Gender & Development

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cgde20

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To cite this article: Mónica Orozco, Javier Franco, Melanie Marchant & Rodrigo Valdivia (2022) The role of care and the local economy in women's labour force participation: evidence from Mexico and Colombia in the pandemic era, Gender & Development, 30:1-2, 145-175, DOI: 10.1080/13552074.2022.2066816

To link to this article: https://doi.org/10.1080/13552074.2022.2066816

Published online: 31 Aug 2022.

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GENDER & DEVELOPMENT
2022, VOL. 30, NOS. 1–2, 145–175
https://doi.org/10.1080/13552074.2022.2066816

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ABSTRACT

Women face disproportionate care burdens on their time because of traditional gender roles, lack of public policies supporting them and the lack of government services for satisfying society's care needs. This unequal distribution of care responsibilities reduces their opportunities to fully participate in labour markets. We argue that all else equal, women's physical proximity to affordable care services is key to determining their accessibility to them. In addition, services may have different effects on women's labour force participation (LFP), depending on their care responsibilities and other characteristics of their social and economic local conditions, such as size and type of economic output. We use geospatial analysis to explore the relationship between the local supply of care services and women's LFP. We use the population census and the intercensal population survey of Mexico, together with data from economic censuses and directories of care and financial services. We also develop an exploratory data analysis model for the Colombian case. We find that, given gender roles in care provision and women's accessibility to economic sectors, the supply of care services and the type of local economies are quite significant in determining their LFP, regardless of their educational level. Accordingly, mere investment in care services may not be enough since the economic output and type of activities also interfere with LFP. Besides, this effect increased considerably during the COVID-19 pandemic.

Les femmes sont confrontées à des travaux de soins disproportionnées en raison des rôles de genre traditionnels, du manque de politiques publiques et de la fourniture de services gouvernementaux pour répondre aux besoins de soins. Cette répartition inégale des responsabilités familiales réduit leurs possibilités de participer au marché du travail et dans d'autres domaines. Notre approche anticipe que la proximité territoriale des services de soins est essentielle pour déterminer leur accessibilité. En outre, les services peuvent avoir des effets différents sur la participation des femmes au marché du travail, en fonction de leurs responsabilités familiales et d'autres caractéristiques de leur environnement social et économique, telles que la taille et le type de production économique. Nous utilisons l'analyse géospatiale pour explorer la relation entre l'offre locale de services de soins et la participation professionnelle des femmes. Nous utilisons le recensement de la population et l'enquête démographique intercensitaire du Mexique, ainsi que les données des

KEYWORDS

Women's labour supply; care work; geospatial analysis; labour market; economic sectors

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recensements économiques et des répertoires d'attention et de services financiers. Nous avons également développé un modèle d'analyse exploratoire des données pour le cas de la Colombie. Nous constatons que, compte tenu des rôles de genre dans la prestation de soins et de la ségrégation des femmes dans les secteurs économiques, l'offre de services de soins et le type d'économies locales sont très importants pour déterminer leur participation au marché de travail, quel que soit leur niveau d'éducation. Par conséquent, le simple investissement dans les services de soins peut ne pas être suffisant, puisque la production économique et le type d'activités interfèrent également avec la participation des femmes au travail. De plus, cet effet a considérablement augmenté pendant la pandémie de COVID-19.

Las mujeres enfrentan cargas de cuidado desproporcionadas debido a los roles de género tradicionales, la falta de políticas públicas y provisión de servicios gubernamentales para satisfacer las necesidades de cuidado. Esta distribución desigual de las responsabilidades de cuidado reduce sus oportunidades de participar completamente en los mercados laborales. Nuestro enfoque prevé que dado todo lo demás constante, la proximidad territorial de las mujeres a servicios de cuidado asequibles es clave para determinar su accesibilidad a ellos. Además, los servicios pueden tener diferentes efectos sobre la participación laboral de las mujeres, según sus responsabilidades de cuidado y otras características de su entorno social y económico, como el tamaño y el tipo de producción económica. Usamos el análisis geoespacial para explorar la relación entre la oferta local de servicios de cuidado y la participación laboral de las mujeres. Utilizamos el censo de población y la encuesta intercensal de población de México, junto con datos de censos económicos y directorios de cuidado y servicios financieros. También desarrollamos un modelo de análisis de datos exploratorio para el caso de Colombia. Encontramos que, dados los roles de género en la prestación de cuidados y la accesibilidad de las mujeres a los sectores económicos, la oferta de servicios de cuidados y el tipo de economías locales son muy importantes para determinar su participación laboral, independientemente de su nivel educativo. En consecuencia, la mera inversión en servicios de cuidado puede no ser suficiente, ya que la producción económica y el tipo de actividades también interfieren con la participación laboral de las mujeres. Además, este efecto aumentó considerablemente durante la pandemia de COVID-19.

1. Introduction

Care work around the world is mainly provided by women (Organización Internacional del Trabajo 2021), mostly in the form of unpaid social and family support arrangements. This reality burdens women's time use and reduces opportunities to participate in paid work for economic empowerment, as well as their educational, social, and political participation (Folbre 2018). As care work is a key part of a household's production process (Grossbard 2015) and creates well-being for their members, women evaluate their labour decisions based on their care responsibilities and care options. For these reasons, care work is essential to understand patterns in women's labour force participation (LFP).

Besides, studies on women's participation (Apps *et al*. 2012) and time spent in paid work (López-Rodríguez and Orozco 2019) show the positive relationship of women's labour supply with the availability of child-care services, as well as positive effects on their labour incomes (Evans *et al*. 2021). Territorial variations in LFP are closely linked with inequalities in the local availability of social infrastructure for care, a correlation of 0.35 within Mexico's various municipalities. These together with the characteristics of the local economies and other factors, define local conditions that impact women's real choices and opportunities of empowerment, social mobility, and well-being.

Our research aims to reflect on these inequalities and their geospatial underpinnings. Local labour markets and care infrastructure may constitute barriers for women's employment choices, and therefore are relevant to explain LFP outcomes. Using geospatial data analysis, we highlight the importance of local approaches in policy design, keeping in view their unique local conditions. In Mexico, Rodríguez and García (2018) applied such a model, finding geospatial patterns and negative associations between time spent on all types of care such as face-to-face persons care and unpaid domestic work – with women's LFP. Using this type of approach, a study in Norway also documents the relationship between gender inequality and fertility, with schooling, labour participation, income, and access to formal child-care services as analysed variables (Arnstein *et al*. 2012).

We use geospatial analysis to study the cases of Mexico and Colombia regarding care, local economic characteristics of the municipality, and LFP. Our approach enriches previous studies of the Mexican case by introducing care services supply and characteristics of the local economies, aiming to show the important link between labour market and care policies. This model shows its potential for replicability in Colombia, but due to the limitation of data on care services, it only shows the relationship between care burdens and characteristics of local economies with LFP. These two countries have similar demographic structures, and their social organisation of care is highly dependent on women's unpaid work. Besides, they have introduced similar childcare policies for children with positive effects on women's LFP. In Mexico, they have implemented care centres (Calderón 2014), as well as in Colombia (Attanasio and Vera-Hernández 2004). The geographic scope of these policies varies along each country according to each policy targeting mechanism. Local conditions with regards to the care services, financial services, and local economies are defined using municipal data.

We analyse information from the National Population and Housing Census (CNPV, Spanish abbreviation) of Mexico, collected during the year 2020 at the height of the health and economic crisis due to the COVID-19 pandemic. This source allows us to perform geospatial analysis at the municipal level to study women's LFP in different local conditions; using different data sources, we introduce in the model the availability of care services and characteristics of the local economy. Our research shows that although child-care services are closely related to women's LFP, they are not the only relevant factor. For that, we also include the availability of financial services, considering that financial inclusion has been on the policy agenda of governments and agencies to promote entrepreneurships and self-employment (Duflo *et al*. 2013). This type of infrastructure may partially influence women's LFP through their access

to savings and credit for their own business (López-Rodríguez and Orozco 2019), Our aim is to measure the extent of this influence once care services are considered. In addition, we compare municipal estimations with the situation that prevailed in 2015 (the nearest available LFP data at the municipal level), considering the fading out of child-care services due to the cancellation of public programmes and reinforced by the pandemic.

For Mexico, we find that an additional public or private child-care service for each one thousand persons in the municipality has a positive association of 10.3 per cent in women's LFP. The spillover effects of services to neighbouring municipalities are, in general, small, possibly due to the low coverage of childcare centres in the country. We also find a positive association of LFP with the output of the tertiary sector (services), with an increase of 1.3 in LFP. In the same way, although to a lesser extent, financial inclusion is positively associated with the female labour supply, an additional access point is associated with an increase of 0.1 per cent in women's LFP. In our municipal analysis, we find a dramatic reduction in the supply of Childcare Centers (CAI, Spanish abbreviation) by year 2020, driven by federal policy decisions adopted in the previous year and the social distancing in response to COVID-19. Compared to 2015, the loss in infrastructure of CAI increases the negative effect on the LFP generate from the presence of children under 5 in the population, especially for women aged 15–34 years and adults (over 50 years), commonly the main providers of unpaid care.

In Colombia, constrained by the analysis of publicly available information prior to the start of the COVID-19 pandemic, we find similar associations reaffirming the structural inequality of opportunities for women in different latitudes.

2. Methodology

Women's time-use burdens result from the gendered division of labour and the consequent disproportionate loads of unpaid domestic and care work they face. The absence of policies articulated in a care system plays a central role in this unequal distribution; mainly impacting women from lower socioeconomic strata, who face the highest care burdens (Esquivel 2012), and who commonly lack economic resources, family and community support networks, or personal educational resources to meet their home's care needs. In general, these situations alter their choices in different dimensions of their lives, hindering their human development. At the workplace, time constraints limit their longevity and availability for full-time participation (López-Rodríguez and Orozco 2019), besides childbearing women face more discrimination (Ramírez *et al.* 2016).

This, in turn, reduces their social mobility (Mancini 2019). Throughout the life course, barriers to access to the labour market impact their economic empowerment by curbing their opportunities to generate income, acquire goods and assets, and access social security benefits (Kabeer 2018). In the long term, limited access to social security pensions upon reaching retirement age can hinder social mobility and well-being (Orozco 2020).

