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Julian Pedrazzi y Leonardo Peñaloza-Pacheco

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# Heterogeneous effects of forced migration on female labor supply\*

Julian Pedrazzi<sup>†</sup>      Leonardo Peñaloza-Pacheco<sup>‡</sup>

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## Abstract

In this paper we analyze the impact of Venezuelan migration on the female labor supply in Colombia. Using an instrumental variable approach we found significant drops in the female labor supply, mainly on those women with lower qualifications. In contrast, we observe significant increases for high-skilled women with family responsibilities, such as childcare. These results are consistent with a redistribution of time use, where women spend fewer hours on household tasks and more time in the labor market. Our results provide novel evidence of the consequences of forced migration between developing countries on the female labor supply.

*JEL Classification:* F22, J22, J16.

*Keywords:* Forced Migration, Female Labor Supply, Labor Market, Colombia, Venezuela.

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<sup>†</sup>Centro de Estudios Distributivos, Laborales y Sociales (CEDLAS), IIE-FCE, Universidad Nacional de La Plata. E-mail: [pedrazzi.julian@gmail.com](mailto:pedrazzi.julian@gmail.com).

<sup>‡</sup>Centro de Estudios Distributivos, Laborales y Sociales (CEDLAS), IIE-FCE, Universidad Nacional de La Plata. E-mail: [leopacheco93@gmail.com](mailto:leopacheco93@gmail.com)

# 1 Introduction

In Latin America and the Caribbean, nine out of ten people employed in the domestic service sector are women. This sector represents a significant fraction of female employment in the region. Unlike what happens worldwide, where only 5% of women work in this sector, in Latin America this percentage reaches values close to 13% (ILO, 2015). The provision of this service has a direct impact on the distribution of domestic tasks within families and on the possibilities of women's insertion in the labor market. (Farré et al., 2011)

Furthermore, the domestic service sector often has a significant participation of migrant workers. In the case of Colombia, the increase in the migratory flow of Venezuelans has notably modified the composition of immigrants across different sectors of the labor market. In particular, the participation of Venezuelan women in the domestic service increased significantly. In the departments most affected by migration, this percentage increased by more than 10 percentage points.

This situation raises questions about the effects that the arrival of migrants can have on the cost of domestic service. Did an increase in the supply of domestic labor reduce wages and, therefore, the price of such service? If so, did it increase the hiring of these services by families? In turn, given that women tend to be the main responsible for domestic chores, how did an increase in the hiring of domestic service impact the female labor supply? Was there a redistribution of time use between household tasks and hours dedicated to the labor market?

In this paper we evaluate whether the arrival of Venezuelan immigrants affected the labor supply of native women in Colombia. A greater labor supply can generate a drop in the value of goods and services that are intensive in this factor (Cortes, 2008). In particular, the arrival of migrants can affect the price of services that are close substitutes for household chores, such as domestic service, generating incentives to hire and substitute hours dedicated to household tasks for time in the labor market (Cortes and Tessada, 2011). However, there are other effects previously explored in the literature. The arrival of migrants can increase competition in the labor market and generate pressure to replace native workers with migrants (Card, 1990; Borjas, 2003). The total effect will depend on the degree to which these workers replace or complement each other (Peri, 2009).

The most productive women in the labor market have greater incentives to hire domestic service, since they have a higher opportunity cost of dedicating their time to household tasks (Cortes and Tessada, 2011). Spending time at home implies a greater loss of income compared to less productive women. For this reason, we estimate effects by level of qualification in our analysis, expecting a positive impact on the most qualified women. Nevertheless, in the case of less educated natives, we could observe effects in the opposite direction. A significant increase in the labor supply could affect their employment opportunities due to a direct replacement between native and foreign workers.

We also analyze how migration affected those women who have greater family responsibilities, such as childcare. Recent literature shows that the arrival of a child is one of the main factors limiting women's labor supply (Kleven et al., 2019; Berniell et al., 2019; Mata et al.,

2020). Therefore, given a fall in the price of domestic service, we hope that women with young children in charge will benefit more (Farré et al., 2011; Barone and Mocetti, 2011).

