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A joint publication of the
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A joint publication of the UP School of Economics (UPSE)
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Publication Information: The PRE (ISSN 1655-1516) is a peer-reviewed journal published every June and December of each year. A searchable database of published articles and their abstracts is available at the PRE website (<http://pre.econ.upd.edu.ph>).

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Acknowledgements: The PRE gratefully acknowledges the financial support towards its publication provided by the Philippine Center for Economic Development (PCED). The Review nonetheless follows an independent editorial policy. The articles published reflect solely the editorial judgement of the editors and the views of their respective authors.



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The Philippine Review of Economics

Vol. LX No. 1
June 2023

ISSN 1655-1516
DOI: 10.37907/ERP3202J

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Women's market work and childcare policies in Colombia: policy simulations using a computable general equilibrium model

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In recent decades, Colombia has made significant progress towards achieving gender equality in its labor market. However, persistent inequalities in unpaid care work remain a significant challenge, resulting in heavy care workload for women. This study evaluates the impact of three government policy options that can help reduce women's unpaid work: subsidy for childcare services provided by the market, an increase in public provision of childcare services, and cash transfers to households with children using a care-extended computable general equilibrium model (CGE) calibrated to Colombian data. The results show that while all policies improve family economic situations by increasing private consumption, childcare provision, whether through subsidies or as a public good, has a more significant impact on increasing female market work while cash transfers increase unpaid work performed inside the home. These findings underscore the importance of policy design and their analysis regarding their impact on gender inequalities, labor supply, and economic growth.

JEL classification: E6, J16

Keywords: economic modeling, computable general equilibrium, social accounting matrix, feminist economics, care, unpaid care work, time use, Latin America, Colombia

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1. Introduction

In recent decades, Colombia has made significant progress towards achieving gender equality in its labor market. Women's participation in the workforce has increased considerably, and several indicators are now comparable to those of high-income countries [Iregui et al. 2021]. In fact, according to Elias and Ñopo [2010], Colombia experienced the highest increase in women's labor force participation throughout Latin America, transitioning from having one of the lowest female participation rates in the region, nearly 40 percent in 1985, to one of the highest female participation rates at 60 percent in 2017 [Iregui et al. 2021]. Despite these advances, the gender-based participation gap continues to persist. Women's participation rate in Colombia for 2022 was 51.8 percent compared to men's participation rate of 76.5 percent, notwithstanding the fact that women have higher levels of education.¹ Furthermore, Colombia has one of the highest rates of female unemployment in Latin America, reaching 14.3 percent in 2022 compared to the unemployment rate of 8.4 percent on average for the region for 2022.²

One of the main reasons why gender equality has not been fully achieved in the labor market is the unequal distribution of unpaid care responsibilities, which primarily fall on women. Household work, which is a non-GDP productive activity, presents a significant obstacle for women's participation in paid work, reducing their productivity, limiting their career advancement, and perpetuating gender inequality. Colombia's time use survey from 2021 shows that women account for most of the unpaid care work.³ The average woman spent seven hours per day on paid work, while the average man spent 8.57 hours. In contrast, women spent seven hours and 44 minutes per day on unpaid care work, while the average man only spent three hours and six minutes [ENUT 2020-2021].

Moreover, women with children often face significant challenges and constraints in advancing professionally, as they bear a disproportionate responsibility for unpaid care work. As such, policies aimed at supporting this group are crucial for promoting gender equality in the labor market, enhancing women's economic empowerment, and contributing to overall economic development. In practice, such policies can include subsidies for families with young children and the provision of accessible, affordable, and high-quality childcare services.

¹ Data for Colombia is sourced from the National Administrative Department of Statistics [DANE 2022].

² Data for Latin America and the Caribbean is sourced from the International Labour Organization [2023] and for Colombia from DANE [2022].

³ Unpaid care work is not included in the calculations of the GDP and includes direct, indirect, and passive unpaid care. Direct care includes activities such as feeding, bathing, dressing, or taking other household members to places they require. Indirect care includes activities such as cooking, cleaning, and grocery shopping for the household. Finally, passive care includes monitoring and watching over dependent household members (children, elderly, or disabled).

The COVID-19 pandemic has brought attention to the unequal burden placed on women in both unpaid and paid care work and highlighted the critical importance of care services. The pandemic has revealed that a lack of support for unpaid care work can have significant economic and social consequences, including the reversal of progress made in reducing gender gaps observed in previous decades [Garcia-Rojas et al. 2020]. The pandemic also exposed the imbalances and precarious conditions in the paid care sector. In Colombia, the care sector is highly feminized, with women constituting 75 percent of the workforce. Additionally, much of this employment is informal and done under precarious conditions. In 2020, only two percent of the total number of women working in the paid care sector were employed by the government compared to three percent of men.⁴ Therefore, efforts investing in the care economy could serve a dual purpose: closing gaps in the labor market and enabling women to regain their pre-pandemic momentum, while simultaneously improving the labor conditions for care workers. This includes providing better wages, access to benefits, training opportunities, and other supportive measures.

While the government of Colombia has made some progress in addressing care needs, including the institutionalization of a comprehensive state policy for early childhood development in 2011 [Meurs 2020], there is still a lack of a comprehensive framework for a care system in the country. The burden of care provisioning falls disproportionately on families, while other key actors, such as governments, underinvest in this area. Economic, social, and demographic changes such as urbanization and growing nuclearization of families, aging population, and increasing need for women to take on income-earning roles, have posed difficulties for families to meet their care needs on their own. However, there is little information available on the macroeconomic effects of policy options aimed at redistributing care responsibilities among households, governments, and businesses. A gender-aware, comprehensive policy analysis of possible interventions can shed light on their macro- and micro-level impacts.

However, to date, the vast majority of the models used in policymaking do not consider gender in labor markets and overlook the impact of care work on the economy, thus rendering such policy tools unsuitable for analyzing policies addressing the care and gender equality in Colombia and in other contexts. To tackle this issue, we employ a Gendered Computable General Equilibrium model (CGE) called GEM-Care, first developed by Cicowiez and Lofgren in 2017, and we calibrate for the Colombian context. GEM-Care Colombia extends the scope of activities beyond GDP to consider unpaid care work as well as personal and leisure activities. It emphasizes the importance of unpaid care work in producing and maintaining the labor force, its interconnection with paid work in terms of time use, and demonstrates its significant impact on the economy as a whole.

⁴ The paid care sector in Colombia includes services such as health and medical assistance, childcare, elderly care, and food preparation and cleaning services [Herrera-Idárraga et al. 2020].

Ignoring unpaid care work in policy analyses can yield misleading predicted outcomes and limit the effectiveness of policies aimed at promoting female labor participation and advancing gender equality. Overall, by incorporating unpaid care work into our analysis through GEM-Care Colombia, we can enhance the effectiveness of economic policies, generating sustainable growth with greater equality and well-being for both women and men.

We use GEM-Care Colombia to investigate the impact of three common policies aimed at reducing the care burden on families with young children. Specifically, we compare the effects of equal increases in government spending on a subsidy for childcare services provided by the market, an increase in public provision of childcare services, and cash transfers from the government to households with children. Our findings indicate that while these policies improve the economic situation of families with children, they have different impacts on the amount of time spent on work performed inside and outside the household. Subsidies and public provision of childcare services increase private consumption and investment, as both men and women shift working hours from unpaid care work to GDP production. However, cash transfers to households with young children lead to a reduction in work performed outside the home and an increase in unpaid care work by both men and women. In this scenario, the production levels of all GDP activities decreased due to the decrease in economic activities resulting from the increase in hours spent on unpaid care work. Moreover, both men and women, but particularly men, increase their leisure time. Hence, to foster potential benefits for gender equality and economic development, our results suggest that public policy could consider prioritizing the development and implementation of programs aimed at distributing government-provided childcare services to households and potentially increasing the State's provision of public care.

Our paper's contribution to the literature is twofold. Firstly, we implement simulation analysis using GEM-Care Colombia, a unique and pioneering analytical tool that enables us to assess various care policies' macroeconomic and sectoral effects. Secondly, we compare different policies that have been used and are currently being discussed for the redistribution of unpaid care in Colombia. The findings and methods used in this study may have implications for other developing countries. Given that other Latin American and Caribbean countries face similar challenges in this area, the findings in this study might be relevant to the region as a whole.

2. Background

The economic, social, and cultural context of a Latin American developing country such as Colombia makes it an interesting case study to analyze the economic and welfare effects of fiscal policies that support childcare provisioning. Socially ascribed gender roles continue to significantly affect individual decisions regarding time use. Feminization of unpaid care work persists despite

the government's efforts to reduce, redistribute, and recognize the unpaid care burden. The feminization of unpaid care work, the persistent gender gap in labor force participation, and occupational segregation are common features throughout Latin America [UN Women n.d.].

In 2010, the Colombian government enacted the Law 1413 that made an important contribution for the recognition and visibility of unpaid care work. The Law's objective is to measure women's contribution to the country's economic and social development by including the care economy (which encompasses all unpaid work activities such as cooking, childcare, doing the laundry, sick care, house cleaning, etc.) in its System of National Accounts. To achieve this objective, the collection of time use data that include unpaid domestic work and care activities performed by household members is required. With that purpose, the National Department of Statistics (or DANE, its acronym in Spanish) conducts, the National Time Use Survey (or ENUT, its acronym in Spanish) on a periodic basis. According to Meurs et al. [2020], the Law 1413 was the first of its kind in the Latin America and Caribbean region and enabled DANE to begin developing an extensive set of gender-disaggregated data that could potentially be used systematically in the design of macroeconomic and social policies.

