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An Empirical Method for Adjusting Time Use Data in Brazil

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Resumo

Um Método Empírico para Ajustar os Dados de Uso do Tempo no Brasil

As mulheres do Brasil, em comparação com outros países da América Latina, gastam substancialmente menos horas em serviços doméstico não remunerados. Além disso, a distribuição dos serviços por idade sugerida pelos dados nacionais é surpreendentemente incomum. Nossa hipótese é que os dados em relação ao uso do tempo no Brasil são falhos, devido, entre outros fatores, à subnotificação de atividades de cuidados diretos. Propomos um método para ajustar os dados de uso do tempo da PNAD com base na relação entre as horas atribuídas aos cuidados diretos não pagos e os cuidados indiretos prestados por uma população de referência. A aplicação deste método aumenta o número de horas gastas em serviços não remunerados em até 60% (mulheres) e 35% (homens), de acordo com a idade. Também altera os perfis etários, tornando-os mais coerente com a literatura. Os dados ajustados de uso do tempo podem ajudar pesquisadores a analisar a segmentada economia do Brasil em mais detalhe, medindo a contribuição de homens e mulheres de diferentes idades para uma fração da economia invisível a partir das estatísticas oficiais.

Palavras-chave: uso do tempo; PNAD; serviços domésticos não remunerados; cuidados não remunerados; Brasil

Abstract

An Empirical Method for Adjusting Time Use Data in Brazil

Compared to other Latin American countries, women in Brazil spend substantially fewer hours on unpaid household services. Also, national data suggest a surprisingly unusual distribution of services by age. We hypothesize that Brazilian time use data are deficient, among other factors, because of the underreporting of direct caregiving activities. We propose a method to adjust PNAD time use data based on the relation between hours allocated to unpaid direct care and indirect care taken from a reference population. The method's application increases the number of hours spent in unpaid services by up to 60% (women) and 35% (men), depending on age. It also changes the age profiles, making them more consistent with the literature. Adjusted time use data can help researchers look at Brazil's gendered economy in more detail, measuring the contribution of men and women of different ages for a fraction of the economy invisible from official statistics.

Keywords: time use; PNAD; unpaid household services; unpaid care; Brazil

Résumé

Une Méthode Empirique pour Ajuster les Données sur l'emploi du Temps au Brésil

Par rapport aux autres pays d'Amérique Latine, les femmes au Brésil consacrent beaucoup moins d'heures aux services ménagers non rémunérés. De plus, les données nationales suggèrent une distribution étonnamment inhabituelle des services selon l'âge. Nous émettons l'hypothèse que les données brésiliennes sur l'utilisation du temps sont insuffisantes, entre autres facteurs, en raison de la sous-déclaration des activités de soins directs. Nous proposons une méthode d'ajustement des données d'emploi du temps PNAD basée sur la relation entre les heures allouées aux soins directs non rémunérés et les soins indirects pris auprès d'une population de référence. L'application de la méthode augmente le nombre d'heures consacrées aux services non rémunérés jusqu'à 60 % (femmes) et 35 % (hommes), selon l'âge. Cela modifie également les profils d'âge, les rendant plus cohérents avec la littérature. Les données ajustées sur l'utilisation du temps peuvent aider les chercheurs à examiner plus en détail l'économie sexospécifique du Brésil, en mesurant la contribution des hommes et des femmes d'âges différents pour une fraction de l'économie invisible dans les statistiques officielles.

MOTS-CLÉS: emploi du temps ; PNAD ; services ménagers non rémunérés ; soins non rémunérés; Brésil

Resumen

Un Método Empírico para Ajustar los Datos de uso del Tiempo en Brasil

En comparación con otros países latinoamericanos, las mujeres en Brasil dedican sustancialmente menos horas al trabajo doméstico no remunerado y presentan una distribución por edad inusual para esa actividad. Nuestra hipótesis es que los datos brasileños sobre el uso del tiempo son deficientes, entre otros factores, debido al subregistro de las actividades de cuidado. Proponemos un método, para ajustar los datos de uso del tiempo de la PNAD, basado en la relación entre las horas de cuidado directo y cuidado indirecto de una población de referencia. Obtuvimos un aumento en las horas dedicadas a lo trabajo doméstico no remunerado para hombres y mujeres, y también perfiles de edad ajustados, consistentes con la literatura. Los datos ajustados pueden ayudar a que las investigaciones futuras en Brasil puedan medir la contribución de hombres y mujeres, de diferentes edades, para una fracción de la economía que ha sido invisible en las estadísticas oficiales.

Palabras-clave: uso del tiempo; PNAD; trabajo doméstico no remunerado; cuidado no remunerado; Brasil

Introduction

Across the world, unpaid household services are performed mainly by women. Brazil is no different. However, time use data limitations have precluded Brazilian social scientists from correctly measuring housework by gender. Earlier studies have examined unpaid household activities using data from small and local surveys or qualitative research (Aguar, 1984; Figueiredo, 1980; Machado Neto, Britto, 1982; Souza, Neubert, Aguiar 2003). On another front, the National Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios – PNAD) – which collects demographic and socioeconomic data on a yearly basis – has tried to fill in such gap by including a single question on the amount of time spent on household tasks. Yet international comparisons show significantly fewer hours of unpaid household services in Brazil than in other countries, raising concern about potential flaws and preventing the extensive use of existing data.

This article proposes a method to adjust time use data from PNAD. It focuses on measuring unpaid care for children and the elderly, which we infer to be mostly biased in Brazilian data. Our analysis enables an indirect estimation of the number of daily hours spent on unpaid care and their inclusion to the household services originally reported by PNAD. We expect the adjustments to fix the age profiles of time use, improving the international comparability of data.