Our empirical strategy exploits the concentration of Venezuelans across the departments of Colombia over time. Since they are not located randomly, we instrument the proportion of immigrants with a prediction of the distribution of Venezuelans in each department of Colombia. Following Del Carpio and Wagner (2015) and Caruso et al. (2019), we construct our instrument considering the proportion of people living in each state of Venezuela and the distance between these states and the departments of Colombia.

Previous literature uses instruments that are based on the past distribution of immigrants (Cortes and Tessada, 2011; Farré et al., 2011; Barone and Mocetti, 2011). There are two important differences from these analyses. First, the migratory flow is of a particular nationality, which does not allow us to take advantage of the typical variability of the shift-share type instruments (Card, 2005). On the other hand, the influx of immigrants was sudden and due to extreme causes, constituting an episode of forced migration (Del Carpio and Wagner, 2015; Morales, 2018; Caruso et al., 2019). These elements suggest that immigrants were located in the departments closest to the border, giving greater relevance to the argument of distance, in contrast to that of networks.

Our main results show that, given the increase in migratory flows, there is a drop in the female labor supply. However, when we estimate this effect taking into account the level of qualification of women, we find that these results hold only for the lower-middle part of the distribution in terms of qualification. In the case of high-skilled women, we found no negative effects.

On the other hand, if we restrict the analysis to women with dependent children, we find similar effects in the lower-middle part of the educational distribution. However, there is a significant positive impact for the more educated women. Considering an average increase in the share of Venezuelan immigrants in the 2013-2019 period of 3 p.p., our estimates show a positive effect in the labor force participation and the rate of employment of high-skilled women close to 1% and 2.5%, respectively, relative to the baseline period prior to the Venezuelan exodus (2013). This result is consistent with the channel associated with domestic service, where the main beneficiaries are the more productive women with greater responsibilities in the household (Farré et al., 2011; Barone and Mocetti, 2011).

We also provide evidence that supports the domestic service channel. We notice significant drops in the hourly wages in this sector. Given that the domestic service is a labor-intensive sector, a drop in wages can translate directly into a reduction in its market price. In line with this result, we find increases in the use of live-in domestic service. In addition, we observe decreases, although not significant, in the time dedicated to household tasks. We only find significant reductions of the time dedicated to household chores for the women most affected by the reduction in the price of domestic service: those with higher qualifications and with younger dependent children.

Finally, as a robustness check, we examine how the arrival of Venezuelan immigrants affected the labor supply of men. The domestic service channel mainly affects women, since they are

the ones who restrict their participation in the labor market in order to spend time at home (Kleven et al., 2019). We find negative and significant effects only for low- and medium-skilled men. This result is consistent with the direct effects, where incoming migrants displace native ones. We do not find evidence that men are affected by the channel associated with domestic service.

Previous literature has focused on developed countries, where similar results have been found. In the United States, Cortes (2008) finds that migration flows in recent decades reduced the price of services intensive in the use of low-skilled migrant workers, such as domestic service. She notes that this reduction had a positive effect on the hours worked by native women located at the higher part of the labor income distribution (Cortes and Tessada, 2011). At the same time, she finds significant reductions in the time dedicated to household tasks.

Similarly, Farré et al. (2011) observe an increase in the probability of being employed for high-skilled Spanish women with family responsibilities, such as caring for children or the elderly, as a result of immigration. In the case of Italy, Barone and Mocetti (2011) note that the increase in migrants specializing in domestic tasks had a positive effect on the working hours of high-skilled native women. This result is greater for women with small children and non-existent for men, providing evidence that the effect is associated with a fall in the price of domestic service. Finally, in a recent study on the Dominican Republic, Hiller and Rodríguez Chatruc (2020) found that female migration is associated with a drop in the hours worked by less qualified native women, while increases in this dimension are observed for high-skilled women with family responsibilities.