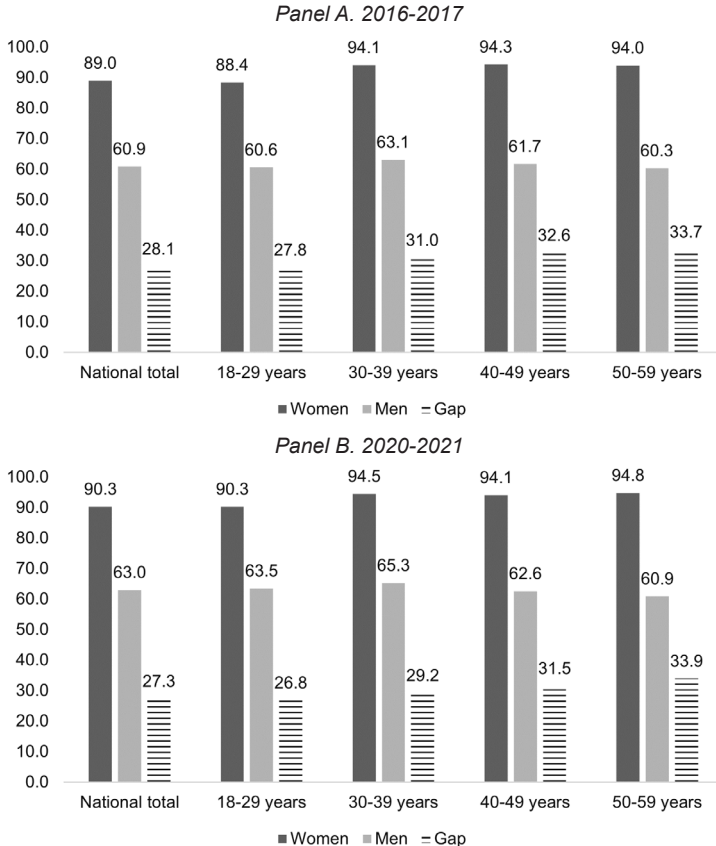
Currently, families still meet most of the care needs in the country. However, wealthier households have access to private, paid services such as daycare centers and domestic workers, while poorer households depend on the women to provide much of the care themselves [Meurs et al. 2020]. The quality, quantity, and type of care services available to households not only vary between low-income and high-income households; they also depend on the geographical area of residence since there are significant differences in the services available in urban and rural areas. These differences in care provisioning across households are considered in GEM-Care Colombia.

The public provision of childcare services is led by the Colombian Institute of Family Welfare (or ICBF for its acronym in Spanish). The ICBF provides public education and care services for vulnerable children through different channels including institutional centers such as Child Development Centers, Children's Homes, and Social Kindergartens. The Community Mothers Program (or *Madres Comunitarias*) is another channel, and the largest to date, with approximately 69,000 community-based female care workers (called "mothers" for their care service) and a few community-based male care workers (called "fathers" for their care service) attending to the needs of 1,077,000 children [ICBF n.d.]. These "mothers" and "fathers" provide home-based childcare that targets nutrition, health, protection, and psychosocial development of children. However, the coverage and quality of those programs remain insufficient as families clearly need more government support in the provision of care services [Meurs et al. 2020].⁵ In addition, the influx in the past several years of more than two million

⁵ See Meurs et al. [2020] for a more in-depth and detailed summary of the government's efforts to reduce, redistribute, and recognize the unpaid care burden in Colombia.

Venezuelan immigrants, including families with children, has further increased the demand for care, making increasing government participation in the provision of childcare service particularly urgent.

FIGURE 1. Participation rates in unpaid care work by gender and age groups



Source: Authors' calculations using the annexes from ENUT 2016-2017 and ENUT 2020-2021.

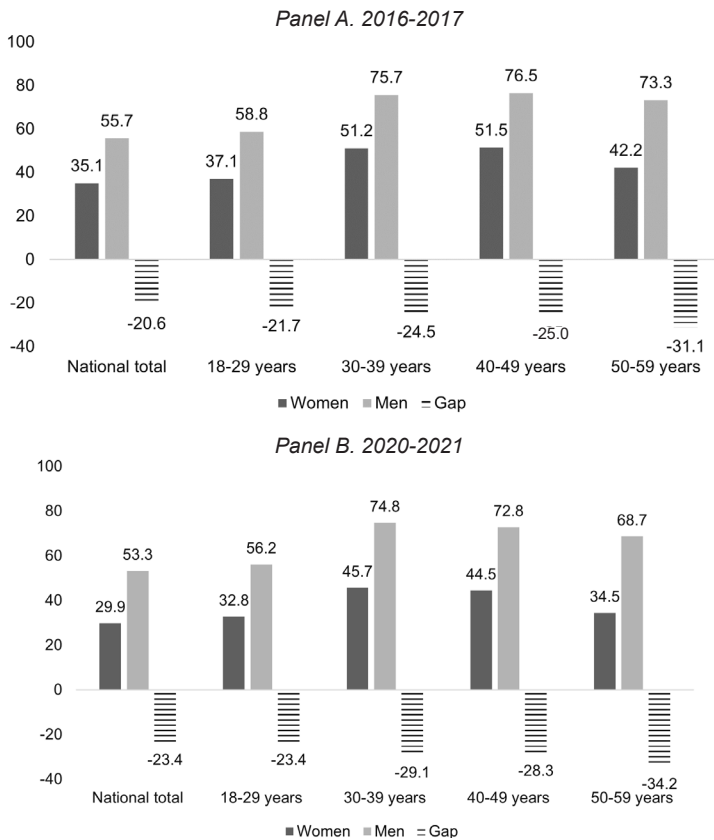
Note: Unpaid work comprises all the unpaid activities carried out with the objective of providing services for family and community members. Unpaid work is not included in the calculations of the GDP and includes direct, indirect, and passive unpaid care. Direct care includes activities such as feeding, bathing, dressing, or taking household member dependents to places they require. Indirect care includes domestic chore activities such as cooking, cleaning, and grocery shopping, etc. for the household. Finally, passive care includes monitoring and watching over dependent household members (minors, elderly, or disabled).

According to data from the National Survey of Time Use for 2016-2017, 61 percent of working-age male respondents engage in unpaid care work, compared to 89 percent of female respondents in the same age group.⁶ Moreover,

⁶ In Colombia, the working-age population is defined beginning at ten in rural areas and at 12 in urban areas. Therefore, the time use section in the questionnaire for the ENUT is applied to household members ten years old and above and the national-level calculations are for the population beginning at that age.

women spend an average of six hours and 52 minutes per day in unpaid care activities, while men spend only three hours and 19 minutes, resulting in a gender gap of three hours and 33 minutes in unpaid care activities. This gap increased by more than an hour during the COVID-19 pandemic [ENUT 2016-2017, ENUT 2020-2021]. As shown in Figure 1, the gender gap in participation in unpaid care work increases with the age range of the sampled respondents. In particular, the largest gap is found in the 50 to 59 years old age group, while the lowest gap is in the 18 to 29 years old age group.

FIGURE 2. Participation rates in paid work by gender and age groups



Source: Authors' elaboration using the annexes from ENUT [2016-2017] and ENUT [2020-2021].
 Note: Paid work refers to all the activities carried out by individuals, aimed at producing goods and services to obtain a compensation (often monetary) of some kind. It does not include the time household members spend producing goods for their own consumption, making paid work a subset of the activities included in the NAS.

The reverse pattern is seen in paid work activities, where men participate more than women (see Figure 2). According to data from the National Survey of Time Use for 2020-2021, 53 percent of male respondents from the working

age population engage in paid work activities, compared to 30 percent of female respondents in the same age group. Moreover, women spend an average of seven hours and 37 minutes per day in paid activities, while men spend eight hours and 57 minutes, resulting in a gender gap of one hour and 20 minutes in paid work. The gender gap in participation in paid activities increases depending on factors such as the geographic region of residence, the economic sector of occupation, and age. As shown in Figure 2, the largest gender gap in participation in paid work is found in the 50 to 59 age range, and the lowest in the 18 to 29 age range.

TABLE 1. Participation rates and time spent in unpaid and paid work by gender and age groups

	2016-2017			2020-2021		
	Women	Men	Gap	Women	Men	Gap
<i>Panel A. Time in unpaid work per day (hh:mm)</i>						
National total	6:52	3:19	3:33	7:44	3:06	4:38
18-29 years	8:14	3:05	5:09	9:50	2:50	7:00
30-39 years	8:56	4:12	4:44	10:45	3:51	6:54
40-49 years	7:07	4:01	3:06	7:52	3:43	4:09
50-59 years	6:33	3:30	3:03	6:39	3:19	3:20
<i>Panel B. Time in paid work per day (hh:mm)</i>						
National total	7:36	9:13	-1:37	7:37	8:57	-1:20
18-29 years	8:02	9:18	-1:16	7:44	8:50	-1:06
30-39 years	8:04	9:44	-1:40	8:00	9:28	-1:28
40-49 years	7:57	9:39	-1:42	8:10	9:19	-1:09
50-59 years	7:33	9:36	-2:03	7:25	9:11	-1:46

Source: Authors' calculations using the annexes from ENUT [2016-2017] and ENUT [2020-2021].