The following sections introduce the problem by discussing the main characteristics and issues of PNAD time use data, propose a correction method, and show results from its application on the distribution of hours allocated to total unpaid household services by age and gender. We claim that our approach helps correctly measure Brazil's gendered economy, but it does not substitute for developing a comprehensive, nationally representative time use survey.

Background

PNAD data collection on time use¹

PNAD is a nationally representative stratified random sample survey of the Brazilian population. It has collected data every year from the late 1970s to 2015, except in census years. It contains a comparable set of demographic and socioeconomic variables, including detailed informa-

tion on employment status, occupation, income, and education for all household members. This high-quality data set has been used extensively in the social sciences (e.g. Heaton, Mitchell, 2012; Bither-Terry, 2014; Cepaluni, Hidalgo, 2016; Maia, Sakamoto 2016; Marteleto, Dondero, 2016.

The first time PNAD asked about time spent on household activities was in the 1982 survey, but it was only a single question for individuals aged 4 to 18. In 1985, the survey asked a similar question concerning individuals up to 17 years old. Both initiatives aimed to measure the impact of other activities on youth education. Between 1985 and 1990, the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE) decided to interrupt the collection of data about time use, and none of its surveys continued to ask students or other participants about unpaid household activities. From 1992 through 2000, a single question was reintroduced into the main questionnaire regarding any person aged ten and older. Respondents were asked whether they spent time on unpaid household services in the week of reference regardless of their economic activity situation and occupational status. In 2001, a second question was added: respondents whose answer for the first question was affirmative were asked about the total number of hours per week they used to help with these activities. Although the PNAD questionnaire ask neither about performance nor about time spent on specific activities, the interviewer's manual listed several items that respondents should consider in their answers during the interview (details in Annex 1). Between 2001 and 2015, the same data were collected in every survey year. In 2015, PNAD was replaced by Continuous PNAD (PNAD Contínua – PNADC), which covers content from both the original PNAD and the Monthly Employment Survey (Pesquisa Mensal de Empregos – PME) and collects longitudinal data on labor and income indicators.

A myriad of studies has used PNAD's data about time use to investigate unpaid household work in Brazil (e.g. Fontoura, Gonzalez, 2009; Marri, Wajnman, 2007; Melo, Castilho, 2009; Melo, Considera, Di Sabbato, 2016; Soares, 2008; Soares, Saboia, 2007; Madalozzo, Martins, Shiratori, 2010) and reported some noteworthy findings. First, women spend twice as many hours as men on unpaid services in almost all age groups (Soares, 2008). The position in the family also affects their unpaid workload: wives do three times more housework than their spouses, and men in the position of sons have the lowest workload in the household (Soares, Saboia, 2007). Also, female labor force participation is negatively related to unpaid work (Madalozzo, Martins, Shiratori, 2010)

The difference between male and female domestic workloads is also associated with education levels. The higher the education level, the smaller the gender gap in hours of domestic activity. Melo and Castilho (2009) estimated that women with lower schooling levels devote on average 54% more time to unpaid housework activities than men with the same education. At the top of the educational distribution, the difference reduces to 37%. The authors also demonstrated that agricultural workers, and those who work in the production, repair, and maintenance of goods and services, sales, and service providers, are the ones who devote more time to household chores.

However, the quality of PNAD data is uncertain. Its methodology for collecting data about time use has been used elsewhere before,² and it is generally referred to as stylized questions (Borra, Sevilla, Gershuny, 2013; Kan, Pudney, 2008). Compared to the more detailed but costly diary-keeping questionnaire, which involves recording activities for several days, it probably offers less accurate estimates. Stylized questions require respondents to go through a “cognitive process”, and they may have varying interpretations of the questions asked (Winkler, 2002). Also, respondents need to estimate the time devoted to household chores during the reference week. The time estimate is sensitive to the education level of respondents, who may have different skills to accurately calculate the number of hours per week (Aguiar, 2010). Some studies showed that stylized questions reveal a higher number of hours devoted to housework activities than diary measures (Baxter, Bittman, 1995; Bianchi et al., 2000; Juster, Ono, Stafford, 2003; Niemi, 1993; Robinson, 1985). They also indicated that differences between both methods are more significant for women than for men (Baxter, Bittman, 1995; Niemi, 1993; Robinson, 1985). However, there is also evidence in the opposite direction, showing that stylized questions underestimate the number of hours used in household activities (Bonke, 2005). In the case of Brazil, Pinheiro (2018) further demonstrated that estimates vary according to who – men or women – reports the information in the survey. When men are the respondents, they inform more hours of housework for themselves, whereas among women, the differences between self-reported or third-party information are residual.

The problems of PNAD are even worsened by the fact that the list of activities indicated in the interviewer’s manual refers to a restricted set of activities, and it is unclear whether it is always presented to respondents. It ignores tasks such as minor repairs or household maintenance, household organization, shopping, and household services performed in other households – tasks that the literature shows to be more frequently performed by men (Nieto, 2014). More importantly, the manual ignores the unpaid care of the elderly, the sick, or people with special needs. It mentions the care of children or minor household members. However,

what should be considered childcare is not described in the manual, leaving room for respondents' interpretation. Therefore, missing information on care activities is a critical issue in PNAD, which adds to the other methodological problems related to stylized questions. All of these factors suggest that women's contribution to Brazil's economy has been underestimated.

The Continuous PNAD (PNADC) collection of time use data

In 2011, IBGE redesigned PNAD to implement Continuous PNAD (PNADC). Both PNAD and PNADC were carried out simultaneously until 2015, when PNADC replaced PNAD permanently. It applies a household rotation scheme, which was not part of PNAD's original design.