Paid work may be a path to economic empowerment and well-being for women in different dimensions. It can increase their capacity to make decisions and negotiate within households and communities, to manage and expand the resources they have such as time, personal capacities, and material resources (Orozco *et al.* 2016), to decrease their risk of gender-based violence or fleeing from it (Orozco 2020), and to achieve agency to overcome conditions of poverty for themselves and their families (Orozco 2018). Care systems can alleviate the negative effects of women's disproportionate burden of domestic and unpaid care work (Folbre 2006) by reducing their time use in these activities (International Labour Organization 2018) and enabling their choices, providing opportunities to participate in different fields, including work.

Care systems include formal or institutional settings and support for non-formal provision mechanisms. Formal mechanisms include policies, programmes, activities, and services of public and private provision, under the regulation of the state; while the non-formal mechanisms comprise women's unpaid work provision in their homes and their family and support networks (International Labour Organization 2018). The latter rely on women's social capital and connections (López-Rodríguez and Orozco 2019). In Mexico, a recent study by Talamas (2021) indicates that grandmothers play a key role in the care of their grandchildren. Their death has a negative impact of 27.0 per cent on the labour participation of their daughters. When the social organisation of care relies on women's unpaid work, they compensate for the lack of services that reinforce inequalities via intergenerational solidarity. Support for non-formal mechanisms is imperative within a care system to grant the right of every person to care for significant others, no matter how universal the institutional arrangements are or if unpaid care work is the result of a personal choice.

Moreover, care systems may potentially generate positive effects and social mobility for care recipients such as children (Evans *et al.* 2021), ill people, people with a disability, and older adults (Kröger 2009; Chakravarti 2018) – since these systems provide specialised resources for their care and capacity development (Orozco 2020). As well, care services can offset development deficits (Attanasio *et al.* 2021) generated by socioeconomic inequalities, in which people with fewer resources access fewer livelihood opportunities. They can also contribute by generating new sources of employment in care services within the paid labour market (ONU Mujeres and Comisión Económica para América Latina y el Caribe 2021). In brief, care systems have multipurpose effects further than women's labour and empowerment (Centro de Estudios Espinosa Yglesias 2022; Orozco *et al.* 2022), and result from co-ordination mechanisms and policies enacted from different actors. Commonly, empirical research is constrained by data limitations to assess all their possible benefits.

However, each country applies different care policies. Relative to child care, policy interventions might increase the supply of services, such as care centres and domiciliary services etc, or intervene in unpaid care strategies such as training or cash transfers for mothers or other primary caregivers. The former are effective to release women's time to increase LFP or full-time work, whereas the later might have mixed effects compromising even more women's time, reinforcing stereotypes or reducing women's opportunity cost. Therefore, policy orientations might be central to reduce inequalities and increase

women's opportunities, including labour participation (Attanasio and Vera-Hernández 2004; Calderón 2014).

Furthermore, it is worth to consider that other social and economic local conditions limit/expand women's choices, their economic empowerment and well-being, such as (Orozco 2020): (1) physical factors – geographical isolation, travel time to the workplace or basic social infrastructure, care services included; (2) labour demand or economic activity that is proxied by sector's economic output; (3) financial inclusion such as availability of ATMs, entrepreneurial loans, or saving accounts – that could help their economic empowerment (Hendriks 2019), enabling their opportunities for self-employment or entrepreneurship (López-Rodríguez and Orozco 2019); and (4) normative-institutional factors. The latter include social norms such as subjective and written – that define gender roles (Deshpande and Kabeer 2019), which, when discriminatory, prevent the resources of the state and society from being used to guarantee equal opportunities for all.

The new conditions generated by the COVID-19 pandemic exacerbated inequalities. Social distancing and shelter-in-place measures had immediate consequences on the operation of schools, child-care services, and the possibilities of paid domestic workers accessing their workplaces, increasing the burden of care for women. Besides, there was a resounding fall in the economic growth worldwide, in which Latin American countries were no exception. In Mexico, for example, such falls together with the sharp increase in domestic and care work led to a rise from 22.9 to 27.6 per cent of GDP in the value of household unpaid work (Instituto Nacional de Estadística y Geografía 2021). All over the world, unemployment and reduced hours of paid work also affected women to a greater extent, increasing gender inequality (Reichelt *et al.* 2020). Jobs in the tertiary sector, where women's share of labour is higher, were particularly affected (International Labour Organization 2021). Also, because of the pandemic, care policies were challenged to an altogether different extent as the supply of care services, either in centres or domiciliary, were temporarily or even permanently closed.

Based on data that are statistically representative of municipalities in Mexico in 2020, we estimate the relationships between female LFP and the availability of care services in different local contexts, the economic activity of the primary, secondary, and tertiary sectors, as well as services for financial inclusion (see definitions and sources in Table 1). Our approach is descriptive, we contrast our results with Mexican data for 2015 to identify changes that occurred in the relationships in the context of the COVID-19 pandemic. Likewise, we illustrate the replication potential of our approach for other countries with a case study for Colombia, based on publicly available statistical information for 2018, also at the municipal level.

We use geospatial models to consider territorial patterns of LFP and its relationship with different factors, including those that reflect women's local conditions (Orozco 2020; Orozco et al. 2021). By combining the feminist perspective of the care economy that studies care work in relation to gender dynamics (Esquivel *et al.* 2012) and the use of geo-referenced information systems (GIS), we use the available data from population and economic censuses, intercensal surveys, and registries of services – described

Table 1. Variable description

Variable	Description	Sources[a]
Mexico		
WomenLFP	Labour participation of women aged 15 and over.	CNPV 2020 and EI 2015
SchoolingWomen15	Average schooling of women aged 15 and over.	CNPV 2020 and E1 2015
ChildrenUnder5	Proportion of children aged 0–4.	CNPV 2020 and E1 2015
ChildcareCenterCAI	Childcare Centers (CAI) per 1,000 inhabitants (includes public and private services).	DENUE 2020 and 2015
AgriculturalOutput	Logarithm of million pesos of gross output in agricultural activities.[b]	CE 2019 and 2014
IndustrialOutput	Logarithm of million pesos of gross output in industrial activities.	CE 2019 and 2014
ServicesOutput	Logarithm of million pesos of gross output in service activities.	CE 2019 and 2014
ServicesOutput_5quintile	Dummy for quintile 5 of ServicesOutput	CE 2019
CAI_ServicesOutput_5quintile	CAI in municipalities with higher output of the tertiary sector. Interaction of ServicesOutput_5quintile and ChildcareCenterCAI.	CE 2019 and DENUE 2020
FinancialServInfrastructure	Financial services infrastructure.	BDIF 2020 and 2015
FinancialServicesOutput	Interaction between financial services and gross output of service activities.	BDIF 2020 and 2015
WomenAged15to19	Proportion of women aged 15–19.	CNPV 2020 and E1 2015
WomenAged20to34	Proportion of women aged 20–34.	CNPV 2020 and E1 2015
WomenAged35to49	Proportion of women aged 35–49.	CNPV 2020 and E1 2015
WomenAged50to64	Proportion of women aged 50–64.	CNPV 2020 and E1 2015
Inhabitants	Size of the municipality (thousand persons).	CNPV 2020 and E1 2015
Colombia		
WomenLFP	Labour participation of women aged 15 and over.	CNPV 2018
SchoolingWomen15	Average schooling of women aged 15 and over.	CNPV 2018
ChildrenUnder5	Proportion of children aged 0–4.	CNPV 2018
ChildcareBarriers[c]	Proportion of children from 0 to 5 years in the household without access to health services or who spend most of their time with their father or mother at work, at home alone, or are cared for by a relative under 18 years.	CNPV 2018
Inhabitants	Size of the municipality per thousand people.	CNPV 2018
AgriculturalOutput	Logarithm of million pesos of gross output in agricultural activities per 1,000 inhabitants.[d]	DANE, *Grandes Actividades Económicas* 2018
IndustrialOutput	Logarithm of million pesos of gross output in industrial activities per 1,000 inhabitants.	DANE, *Grandes Actividades Económicas* 2018
ServicesOutput	Logarithm of million pesos of gross output in service activities per 1,000 inhabitants.	DANE, *Grandes Actividades Económicas* 2018
WomenAged15to44	Proportion of women aged 15–44.	CNPV 2018
WomenAged45to64	Proportion of women aged 45–64.	CNPV 2018
CareBurden0to4	Care burden of people aged 0–4. *Escala de Colombia*.[e]	CNPV 2018
CareBurden5to14	Care burden of people aged 5–14. *Escala de Colombia*.	CNPV 2018
CareBurden65to74	Care burden of people aged 65–74. *Escala de Colombia*.	CNPV 2018
CareBurden75to84	Care burden of people aged 75–84. *Escala de Colombia*.	CNPV 2018
CareBurdenOver75	Care burden of people aged 75 and over. *Escala de Colombia*.	CNPV 2018
CareBurdenOver85	Care burden of people aged 85 and over. *Escala de Colombia*.	CNPV 2018
TotalCareBurden	Total care burden. *Escala de Colombia*.	CNPV 2018

[a]Sources use Spanish abbreviations. For Mexico: National Population and Housing Census (CNPV), Economic Census (CE), Intercensal Survey (EI), National Statistical Directory of Economic Units (DENUE) and Financial Inclusion Database (BDIF). For Colombia: National Population and Housing Census (CNPV), Main Economic Activities from the National Administrative Department of Statistics (DANE).

[b]US$1 = 20.5 Mexican pesos recovered on 3 January 2022.

[c]Variable that measures child-care barriers based on the methodology from the Multidimensional Poverty Index (IPM) based on National Quality of Life Survey (ECV) 2018 and predicted to CNPV 2018.

[d]US$1 = 4,064.3 Colombian pesos recovered on 3 January 2022.

[e]The *Escala de Colombia* [Colombian Scale] is based on the National Survey of Time Use (ENUT) estimates calculated by Orozco and Sánchez (2020) and predicted to CNPV 2018.

Source: Own elaboration.

in Section 3 – to reveal gender inequalities and explore potential solutions (Bosak and Schroeder 2005). The contribution of the geospatial approximation is to show spillover or indirect effects, emphasising the effects that local care policies might have inside the studied municipalities and their neighbouring municipalities.