Table 1 compares the daily time that women and men spend on average doing unpaid and paid work. It shows that, for all age groups, women spend more time per day on average in unpaid care work activities than men (six hours and 52 minutes vs. three hours and 19 minutes in 2016-2017; seven hours and 44 minutes vs. three hours and 6 minutes in 2020-2021), and men spend more time per day on average in paid work activities than women (nine hours and 13 minutes vs. seven hours and 36 minutes in 2016-2017; eight hours and 57 minutes vs. seven hours and 37 minutes in 2020-2021). The largest gender gaps in unpaid care work are among the 18 to 29 years old individuals (seven hours on average in 2020-2021), followed by the 30-39 years old cohort (six hours and 54 minutes). This may be explained mainly by the unpaid childcare burden faced by women in their childbearing years.⁷ The largest gender gap in paid work on average is among

⁷ The fertility rate in Colombia has been decreasing during the last few decades, a pattern seen in many parts of the world, and is currently 1.74 births per woman.

the 50 to 59 years old individuals (one hour and 46 minutes in 2020-2021). A plausible explanation for the latter is the fact that the retirement age for women in Colombia is 57, while for men, it is 62.

The time use patterns suggest that the heavy unpaid domestic chores and childcare workload serve as a barrier for women in childbearing ages to participate and remain in the labor market. Approximately 60 percent of unpaid caregivers in Colombia are between 20 and 40 years of age, and half of caregivers between 20 and 54 years of age also have paid jobs [DANE 2020]. Over the second half of the 20th century, the female participation in the labor market has increased. However, the increase in women's participation in paid work has not been accompanied by a significant increase in men's participation in unpaid care work [Meurs et al. 2020]. As a result, female caregivers face a “double shift” (or *doble-jornada*), which can lead to long working days and time poverty thus adversely affecting their well-being (Floro [1995]; Bardasi and Wodon [2010]; Hirway [2010]).⁸

Overall, increasing household's access to affordable childcare services, whether public or private, can help reduce the unpaid workload of women, allowing them to spend their time on paid activities and leisure. Reducing gender inequality within the household can also result in the reduction of gender gaps outside the household. The simulation analysis presented in Section 5 evaluates the extent to which a better sharing of the responsibility for childcare among the State, the community, the family, and businesses help reduce gender inequalities.

3. Literature review

This paper contributes to three key areas of the literature. First, it contributes to the literature on gender-sensitive policy modeling by applying a care-focused CGE model to the analysis of various options for care policy in a developing-country setting. Second, it provides a better understanding of the macroeconomic as well as welfare effects of public spending on childcare services. Third, it contributes to the growing body of literature on the effects of government spending on childcare and early childhood education, whether through subsidies to market-based childcare services, public provision of childcare services, or cash transfers to households with young children.

CGE models have been used to assess the impacts of policy changes on a wide range of standard economic indicators, including value added, employment, trade, consumption, investment, and household welfare, both at the macro and more disaggregated levels. Over the last 20 years, researchers have started to further develop their model structures and databases to address the effects of policies and economic shocks from a gender perspective.⁹

⁸ Time poverty is defined as the insufficiency of time available for rest and leisure, taking into account the time allocated to work obligations, including labor market activities, domestic chores, and other responsibilities like collecting water and firewood.

⁹ See Fontana et al. [2020] for a recent survey of the literature.

Gender-aware CGE models in the literature can be divided into two groups. The first group includes models that only cover the part of labor or time use that falls under GDP production (Arndt and Tarp [2000]; Arndt et al. [2006]; Arndt et al. [2011]). From a gendered perspective, they are limited to analyses of male-female differences in terms of employment, wages, and labor incomes at both the sectoral and economy-wide levels. The second group extends the scope to include leisure and household services production for own consumption and related time use of individuals. Household services production refers to reproductive activities performed by household members, such as care for children and elderly (direct and passive care), and cooking, cleaning, and shopping (indirect care).

Those models are able to also analyze the impact of policies on women's and men's time in leisure and in the production of goods and services, both included and excluded from GDP. The allocation of time across these three dimensions affects both individual and household well-being. Fontana and Wood [2000] were the first to develop a model with this extension. To date, gender-aware models in this group have been applied to analyze issues related to international trade, capital flows, and education (Fontana [2004]; Cockburn et al. [2007]; Siddiqui [2009]; Ruggeri-Laderchi et al. [2010]; and Mosa et al. [2020])

GEM-Care Colombia, the version of GEM-Care used in this paper, differs from the models in the second group in terms of its treatment of care services, which involves both changes in the model structure and additional disaggregation of the household sector in the database. On the demand side, we assume that households consider care services produced by their own members and those produced outside the household as imperfect substitutes. Outside the household, such services are provided by the private and public sectors such as daycare centers. This allows us to differentiate the effects of reducing the care workload performed by household members, particularly women, through public spending on childcare or by means of cash transfer programs to households with childcare needs.

In recent years, there has been increasing interest in the benefits of expanding childcare infrastructure, not only in terms of children's development but also in terms of enhanced well-being of their parents and society as a whole. For instance, Noboa-Hidalgo and Urzua [2012] analyzed the effects of public childcare centers on children's cognitive and socio-emotional development in Chile, finding significant positive effects.¹⁰ Similarly, Bernal and Fernández [2013] studied the impact of a subsidized childcare program on children's nutritional status, cognitive and socioemotional development in Colombia, and found that cognitive and socio-emotional skills improved significantly after 15 months of program exposure.

¹⁰The authors measured cognitive and socio-emotional development using the Battelle Development Inventory Test (BDITT), a comprehensive psychological assessment that evaluates fundamental dimensions of cognitive and socioemotional development for children aged zero to eight. Some of the dimensions it considers are the ability of children to regulate their emotions and their receptive and expressive communication skills.

Expanding public childcare programs can also have positive effects on parents, particularly mothers. Zoch and Schober [2018] found that the expansion of public childcare for children under the age of three in Germany was associated with changes in gender ideologies among mothers without a college degree.¹¹ Similarly, Müller and Wrohlich [2020] estimated the causal effect of expanded subsidized childcare for children up to three years old on mothers' employment in Germany, and found that a one percentage point increase in childcare slots led to a 0.2 percentage point increase in the labor market participation rate of mothers. A study by Ilkcaracan et al. [2015] for Turkey found that expanding the early childhood care and preschool education sector creates more jobs and does so in a more gender-equitable way than an expansion in the construction sector. Similar results on the effects of expanded childcare services on mothers' labor supply are found in Berlinski and Galiani [2007], Lefebvre and Merrigan [2008], Bauernschuster and Schlotter [2015], and Eckhoff-Andresen and Havnes [2019].

The findings of these studies suggest that making childcare services more widely available can have multiple positive effects on children, parents, and society as a whole. Nevertheless, further research is needed to better understand the mechanisms through which such programs operate, and to analyze the consequences of alternative designs for expanded public childcare programs.

Evaluations of cash transfer programs show mixed results regarding their impacts on children and parents, particularly mothers. For instance, Rønsen [2009] and Hardoy and Schone [2010] found that a cash transfer program to parents of one- to two-year-olds in Norway had little effect on mothers' labor supply in the short run, and negative effects in the long run. Negative impacts on female labor force participation have also been identified in the impact evaluation of several cash transfer programs across Latin America. For example, Garganta et al. [2017] analyzed a cash transfer program in Argentina and found a negative and statistically significant effect on the labor force participation of married women. Medeiros et al. [2008] also found a reduction in the probability of labor participation among eligible women in Brazil's *Bolsa Familia* program. Similar results have been found for other countries by Ferro et al. [2010], Teixeira [2010], Scarlato et al. [2014], and D'Agostino and Scarlato [2019]. However, as shown in Molina-Millan et al. [2019], the effects of these programs on female labor participation and work hours depend on the design of the program.

The papers discussed above estimate partial equilibrium effects of increasing the public spending on public childcare services and cash transfer programs. General equilibrium effects, however, can provide crucial information and new insights for public policy discussions that partial equilibrium estimates fail to provide [Acemoglu 2010]. For one, they consider the interrelationships among the actors in the economy and hence the direct and indirect effects that could be

¹¹ The authors use the term gender ideologies to denote individuals' level of support for the division in paid and unpaid care work based on the belief in multiple gendered separate spheres.

generated. The CGE method also enables us to assess both the short- and long-run macro and meso-economic effects of different shocks within a framework of analytical consistency that alternative methods do not allow.

4. Model and data

In this section, we present a brief description of GEM-Care Colombia and its database. A detailed presentation of GEM-Care Colombia, including its variables and equations, is given in Cicowiez and Lofgren [2022].¹²

4.1. Model

GEM-Care is a gendered dynamic recursive CGE model designed for policy analysis at the country level, with a special focus on issues related to the care economy.¹³ Apart from the gender- and care-related aspects, which will be discussed next, the bulk of the structure of GEM-Care is similar to that of other CGE models: it is a system of non-linear equations that is solved numerically providing an economy-wide and multi-sectoral representation of the real sphere of the economy, with the bulk of the data derived from a base-year social accounting matrix (SAM). The equilibrium aspect of the model refers to the fact that, under each solution, agents are assumed to have reached “optimal” decisions, meaning that, subject to budget constraints, producers and consumers maximize profits and utility, respectively, while government decisions respect a set of rules such as, for example, to tax on the basis of policy-determined rates and to make sure that spending and receipts, including borrowing, are equal. Similarly, the economy is assumed to operate under a budget constraint in its dealings with the rest of the world (represented by the balance of payments). Prices play a key role in market allocation, making sure that, in the context of government policy interventions and international trade, the quantities supplied and demanded (including stock changes) are equal. Production and household consumption are modelled using constant-elasticity-of substitution (CES) and linear-expenditure-system (LES) functions, both of which permit adjustments in response to changes in prices and wages, the sizes of which depend on elasticity values. Similarly, in foreign trade, buyer choice between imports and purchases of domestic output are covered by CES functions (in this context called Armington functions) while constant-elasticity-of-transformation (CET) functions are used to capture producer decisions about the allocation of output between exports and domestic sales.