PNADC has also used stylized questions for time use data, but it has changed the original questionnaire structure. Between 2012 and 2015, a breakthrough in comparison with PNAD lay in asking about the number of hours spent in each of both major categories of activities – care and other unpaid household activities – separately. The survey also identified the number of caregiving hours performed by household members according to large age groups. However, IBGE never released the microdata about time use collected in those years to public use and decided to change the questionnaire after that.³ Following the scheme adopted in PNAD 2001, PNADC has since 2016 asked only about the total time spent on all activities (care and others) together. On the other hand, it has included a list of activities to its questionnaire, making it easier for respondents to remember the total number of housework hours. It still identifies household members who received care, but not the hours spent with each of them (details in Annex 1).

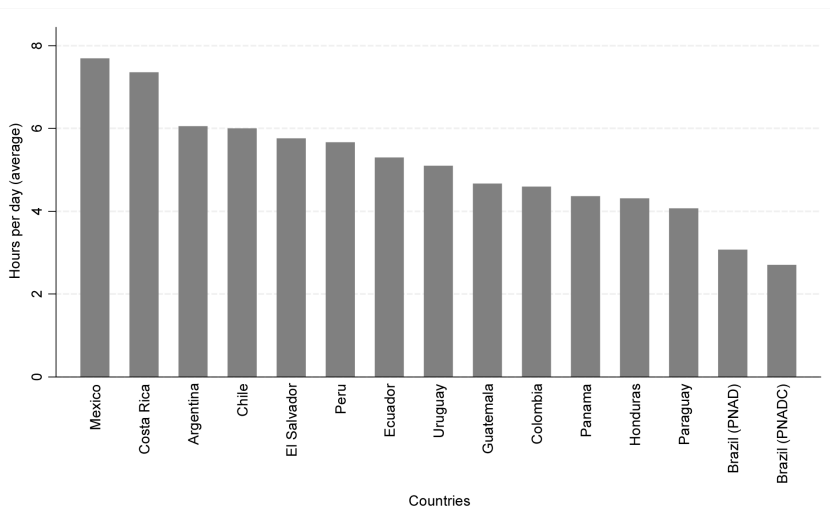
IBGE has already published some descriptive results based on time use data from PNADC. The institute's first newsletter showed that 32.4% of women and 21.0% of men reported providing care to other members and non-members of the household. Among caregivers, 64.7% of men and 60.7% of women had ages between 25 and 49. Not surprisingly, a lower proportion of white women (29.3%) contributed to care activities, compared to 35.3% of brown and 34.0% of black women (IBGE, 2017). Regarding other household services, 89.8% of women and 71.9% of men spent time performing tasks. PNADC results are significantly different from those collected by PNAD. In the original survey, only 50% of men contributed to household services (Soares, 2008; Melo, Considera, Di Sabbato, 2016). Differences between the results of both surveys about the gender gap may be due to the fact that PNADC includes activities in which men typically engage more or the same as women, such as minor repairs and home maintenance. In PNADC, men's participation rates in

those tasks are almost double that of women. Another example is men's and women's involvement with household management activities, which are practically identical in PNADC (IBGE, 2017).

Inconsistencies between PNAD and PNADC reinforce the hypothesis about the low quality of time use data in Brazil. International comparisons give additional support to our suspicion. For example, Figure 1 displays the average of total daily hours spent on unpaid household services by women aged 15 years and older in different countries, extracted from the Gender Equality Observatory of Latin America and the Caribbean (LAC).⁴ PNAD and PNADC are the only surveys in the region that rely on a single stylized survey question. Among all countries compared, Brazil has the lowest average of daily work hours performed by women. Also, as anticipated, both national surveys provide different results. The 2016 PNADC captured fewer hours performed by women than the 2013 PNAD, despite having a more detailed list of activities in its questionnaire.

Figure 1

Total unpaid household services hours per day by women 15 years and older, Brazil (PNAD and PNADC) and selected LAC countries



Source: Gender Equality Observatory of Latin America and the Caribbean (2007 – 2016), Pesquisa Nacional por Amostra de Domicílios, IBGE, 2013, and 2016.

Demographic, economic, social, and cultural factors could also explain some of the differences observed in Figure 1. One alternative explanation for the lower level of unpaid household services lies in Brazil's relatively high female labor force participation rates. However, women's reported

domestic workload is heavier even in LAC countries where labor market participation is higher than in Brazil (results available upon request). A second related explanation is the large number of domestic workers available in the Brazilian job market, hired chiefly but not only by upper-class families. To test it, we estimated the percentage of the female workforce employed in domestic services. We compared it to women's daily unpaid workload in the LAC countries (results available upon request). Once again, the association between both variables is unclear. Some countries where paid domestic workers have a participation similar to that of Brazil have reported higher hours of unpaid household activities.

In summary, the fewer hours spent on unpaid household services do not seem related to the labor market's idiosyncrasies. The inclusion of a more comprehensive list of activities in PNADC has not changed the bigger picture of Brazil's time use statistics. Contrary to initial expectations, new data suggest fewer hours performed by women than the original PNAD. For a country with a history of underestimating women's economic contribution, PNADC results look doubtful. This also affects the comparability of estimates over time and space. As new PNADC data are collected, other analyses will be necessary to clarify the inconsistencies between both surveys. The current study opts to analyze only data from the original PNAD, since it has been under more intense scrutiny by the literature.

