(Female Employed)	0.00204	-0.00752	0.00749	8.11e-05	0.00247
	(0.00233)	(0.00616)	(0.00653)	(0.000940)	(0.00556)
η(Full-Time)	0.000278	0.00515	-0.000545	-9.07e-05	0.00223
	(0.00205)	(0.00531)	(0.00617)	(0.000868)	(0.00483)
η(Employed)	-0.00564**	-0.0164**	-0.0178**	0.00110	-0.0132*
	(0.00288)	(0.00786)	(0.00873)	(0.00122)	(0.00722)
η(Children 0 to 6)	-0.00167	-0.00343	-0.00574	6.53e-05	-0.00404
	(0.00151)	(0.00427)	(0.00451)	(0.000744)	(0.00368)
η(Children 6 to 12)	0.00488***	0.0113**	0.0118**	0.00237***	0.0132***
	(0.00154)	(0.00467)	(0.00459)	(0.000827)	(0.00342)
η(Elderly)	0.00277	0.0153***	0.00701	0.000674	0.00496
	(0.00189)	(0.00524)	(0.00598)	(0.000760)	(0.00486)
η(High Educational Level)	0.00910	0.00919	0.0117	0.00405*	0.0495***
	(0.00601)	(0.0168)	(0.0178)	(0.00221)	(0.0152)
η(Middle Educational Level)	0.00557***	0.0142**	0.00582	0.000546	0.0173***
	(0.00206)	(0.00574)	(0.00613)	(0.000822)	(0.00498)
η(Spouse)	0.00157	0.00867	0.00838	0.00206**	0.00649
	(0.00231)	(0.00611)	(0.00665)	(0.000986)	(0.00550)
η(Mills)	0.0468***	0.0392***	0.133***	0.0124***	0.116***
	(0.00537)	(0.0120)	(0.0145)	(0.00439)	(0.0128)
Observations	46,863	46,863	46,863	46,863	46,863

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020)

Table 90 – QUAIDS - Couples

	Ultra-processed	Processed	*In Natura*	Ingredients	Other Foods
α	0.1080***	0.2720***	0.2570***	-0.0113***	0.3739***
	(0.0077)	(0.0083)	(0.0107)	(0.0033)	(0.0157)
β	-0.0040	-0.0851***	-0.0004	0.0122***	0.0772***
	(0.0048)	(0.0049)	(0.0070)	(0.0016)	(0.0109)
γ_{i1}	0.0061***	-0.0015*	-0.0055***	0.0009***	-0.0000
	(0.0010)	(0.0008)	(0.0006)	(0.0003)	(0.0008)
γ_{i2}	-0.0035***	0.0237***	-0.0065***	0.0025***	-0.0018***
	(0.0005)	(0.0016)	(0.0011)	(0.0004)	(0.0019)
γ_{i3}	-0.0055***	-0.0065***	0.0384***	-0.0006**	-0.0258***
	(0.0006)	(0.0011)	(0.0017)	(0.0003)	(0.0016)
γ_{i4}	0.0009***	0.0025***	-0.0006**	-0.0035***	0.0006*
	(0.0003)	(0.0004)	(0.0003)	(0.0005)	(0.0004)
λ	-0.0026***	0.0056***	-0.0048***	-0.0020***	0.0038*
	(0.0009)	(0.0009)	(0.0013)	(0.0003)	(0.0020)
η(Age)	-0.0026***	-0.0039***	-0.0074***	0.0001	-0.0051***
	(0.0003)	(0.0008)	(0.0007)	(0.0003)	(0.0006)
η(Age_sqr)	0.0000***	0.0000***	0.0001***	-0.0000	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
η(Female)	-0.0007	0.0081	-0.0018	0.0030*	0.0005
	(0.0028)	(0.0080)	(0.0080)	(0.0017)	(0.0064)
η(Black)	-0.0055**	-0.0089	-0.0059	0.0008	-0.0106*
	(0.0023)	(0.0062)	(0.0068)	(0.0010)	(0.0057)
η(Female Employed)	-0.0039	-0.0114	-0.0029	-0.0013	-0.0070
	(0.0032)	(0.0086)	(0.0085)	(0.0011)	(0.0073)
η(Full-Time)	0.0001	0.0017	-0.0055	-0.0007	-0.0006
	(0.0025)	(0.0067)	(0.0072)	(0.0011)	(0.0059)
η(Employed)	-0.0001	-0.0061	0.0017	0.0018	0.0005
	(0.0032)	(0.0093)	(0.0092)	(0.0013)	(0.0077)
η(Children 0 to 6)	-0.0051**	-0.0139***	-0.0157***	0.0010	-0.0121**
	(0.0021)	(0.0052)	(0.0059)	(0.0014)	(0.0051)
η(Children 6 to 12)	0.0026	0.0003	0.0076	0.0023**	0.0094**
	(0.0020)	(0.0054)	(0.0057)	(0.0011)	(0.0043)
η(Elderly)	-0.0010	0.0056	-0.0030	-0.0000	-0.0016
	(0.0026)	(0.0075)	(0.0083)	(0.0012)	(0.0069)
η(High Educational Level)	0.0117	0.0157	0.0139	0.0004	0.0535**
	(0.0100)	(0.0279)	(0.0301)	(0.0026)	(0.0249)
η(Middle Educational Level)	0.0076***	0.0228***	0.0037	0.0002	0.0180***
	(0.0027)	(0.0083)	(0.0077)	(0.0010)	(0.0064)
η(Mills)	0.0539***	0.0468***	0.1440***	0.0077	0.1210***
	(0.0072)	(0.0154)	(0.0192)	(0.0073)	(0.0171)
Observations	29,266	29,266	29,266	29,266	29,266