¹² Documentation of a similar model in English is available on request from the authors.

¹³ GEM-Care is an extension of GEM-Core [Cicowiez and Lofgren 2017] which, in turn, takes elements from Lofgren et al. [2013] and Lofgren et al. [2002]. GEM-Care, like other CGE models, can be classified as a multipurpose model. That is, although it focuses on the care economy, it can be used to analyze, with a gender perspective, a broad range of issues for which CGE analysis is typically relevant.

As is the case for most CGE models, the dynamics of GEM-Care is recursive: actors are assumed to be myopic, making decisions based on data for the current year, which are influenced by past decisions. The model is appropriate for medium- to long-run analysis of shocks that have significant repercussions beyond the sector or household that is affected directly. GEM-Care also has the ability to capture links between different parts of an economy such as those between production sectors via intermediate demands, or between household incomes (from production) and household demand with feedback on production.

The model incorporates several aspects of gender in general and of the care economy in particular. We highlight here the model's key features. First and most importantly, the model disaggregates production activities, including their use of labor, into GDP and non-GDP, the latter being represented by household services that are produced for own consumption (referred to as household services in the rest of the paper).¹⁴ These services are further disaggregated into childcare, elder care, and other domestic work. The inclusion of these non-GDP activities makes it possible to examine how they are impacted by government policies and other types of shocks. GDP activities, market and non-market, refer to activities whose output are part of GDP; among these, the non-market GDP segment are the activities for which the bulk of demand and supply is driven by government decisions.

If both the GDP sphere and the non-GDP household sphere produce services that meet similar needs (for example childcare), households face a choice—services from these different sources are treated as imperfect substitutes.¹⁵ Similarly, in all production activities, whether GDP or non-GDP, male and female labor are treated as imperfect substitutes. Apart from working in GDP and non-GDP production, men and women allocate time to leisure and self-maintenance, the latter being exogenous.¹⁶ Persons who are defined as “unemployed” (a concept related to GDP work) allocate their time to activities other than GDP production.

Figure 3 shows the technology that determines the level of GDP production activities in GEM-Care Colombia. At the top, a Leontief (fixed coefficient) function combines aggregate value added (generated by factors of production, most importantly labor and capital) and intermediate inputs in fixed proportions. The next level shows that aggregate value added is generated by aggregate labor and capital using a CES function. At the bottom level, male and female labor are combined to generate the labor aggregate. The CES functions permit the proportions between the different factor inputs to change in response to changes in wages and rents. For household services, the structure is much easier since the only input is male and female labor. In other words, we assume that the production

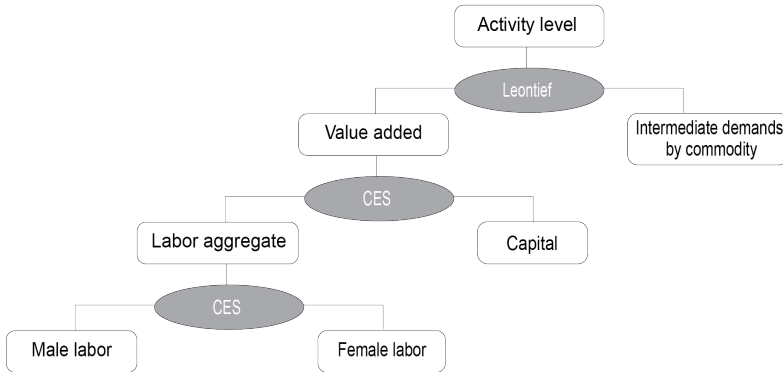
¹⁴ It should be noted that the disaggregation to which we refer depends on the specifics of the database, which are discussed in Section 4.2.

¹⁵ In particular, households face a choice between own production and drawing on domestic help (for care and other domestic work) and/or childcare centers to meet some of their service needs.

¹⁶ Leisure includes time spent on socializing, sports, religious practices, and cultural activities. Self-maintenance is the time spent on activities necessary for sustained functioning such as sleeping, hygiene, eating, and drinking.

of unpaid care work services does not use capital and intermediate inputs.¹⁷ Implicitly, the use of intermediate inputs in the production of non-GDP services is recorded as household consumption.¹⁸

FIGURE 3. Production technology in GEM-Care Colombia



Source: Authors' elaboration.

Figure 4 summarizes the treatment of household consumption in GEM-Care Colombia. Taking prices and wages as given, each household is assumed to maximize utility, represented by a two-level nesting of utility functions, Stone-Geary (which generates LES demand functions) at the top and CES at the bottom. The diagram indicates that, at the top, the household makes a choice across four items: (a) an aggregate of household services and their GDP substitutes, (b) other goods and services, and (c) male and female leisure (treated as separate items). The bottom of the diagram shows the composition of care services, which is determined by allowing for (imperfect) substitution between services provided by the household itself, the market, and the government (non-market). Consequently, if market-provided care services become cheaper or if the government increases the provision of free care services, households will reduce the time they spend on unpaid care services.

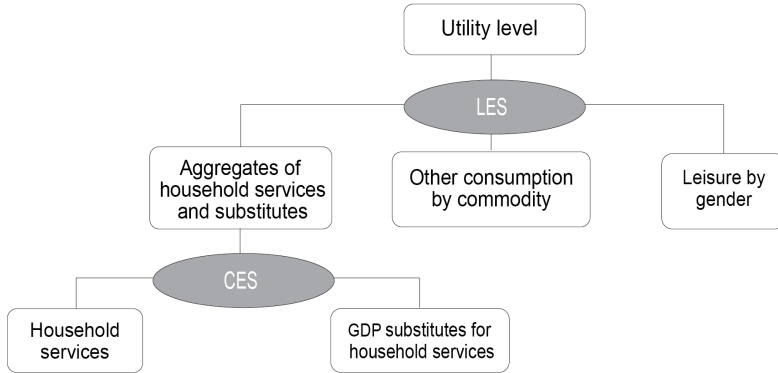
GEM-Care Colombia also models government income sources (for example taxes) and expenditures (for example public provision of care services) as policy instruments that can be used to design counterfactual scenarios. Importantly, unlike other CGE models, GEM-Care Colombia brings attention to alternative sources of financing for government spending, including domestic and foreign government borrowing.

¹⁷ This assumption is made due to lack of data and information.

¹⁸ If data on non-labor input use for household service production were available, the technology would be adjusted to take on the more complex structure shown in Figure 3.

In summary, GEM-Care Colombia can serve as a “laboratory” in which controlled experiments can be conducted. For example, we can examine what would happen if the Colombian government introduced a subsidy to the private provision of care services that is financed in a specified way while keeping everything else (including other public policies) unchanged. By comparing the before and after situations, we can then identify (and quantify) (a) the expected effects of such a policy intervention, and (b) the relative importance of the different macro and meso transmission channels of the policy intervention.

FIGURE 4. Household consumption in GEM-Care Colombia



Source: Authors' elaboration.

4.2. Data

GEM-Care Colombia is calibrated to a 2017 SAM that incorporates the unpaid care work.¹⁹ The SAM building process is described in detail in Cicowiez et al. [2022].²⁰ The disaggregation of the SAM is shown in Table 2. The production is disaggregated into 76 activities and outputs, 22 of which count as part of GDP. Among the services with imperfect GDP and non-GDP substitutes, it distinguishes between childcare, elderly care, and other domestic services. The households are split into six representative types based on location (rural or urban) and care needs: (i) working-age head (15-64 years old) without children under six, (ii) working-age head with children under six, and (iii) non-working-age head (more than 64 years old). The production activities demand, and the households supply six types of labor categories, split by gender (male and female) and education level (primary, secondary, and tertiary education).

¹⁹ At the time of writing, 2017 was the latest year with all the information required to build a gendered and care-extended Colombian SAM available.

²⁰ As part of the building of the SAM, it was necessary to estimate the monetary values of time used in the different production activities and leisure. The time spent in GDP production was valued on the basis of official statistics while the valuation of household service time was based on the input-based replacement cost method used by DANE, i.e., the imputed wages were set equal to the wages earned by those working in the GDP care services. Leisure time was valued on the basis of the opportunity cost defined as the market wage of the person enjoying the leisure.