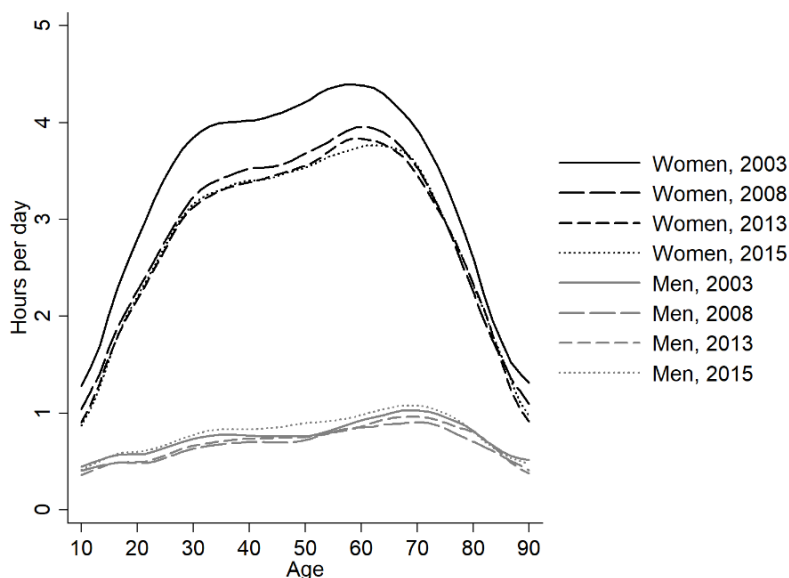
Time use estimates over the course of life: what can age profiles tell us about the quality of PNAD data?

Unpaid household services include direct care – taking care of children, elders, sick or people with disabilities – and other household services, also known as indirect care – cooking, cleaning, management, and maintenance. They are related to changes throughout life, including transitions to adulthood, marriage, parenthood, and labor market entry and exit. Age is thus a central dimension for analyzing time use estimates and can help uncover data inconsistencies. Figure 2 shows the average total daily hours devoted to household services by age and gender in PNAD 2003, 2008, 2013, and 2015. The estimates show important level changes and a reduction in gender differences over time. Fewer unpaid work hours among women rather than more hours among men explain the variations (Pinheiro, 2018). During these five years, female participation in Brazil increased by more than four percentage points, from 58.8% to 63.0% (Barbosa, 2014), following national economic growth. In addition, the total fertility rate (TFR) fell from 2.09 to 1.72 (17.7%) between 2005 and

2015 (IBGE, 2016). Lower fertility levels are associated with lower demand for household services. Nevertheless, despite shifts in the curves, age patterns look very consistent throughout the years.

Figure 2

Total unpaid household services: hours per day by age and gender, Brazil, PNAD, 2003-2015.



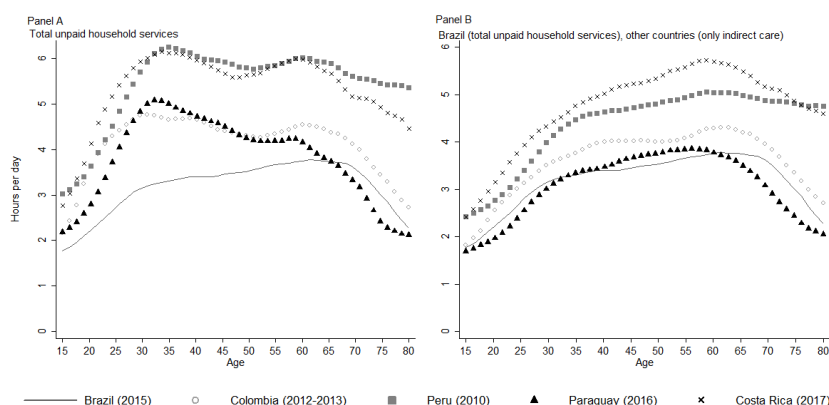
Source: Pesquisa Nacional por Amostra de Domicílios, IBGE, 2003, 2008, 2013, and 2015.

Distribution consistency throughout the years does not guarantee the age pattern is correct. Thus, we estimated time use age profiles for selected Latin America and the Caribbean countries and compared them to Brazil to look for discrepancies. We included estimates from Colombia, Paraguay, Peru, and Costa Rica, where microdata are public. Figure 3, panel A, shows the average total daily hours devoted to household services by women by age in each country. Brazilian estimates are not only lower but also display a different age pattern. In the literature, the age pattern of hours devoted to unpaid housework is usually marked by two peaks. The first one occurs between the ages of 20 and 40 and is associated with children at home, increasing the demand for direct and indirect care. The second peak occurs around the age at which women retire, since exiting the labor force increases their availability for unpaid work. Both peaks are evident in the estimates for the other four LAC countries. However,

the number of daily hours in Brazil does not grow at ages when women are more likely to take care of children at home. In Figure 3, Panel B, we excluded the hours devoted to unpaid direct care activities from the other four countries' data to offer additional evidence of Brazilian data issues. Limiting the estimates makes age profiles very similar to the Brazilian one, particularly in Colombia and Paraguay. This result supports our suspicion according to which hours spent on direct care are underreported in PNAD.

Figure 3

Total female unpaid household services: hours per day by age, Brazil and selected LAC countries.

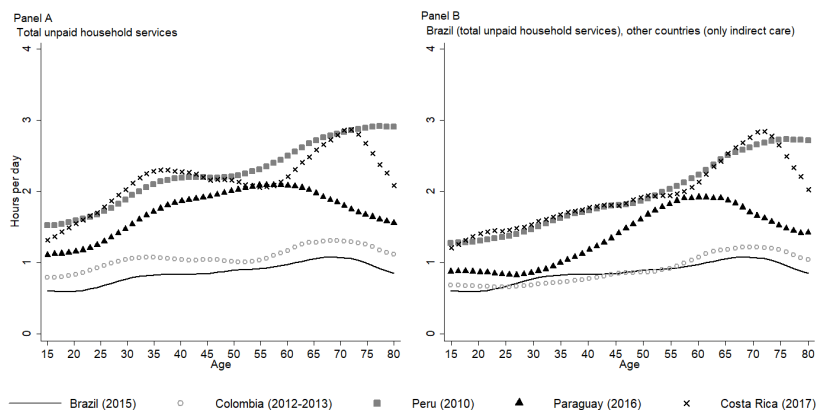


Source: PNAD (Brazil, 2015); ENUT (Colombia, 2012-2013), ENUT (Peru, 2010); EUT (Paraguay, 2016); EUT- GAM (Costa Rica, 2017).