The estimates allow us to identify the relationship between each factor and LFP, through direct and indirect effects; the latter determined by municipal boundaries and adjacent territories. For example, the total effect of an investment in CAI might have effects in the same municipality where they start running and in neighbouring municipalities if they serve women from other municipalities who commute from living to working places.

Our model specification is inspired by models of labour supply at the individual level that consider women's time use in domestic work and unpaid care (Grossbard 1984; Grossbard and Neuman 1988) and the presence of care services as characteristics of the environment (Apps *et al.* 2012). The geospatial dimension relies on two basic equations, using aggregated data at the territorial level (Loftin and Ward 1983):

$$y = \alpha + \beta X + \varepsilon \tag{1}$$

$$y = \alpha + pWy + \beta X + \varepsilon \tag{2}$$

$$\varepsilon = \lambda W\varepsilon + u$$

where for Equation (1): y is the dependent variable (economic empowerment, labour supply or income); α is the average or intercept; β is a parameter vector; X is a matrix of explanatory variables, including the availability of care services; and

ε is an error vector; and for Equation (2): y is the dependent variable (economic empowerment, labour supply or income); α is the average or intercept; β is a parameter vector; X is a matrix of explanatory variables (schooling, children's presence, output of the economic sectors, financial services, age structures, and municipality's size see variables listed in Table 1), including the availability of care services; ε is an error vector; Wy is a spatial lag; p is a spatial autoregressive parameter of Wy; $W\varepsilon$ is the spatial lag of the error; λ is the special delayed coefficient of autoregressive errors of $W\varepsilon$; and u is an independently distributed error term.

In the available literature on labour supply, the access to care services in X usually is constrained to child-care services, commonly due to information limitations, although conceptually it could include care for other population groups, such as ill people, people with a disability, and older adults when available.

3. Data

3.1. Mexico

Since there is no single source of data that encompasses all the information required, we merged various datasets to create a synthetic database at the municipal level. We used the sample of the National Population and Housing Census (CNPV, Spanish abbreviation) 2020, Economic Census (CE, Spanish abbreviation) 2019, National Statistical Directory of

Economic Units (DENUE, Spanish abbreviation) 2020 of the National Institute of Statistics and Geography (INEGI, Spanish abbreviation) and the Financial Inclusion Database (BDIF, Spanish abbreviation) 2020 of the National Banking and Securities Commission (CNBV, Spanish abbreviation). To study the relationship of care services and LFP prior to the pandemic, we study data for 2015, the last available source for municipal data. We used the Intercensal Survey (EI, Spanish abbreviation) 2015, DENUE 2015, CE 2014 and the BDIF 2015. All data sources are publicly accessible. Table 1 shows the variables used from each source and Table 2 summarises the characteristics of each source.

The CNPV 2020 sample and EI 2015 are representative at the national, state, and municipal levels, although they provide individual and geo-referenced information that can be aggregated at different levels. Our interest is the municipal level since it is the smallest statistical representative unit for women's LFP and demographic structures. These two data sources form a territorial panel at the municipal level, however, not all variables are captured in both years or under the same methodology, nor are all of them observed in both years. The EI 2015 recorded information on time use in unpaid work activities, but the CNPV 2020 does not. INEGI also made improvements in the registration of paid work by 2020, making the EI 2015 data not strictly comparable since it underestimates LFP misreporting work as a secondary activity, as will be shown in the Results section. This prevents us from analysing the information as a panel or using a longitudinal approach,[1] limiting us to develop cross-sectional analysis at two points in time. Throughout the analysis, we reiterate the possible implications of these characteristics of the data but also provide estimations based on comparable categories of LFP. Other variables listed in Table 1 are consistently captured.

Conversely, the DENUE allows the geo-positioning of every economic unit in urban areas, including child-care services (CAI), and services for people with a disability or older adults; while the CE provides information on the economic units at the municipal level, such as economic output and number of employees.

The CNPV 2020 sample includes 15.0 million people, and representation of each of the 2,469 municipalities. We analyse women aged 15 and over who declared an employment situation and schooling (5.6 million in the sample) (Table 2).

DENUE registers 10,851 CAI in 2020 and 13,445 in 2015 (Table 2; Figure 1, panel a). This significant reduction in the number of CAI implies a fall of 19.3 per cent or 2,594 fewer centres, 59.7 per cent of them being private services. The reduction concentrates in certain municipalities, 52.2 per cent of the 1,392 municipalities with CAI in at least one of the observed years registered fewer services. In 75 per cent of them the total number of CAI was reduced by more than 30 per cent (Figure 1, panel b). This enormous reduction in the social infrastructure hampers the expected long-term effect of the available care services and, consequently, women's paid and unpaid work. By 2020, the targeting of the CAI in Mexico appears more extended in areas with higher output and economic dynamism, where women's LFP are already higher. As many of these services are not free of charge, the vanishing of services in poorer areas may be the result of shortages in household consumption during the pandemic.

Table 2. Key quantitative features of each data source from Mexico and Colombia

	Mexico								Colombia
	National Population and Housing Census sample 2020	Intercensal Survey 2015	National Statistical Directory of Economic Units 2015	National Statistical Directory of Economic Units 2020	Economic Census 2014	Economic Census 2019	Financial Inclusion Database 2015	Financial Inclusion Database 2020	National Population and Housing Census 2018
Representativeness	National, state, municipal levels	National, state, municipal levels	National, state, municipal levels		National, state, municipal levels		National, state, municipal levels		National, state, municipal levels
No. of municipalities	2,469	2,457	2,457	2,469	2,457	2,465	2,457	2,466	1,122
No. of cases	15.0 million people[a]	23.0 million people[b]	13,445 CAI	10,851 CAI	4.2 million units	4.8 million units	1.4 million units	2.3 million units	44.2 million people
Women aged 15+ with employment and schooling data	5.6 million	8.3 million	–	–	–		–		17.4 million

[a]Representing a population of 125.5 million people.
[b]Representing a population of 124.2 million people.
Source: For Mexico: elaboration based on CPNV sample 2020, EI 2015, DENUE 2015 and 2020, CE 2014 and 2019, and BDFI 2015 and 2020. For Colombia: elaboration based on CNPV 2018.

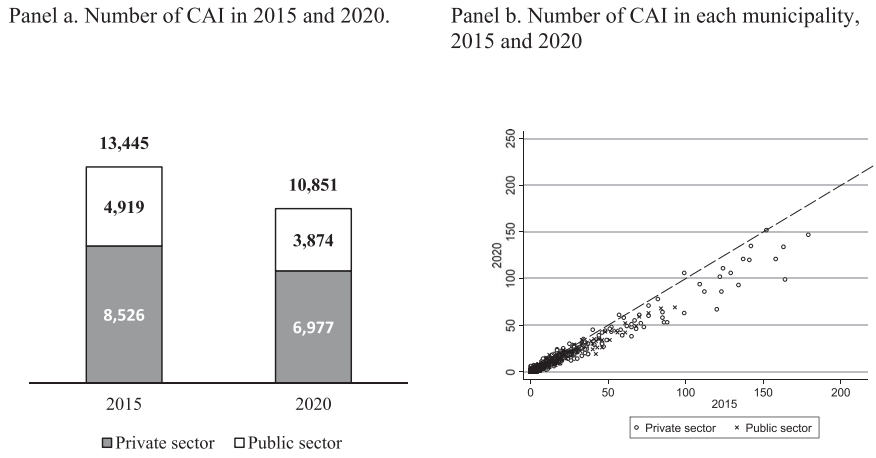


Figure 1. Contrast of total Childcare Centers (CAI) in 2015 and 2020 at the national and municipal level. Panel a: Number of CAI in 2015 and 2020. Panel b: Number of CAI in each municipality, 2015 and 2020. Source: Elaboration based on DENUE 2015 and 2020.

The CE information for both years allow us to estimate the total municipal output by economic sectors, and relative to the municipal population; whereas BDIF let us identify a measure of approximation to local financial inclusion, accounting for the total of branches, correspondents, ATMs, point-of-sale terminals (TPV, Spanish abbreviation), and establishments (Table 2).

3.2. Colombia

Colombia has two main sources of data useful to our purposes: the National Population and Housing Census (CNPV) 2018 and the municipal economic output from the three main economic activities (DANE, *Grandes Actividades Económicas* [Main Economic Activities] 2018). Besides, in the CNPV we used a predicted variable that measures child-care barriers based on the methodology from the Multidimensional Poverty Index (IPM, Spanish abbreviation)[2] and the Colombian Scale for Care (Orozco and Sánchez 2020) (Table 1).

Although the CNPV 2018 records children's attendance at care services, this variable is not fully accessible in the public dataset. The available data only allow us to measure child-care barriers for infants whose parents were already in the labour market,[3] but not for the rest of the population. The darkest areas in Figure 2 show municipalities where 4.2 per cent or more children with working parents lack adequate care (no access to health services or are cared for by a person under 18 years old or by their parents at the workplace). Those municipalities represent 10 per cent of all municipalities in the country, since the colour labels in the figure were defined as the cumulative percentiles 10, 25, 50, 75, 90, and 100 of the child-care barriers variable. As long as Colombian

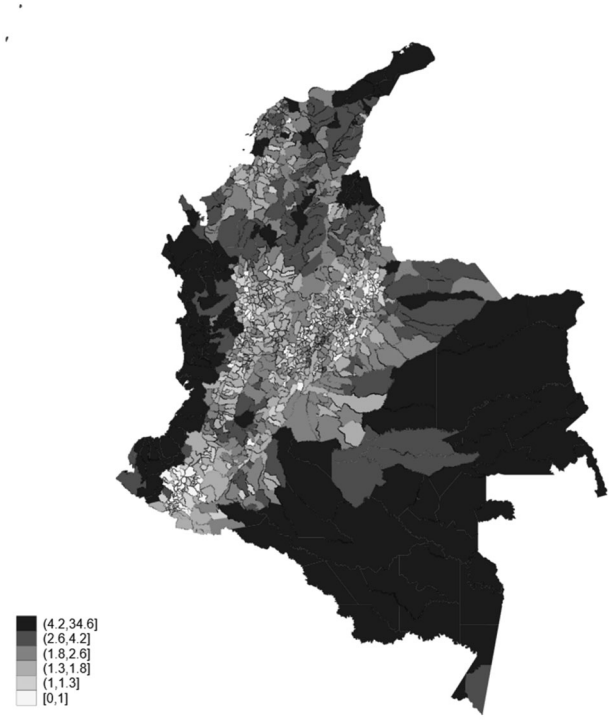


Figure 2. Child-care barriers for children whose parents are in the labour market, Colombia.