This is one of the first papers to analyze how a sudden forced flow of immigrants between developing countries can affect the female labor supply. This allows us to highlight the two effects evaluated in the literature, the direct one and the one associated with domestic service. For the latter, we found similar evidence to that found in developed countries. However, unlike the previous literature, there are direct effects that must be taken into account, especially for low-skilled women.

The rest of the paper continues as follows: section 2 analyzes the migratory flow of Venezuelans to Colombia. Section 3 shows the data used and its main descriptive statistics. Section 4 presents the empirical strategy. Section 5 presents the main results in the labor market of native women. Section 6 provides evidence to support the proposed mechanisms. Section 7 shows some robustness exercises. Finally, section 8 concludes.

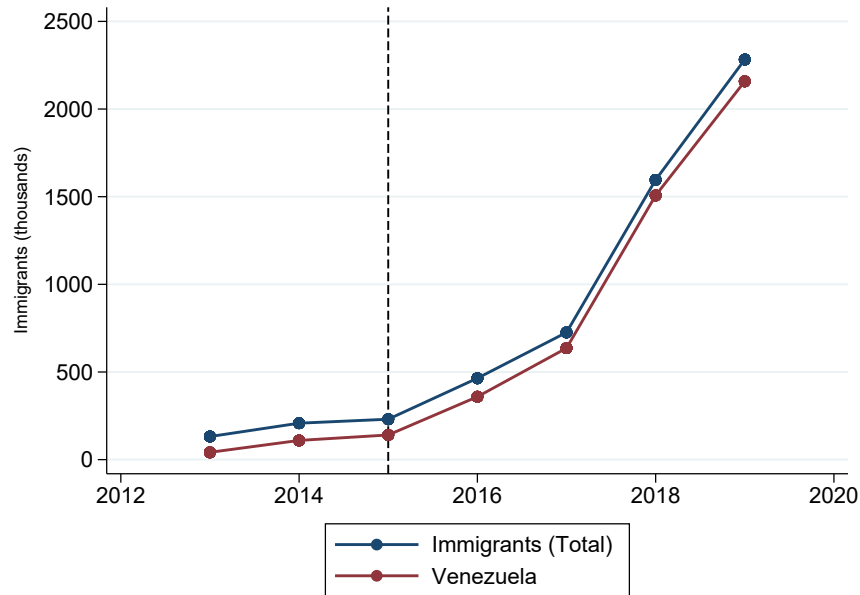
## 2 Venezuelan Forced Migration

### 2.1 Crisis and Venezuelan exodus

Since the beginning of the last decade, Venezuela's economic and social crisis has forced millions of people to leave their homes and migrate to different Latin American countries. By the end of 2015, the number of Venezuelan migrants in the world amounted to 700,000, while by 2019, this number increased to 4 million people (UNHCR and IOM, 2019). Possibly due to geograph-

ical proximity, one of the main destinations chosen by Venezuelan migrants was Colombia. At present, it is estimated that the number of Venezuelans who entered Colombia reaches 2 million people (Figure 1).