Figure 4 provides the same kind of estimate for men. Age profiles confirm that the average time devoted by men to unpaid household services is significantly shorter than women's. The underreporting of hours dedicated to direct care appears to have a lighter impact on the male age profile. Nevertheless, after omitting the data in the other four countries (Panel B), age pattern issues also arise for men, mainly at ages 25 to 40.

Figure 4

Total male unpaid household services: hours per day by age, Brazil and selected LAC countries.



Source: PNAD (Brazil, 2015); ENUT (Colombia, 2012-2013), ENUT (Peru, 2010); EUT (Paraguay, 2016); EUT- GAM (Costa Rica, 2017).

Given the limitations and potentialities of Brazilian data, we propose a methodology to correct the underreporting of unpaid direct care by PNAD. Data from other Latin American countries are indispensable for developing our methodological approach.

Adjusting PNAD estimates: a methodological proposal

this article provides a method to modify the data from PNAD and improve the consistency and comparability of Brazilian time use estimates. To do this, we assume that respondents correctly report the time spent on indirect care – other household services – but underreport time allocated to direct care. We tackle this issue by calculating the time allocated to direct care from another source and adding it to total housework hours. Some earlier studies have also proposed adjustments in stylized questions collected in other countries by combining different sources of time use data with imputation methods (Borra, Sevilla, Gershuny, 2013; Gershuny, 2003; Kan, Pudney, 2008). However, they took advantage of detailed data collected from smaller samples of the same populations. In Brazil, the unavailability of data and the differences in sample design (time, space) between PNAD and local surveys precluded us from using a similar strategy.

Here we use a modified version of the indirect standardization demographic method (Shryock, Siegel, 1973) and international data to adjust the PNAD estimates. We assume that the Brazilian population experiences the same relationship between the number of hours spent on direct and indirect care as a reference population. This assumption makes the selection of the reference population a critical step in obtaining reliable adjustment factors. Figures 3 and 4 showed that both Colombian and Paraguayan age profiles became comparable to Brazil's after excluding unpaid direct care from the data. Although both countries could serve as the reference population for our method, we chose to use Colombian data for a few reasons. As shown in the graphs, Colombian data fit the Brazilian male estimates somewhat better than Paraguayan data. Second, the Colombian time use survey allows us to identify the household residents who provided and received direct care, improving our methodology. Finally, Colombia and Brazil are neighboring countries in South America with similar social, economic, and demographic histories. Since context helps shape time use within the household, Colombia is a natural reference for Brazil among other countries.⁵

Colombia's National Time Use Survey (Encuesta Nacional de Uso del Tiempo – ENUT) collected data on each of a set of many household activities between August 2012 and July 2013. Besides indirect care (other household services), it includes detailed information about direct care (details in Annex 3). Therefore, we could select information on direct care activities that may be missing from Brazilian data. We started by excluding emotional support and activities performed outside the household (e.g. taking family members to work) from Colombian data. These are activities about the beneficiaries of which we do not have any information and which cannot be easily distributed by age and gender (Donehower, 2014).

Followingly, we classified remaining direct caregiving hours according to the age of household members receiving care (0-5, 6-14, and 80 years and older). They are: i) at least one child aged 0-5; ii) at least one child aged 6-14; iii) at least one elderly aged 80 or older; iv) at least one child aged 0-5 and one child aged 6-14; v) at least one child aged 0-5 and one elderly aged 80 years or older; vi) at least one child aged 6-14 and one elderly aged 80 years or older; vii) at least one child aged 0-5, one child aged 6-14, and one elderly aged 80 years or older. We did not include ages 15-79 since the beneficiaries are significantly less frequent among adults. We then grouped households according to seven mutually exclusive arrangements formed by all possible combinations of these three age groups. The seven resulting categories reflect the effect of one or more individuals who need help on the number of hours spent on unpaid direct care.

Next, we estimated sets of ratios $K_{i,j,l,m,n}$, representing the ratios between hours allocated to unpaid direct care (DC) and indirect care (IC). In addition to household composition, represented by the seven categories of household arrangements described before, we calculated the ratios according to four different sociodemographic individual and household variables related to housework: gender, age, occupational status, and urban/rural situation.

$$K_{i,j,l,m,n} = \frac{DC_{i,j,l,m,n}}{IC_{i,j,l,m,n}} \quad (1)$$

where:

i: gender

j: age

l: occupational status

m: urban/rural situation of the household

n: type of household arrangement

Estimating specific ratios for population subgroups, defined according to five different sociodemographic variables, makes the standardization method more accurate. On the other hand, it can reduce sample size and increase the chances of atypical values in the database. We were able to smooth most outliers only by adding individual times within each cell. However, we still found a few atypical values. For these cases, we re-estimated K by fitting a linear regression model in which predictors were the same five sociodemographic variables of Equation 1.