Percentage of children from 0 to 5 years in the household with no access to health services or who spend most of their time with their father or mother at work, at home alone, or are cared for by a relative under 18 years. Each category defined as percentiles 10, 25, 50, 75, 90, and 100 of the variable. Source: CNPV 2018.

data on child-care services were not fully public and the available data showed limitations, we concentrated our analysis on the relationship of unpaid care provision and women's LFP.[4]

Our variable measures care burden in the CNPV using the *Escala de Colombia* [Colombian Scale] for children under 5 and other population groups and the approach proposed by Durán (2012). This approach computes the care burden as the total number of care units for society among the number of people aged 15–64 years. A care unit in Colombia is equivalent to the average care time required by a person aged 15–64: 2 hours and 42 minutes per day (Orozco and Sánchez 2020, 44). It encompasses the care provided by households, considering the available infrastructure for care services (Orozco and Sánchez 2020, 43). The average care burden in the population registered in the CNPV is 2.07 care units for each person in the age group 15–64 years.

4. Context

Colombia and Mexico share some characteristics, such as the level of female LFP and schooling. In Mexico, according to the CNPV 2020, 40.4 per cent of women aged 15 and over

participate in the labour market[5] and have an average schooling of 9.6 years. LFP in Colombia is 2.7 percentage points lower than in Mexico, while schooling is 0.2 years lower.

Mexico's territory comprises 2,469 municipalities and Colombia has 1,122. The municipal average size in the former is 50,800 inhabitants, with a wide range of variation, from 100 to 1.9 million inhabitants (Table 3). Whereas the latter's average size is 39,400 inhabitants, varying from 200 to 7.2 million inhabitants. In Mexico, one out of five municipalities belong to the state of Oaxaca (south), those are basically small territories with the presence of the indigenous population governed by *usos y costumbres* [traditions and customs] and higher poverty rates. Figure 3 shows the economic output per capita in each municipality of Mexico and Colombia, the former presents higher territorial inequality and concentration of wealth.

In both countries, is a huge territorial gap in women's LFP across various regions, with lower LFP in smaller municipalities. That leads to an estimation of labour participation 4.5 percentage points higher at this aggregation level compared to the population data. The secondary sector in Mexico represents 58.1 per cent of the country's economic output, followed by tertiary (41.6 per cent) and primary sectors (0.3 per cent). While in Colombia the output of the tertiary sector represents 67.1 per cent, the secondary and primary sectors correspond to 19.5 and 13.3 per cent, respectively. Since women's LFP is segregated by sectors, with the lowest participation in agriculture, the greater size of this sector in Colombia could imply additional barriers for their labour participation.

Despite these similarities, both countries follow different policy approaches towards child care which in turn creates varying outcomes for women's care burdens and economic participation. For the purposes of our analysis, Mexico's policies that may have influenced our data involve CAI from the programme *Estancias Infantiles* [children's day-care centres] which in 2019 was cancelled and replaced by the programme *Apoyo para el Bienestar de las Niñas y Niños Hijos de Madres Trabajadoras* [Support for the Well-being of Girls and Boys Children of Working Mothers]. *Estancias* benefited 289,821 children in 2015 (Secretaría de Bienestar 2015); it used to include incentives to increase supply services. *Apoyos para el Bienestar* consists of a non-conditional cash transfer that cancelled supply incentives and reduced benefits from its predecesor (Comisión Nacional de los Derechos Humanos 2019). Because of the policy changes and the pandemic, in 2020 *Apoyos para el Bienestar* benefited only 192,168 children (Secretaría de Bienestar 2020). These programmes run mainly in urban areas, where women's LFP is higher. *Estancias* contributed to the whole country supply of child-care services. By 2019, the CAI services from public and private providers granted access to about 34.4 per cent of children under 5, according to the National Time Use Survey (ENUT).

Meanwhile, Colombian child-care policies are based in its *Programa Hogares Comunitarios* [Community Homes Programme], intended to increase supply services and to improve quality of unpaid care work (Instituto Colombiano de Bienestar Familiar 2014). By design, this programme is targeted to rural and semi-urban areas, where economic output and women's LFP are smaller. This programme intended to cover around 2.1 million children by 2018 (Escobar *et al.* 2017).

Table 3. Descriptive statistics for Mexico and Colombia with municipal data

	Mexico								Colombia			
	2015				2020				2018			
Variable[a]	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
Labour participation of women aged 15+ (WomenLFP)[b] (%)	22.9	10.53	0.47	54.2	30.50	10.60	2.80	62.90	26.0	9.4	0.0	63
Average schooling of women aged 15+ (SchoolingWomen15)	7.1	1.6	2.4	13.3	7.8	1.5	3.1	13.6	7.7	1.339	3.17	13.02
Proportion of children aged 0–4 (ChildrenUnder5) (%)	9.4	1.7	3.0	18.2	8.8	1.7	2.3	17.2	7.3	2.0	3.3	23.0
Childcare Centers per 1,000 inhabitants (ChildcareCenterCAI)	0.1	0.1		2.5	0.05	0.1	0	1.1				
Logarithm of million pesos (AgriculturalOutput)[c]	0.1	0.4		5.4	0.2	0.4	0	4.7	1.4	0.8	0	5.4
Logarithm of million pesos (IndustrialOutput)	1.5	1.4		8.8	1.8	1.5	0	9.2	1.0	0.6	0	4.4
Logarithm of million pesos (ServicesOutput)	1.7	1.1	0.0	8.9	2.2	1.1	0	7.6	2.1	0.4	0.9	5.1
Financial services infrastructure (FinancialServInfrastructure)	2.7	6.3	0.0	95.3	5.2	9.8	0	169.4				
Dummy for quintile 5 of ServicesOutput(ServicesOutput_5quintile)					0.2	0.4	0.0	1.0				
Interaction of ServicesOutput_5quintile and ChildcareCenterCAI (CAI_ServicesOutput_5quintile)					0.0	0.0	0.0	0.4				
Proportion of women aged 15–19 (WomenAged15to19) (%)	12.6	2.6	3.1	25.1	11.6	2.4	3.4	22.2				
Proportion of women aged 20–34 (WomenAged20to34) (%)	31.5	4.7	12.1	51.8	30.1	4.6	5.6	50.1				
Proportion of women aged 35–49 (WomenAged35to49) (%)	25.4	2.7	12.4	36.5	25.4	2.6	13.7	34.8				
Proportion of women aged 50–64 (WomenAged50to64) (%)	17.1	2.6	6.8	31.0	18.6	2.9	8.6	30.8				
Proportion of women aged 15–44 (WomenAged15to44) (%)									60.1	9.2	33.6	106.4
Proportion of women aged 45–64 (WomenAged45to64) (%)									28.0	3.6	13.6	37.3
Size of the municipality per thousand people (Inhabitants)	50.5	157.9	0.1	3,283.1	50.8	146.3	0.1	1,910.6	39.4	242.6	0.2	7,181.5
Care burden of people aged 0–4 (CareBurden0to4)									0.5	0.2	0.2	1.8
Care burden of people aged 5–14 (CareBurden5to14)									0.6	0.2	0.2	2.2
Care burden of people aged 65–74 (CareBurden65to74)									0.1	0.0	0.0	0.2
Care burden of people aged 75–84 (CareBurden75to84)									0.1	0.0	0.0	0.4
Care burden of people aged 75 and over (CareBurdenOver75)									0.2	0.1	0.0	0.6
Care burden of people aged 85+ (CareBurdenOver85)									0.1	0.0	0.0	0.2
Total care burden (TotalCareBurden)									2.3	0.3	1.7	3.9

[a]See complete variable definitions in Table 1.
[b]In 2020, the mean corresponds to 23.4 per cent when using a comparable definition of LFP with 2015, which does not capture work as a secondary activity.
[c]Million pesos on a logarithmic scale; where US$1 = 20.5 Mexican pesos recovered on 3 January 2022 and US$1 = 4,064.3 Colombian pesos recovered on 3 January 2022.
Source: For Mexico: elaboration based on CNPV 2020, CE 2019, DENUE 2020 and BDIF 2020. For Colombia: elaboration based on CNPV 2018 and the DANE, *Grandes Actividades Económicas* [Main Economic Activities] 2018.

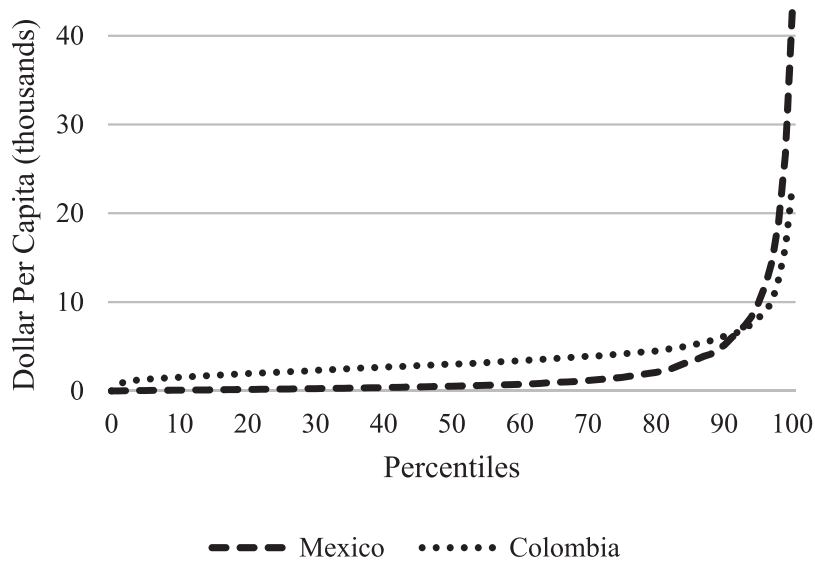


Figure 3. Economic output per capita in municipalities, Mexico and Colombia. Source: Elaboration based on CNPV 2020 and CE 2019 for Mexico and CNPV 2018 and DANE, *Grandes Actividades Económicas* [Main Economic Activities] 2018 for Colombia.