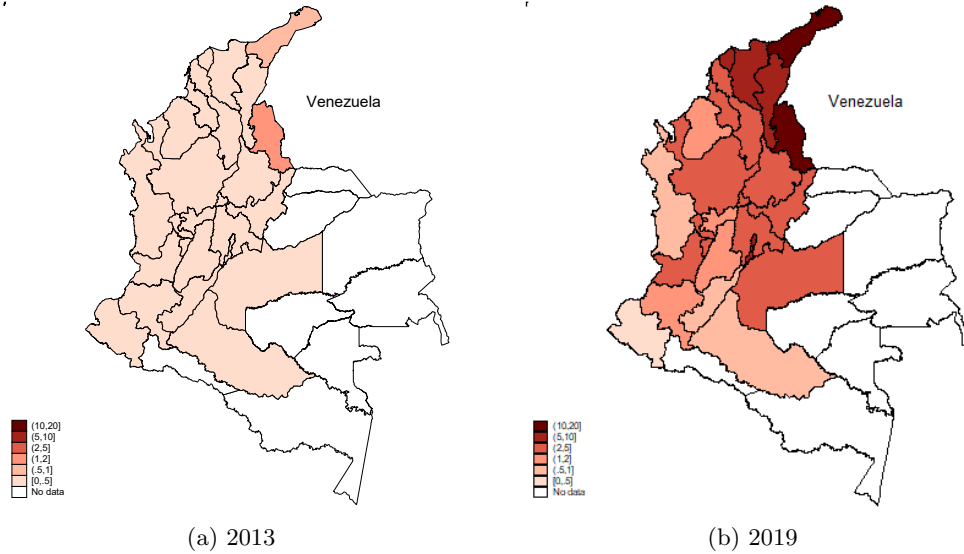
Figure 1: Migratory inflow 2013-2019



Note: Own elaboration based on GEIH.

Although migrants were distributed throughout the Colombian territory, they were located primarily in those departments that are closest to the border, such as La Guajira and Norte de Santander (Figure 2). The increase in labor supply generated pressures on the labor market, which caused significant reductions in the real wages of natives and migrants, concentrating on informal and low-skilled workers (Caruso et al., 2019; Peñaloza Pacheco, 2019). One explanation for the difference found between these results and the literature from developed countries (Cortes, 2008) can be attributed to the fact that natives and migrants have more characteristics in common and therefore compete for the same jobs. Therefore, with a greater degree of substitutability between them, it is expected that the effects generated on the labor market for residents will be significantly greater (Peri, 2009).

Figure 2: Venezuelan Immigration by Department (% Population)



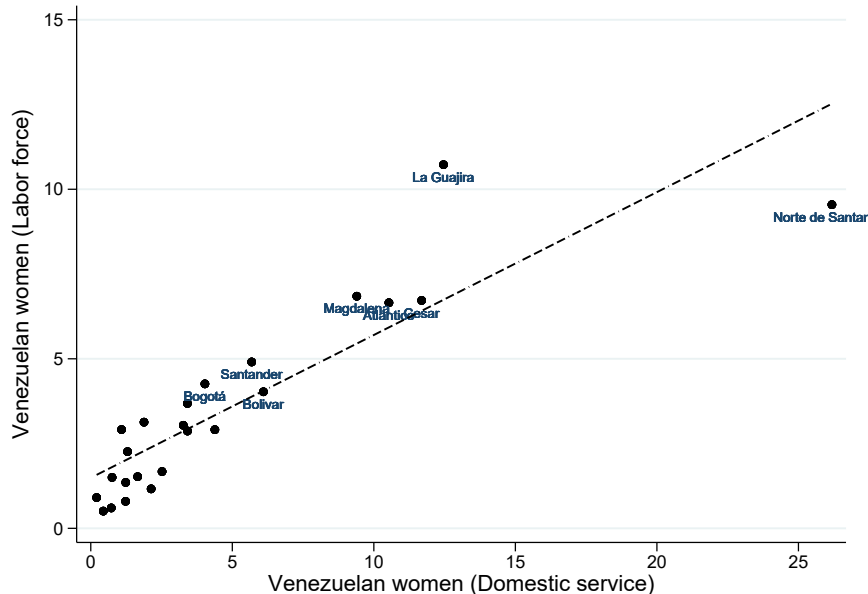
Notes. Source: Own elaboration based on GEIH data. The departments without data in the figures are mainly departments in the Amazon region with low population density and small major cities for which no information is available. According to the last available census in Colombia (2018), the aggregate population in these departments represents less than 3% of the total population of Colombia.