After calculating the ratios for Colombia, we applied them to PNAD data. We multiplied the subgroup-specific ratios by the number of hours allocated to indirect care (other household services) in Brazil. We imputed direct care only for individuals who reported performing these other activities, following the method's conception. The result is the estimated number of hours spent on direct caring in Brazil for each population subgroup:

$$DC_{i,j,l,m,n}^{Brazil} = K_{i,j,l,m,n} \times IC_{i,j,l,m,n}^{Brazil} \quad (2)$$

Finally, we added the estimates of unpaid direct care to the original housework profiles reported in PNAD to obtain adjusted distributions of total unpaid household services by age and gender. To avoid implau-

sible results, we assumed the total number of housework hours equals 18 at maximum. Only 0.1% of cases exceeded this value and needed to be capped.

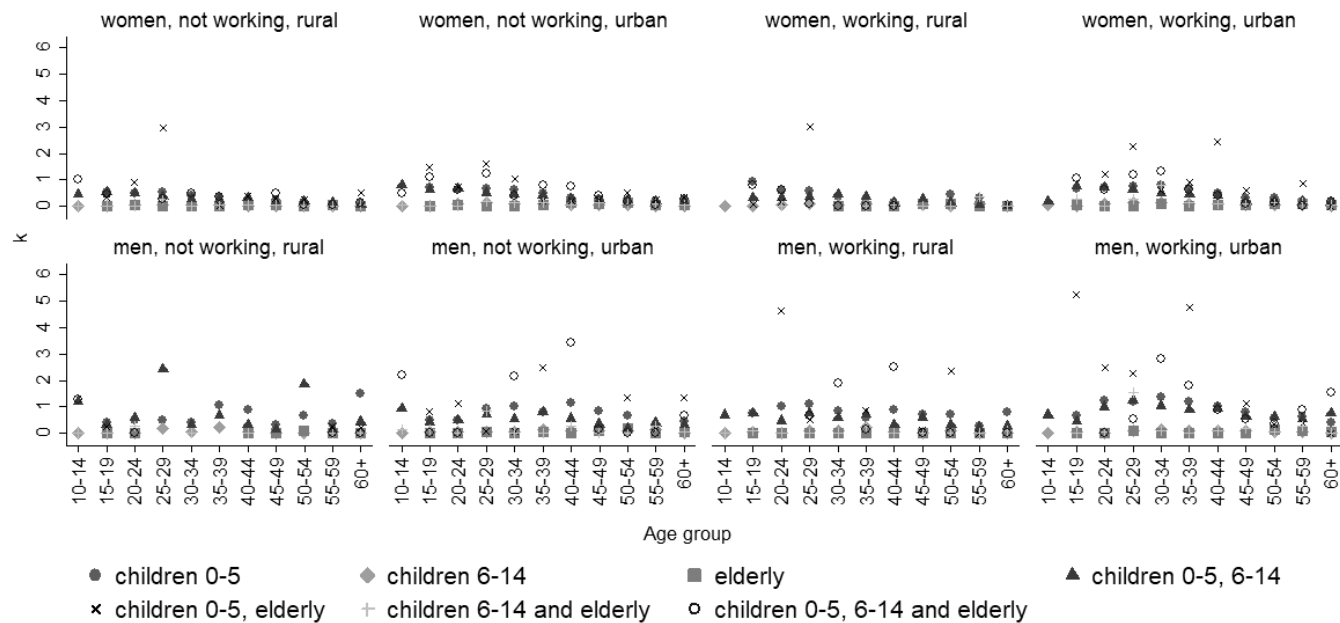
Results

Figure 5 shows the set of ratios K estimated using Colombia as the reference population. Ratios are higher among men, indicating that in Colombia they tend to perform proportionally more direct care hours for each hour of indirect care than women. In other words, men are relatively more engaged with direct caregiving – particularly childcare – than women in proportion to other household services. One explanation is that direct care has long-lasting effects on children and thus parents distinguish it as an investment – which may encourage fathers to get more involved with it (Guryan, Hurst, Kearney, 2008). Also, fathers may enjoy giving care to children more than mothers because of the kinds of activity they do. Usually, they spend proportionally more time in educational and recreational activities than routine childcare activities (Bryant, Zick, 1996; Pleck, Masciadrelli, 2004; Miranda, 2011).

The ratios K calculated for Colombia vary according to household composition and the other sociodemographic variables added in our method. For example, a 30-34-year-old man, economically active in any occupation, living in a household in the urban area with at least one child aged 0-5 and another 6-14 years old, spends one hour on direct care for each hour spent on other household services. The ratio rises to three if there is at least one elderly living in the same household. Among women, ratios vary less by subgroup, and the time allocated to childcare concentrates between ages 20 and 40. The ratios of female subgroups are mostly below one, but they can be higher if women are active in the labor market and live with children aged 0-5 and at least one elderly.

Figure 5

Ratios between hours allocated to unpaid direct and indirect care (other household services) by selected variables, Colombia, 2012-2013.



Source: Encuesta Nacional de Uso del Tiempo, Colombia, 2012-2013.

Table 1 presents the outcomes of applying the adjustment ratios to Brazilian data. It shows the estimated average daily number of hours spent on direct care according to caregivers' age, gender, and kind of household arrangement. These are averages, which thus include individuals who spent time taking care of family members and those who did not. Despite the lower female ratios shown in Figure 5, women dedicate significantly more hours to other household services than men. Therefore, they also spend more time on direct care, as indicated in Table 1.

Regarding household arrangements, the mean daily number of direct caregiving hours among women younger than 40 is the highest in families with young children (0-5 years old) and elderly, followed by those with only young children. Another important finding is the lower number of direct caregiving hours in households where the elderly are the only dependent residents. In fact, among the elderly, the demand for care, such as taking medications, feeding, bathing, and dressing, is causally related to health conditions, which tend to deteriorate only at later ages. According to PNAD 2008, about 25% of individuals aged 80 had at least some difficulty with one activity of daily living (ADL). The proportion increases to 50% at ages above 90. But only 5% of Brazilian households in 2008 had one elderly living in such conditions, reducing its (average) effect. For the sake of comparison, at least one child/youth lived in 50% of the Brazilian households in 2008. Therefore, direct care for the elderly is less common than for children in Brazilian families. This pattern will change gradually in the next decades, as population aging advances.