TABLE 2. Disaggregation of GEM-Care Colombia

Sectors (activities and commodities)	<i>Agriculture and industry (8)</i>
	agriculture; mining; food industry; textiles; petrochemical; metals and metallic products; construction; other industry
	<i>Services, GDP (14)</i>
	trade; hotels and restaurants; transport; professional services; support services; public administration; private basic education; private other education; public basic education; public other education; health; elderly and disabled; domestic services; other services
	<i>Services, non-GDP* (18)</i>
	child care (6); elderly care (6); other (6)
	<i>Leisure (36)</i>
	by household (6) and labor category (6)
Factors (10)***	Labor, male by education level (primary, secondary, and tertiary) (3)
	Labor, female by education level (primary, secondary, and tertiary) (3)
	Capital, private
	Capital, government
	Land
	Extractive
Institutions (6)**	<i>Households (6)</i>
	working age with children; working age without children; elderly (rural and urban)
	Enterprise
	Government
	Rest of the world
Taxes and subsidies (4)	Tax, activities
	Tax, commodities
	Tax, imports
	Tax, income
	Subsidies, commodities
Distribution margins (3)	Trade and transport margins, domestic
	Trade and transport margins, imports
	Trade and transport margins, exports
Investment (3)	Investment, private
	Investment, government
	Investment, change in inventories

*Non-GDP activities and commodities are disaggregated by household.

**The institutional capital accounts are for domestic non-government (aggregate of households and enterprises), government, rest of the world, and the financial institution.

Source: Authors' elaboration.

In addition to the SAM, the GEM-Care Colombia database includes a set of elasticities data and data on time use.²¹ The elasticities are used to model substitutability in production and household consumption as well as decisions related to foreign trade. The production and consumption elasticities indicate the ease with which a production factor or commodity (good or service) can be replaced by another in response to relative price changes in the context of the production and consumption structures shown in Figures 3 and 4; the trade elasticities determine the ease with which (a) domestic output can be switched between exports and domestic sales (CET elasticities) and (b) domestic demand can be switched between purchases of imports and domestic output.

As is typical of CGE analysis, while these elasticities draw on the results from econometric analysis, the specific values used are based on analyst judgement. In our case, the elasticities that matter most are those related to the substitution between male and female labor in the value-added functions, both in household services and GDP production. These elasticities, which may be influenced by government policies, are related to social norms regarding the roles of men and women in production inside and outside the home. Given their importance, we test the sensitivity of key results to the values of these elasticities.²²

It should be noted that, in GEM-Care Colombia, the distribution of household service work between men and women depends on (a) the information recorded by the ENUT regarding the time spent by women and men on these activities, and (b) the elasticities of substitution between female and male labor in these activities.

The time use data are summarized in Figure 5, which shows the total annual time spent by men and women in GDP and non-GDP activities in 2017. It shows that women predominate in non-GDP activities (contributing 78 percent of the total labor time) while men predominate in GDP activities (contributing 63 percent of the total labor time). Overall, the unpaid care work in 2017 is valued at 20.2 percent of GDP.²³

Figures 6 and 7 summarize the data on wages and GDP employment, respectively. Figure 6 shows the average hourly wages of women and men in 2017 by aggregate sector, indexed to a value of one for male work in agriculture. It should be noted that, for household services, wages and incomes are imputed on the basis of the GDP wages of care work whereas leisure is valued on the basis of the opportunity cost, defined by the market wage of the persons who enjoy the leisure. The normalized hourly wages of male and female domestic workers are 1.3 and 0.9, respectively. In turn, the normalized hourly wages of male and female unpaid caregivers are 1.3 and 1.2, respectively. In general, the estimated wage differentials between men and women employed in GDP activities are

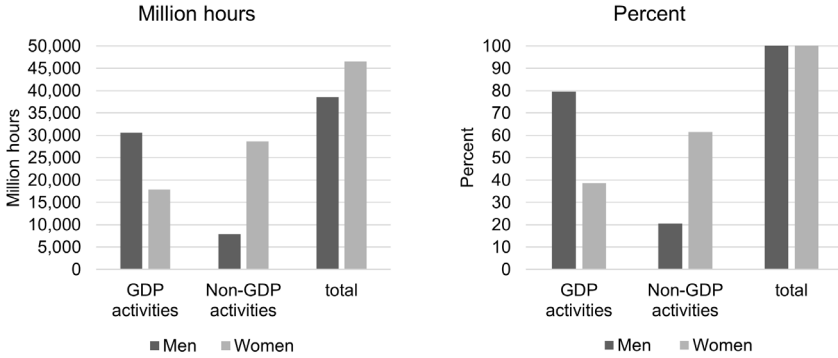
²¹ The elasticities used are provided in Table B.1 in Annex B.

²² The results are reported in Annex A.

²³ These statistics are similar to the estimates in the household production satellite account prepared by DANE (DANE [2021]).

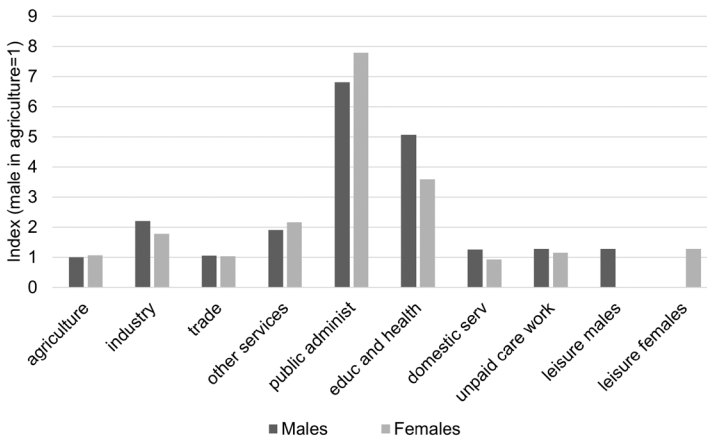
small compared to those in other Latin American countries [Centro de Estudios Distributivos, Laborales y Sociales 2021]. Consequently, the opportunity costs of leisure for men and women are also similar.

FIGURE 5. Time use for men and women (million hours and percent)



Source: Authors' calculations.

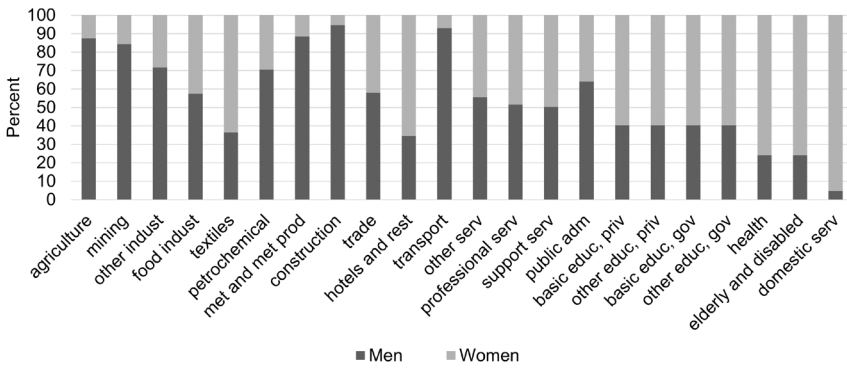
FIGURE 6. Relative wages (male wage in agriculture = 1)



Source: Authors' elaboration.

Figure 7 shows the composition of employment for GDP activities, using the full model and SAM disaggregation (shown in Table 2). The activities with the highest percentage contribution of labor (work hours) by women are domestic service, health, hotels and restaurants, textiles, and education. These are the sectors that would likely benefit the most from policies promoting female employment.

FIGURE 7. Gender composition of labor demand in GDP activities (percentage)



Source: Authors' elaboration.

5. Simulations

In this section, we use GEM-Care Colombia to analyze the various care policy options discussed in Section 3. First, we generate a base or business-as-usual scenario that projects the growth of the Colombian economy until 2030. The base scenario is generated under the assumption that existing policies in the base-year remain unchanged. Second, we show results for non-base scenarios that simulate the impact of three policies: i) the introduction of a subsidy for childcare services provided by the market, ii) an increase in public provision of childcare services, and iii) cash transfers from the government to households with children. In the first case, we also consider three financing alternatives. Drawing on the simulation results, we assess the impact of these three policies with a focus on time use, macroeconomic indicators, household consumption, and sectoral output.

5.1. Policy scenarios

The policy scenarios we consider are described in Table 3. In all cases, we assess the impact of different policy options that benefit households with children under six. The first three scenarios assess the impact of introducing a subsidy to childcare services provided by the market and financed in different ways. In the scenario *sub-tx*, the additional government spending is financed by an increase in income (or direct) taxes on households and enterprises. For *sub-inv*, the additional government spending is financed by a reduction in government investment in basic infrastructure (for example roads) which, in the absence of other changes, has a negative impact on the overall total factor productivity (TFP). In the scenario *sub-ef*, the additional government spending is financed by reduced government consumption which is assumed to be accompanied by an increase in government efficiency, making it possible to provide the same volume of government services in spite of this consumption cut.

In the scenario *gsupply*, the public provision of childcare services is increased. This is modeled in GEM-Care Colombia as an in-kind transfer from the government to households with children. Finally, the scenario *trnsfr* simulates an increase in cash transfers from the government to households with children. This scenario is based on the government program *Ingreso Solidario* that started in April 2021 and ended in December 2022 [Gallego et al. 2021].²⁴ In the *gsupply* and *trnsfr* scenarios, the increase in public spending is also financed by increases in income taxes paid by households and enterprises.

In all five scenarios, the increase in government spending during 2022-2030 period is equivalent to 0.5 percentage points of the base GDP. All scenarios (including the base) are identical during the 2017-2021 period. Moreover, the increase in government spending is assumed to be distributed among households (urban and rural) in proportion to the number of children. None of the scenarios directly benefits households with no children.