## 2.2 Migration and domestic service

Contrary to what happens in developed countries, domestic work in Colombia had a low participation of migrant workers.<sup>1</sup> According to the Great Integrated Household Survey (GEIH, by its acronym in Spanish), in 2013 only 0.13% of domestic workers were from another country. This composition changed significantly after the migratory shock, reaching values close to 4.5% in 2019. The most affected departments are those closest to the border. In 2013, in the border departments of La Guajira and Norte de Santander, the percentage of Venezuelan women in domestic service was less than 1 percent, while in the period 2013-2019, this percentage increased by more than 10 percentage points (Figure 3).

<sup>1</sup>In the United States, 25% of women in private domestic service are migrants, while in cleaning services, they represent 12% (Cortes and Tessada, 2011).

Figure 3: Change in the participation of Venezuelan migrants in the labor force and in domestic service between 2013 and 2019



Note: The axes measure the change in percentage points (p.p.) between 2013 and 2019. The variable on the vertical axis is defined as the change in the percentage of Venezuelan women participating in the labor market in relation to the female labor force. The horizontal axis is defined as the change in the percentage of Venezuelan women working in the domestic sector in relation to the total number of women working in that sector. Own elaboration based on data from the GEIH.

These results reflect a significant increase of Venezuelan women in the domestic sector, especially in those regions that were most affected by migration. We can therefore observe a positive relationship between the departments where the immigration of Venezuelan women was mainly concentrated and those where the participation of migrant women in the domestic sector increased considerably.

The sudden arrival of a large proportion of Venezuelan women may have affected the wages received in the sector. Given that it is a labor-intensive sector, the drop in wages may translate into a reduction in the price of domestic service, generating greater incentives for native women to hire domestic service.

### 3 Data and descriptive statistics

The data used are obtained from the Great Integrated Household Survey (GEIH, by its acronym in Spanish) for the period from April 2013 to December 2019.<sup>2</sup> This survey is carried out by

<sup>2</sup> The sample begins in April 2013 because as of that month there is information on the migratory characteristics of persons.



the National Administrative Department of Statistics (DANE, by its acronym in Spanish) of Colombia, and is representative of the entire national territory. With this information we can identify migrants, using as a definition those who reported being born in Venezuela. We restrict our analysis population to native women between 18 and 64 years old.

Table 1 shows a comparison of the main socio-demographic and labor characteristics of native women with those from Venezuela. In the total sample, a greater proportion of migrant women remain active in the labor market, although this result does not correspond to a higher employment rate. In the remaining characteristics we observe that native women are, on average, older and a smaller proportion of them are married. It is important to note that Venezuelan women are more qualified, on average, than Colombian women, reflecting the fact that the immigration episode of Venezuelan refugees increased the labor supply in Colombia with high-skilled workers, relative to native individuals in the labor market.

Table 1: Descriptive Statistics

Variables	Mean - Colombian	Mean - Venezuelan	Difference	P-value
Labor force participation	0.670	0.706	0.035	(0.032)
Employed	0.587	0.554	-0.033	(0.024)
Hours worked	40.302	45.044	4.742	(0.000)
Married	0.581	0.675	0.094	(0.000)
Age	37.990	30.802	-7.189	(0.000)
Years of education	9.612	10.894	1.282	(0.000)
Hours of domestic work	30.039	31.494	1.455	(0.016)
With 5-year-old or younger children	0.194	0.361	0.167	(0.000)
Observations	1,724,838	18,818	1,743,656	

Notes: The statistics correspond to native and migrant women between 18 and 64 years of age for the entire period analyzed. Own elaboration based on GEIH data. Married refers to women who are living with a partner.

If we separate by qualification level (Table A1), we find that native women with more education have a higher participation in the labor market, are more likely to be employed and spend more hours per week at work. In contrast, they spend fewer hours on household chores. This result can be explained by two reasons. The first one is associated with purchasing power, in which high-skilled women use less time intensive technologies for household tasks. The second is that these women have a higher opportunity cost of dedicating hours to domestic work and therefore have greater incentives to hire an external service, such as domestic service (Marchionni et al., 2019). The latter result can be verified, at least partially, in the proportion of women who have a live-in domestic worker in the household.<sup>3</sup>

<sup>3</sup>The survey can only identify live-in domestic workers, that is, those who live permanently in the household. We cannot observe whether households hire more flexible domestic services where, for example, they are hired for a reduced number of hours. However, it is likely that a less intensive service, where an employee is hired for less time, will have a lower cost and therefore extend to lower parts of the distribution.