Currently, the programmes between the two countries differ in the way they channel their efforts. In the case of Mexico, unconditional cash transfers are provided while in Colombia the programme focuses on community children's centres.

5. Results

Women's LFP in 2020 shows significant variation, from 2.8 to 62.9 per cent in Mexican municipalities, averaging 30.5 per cent (WomenLFP), with higher women's LFP seen in more populated municipalities.[6] On average, each municipality had 0.05 CAI per thousand inhabitants (ChildcareCenterCAI) (Table 3),[7] a rather small coverage of child-care services. Meanwhile, municipalities have an average of five access points to financial services per thousand people (Table 3). As said, we use child care and financial services as proxies of women's opportunities to choose between unpaid child care and participation in the labour market.

The structure of the female population reflects that, on average, 41.7 per cent of the municipal population belong to the 15–34 age group, while the 35–49 age group represents a quarter of the population (Table 3). The first group represents women at reproductive ages, who commonly are discriminated against in the labour market. The percentage of children under 5 averages 8.8 per cent of the population, varying from 2.3 to 17.2 per cent (Table 3). The presence of this group is of particular interest, since they represent a significant proportion of women's care responsibilities.

In Colombia, according to CNPV 2018, women's LFP for those aged 15 and over is 37.9 per cent, with an average school level of 9.8 years. At the municipal level LFP corresponds to 26.0 per cent, reflecting a higher concentration of LFP in larger municipalities, even more than in Mexico.

The structure of the female population aged 15 and over is also very similar to that of Mexico; it concentrates the same 41.7 per cent of the municipal population in women aged 19–34 and a quarter in women aged 35–49. Likewise, both countries share a higher share of women's LFP in the tertiary sector.

Children under 5 years old represent 7.3 per cent of the municipal population (Table 3). A significant proportion of the care burden corresponds to children under 5 (0.5 equivalent to 20.3 per cent) and from 5 to 14 years old (0.6 equivalent to 24.8 per cent) (Table 3). As can be seen, the lack of services for children of working parents and the care burden distribution show geospatial patterns (Figure 2 and Figure 4 panel b, respectively). Particularly, in the eastern municipalities, the percentage of care burden is higher, 2.6–3.9 care units. Darker areas in these figures show that lack of services coincide with higher care burdens. These conditions in turn, show an inverse relationship with women's LFP (Figure 4, panel a), especially in the south region where LFP only reaches up to 15.6 per cent, but also in the north municipalities. This will be considered with our geospatial modelling.

In both countries the presence of children in the territory has a negative effect on women's LFP; Mexico's correlation is higher (Figure 5, panels a and b). There is a linear association: the lower the presence of children in the municipality, the higher women's LFP. In Colombia, this correlation is not so evident in Figure 5: a correlation of −0.18 compared to −0.34 in Mexico. The lower presence of children in the municipalities associates with higher dispersion in the levels of LFP. Figure 5 shows that municipalities with about 5 per cent of children in the population show rates of about 50 per cent for women's LFP, whereas municipalities with 15 per cent of children relates to only 10 per cent LFP.

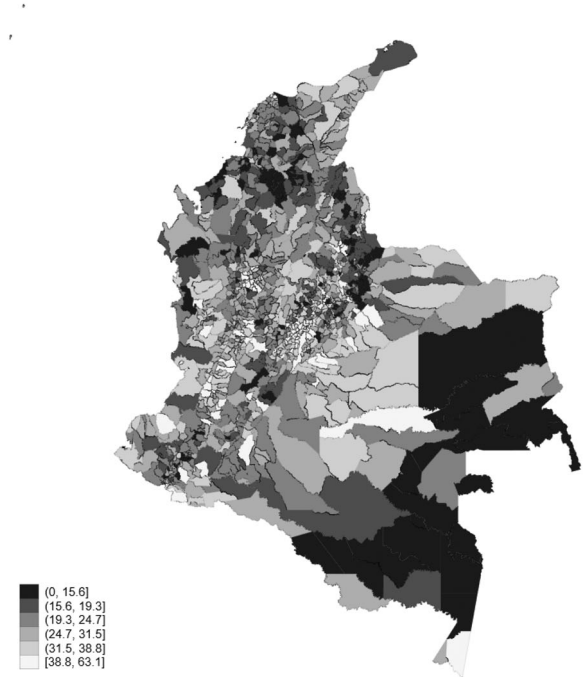
5.1. Geospatial regression

5.1.1. Mexico

Our main interest is to show relationships of what we consider relevant factors with women's LFP in year 2020. However, we also want to identify possible changes along time compared to the 2015 situation. Since EI 2015 lacks complete registration of LFP due to missed registration of work as a secondary activity. In addition to our main model in Table 4, we estimate model B in Table 5 using an incomplete but comparable dependent variable in 2020. This allows us to understand changes potentially attributable to the time elapse and changes linked to differences in data registration of our dependent variable. Table 5 summarises changes from 2015 to 2020 (models A, B and C); it also includes model D, where we explore some relevant interactions between the municipal wealth – using economic output as proxy – and child-care services. Although our estimates do not imply causal results, they reflect the direction and magnitude of the relationship with LFP.

Table 4 shows the relationship between women's LFP and different factors using a geospatial model distinguishing direct, indirect, and total effects. As said, indirect effects capture spillovers based on the existent correlation among neighbouring

Panel a. Percentage of women in the labour force.



Panel b. Care burden, Escala de Colombia [Colombian Scale].

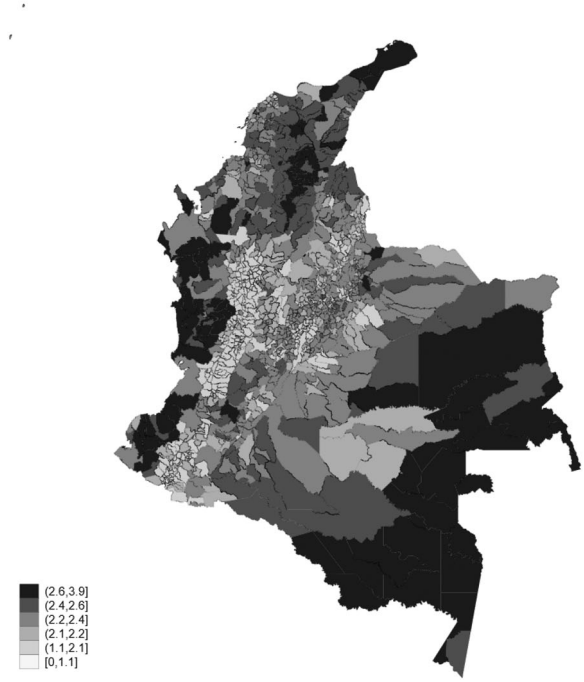
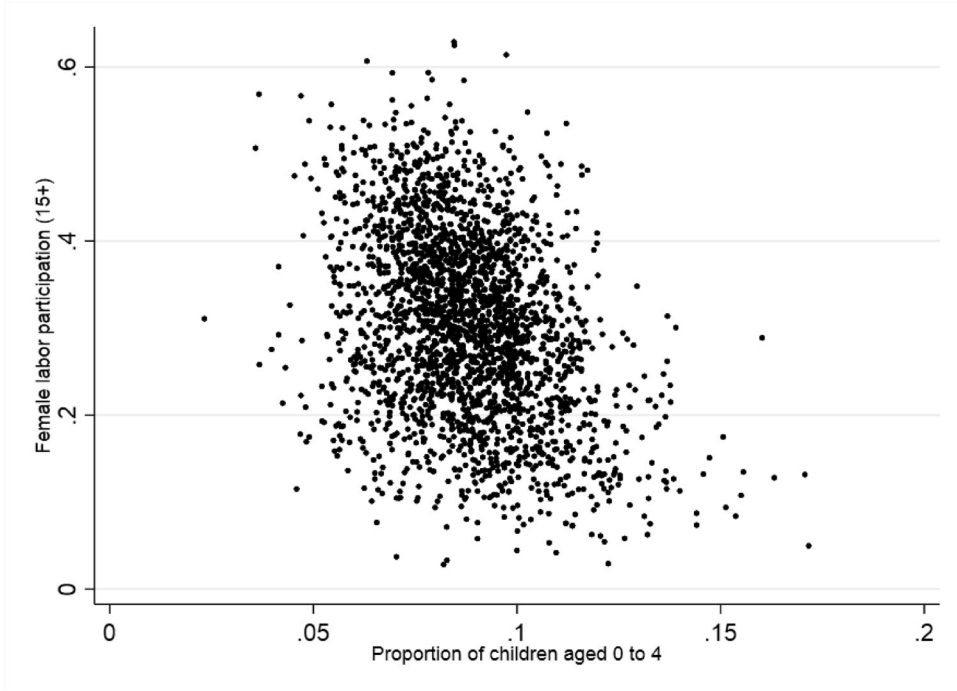


Figure 4. Women's LFP and care burden, Colombia's municipalities. Panel a: Percentage of women in the labour force. Panel b: Care burden, *Escala de Colombia* [Colombian Scale].

Each category defined as percentiles 10, 25, 50, 75, 90, and 100 of the variable. The care burden is calculated as the total number of care units for the society per person in age group 15–64 years (Durán 2012, cited in Orozco and Sánchez 2020). 1 care unit = 2 hours and 42 minutes per day. Source: Elaboration based on CNPV 2018.