Note: *Significant at 10%; **Significant at 5%; ***Significant at 1%.
Source: Survey results, based on data from POF 2017-2018 (IBGE, 2020)

CONCLUSION

This thesis aimed to analyze the determinants of the division of time between household tasks and the labor market in Brazilian households, addressing how this division affects economic conditions, gender inequalities in the labor market, and household food consumption patterns. Through three articles, we seek to understand the determinants of this division, its consequences for income and consumption, as well as the implications for gender equity in Brazil.

The first article, "Gender Norms and Time Allocation: Insights from Household Analysis" revealed that, although there have been advances in female labor force participation, gender norms still exert influence on the distribution of time between household tasks and paid work. Women in patriarchal households continue to be responsible for the majority of household tasks, with the time dedicated to paid work being reduced, especially in the presence of young children. The hypothetical scenario of widespread adoption of more egalitarian behaviors within households suggested that a more balanced redistribution of household responsibilities could result in substantial gains, both for women and for the economy as a whole.

The second article, "Unequal Burdens, Unequal Pay: Household Chores and the Gender Wage Gap in Brazil", focused on the impact of household chores on gender wage inequality. The results showed that the time spent by women on household chores is negatively correlated with their wages, while men's involvement in these tasks can have positive effects on women's income. This suggests that, although women still bear the majority of the household burden, greater involvement of men in household chores could be an important way to reduce the gender wage gap in Brazil. The use of instrumental variables allowed a robust analysis of the impact of this dynamic on wages, reinforcing the importance of policies that promote equality in domestic care.

The third article, "Balancing Work and Food: The Influence of Female Employment on Household Food Consumption", explored the relationship between women's occupational status and household food consumption patterns. The results indicated that the demand for ultra-processed foods is more elastic when the woman is not employed. Conversely, the demand for *In Natura* foods is more elastic in the full sample and in households with couples where the woman is employed. This result may be related to time constraints faced by employed women.

Taken together, the three articles provide an analysis of gender dynamics in Brazil, illustrating how the division of domestic labor is still strongly influenced by cultural and structural norms that perpetuate inequalities. In addition, they highlight the consequences

of this division in both the economic and social spheres. A more equitable redistribution of household tasks, with greater male participation, can be a strategy to promote gender equality, increase female participation in the labor market, and reduce the wage gap.

This research contributes to the debate on public policies aimed at gender equality, suggesting that implementing policies that promote a fairer distribution of domestic work and support women's economic autonomy could not only improve women's living conditions but also generate economic benefits for society as a whole. Looking ahead, more studies should be carried out to understand the different dimensions of this issue and to support the formulation of public policies that combat gender inequalities.

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