## 4 Empirical Strategy

To analyze the effect that the arrival of Venezuelan migrants had on the labor market of native women, we use the following specification:

$$Y_{idrt} = \alpha + \beta m_{drt} + X'_{idrt}\theta + \psi_d + \delta_{rt} + \epsilon_{idrt} \quad (1)$$

where  $Y_{idrt}$  is the variable of interest of the individual  $i$ , in the department  $d$  of the region  $r$  in the month  $t$ . The vector  $X_{idrt}$  includes demographic controls, such as age, education level, marital status, and variables that indicate whether they have dependent children,  $\psi_d$  and  $\delta_{rt}$ , correspond to fixed effects at the department and region-month level, respectively, and  $\epsilon_{idrt}$  is the error term. The relevant variable is  $m_{drt}$ , the proportion of Venezuelan immigrants relative to the labor force, formally:

$$m_{drt} = \frac{V_{drt}}{P_{drt}} \quad (2)$$

where  $V_{drt}$  is the number of Venezuelans and  $P_{drt}$  is the total labor force in the department  $d$  in the region  $r$  in the month  $t$ . It is expected that immigrants are not randomly distributed across Colombia's different departments, and the location decision may be biased by certain unobservables, such as the seeking of job opportunities. To deal with this potential bias, following [Del Carpio and Wagner \(2015\)](#) and [Caruso et al. \(2019\)](#), we instrument the proportion of Venezuelans with the following variable:

$$iv_{drt} = \sum_k \frac{h_k^{1990}}{I_{drk}} V_t \quad (3)$$

where  $h_k^{1990}$  is the proportion of Venezuelans living in the  $k$  state of Venezuela in 1990, the variable  $I_{drk}$  represents the distance between the  $d$  department of the region  $r$  in Colombia and the  $k$  state in Venezuela and, finally, the variable  $V_t$  corresponds to the total number of Venezuelans living in Colombia in the month  $t$ . Therefore, the instrument exploits the distance between the departments in Colombia and the states in Venezuela, the demographic density of each of the states in Venezuela and the total number of Venezuelans in Colombia for each time period. In a given month, the smaller the average distance to all the states in Venezuela and the higher the historical population density of those states, the higher the value of the instrument.

We used different sources of information for the construction of the instrument. First, we calculated the distance by implementing Stata's *georoute* command, which provides information about the distance by car and the travel time under normal traffic conditions between two geographical points ([Weber and Péclat, 2017](#)). Additionally, we obtained the proportion of Venezuelans living in each  $k$  state of Venezuela from the sample of the 1990 Census of Venezuela available at IPUMS.

Previous literature has used instruments that rely primarily on the past distribution of migrants to predict their current location ([Cortes and Tessada, 2011](#); [Barone and Mocetti, 2011](#); [Farré et al., 2011](#)). In our case, we perform an analysis of a migration process with

different characteristics than those generally studied. Firstly, the migratory flow is of a particular nationality. This does not allow us to take advantage of the variability of nationalities typical of the shift-share type instruments (Card, 2005). On the other hand, the influx of immigrants was sudden and due to extreme causes, constituting an episode of forced migration (Del Carpio and Wagner, 2015; Morales, 2018; Caruso et al., 2019). The previous literature analyzes longer periods of time, where the network argument may have greater relevance. In contrast, distance is a more valid instrument for our case, where immigrants fled an extreme situation and are located in the closest place, such as the border departments (Del Carpio and Wagner, 2015).