TABLE 3. Description of the non-base policy scenarios

#Name	Description
1 subtx	Childcare subsidy equivalent to 0.5 percentage of base GDP during 2022-2030 financed with income tax on households and enterprises <i>Same as sub except...</i>
2 sub-inv	...financed with reduced government investment in infrastructure
3 sub-ef	...financed with increased government efficiency
4 gsupply	Increase in government provision of childcare services equivalent to 0.5 percentage of base GDP during 2022-2030 financed with income tax on households and enterprises
5 trnsfr	Transfer to households with working head and children equivalent to 0.5 percentage of base GDP during 2022-2030 financed with income tax on households and enterprises

Source: Authors' elaboration.

5.2. Simulation results

5.2.1. Changes in time use patterns of women and men

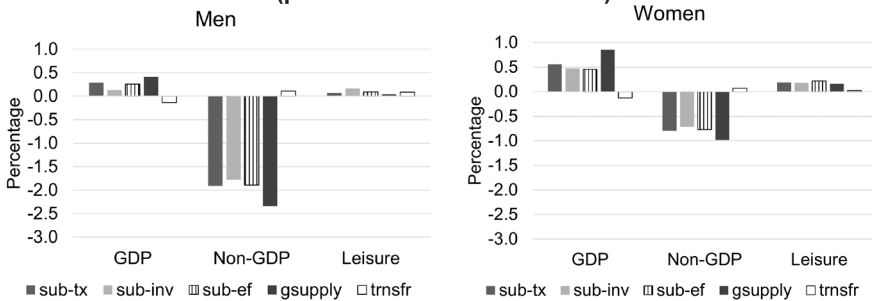
Regardless of the source of government funding, a reduction in the cost of market-provided childcare services (scenarios *sub-tx*, *sub-inv*, and *sub-ef*) encourages female GDP work. This is due to the fact that the services that are encouraged—GDP care—are intensive in female labor at the same time as the services that are discouraged—non-GDP care—also are intensive in female labor. As shown in Figure 8, women increase their time in GDP work by 0.5 to 0.6 percentage, depending on the financing source, as well as their leisure time. The growth in

²⁴The program *Ingreso Solidario* was a cash transfer provided by the national government to households living in poverty, extreme poverty, and economic vulnerability to mitigate the impact of the emergency caused by COVID-19.

paid employment is larger for women than for men. In 2030, the number of full-time jobs (40 hours per week) for men and women increases by around 52,000 and 62,000, respectively. The results are qualitatively similar when we simulate an increase in the public provision of childcare services (*gsupply*). However, the magnitude of the effects is larger because public provision of childcare services is more labor intensive than private provision of childcare services. In other words, for the same increase in government spending, the increase in (female) labor demand is larger for *gsupply* scenario than for the *sub-* scenarios. As a result, for this scenario, women increase their time in market (GDP) work by 0.9 percent (Figure 8).

Under the scenario *trnsfr*, which involves providing a cash transfer to households with children, the effect is a reduction in the time spent by women in GDP work by 0.13 percent and an increase in their time spent on household service by 0.07 percent. The changes are similar for men. The cash transfer allows households to increase their GDP consumption even though they work fewer hours in GDP production—this is due to the income gain from the cash transfer being larger than the income loss due to less GDP work. In addition, men especially, but also women, increase their leisure time. These overall results are mainly due to changes in the time use in households with children under six years of age.

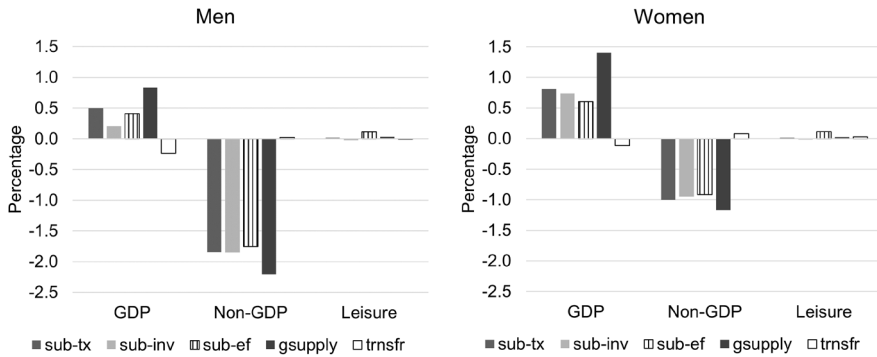
FIGURE 8. Policy scenario 5 changes in time use for men and women in 2030 (percent deviation from base)



Source: Authors' calculations.

The left and right panels of Figure 9 show changes in labor income for men and women, respectively. The results are consistent with the preceding discussion. Thus, for the first three scenarios (*sub-tx*, *sub-inv*, and *sub-ef*), we see the increase in the labor income of women who increase their working hours in GDP activities. At a disaggregated level, the largest increase is for work in care activities included in the GDP. Consequently, the imputed income from household service work decreases for both men and women.

FIGURE 9. Policy scenario-induced changes in labor income for men and women in 2030 (percent deviation from base)



Source: Authors' calculations.

5.2.2. Impact on macroeconomic indicators

For the first three scenarios (*sub-tx*, *sub-inv*, and *sub-ef*), the increase in the subsidy on childcare services purchased in the market leads to substitution away from care services produced within the household. Consequently, household labor income and total household income increase. Figure 10 shows the impacts on private (or household) GDP consumption (panel a), and private GDP and non-GDP consumption (panel b). As indicated, for all three scenarios, private GDP consumption increases compared to the base. However, the size and timing of the increase is influenced by the financing source: except initially, the strongest gains are realized when the source is increased government efficiency (*sub-ef*) followed by direct taxes (*sub-tx*). Financing via reduced infrastructure investment (*sub-inv*) leads to the strongest initial consumption gain but over time the gain shrinks due to the negative impact of this investment decline on TFP and GDP. Figure 5.3 also shows the results for the scenarios *gsupply* and *trnsfr*. For *gsupply*, the addition to the government supply of childcare leads to stronger gains in GDP work, both for men and women, generating higher income gains, something that also is reflected in higher gains in private consumption and investment. For *trnsfr*—a government increase in transfers to households with working-age heads and children financed by an increase in direct taxes—private consumption increases initially but falls below the base towards the end of the simulation period.

The resulting effect on private investment is negative due to the crowding out effect on private investment generated by the increase in income tax (Figure 11). This reduces the stock of private capital and consequently, GDP. The preceding discussion has focused on private GDP consumption, the standard measure of private consumption in economic analysis. Thanks to the extension of our analysis to cover household service production, we also simulated the impact on total private consumption, also including the consumption of household services. As shown in Figure 10b, total private consumption increases in all five scenarios, including the scenario *trnsfr*, which records higher consumption throughout the simulation period.

Moreover, for all scenarios except *trnsfr*—that is, for all scenarios with a decline in the consumption of care services provided by the household—the consumption growth gains compared to the base are considerably lower.

Interestingly, given that the scenario *trnsfr* does not lead to a reallocation of time in favor of activities included in GDP, the tax base of the income tax does not increase. Consequently, the tax collection effort required to finance this scenario is greater than in the first three policy scenarios.

FIGURE 10a. Private GDP consumption by scenario and year (percent deviation from base)

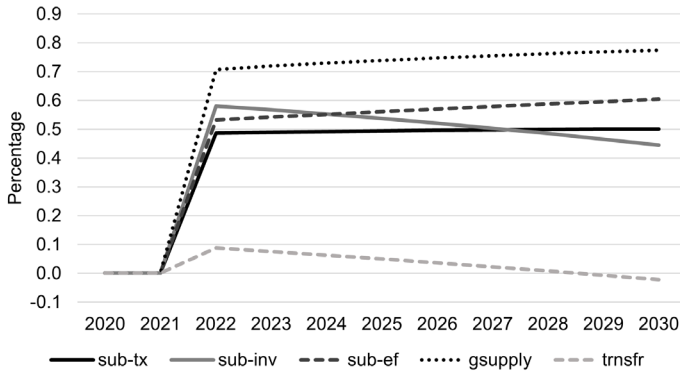
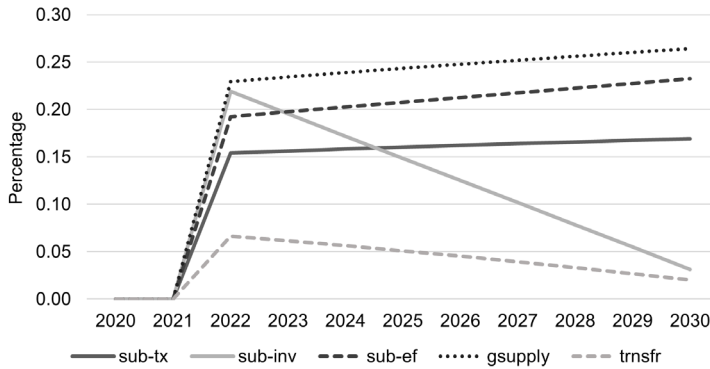


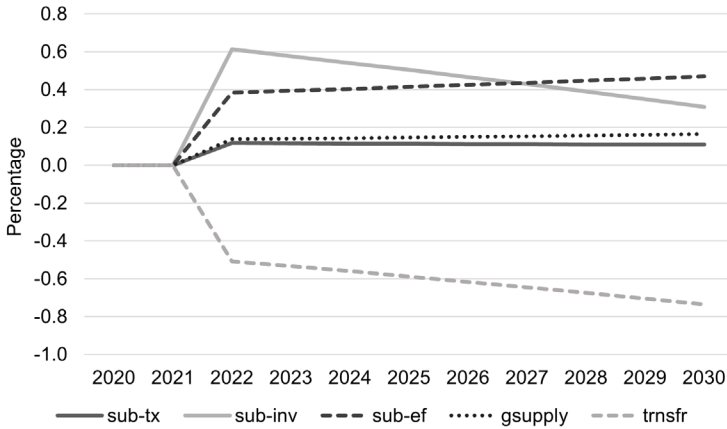
FIGURE 10b. Private GDP and non-GDP consumption (goods and services in GDP and non-GDP) by scenario and year (percent deviation from base)



Source: Authors' calculation.