Panel a. Data of Mexico 2020



Panel b. Data of Colombia 2018

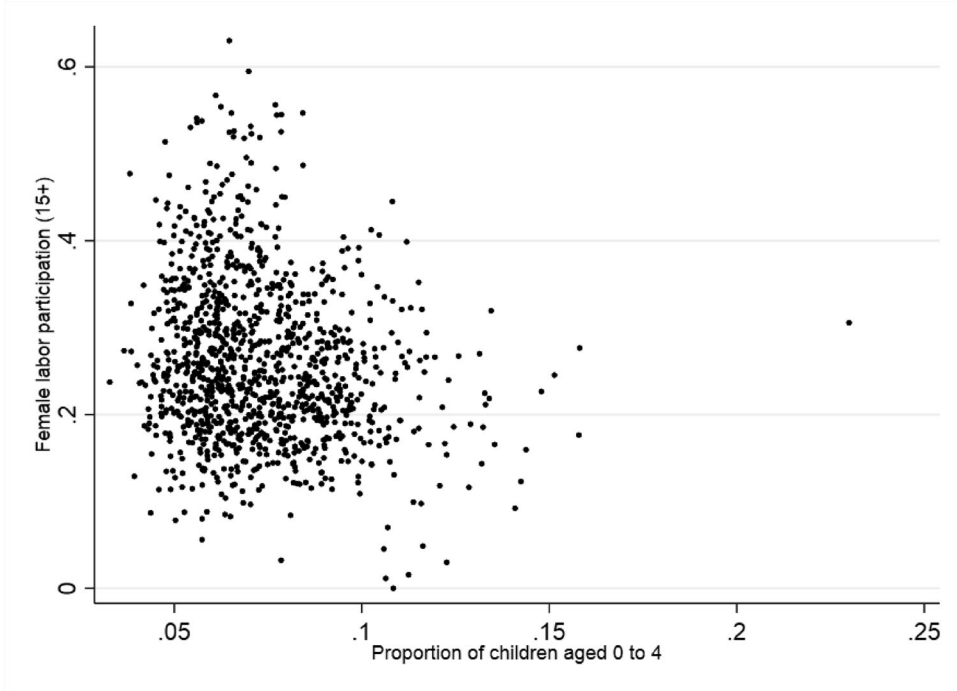


Figure 5. Relationship of women's LFP and presence of children under 5 in each municipality. Panel a: Data of Mexico 2020. Panel b: Data of Colombia 2018. Source: Elaboration based on CNPV 2020 for Mexico and CNPV 2018 for Colombia.

Table 4. Direct, indirect and total effects, geospatial model for Mexico in 2020

	Changes in LFP (d*y*/d*x*)	SD	*Z*	Significance level $p > \|Z\|$	95% confidence interval	
Direct effect						
SchoolingWomen15	0.0210	0.0018	11.9600	0.0000	0.0175	0.0244
ChildrenUnder5	−1.5588	0.1685	−9.2500	0.0000	−1.8892	−1.2285
ChildcareCenterCAI	0.0975	0.0236	4.1400	0.0000	0.0513	0.1437
AgriculturalOutput	−0.0082	0.0036	−2.3100	0.0210	−0.0152	−0.0012
IndustrialOutput	0.0023	0.0014	1.6500	0.1000	−0.0004	0.0051
ServicesOutput	0.0122	0.0025	4.9300	0.0000	0.0073	0.0170
FinancialServInfrastructure	0.0014	0.0006	2.3500	0.0190	0.0002	0.0025
FinancialServicesOutput	−0.0002	0.0001	−2.3000	0.0210	−0.0004	0.0000
Inhabitants	0.0000	0.0000	0.6800	0.4930	0.0000	0.0000
WomenAged15to19	−0.7249	0.1035	−7.0000	0.0000	−0.9277	−0.5220
WomenAged20to34	0.3970	0.0633	6.2700	0.0000	0.2730	0.5211
WomenAged35to49	0.2991	0.0768	3.8900	0.0000	0.1485	0.4497
WomenAged50to64	−0.6013	0.1003	−6.0000	0.0000	−0.7978	−0.4047
Indirect effect						
SchoolingWomenOver15	0.0011	0.0003	3.4600	0.0010	0.0005	0.0017
ChildrenUnder5	−0.0799	0.0238	−3.3600	0.0010	−0.1265	−0.0332
ChildcareCenterCAI	0.0050	0.0019	2.6900	0.0070	0.0014	0.0086
AgriculturalOutput	−0.0004	0.0002	−1.9900	0.0470	−0.0008	0.0000
IndustrialOutput	0.0001	0.0001	1.5300	0.1260	0.0000	0.0003
ServicesOutput	0.0006	0.0002	2.8700	0.0040	0.0002	0.0010
FinancialServInfrastructure	0.0001	0.0000	1.9700	0.0490	0.0000	0.0001
FinancialServicesOutput	−0.0000	0.0000	−1.9500	0.0510	0.0000	0.0000
Inhabitants	0.0000	0.0000	0.6900	0.4910	0.0000	0.0000
WomenAged15to19	−0.0371	0.0115	−3.2300	0.0010	−0.0597	−0.0146
WomenAged20to34	0.0203	0.0066	3.1000	0.0020	0.0075	0.0332
WomenAged35to49	0.0153	0.0057	2.6700	0.0080	0.0041	0.0266
WomenAged50to64	−0.0308	0.0098	−3.1300	0.0020	−0.0501	−0.0115
Total effect						
SchoolingWomenOver15	0.0221	0.0018	11.9700	0.0000	0.0184	0.0257
ChildrenUnder5	−1.6387	0.1772	−9.2500	0.0000	−1.9860	−1.2914
ChildcareCenterCAI	0.1025	0.0248	4.1300	0.0000	0.0539	0.1511
AgriculturalOutput	−0.0086	0.0037	−2.3100	0.0210	−0.0159	−0.0013
IndustrialOutput	0.0024	0.0015	1.6500	0.0990	−0.0005	0.0054
ServicesOutput	0.0128	0.0026	4.9200	0.0000	0.0077	0.0179
FinancialServInfrastructure	0.0014	0.0006	2.3500	0.0190	0.0002	0.0026
FinancialServicesOutput	−0.0002	0.0001	−2.3100	0.0210	−0.0004	0.0000
Inhabitants	0.0000	0.0000	0.6900	0.4930	0.0000	0.0000
WomenAged15to19	−0.7620	0.1086	−7.0200	0.0000	−0.9748	−0.5492
WomenAged20to34	0.4174	0.0666	6.2600	0.0000	0.2868	0.5480
WomenAged35to49	0.3144	0.0807	3.9000	0.0000	0.1562	0.4726
WomenAged50to64	−0.6321	0.1052	−6.0100	0.0000	−0.8382	−0.4259

Reference category for age structure is 65 and older.
Source: Elaboration based on CNPV 2020, CE 2019, DENUE 2020, and BDIF 2020.

municipalities and reflect to what extent their characteristics and its resources affect contiguous areas.[8] For Mexico, the direct effects in Table 4 represent about 95 per cent of the total effect, only the remaining 5 per cent corresponds to spillover effects, and this behaviour is consistent for every factor. It means that, for example, an additional CAI in a certain municipality will produce near 95 per cent of its effect in that same municipality and will spill about 5 per cent of its effect on women's LFP inhabiting neighbouring municipalities.

The relationship of LFP with children under 5 years old is negative, as would be expected when the social care organisation mostly relies on women's unpaid work and provides limited state services. Increasing the presence of infants in the population

Table 5. Total effects, geospatial models for Mexico in 2015 and 2020

Model	(A)		(B)		(C)		(D)	
Variable	2015	Significance level $p > \|Z\|$	2020 same definition as 2015	Significance level $p > \|Z\|$	2020	Significance level $p > \|Z\|$	2020 tertiary sector interaction with CAI	Significance level $p > \|Z\|$
SchoolingWomen15	0.027	0.00	0.028	0.00	0.022	0.00	0.024	0.00
ChildrenUnder5	−1.043	0.00	−1.192	0.00	−1.639	0.00	−1.563	0.00
ChildcareCenterCAI	0.031	0.00	0.111	0.00	0.103	0.00	0.091	0.00
AgriculturalOutput	−0.004	0.23	−0.007	0.02	−0.009	0.02	−0.006	0.08
IndustrialOutput	−0.000	0.86	0.000	0.86	0.002	0.10	0.004	0.00
ServicesOutput	0.018	0.00	0.024	0.00	0.013	0.00		
ServicesOutput_5quintile							0.012	0.09
CAI_ServicesOutput_5quintile							0.101	0.10
FinancialServInfrastructure	0.004	0.00	0.002	0.00	0.001	0.02	0.001	0.03
FinancialServicesOutput	−0.001	0.00	−0.000	0.00	−0.000	0.02	0.000	0.05
Inhabitants	0.000	0.02	0.000	0.30	0.000	0.49	0.000	0.78
WomenAged15to19	−0.443	0.00	−0.206	0.01	−0.762	0.00	−0.818	0.00
WomenAged20to34	0.676	0.00	0.492	0.00	0.417	0.00	0.422	0.00
WomenAged35to49	0.270	0.00	0.384	0.00	0.314	0.00	0.344	0.00
WomenAged50to64	−0.061	0.48	−0.166	0.03	−0.632	0.00	−0.605	0.00

Indirect effects correspond to 2 per cent in 2015 and 5 per cent in 2020. The model in column B restricts the dependent variable to the incomplete registry of labour to make comparable with the 2015 definition of LFP. Reference category for age structure is 65 and older.

Source: Elaboration based on CNPV 2020, CE 2014 and 2019, DENUE 2015 and 2020, BDIF 2015 and 2020, and EI 2015.