Table 1

Estimated unpaid direct care: hours per day by age group, gender, and type of household arrangement, Brazil, 2015.

Age group	Women						
	children 0-5	children 0-5, 6-14	children 0-5, 6-14 and elderly	children 0-5 and elderly	children 6-14	children 6-14 and elderly	only elderly
10-19	1,813	0,931	1,194	2,749	0,023	0,058	0,031
20-29	2,308	2,068	2,081	3,969	0,296	0,361	0,045
30-39	2,214	1,827	2,369	1,730	0,306	0,695	0,089
40-49	1,229	1,193	1,510	2,860	0,221	0,361	0,254
50-59	0,864	0,735	0,501	1,154	0,140	0,367	0,330
60+	0,705	0,503	0,238	0,522	0,057	0,089	0,091

Age group	Men						
	children 0-5	children 0-5, 6-14	children 0-5, 6-14 and elderly	children 0-5 and elderly	children 6-14	children 6-14 and elderly	only elderly
10-19	0,376	0,403	0,575	1,089	0,011	0,042	0,001
20-29	0,816	0,652	0,144	0,848	0,036	0,200	0,017
30-39	1,093	0,707	0,279	1,257	0,089	0,024	0,017
40-49	0,786	0,616	0,412	0,310	0,068	0,061	0,031
50-59	0,421	0,389	0,039	0,491	0,056	0,102	0,110
60+	0,377	0,334	0,229	0,537	0,020	0,014	0,027

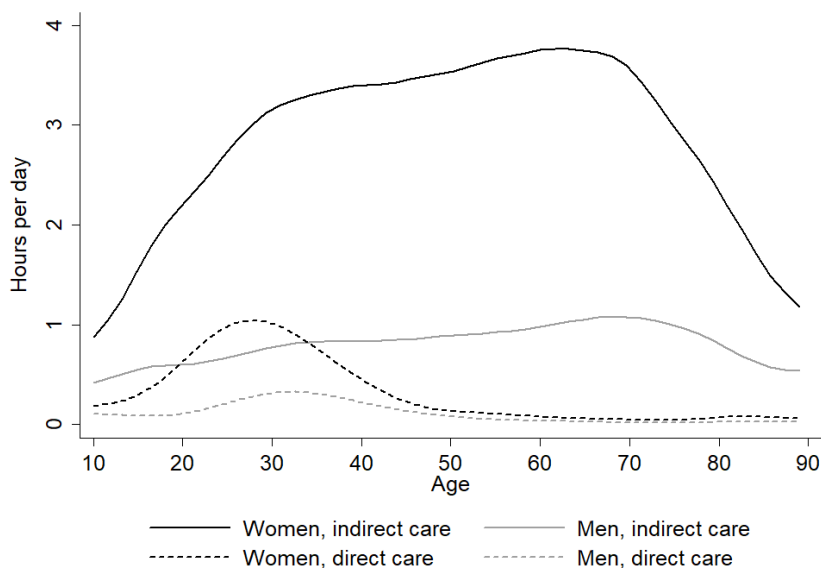
Source: Pesquisa Nacional por Amostra de Domicílios, IBGE, 2015; Encuesta Nacional de Uso del Tiempo, Colombia, 2012-2013.

Figure 6 displays the final age profiles of unpaid household services in Brazil, considering all categories of household arrangements together. For each gender, we show i) the average hours of unpaid direct care indirectly estimated by our method and ii) the average hours of indirect care (other household activities) reported in PNAD. Even after fixing data on unpaid direct care, other household services remain the main component of total housework. The result is not surprising, since other household services include many more tasks than direct care. Also, they need to be done in any household, including families with no dependents.

Overall, women work much longer hours than men. Also, age distributions are not the same for men and women. For example, women's average work hours spent on unpaid direct care peak at about one hour between ages 25 and 30. Among men, the peak occurs between 30 and 35 and is less than 20 minutes a day. In Brazil, fathers are usually older than mothers. Thus, the age distributions reflect differences in age at childbirth by gender.

Figure 6

Estimated unpaid direct care and reported indirect care (other household services): hours per day by age and gender, Brazil, 2015.

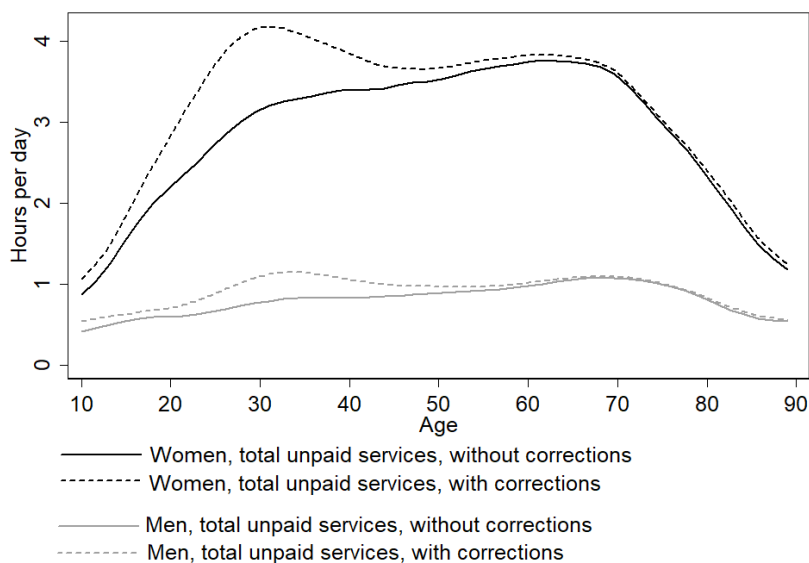


Source: Pesquisa Nacional por Amostra de Domicílios, IBGE, 2015; Encuesta Nacional de Uso del Tiempo, Colombia, 2012-2013.