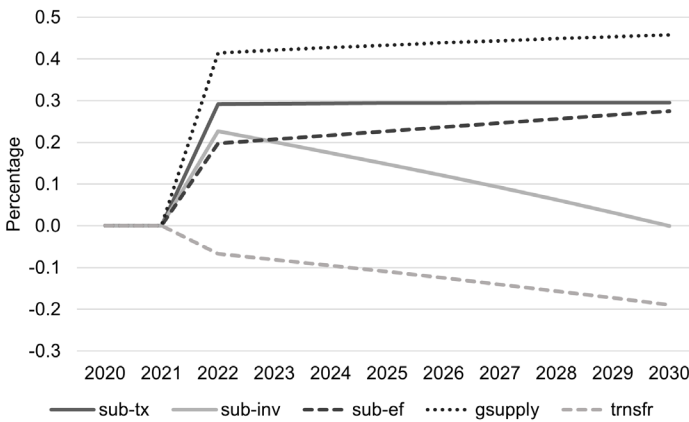
Figure 12 shows the impacts on GDP. In all scenarios except *trnsfr*, the production of GDP care services increases. However, the forward and backward linkages of the childcare sector (private and public) are relatively small since it uses few intermediate inputs and is not an important intermediate input in other production activities. Consequently, the impact on the growth of non-care sectors is relatively small. In the case of the *trnsfr* scenario, the output of all GDP activities decline due to a switch in labor time from GDP to non-GDP productive activities.

FIGURE 11. Private investment by scenario and year (percent deviation from base)



Source: Authors' calculation.

FIGURE 12. GDP by scenario and year (percent deviation from base)



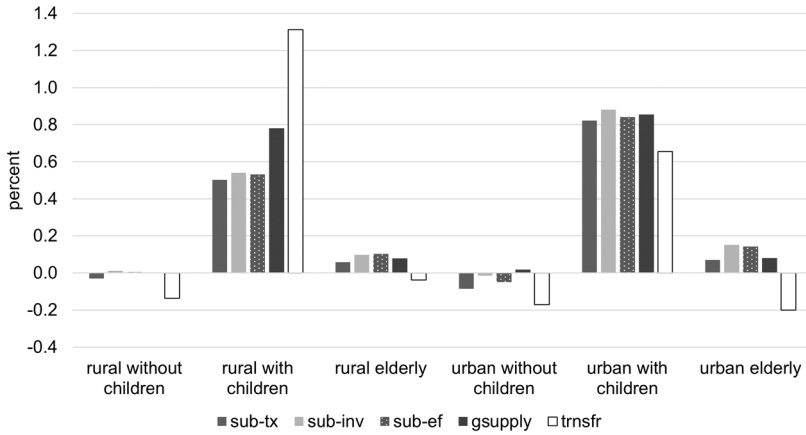
Source: Authors' calculation.

5.2.3. Distributional impacts across households

We next focus on the changes in total household consumption for each of the six representative households in GEM-Care Colombia (Figure 13). In the *trnsfr* scenario, only households that receive the cash transfer (i.e., households with a working-age head and children under six) increase their consumption of both GDP and non-GDP goods and services. In all scenarios, we see positive welfare effects on all households with children. However, we see that the positive welfare effect is stronger for urban households with children compared to rural households with children. This is explained by the fact that urban households with children have considerably higher expenditures on market-provided childcare services and

therefore benefit more from the subsidy. In all scenarios except *sub-ef*, households without children experience a welfare loss as a result of the increase in their tax burden (scenarios *sub-tx*, *gsupply*, and *trnsfr*) or the reduction in public investment in infrastructure (scenario *sub-inv*). However, for the scenario *sub-ef*, the welfare gain for households without children is due to the efficiency gain—their welfare gain would have been stronger if the efficiency gain would have been used for some other purpose such as an increase in public infrastructure investment.

FIGURE 13. Household total (GDP and non-GDP) consumption by representative household type in 2022 and 2030 (percent deviation from base)



Source: Authors' calculation.

6. Conclusion

In recent decades, Colombia has made significant strides in achieving gender equality in its labor market. The country has undergone significant social, economic, and demographic changes. Women's participation in the workforce has increased substantially, reaching levels comparable to high-income countries. Despite this progress, a gender-based participation gap still persists. Women's participation rate in Colombia remains lower than men's, even though women tend to have higher levels of education. Additionally, Colombia faces a high rate of female unemployment compared to the regional average in Latin America. Persistent inequalities in unpaid care work present a major obstacle to continued progress, especially in the labor market.

Economic models typically fail to consider gender in labor markets and issues related to care work, rendering them unsuitable for analyzing the impact of economywide policies addressing care and gender equality in Colombia and other contexts. To address this shortcoming, this paper develops a care-extended CGE model calibrated to the Colombian context, including a pioneering social accounting matrix with labor disaggregated by gender, and extensions covering

unpaid childcare and domestic work. Using the model, we perform simulations designed to analyze and compare the impacts of equal increases in government spending on three policies: i) the introduction of a subsidy for childcare services provided by the market, ii) an increase in public provision of childcare services, and iii) cash transfers from the government to households with children.

The results show that subsidies for private childcare lead to an increase in women's time spent in market work by 0.5 percent to 0.6 percent, depending on the financing source, as well as an increase in their leisure time. The growth of paid employment for women is larger than the employment growth for men since care services are relatively female-labor intensive. For the public provision of childcare, the results are qualitatively similar to the subsidies for private childcare, but the magnitude of the effects is somewhat larger because public provision of childcare services is more labor-intensive than private provision. In this scenario, women increase their time in GDP activities by 0.9 percent. The findings of this research align with previous literature on the impact of government actions in support of childcare, in particular its positive impact on women's participation in the labor market (Berlinski and Galiani [2007]; Lefebvre and Merrigan [2008]; Staab and Gerhard [2010]; Bauernschuster and Schlotter [2015]; Eckhoff-Andresen and Havnes [2019]; Müller and Wrohlich [2020]).

In contrast, the cash transfers to households with young children reduce the time spent by women on market work by 0.13 percent while increasing their time spent on unpaid domestic and care work by 0.07 percent. The changes are similar for men. Men and women both increase their leisure time, with men showing a greater increase. The results are consistent with the evidence of cash transfer programs: while they may alleviate some household constraints, they can have negative impacts on women's labor supply (Medeiros et al. [2008]; Rønsen [2009]; Hardoy and Schone [2010]; Teixeira [2010]; Scarlato et al. [2014]; Garganta et al. [2017]).²⁵ However, the unintended increase in unpaid care work resulting from cash transfer programs could be avoided if the program is accompanied by additional measures, such as workforce-training or mentoring to improve their capabilities and skills for entering the labor market. Another option is to make the cash transfers conditional on enrolling children in early education programs, for business start-up and growth or for search assistance and finding work [Baird et al. 2018].

Overall, policies aimed at supporting families with children need to be carefully designed to mitigate potential unintended consequences. The results of this study show that policies that expand the care infrastructure or reduce the cost of childcare services can have positive employment effects, particularly by increasing the labor force participation of women. However, gender-based occupational segregation remains a persistent issue, and complementary labor policies such as training and increased wages in female-labor dominated

²⁵ These results should be treated with caution, however, since the impact on women's employment depends on the design of the cash transfer program and in some cases, can be positive [Molina-Millán et al. 2019].

occupations, including childcare work, can help reduce this. To avoid the potential negative effects of cash transfers on women's labor market participation and the increase in unpaid care work, it is crucial to design cash transfer programs in a way that incentivizes women's labor participation (Salehi-Isfahani and Mostafavi-Dehzoeei [2018]; Mostert and Castello [2019]; Fruttero et al. [2020]). For instance, the implementation of cash transfer programs that specifically target economically disadvantaged women actively participating in the labor market, whether in formal or informal sector, has been shown to have a positive impact on and increase female labor force participation rates [World Bank 2017]. Additionally, providing intensive skills training alongside cash transfers has also been found to yield positive impacts on labor [Baird et al. 2018].

Finally, our results suggest that policymakers need to recognize and promote the redistribution of unpaid care work within households to transform social beliefs and norms about gender roles. This shift in societal values requires recognition of the vital role that care work plays in our economies and societies.

Acknowledgments: Alan Gomez, Ana Maria Granda, and Ana Pirela provided helpful research assistance. Maria Floro, Natalia Ramirez, and Paula Herrera provided helpful comments. Open Society Foundation and Projects Quanta based at Pontificia Universidad de Javeriana and Digna based at Los Andes University supported throughout the development of the paper. The findings, interpretations, and conclusions in this paper are entirely those of the authors. They do not necessarily represent the views of the institutions we work for.