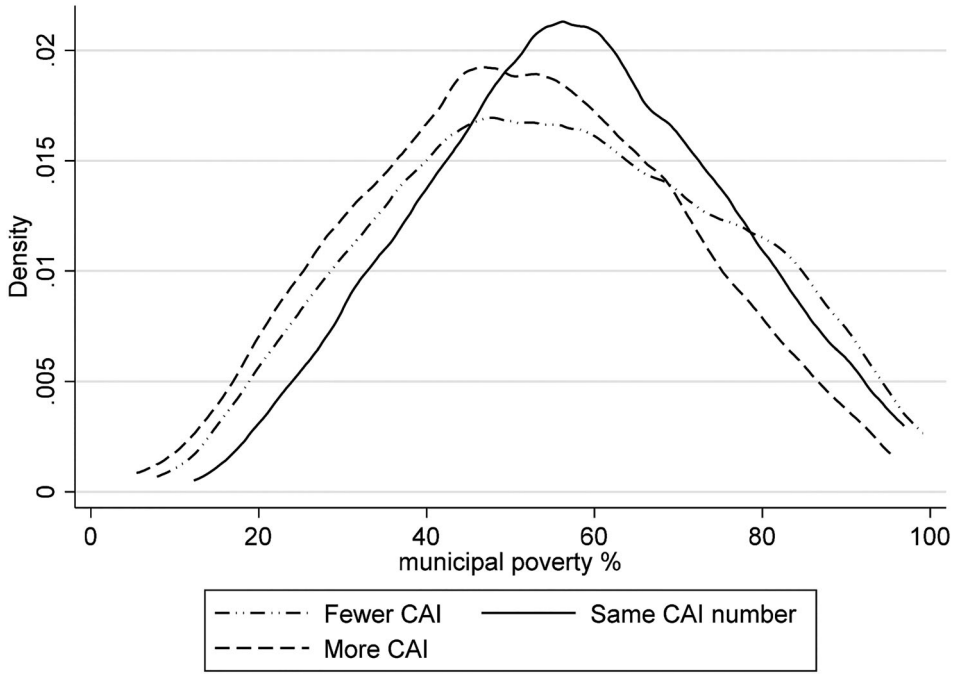


Figure 6. Poverty density for municipalities with fewer, the same, or more CAI in 2020 compared to 2015. Source: Elaboration based on DENUE 2015 and 2020 and poverty incidence estimates from the National Council for the Evaluation of Social Development Policy (CONEVAL) 2021.

by 10.0 per cent reduces women's LFP by 16.4 per cent. In contrast, the availability of CAI has a positive effect of 10.3 per cent (Table 4).[9] This effect, however, varies according to the local economic context; the effect of child-care services rises to 19.2 per cent in municipalities with high output in the tertiary sector (Table 5, model D).

By 2020, the effects of the presence of children under 5 substantially increased its negative association compared to 2015; CAI's effect does so but in the opposite way (Table 5, models A, B and C). Model B uses a restricted but comparable dependent variable with the 2015 data in model A, to confirm that these differences are not due to changes in the specification. A deeper exploration of the data suggests these changes are presumably a result of the substantial reduction in the supply of CAI due to the temporary closure due to the pandemic and the policy decisions already described.[10] As already stated, one in five CAI disappeared in Mexico in the studied period. But permanent closures were not random, they mainly occurred in poorer municipalities (Figure 6), with small economic output, where women's opportunities of employment are lower, and resources to maintain the running of care services are scarce. As a result, the effect of children's presence increased by a half, whereas for CAI it increased more than three times compared to 2015 (Table 5, models A, B and C), showing a stronger relationship between LFP and the availability of care services. The result stands out since further reflecting the temporary closures due to social distancing in response to

the COVID-19 pandemic, it reflects the permanent loss in social infrastructure of child-care services and a potential long-term effect on children's well-being and women's paid and unpaid work.

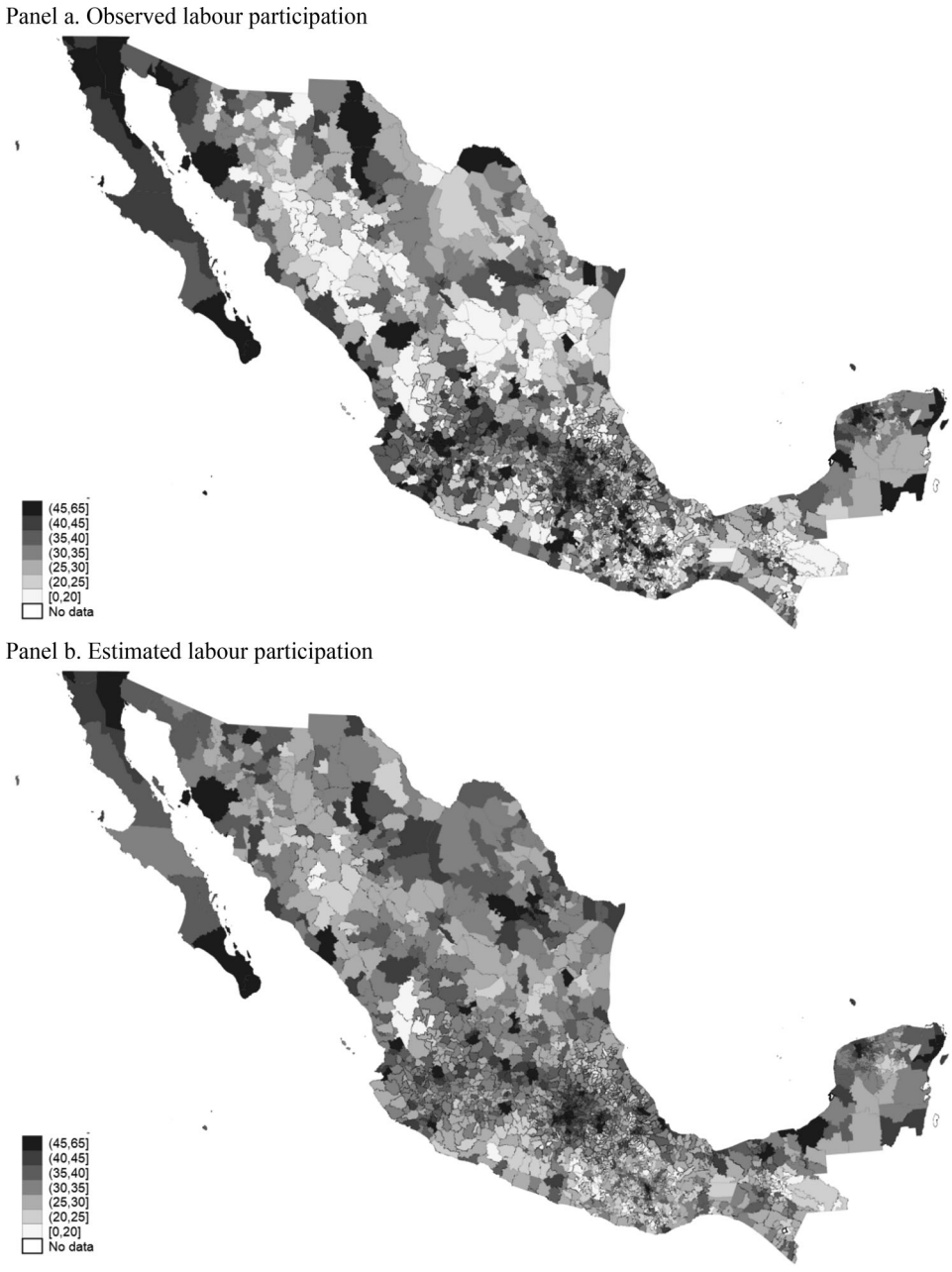
Beyond child care, we explored the relationship between LFP and other care services, such as care for ill people, people with disability, and older adults. By 2020, the coverage of these types of services is quite low and they are concentrated in municipalities with high rates of women's LFP. Their relationship with women's LFP is weak, probably because there are few of them, and unlike child-care services, the supply of these types of services has not been incentivised with subsidies or transfers to make them more available to the population in the lower socioeconomic strata.

Consistent with the literature, the education effect is positive and significant: a one-year increase in women's average schooling increases their LFP. In contrast with other studies where the emphasis commonly relies on education as the main explanatory variable (Ince 2010), we included context variables such as the local size of the economy and the presence of care services, as a result the schooling effect decreases.[11] An increase of an average year translates into a 2.2 per cent increase in LFP, with a spillover or indirect effect of 0.1 per cent on neighbouring municipalities (Table 4).

Whereas the positive association between CAIs and women's LFP occurs in all municipalities, including those with higher levels of poverty,[12] the size of the economic output and type of activities also interfere with its potential effect. That is, the mere investment in CAI may not be enough, as can be seen in the effects for economic activities. Women's participation is higher in municipalities where the services sector prevails. An increase of 1 per cent in this sector leads to a 1.3 per cent increase in LFP (Table 4), considerably higher compared to 0.2 per cent for an increase in the industrial sector, and contrary to an expected decrease of 0.9 per cent inherent to the agricultural sector. This suggests that primary and secondary sectors lack of conditions for women's LFP. Therefore, gender-inclusive sectoral policies and affirmative action would be required to grant inclusive mechanisms of recovery in these sectors. The EI 2015 estimates confirm the results for the primary and secondary sectors (Table 5).

The age structure of the female population influences labour participation at the local level; our reference group is 65 and older. If the group aged 20–34 increases by 10 per cent, LFP increases by 4.2 per cent, whereas for women in the 35–49 age group it augments by 3.1 per cent. In contrast, participation decreases by 7.6 per cent and 6.3 per cent for the 15–19 and 50–64 groups, respectively (Table 5, model C). The latter is an important segment of women that usually resolves the lack of an institutionalised care system, taking care of their grandchildren so their daughters or sons can work. Compared with EI 2015, the effect of the 20–34 age group experienced a reduction of about a third of its magnitude. Overall, women in reproductive ages and older adults were the most affected since they are among the main care providers.

Finally, financial services can offer women opportunities to enter the labour market, e.g. through entrepreneurship credits. An additional access point is associated with an



Source: elaboration based on CNPV 2020, CE 2019, DENUE 2020 and BDIF 2020.

Figure 7. Women's LFP observed and estimated with geospatial analysis, Mexico 2020. Panel a: Observed labour participation. Panel b: Estimated labour participation. Source: Elaboration based on CNPV 2020, CE 2019, DENUE 2020, and BDIF 2020.

increase of 0.1 per cent in women's LFP (Table 4), marginally decreasing in municipalities with higher gross output of the tertiary sector.

The maps in Figure 7 illustrate the geospatial correlation of observed and estimated LFP (panels a and b, respectively). Most of the estimated values are closely matched to

Table 6. Total effects, geospatial model for Colombia in 2018 and Mexico 2020.