Finally, Figure 7 compares total unpaid household services by gender and age, with and without the corrections on PNAD data. The bimodal shape becomes more apparent with the adjusted data, making the child-caring age peak stand out. Consequently, the age at which women work the longest hours is reduced from 58 to 29. According to our estimates, at age 28, women work 1.1 more hours (from 3.1 to 4.2) than originally reported by PNAD. At the same age, men work 17 more minutes per day on average – a change from 43 to 60 minutes. In the adjusted estimates, both household size and composition matter, which affects mostly women's work. At around age 28, women live with, on average, 2.7 other individuals, compared to 2 at around age 58. Also, 43% of these women reside with children 0-5, compared to only 8% at age 58. Simply put, our imputation method was able to fix at least part of the problems of Brazilian time use data. After adjusting hours spent on direct care, Brazilian age profiles became similar to Latin American and European patterns, usually calculated with higher-quality data.

Figure 7

Total unpaid household services by gender and age, with and without the corrections, Brazil, 2015.



Source: Pesquisa Nacional por Amostra de Domicílios, IBGE, 2015; Encuesta Nacional de Uso del Tiempo, Colombia, 2012-2013.

Discussion

This study took a novel look at time use data, particularly those requiring respondents to interpret stylized survey questions. Our main contribution was to propose and apply a method to adjust Brazilian time use data, focusing on missing unpaid direct care time. First we examined the evolution of time use data collection in the two chief nationally representative Brazilian household surveys throughout the years – PNAD and PNADC –, stressing their main methodological issues. Based on earlier findings and new empirical evidence, we claimed that Brazilian data are deficient, among other factors, because of the underreporting of direct caregiving activities. Compared to other Latin American countries, women in Brazil spend substantially fewer hours on unpaid total household services. Also, the age distribution of unpaid services suggested an unusual pattern compared to neighboring countries. Notably, it revealed a surprisingly low number of hours spent on domestic work between ages 20 and 40, a life stage at which men and women are more likely to take care of children at home.

Our correction procedure was inspired by indirect standardization, a classical demographic method. We input unpaid direct care hours to Brazilian data according to their relation to hours spent on indirect care (other household chores) in a reference population. The selection of the reference population is critical for the method to provide accurate estimates. One typical choice is to select a population that shares similar social, economic, and demographic characteristics with the population under investigation. Accordingly, Latin American countries are natural candidates to provide data to Brazil. Our analyses suggested that Colombia and Paraguay present sex and age-specific profiles that are more like Brazil's. We ended up electing Colombia as our reference because of a few factors, including its more detailed survey data. Still, there is no guarantee it is the best standard. Therefore, instead of estimating a single Colombian time use pattern to apply to Brazil, we calculated specific ratios based on different household and individual characteristics. By doing so, we mitigated existing compositional differences between both countries, improving imputation quality.

We obtained two main results after adjusting PNAD data. There was an increase in the average number of daily hours spent on unpaid household services for both men (0.1 hours) and women (0.5 hours) aged 15 and older. Most importantly, the adjusted age profiles became like those

from other countries, characterized by peaks around two stages of life: parenting and retirement ages. The increment in daily hours was as high as 23 minutes (60%) and 1.1 hours (35%) at age 29, respectively, for men and women.

Adjusted time use data can help future research to look into Brazil's gendered economy in more detail, measuring the contribution of men and women of different ages to a fraction of the economy that has been invisible from official statistics. For example, Jesus (2018) has shown that 82% of all household production in Brazil is performed by women and girls, while men and boys perform 63% of all market production. If the time spent on household production by women and men in Brazil were valued, it would be equivalent to approximately 10.5% of the country's gross domestic product. Since age is related to transitions that affect family structure, work, and retirement, it is a useful marker for measuring life-cycle factors associated with the production and consumption of household services. Without correctly estimating time transfers among household members, one can tell little about the hidden processes behind gender inequality, including labor market specialization.

Also, since our method accounts for various individual and household variables, it can capture differences across population subgroups beyond age and gender. For example, with the adjusted data, one can measure the production and consumption of direct care according to race, socio-economic status, and regions, helping reveal other sources of inequality in household production.

There is no doubt that fixing sex and age-specific patterns and levels of unpaid direct care resulted in more reliable time use data for Brazil. However, there are limitations. Our method produces estimates based on standard distributions from a different population and cannot measure subtypes of household services that are too specific. Therefore, we cannot stress enough the need for a comprehensive, detailed, nationally representative survey to improve our understanding of how individuals spend time on household activities in Brazil.

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Notes

1. This section is a revised version of the literature review presented in Jesus (2018).
2. Some examples are the Panel Study of Income Dynamics and the National Survey of Families and Households (United States), the Canadian General Social Survey (Canada), and the Home On-line Study (UK).
3. According to a technical note from IBGE about the revision of PNADC's questionnaire, data on care and other unpaid household activities have been collected together since the 4th quarter of 2015 due to the simultaneity of many household activities.
4. Annex 2 describes the methodologies used in each survey.
5. For a detailed discussion on Brazil's and Colombia's socioeconomic and demographic similarities, see Jesus (2018).

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