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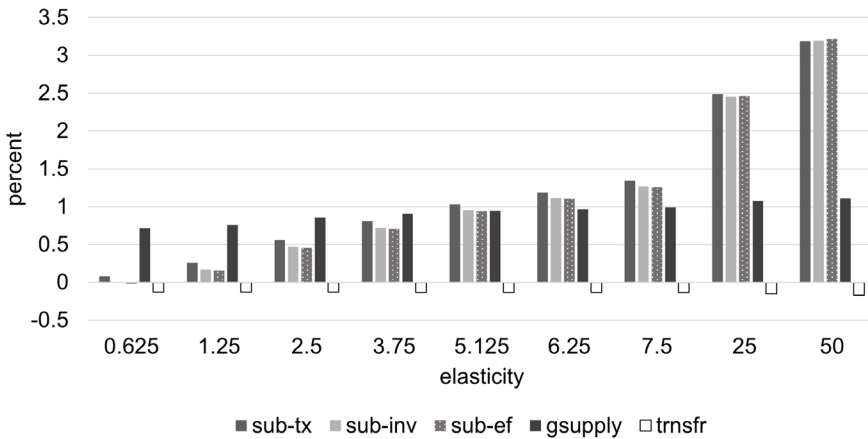
Annex A. Sensitivity analysis

Like any other CGE model, GEM-Care Colombia requires data on several elasticities. The uncertainty regarding the value of these elasticities, in this and other model analyses, implies uncertainty about simulation results. Consequently, it is important to analyze the sensitivity of key results, in this analysis, the level of female GDP work, to selected parameter values. On an a priori basis, the following elasticities were singled out as having the strongest impact on the strength of the links between shocks affecting childcare services and female GDP work:

(a) substitution between GDP and non-GDP in the consumption of domestic and care services; and (b) substitution between male and female labor in both GDP and non-GDP production. Figures A.1 and A.2 show how the size of the change in female GDP work is affected by changes in these three elasticities: consumption elasticity (Figure A.1), and both labor substitution elasticities together (Figure A.2).

Figure A.1 shows the relation between the elasticity of substitution between GDP and non-GDP services in consumption and female labor supply to GDP activities. The subsidy (*sub*) and *gsupply* scenarios promote the consumption of GDP care services, which are intensive in the use of female labor. At the same time, reduced consumption of home care releases female time for other uses. Figure A.1 shows that, for the subsidy scenarios, the value of this elasticity has a relatively strong impact on the female GDP labor supply. For the wide range of elasticities that are tested (from 0.625 to 50 with 2.5 as the central value, used in the paper), the changes in this supply range from close to zero to 3 percent. For the *gsupply* scenario, the impact of higher elasticities on the change in the female GDP labor supply is also positive but less strong; the increases range between roughly 0.7 and 1.1 percent. For the scenario *trnsfr*, changes in this elasticity do not matter.

FIGURE A.1. Sensitivity analysis with respect to elasticity of substitution between consumption of GDP and non-GDP services: Female time use in GDP activities in 2030 (percent change from base)

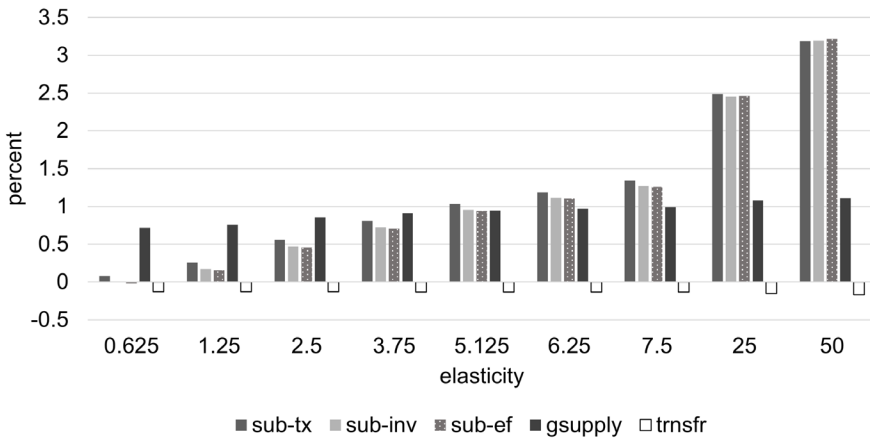


Source: Authors' calculation.

Figure A.2 shows that, for the *sub* and *gsupply* scenarios, the shift from the minimum to the maximum values of the elasticity of substitution between men and women both at home and in GDP activities (from 0.175 to 14 with 0.5 as the central value for home activities and 0.9 for GDP activities) increases female labor supply to GDP activities by a modest 0.1-0.2 percent. For the *trnsfr* scenario, a higher elasticity leads to a larger reduction in the female GDP labor supply,

from -0.1 percent to -0.2 percent. In Figure A.2, higher elasticities mean that the responses to changes in female wages relative to male wages are stronger. For the *sub* and *gsupply* scenarios, the increase in female GDP employment is due to a relative decline in female wages; for the *trnsfr* scenarios, the decrease in female GDP employment is due to a relative increase in female wages. In addition to the results reported in Figure A.2, we also tested the impact of individually changing the GDP and the non-GDP labor substitution elasticities. As expected, the changes were smaller. The results are available on request.

FIGURE A.2. Sensitivity analysis with respect to elasticity of substitution between male and female workers in GDP and non-GDP production: Female time use in GDP activities in 2030 (percent change from base)



Source: Authors' calculation.

In sum, the direction of change in female GDP work is the same across all scenarios for the wide range of elasticities that were tested. The elasticity of substitution in consumption is the key elasticity: if the elasticity is very low, home and GDP care are used in near fixed proportions, the policies that depend on responses to price incentives – the subsidy and *gsupply* scenarios—have little impact. On the other hand, if the elasticity is very high, home and GDP care are viewed as close substitutes and a decline in the relative price of GDP care leads to a substantial switch in care demand from the home to GDP production, reducing demand for female work at home but increasing demand in the GDP labor market since GDP care is intensive in female labor. The sensitivity analysis results indicate, from a policy perspective, the need to better understand the determinants of these elasticities. With regard to the elasticities for male-female labor substitution, the impact of changing the values is very small. The reason is that, for these elasticities to matter, relative wages of male and female labor have to change. However, the scenarios examined in this paper yield impacts on the labor market that are too small to have any strong differential impact on male and female wages.

Annex B. Elasticities

The elasticities used are provided in Table B.1. They were defined on the basis of the literature and authors' assessments, drawing on a combination of econometric evidence and experience from similar country applications.

TABLE B.1. Labor, value-added, trade, and consumption elasticities

Sector	Labor	VA	Armington	CET	LES-price	Cons-Source
Agriculture	0.9	0.25	2	2	-1	n.a.
Mining	0.9	0.2	2	2	-1	n.a.
Other industry	0.9	0.95	1.5	1.5	-1	n.a.
Food industry	0.9	0.95	1.5	1.5	-1	n.a.
Textiles	0.9	0.95	1.5	1.5	-1	n.a.
Petrochemical	0.9	0.95	1.5	1.5	-1	n.a.
Metals and metallic products	0.9	0.95	1.5	1.5	-1	n.a.
Construction	0.9	0.95	0.9	0.9	-1	n.a.
Trade	0.9	0.95	0.9	0.9	-1	n.a.
Hotels and restaurants	0.9	0.95	0.9	0.9	-1	n.a.
Transport	0.9	0.95	0.9	0.9	-1	n.a.
Other services	0.9	0.95	0.9	0.9	-1	n.a.
Professional services	0.9	0.95	0.9	0.9	-1	n.a.
Support services	0.9	0.95	0.9	0.9	-1	n.a.
Public administration	0.9	0.95	0.9	0.9	-1	n.a.
Basic education, private	0.9	0.95	0.9	0.9	n.a.	n.a.
Other education, private	0.9	0.95	0.9	0.9	-1	n.a.
Basic education, government	0.9	0.95	0.9	0.9	n.a.	n.a.
Other education, government	0.9	0.95	0.9	0.9	-1	n.a.
Health	0.9	0.95	0.9	0.9	-1	n.a.
Elderly and disabled	0.9	0.95	0.9	0.9	n.a.	n.a.
Domestic services	0.9	0.95	0.9	0.9	n.a.	n.a.
Child-care, non-GDP	0.5	n.a.	n.a.	n.a.	n.a.	n.a.
Elderly care, non-GDP	0.5	n.a.	n.a.	n.a.	n.a.	n.a.
Other care, non-GDP	0.5	n.a.	n.a.	n.a.	n.a.	n.a.
Composite, child care	n.a.	n.a.	n.a.	n.a.	-0.50	1.50
Composite, elderly care	n.a.	n.a.	n.a.	n.a.	-0.50	1.50
Composite, other care	n.a.	n.a.	n.a.	n.a.	-0.50	1.50
Leisure, male	n.a.	n.a.	n.a.	n.a.	-0.85	n.a.
Leisure, female	n.a.	n.a.	n.a.	n.a.	-0.85	n.a.

Notes:

Labor is CES function between male and female labor.

VA is CES value-added function.

Armington is CES aggregation function for domestic demand (elasticities of substitution between imports and domestic output).

CET is Constant Elasticity of Transformation function for domestic output (elasticities of transformation between exports and domestic supply).

LES is Linear Expenditure system (own-price elasticities of household consumption) for the household.