Model	(A)		(B)		(C)	
Variable	Colombia with children under 5	Significance level P> |Z|	Mexico without CAI	Significance level P> |Z|	Colombia with care burden	Significance level P> |Z|
SchoolingWomen15	0.047	0.00	0.024	0.00	0.046	0.00
ChildrenUnder5	−0.285	0.10	−1.655	0.00		
CareBurden0to4					−0.041	0.06
CareBurdenOver75					−0.031	0.61
WomenAged15to19			−0.737	0.00		
WomenAged20to34			0.433	0.00		
WomenAged35to49			0.338	0.00		
WomenAged50to64			−0.597	0.00		
WomenAged15to44	0.158	0.00			0.138	0.06
WomenAged45to64	0.216	0.08			0.213	0.08
AgriculturalOutput	0.004	0.13	−0.008	0.03	0.004	0.18
IndustrialOutput	0.004	0.38	0.002	0.13	0.004	0.41
ServicesOutput	0.036	0.00	0.014	0.00	0.036	0.00
Inhabitants	0.000	0.46	0.000	0.33	0.000	0.44

Source: For Colombia: elaboration based on CNPV 2018. For Mexico: elaboration based on CNPV 2020, CE 2019, DENUE 2020 and BDIF 2020.
Notes: in model C, indirect effects contribute with about 9.0%.

those observed, although in some northern municipalities participation is overestimated. Our exploration indicates that where the population structure is young and there is less presence of children compared to other territories, the reduced size of the economic sectors limits the possibilities of women's employment.

Overall, the effects of factors on women's LFP in 2015 and 2020 vary in magnitude given the changes that took place in care supply and the economy which occurred.

5.1.2. Colombia

Our model for Colombia uses a different specification since the variable that measures access to care services is not available. First, we confirmed the model behaviour by estimating the same specification for Mexico (Table 6, models A and B). In summary, the education effect is more relevant in Colombia, whereas the effect for the presence of children under 5 in this country is consistently lower compared to data collected in Mexico both prior to and during the pandemic data in Mexico. This might be in concordance with the bigger economic contribution of the services sector in Colombia, where women find working flexibility to make compatible paid work and taking with them their children, as possible confirms the observed care barriers for children of working parents (Figure 1).

The care burden of children under 5 captures the population's age structure and time devoted to care within households, which in turn, is conditioned on the availability of care services (Orozco and Sánchez 2020). A 1.0 per cent increase in the care burden of children reduces by 4.1% women's LTP (Table 6, model C). We also explore the care burden of adults aged 75 and over, in this case the negative effect of 3.1 per cent is similar in magnitude to that for children, signaling for the relevance of this type of care. Although on average, it is still short compared to infant´s burden given the population structure. It ´s worth say ing that in absence of the variable controlling for the care burden of elder, the effect of children´s burden slightly increases. We consider this finding suggestive, since most of the research on women´s LFP and care is centered in childcare, lacking

estimates of this important and marginally increasing type of care associated to aging because of demographic transitions.

As in the case of Mexico, the effect of education is positive and significant, however it is substantially higher as its relevance almost doubles. Likewise, the size of the primary and secondary sectors does not show a statistically significant relationship with women's LFP. Although in Colombia the contribution of the primary sector to the economy is proportionally greater compared to Mexico, the lack of statistical significance indicates that women face similar barriers to participation in this sector. This suggests the need for inclusive work strategies for women in both countries, such as those oriented to reduce segregation in agricultural and industrial sectors where the nature of jobs might impede carrying their children with them or not be flexible to accommodate schedules: CAI, flexible hours, and licences for men and women so that care can be redistributed, social protection that includes other care services beyond children, and promotions. Presumably, women's participation occurs to a greater extent in municipalities with higher output in the tertiary sector since it might be more flexible for them.

In Colombia, the model suggests that spillover effects are larger than those in Mexico, i.e. 9.0 per cent compared to 5 per cent. This may be due to the degree of territorial integration, the higher wealth inequality of territories, and the larger size of municipalities in Mexico, maybe with more activities and services within the municipality, geographical characteristics, and accessibility among territories (as shown in Table 3 and Figure 3). To further understand these results in future studies, other information should be produced, such as borders, distances, commuting time and types of communication routes.

6. Conclusion

The COVID-19 pandemic hit hard the economies and health systems all around the world, but departing from previous global crises, it also challenged educational systems, social protection mechanisms, and the social organisation of care, particularly reducing the already scarce services available. Potentially setting back the possibilities to advance in the emerging efforts to create care systems. Since social protection systems are extremely weak in their care component and care provision all around the world, and especially in Latin America, relies on women's unpaid work, shock meant that besides institutional challenges, the pandemic challenged lives and livelihoods while also increasing the unpaid care loads of women in their households. As a direct consequence, it provoked a displacement of women's paid production (LFP) due to sharp increases in unpaid production (care and housework).

Our research recapitulates on the hit to formal childcare institutions in Mexico that was exacerbated by the pandemic and policy decisions adopted, the consequent increase in the relevance of unpaid care work and their joint effect on women's LFP. Using the case of Mexico, we show that the disruption to care services compromises the advancements to the construction of a robust care system, since changes seems to be more than transitory, resulting in the collapse and vanish of social infrastructure for care. We provide estimates of changes in magnitude of variables that are proxy of care activities, and by highlighting their increased relevance to explain

women's LFP and emphasize that this might result in a structural recoil for women and care recipients.

We find that supply-side and demand-side factors such as gender roles, social infrastructure for care and the type of local economies are quite significant, challenging the idea of labour studies neutral to gender perspective that education is the most relevant factor influencing labour. Although education is central to study LFP, other structural conditions may importantly enhance or limit women's inclusion in labour markets. An exploratory model for the case of Colombia also confirms our results, furthermore it provides relevant insights to amplify the analysis beyond childcare, to include elder's care, commonly limited either by data availability and/or the shortness of coverage of policies oriented to their care.

Schooling is a consistent factor in the period 2015-2020 analyzed for Mexico, despite the pandemic and variations possibly associated to data collection as said, 2015 data fails to efficiently capture women's informal work. In contrast, our analysis shows that when comparing the municipal data with the situation five years before the COVID-19 pandemic started, important changes occurred in the relationship of women's LFP with gender roles and local conditions related to care services and the economy. In brief, the role of variables that serve as proxy for their care responsibilities and supply of care services substantially increased their relevance. The economic output of the services sector preserved its significant effect, whereas the primary and secondary sectors are not statistically significant compared to 2015.

Although the pandemic shock affected all over the population distribution regardless of their schooling or socioeconomic levels, our results suggest that what particularly mattered to explain levels of women's LFP was their care roles and services availability. Together with the characteristics of local economies, where barriers to the agricultural and industrial sectors are common for women, the pandemic's hit to the social organisation of care was determinant to collapse their involvement in paid employment and is therefore essential to be considered in the design of recovery strategies. Lack of inclusiveness in agricultural and industrial sectors entail important barriers to women's economic empowerment, reflected in poor statistical associations between women's LFP and these sector's economic output.

Our municipal analysis for Mexico shows quite small spillovers to neighboring territories for education, work, care services and economic output. This may suggest that local policies could be harnessed by increasing coverage and articulation, but also those local interactions are constrained by geography, roads, or distances. This is an important issue to be considered in the design of policy actions, since it was confirmed with the pre and during pandemic data, suggesting a structural condition. The case of Colombia shows a bit different story, with higher spillovers that should be further analyzed with additional data.

It is also common that recovery strategies are centred in industries where women are misrepresented, such as construction, thus leaving women's employment recovery unattended (see Atlantic Council 2021 for the case of Colombia and International Trade Administration 2021 for Mexico). A gender-responsive recovery should consider gender-responsive sectoral policies to make the recovery strategies more inclusive, but mainly

to explicitly link them with the provision of care services supply and its expansion. In parallel, efforts to tackle structural inequalities and pervasive segregation in education and workplaces need to be supported as a long-term growth strategy. Social protection systems are extremely weak in their care component and COVID-19 evidenced the need for restructures oriented towards the construction of care systems in order to reduce inequalities, empower women, and improve well-being. Taking into account that mere investment in CAI may not be enough, since the economic output and type of activities also interfere with its potential effect these interactions should be considered in a growth strategy.

Notes

1. The CNPV 2020 captures labour participation with two categorical questions. The first captures the main activity carried out by the person, either inside or outside the labour market. The second is a verification that captures paid work as a secondary activity. Meanwhile, the EI 2015 captures labour participation with two questions. The first is dichotomous and captures whether the person is in the labour market. If not, the second question captures her main activity, but this might be inside or outside the labour market, leading to under-registration of work as a secondary activity.
2. The National Administrative Department of Statistics (DANE, Spanish abbreviation) carries out the IPM based on the National Quality of Life Survey (ECV) 2018. Besides, the DANE conduct the census prediction as part of its post-census studies to approximate multidimensional poverty at the municipal level (National Administrative Department of Statistics 2020). It provides information on poverty and its components at the municipal level.
3. The variable measures the proportion of children aged 0–5 with no access to health services or who spend most of their time with their parents at work, at home alone, or cared for by a person under 18 years old.
4. DANE is in the process of gathering its CE, which specifically contemplates the recollection of data in economic units dedicated to the provision of care services and their characteristics (Departamento Administrativo Nacional de Estadísticas 2021).
5. These percentages decrease considerably in the population group of 15–29 years, where women are in the life course corresponding to upbringing.
6. These data reflect the improvements that INEGI made in the data collection of informal work with respect to EI 2015. In 2015, 35 per cent of women were captured participating in the paid labour market. This should be taken in consideration when interpreting results, since underestimation is particularly relevant for the lower socioeconomic strata.
7. On average, 4.4 CAI in each municipality.
8. Different indirect effects are recorded in each municipality, as each is affected by the characteristics of its own neighbours.
9. Average effects; the spillover will be higher in some municipalities and lower in others.
10. To verify the consistency of the comparison, Table 5 shows the estimation restricting the dependent variable of 2020 to the categories comparable to 2015. Part of the change in the variable of children is accentuated when considering the complete labour information. The same happens with the age structure of the female population; while in the service sector it is attenuated.
11. Intermediate models not shown.
12. The municipal poverty percentage variable comes from the National Council for the Evaluation of Social Development Policy (CONEVAL, Spanish abbreviation) with information from 2020. It is not included in the model because we are interested in estimating the effect of individual factors that the measurement uses, such as schooling.

Acknowledgements

We thank the Mexican statistics office, INEGI, for their policy of public data, that allows research advancement. As well as ONU Mujeres and the Global Centre of Excellence on Gender Statistics for fostering valuable discussions and studies in this topic. We kindly appreciate Daniela Rico's help. GENDERS' research in labour and care work started several years ago with the support of Oxfam and its involvement in the Red de Cuidados en México. This work benefits from the foundations of such research and is fully financed with GENDERS' own resources.

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