Figure A1 shows a positive relationship between the proposed instrument and the proportion of immigrants in each of the departments under study. Similarly, the instrument shows a positive and statistically significant relationship to predict the proportion of migrants, with an F-statistic that exceeds the standard values (Table A7). These results suggest that the condition of relevance in the first stage is met satisfactorily.<sup>4</sup>

One possibility is that the exclusion restriction may be violated, for example, if the distance reflects other differences between regions. This could happen if the areas closest to the border are the ones that offer the best job opportunities for migrants (Del Carpio and Wagner, 2015). This possibility is at least partially controlled when we incorporate fixed effects by department and region-month.

## 5 Main results

### 5.1 The labor market for native women

Table 2 shows the effect of migration on the labor market of native women. In all cases, we find a significant drop in the female labor supply at both the extensive and intensive margins. In the intensive margin, we observe that 1 percentage point (p.p.) increase in the immigration of Venezuelans reduced the hours dedicated to the labor market by 1.3%, on average. Our estimates also indicate a negative effect on the extensive margin of the female labor supply. We can observe in Table 2 that 1 p.p. increase in the immigration of Venezuelans reduced the likelihood of being employed and of participating in the labor market in 0.5 percentage points, on average.

To understand the magnitude of the effect we can consider as a baseline the labor force participation and the rate of employment of native women prior to the Venezuelan exodus (i.e. in 2013) and the average increase in the share of immigrants in the 2013-2019 period in Colombia. According to our calculations based on GEIH, in 2013 the rate of labor force participation and employment among women was about 67% and 61%, respectively, and the average increase in the share of Venezuelan immigrants in the period 2013-2019 was close to 3 p.p. Therefore, our estimates indicate a reduction in both variables close to 2.2%, on average due to the Venezuelan exodus, relative to the baseline period (2013).

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<sup>4</sup> Table A7 shows first-stage estimates for regressions on female labor market.

Table 2: Effect of immigration on the female labor supply

	OLS		IV	
	(1)	(2)	(3)	(4)
<b>Labor force participation</b>				
Share of immigrants	-0.001 (0.001)	-0.001 (0.001)	-0.005*** (0.001)	-0.005*** (0.001)
<b>Employed</b>				
Share of immigrants	-0.000 (0.001)	-0.001 (0.001)	-0.005*** (0.001)	-0.005*** (0.001)
<b>Hours (logs)</b>				
Share of immigrants	0.001 (0.004)	-0.000 (0.003)	-0.013*** (0.004)	-0.013*** (0.004)
F-statistic			104.35	104.38
Observations	1,132,486	1,132,486	1,132,486	1,132,486
Individual controls	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. Women who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Nevertheless, we find differential effects by qualification level. In particular, for low- and medium-skilled women, we find negative and significant coefficients (Table 3). Our estimates show a greater effect for low- and medium-skilled women compared to the average estimates presented above in Table 2.

Specifically, Table 3 shows that an increase in 1 p.p. of Venezuelan immigration reduced, on average, the hours in the labor market of low-skilled women by 2.1%. Furthermore, in the extensive margin, according to our calculations, the labor force participation and the rate of employment of low-skilled women in 2013 was about 59% and 53%, respectively. Thus, considering an average increase of the share of Venezuelan immigrants of 3 p.p., our estimates showed in Table 3 suggest a reduction in the labor force participation and the rate of employment of low-skilled women close to 4.6% and 4.5%, respectively, relative to the baseline period. This result is consistent with direct effects, where migrant women displace native women in their jobs. Nonetheless, this does not happen for high-skilled women. Although the effects are small, they are positive, which does not contradict the channel associated with domestic service.

Table 3: Effect of immigration on female labor supply by qualification level

	Labor force participation		Employed		Hours (logs)	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: Low skilled</b>						
Share of immigrants	-0.008*** (0.001)	-0.009*** (0.002)	-0.008*** (0.002)	-0.008*** (0.001)	-0.020*** (0.006)	-0.021*** (0.005)
F-statistic	111.00	111.03	111.00	111.03	111.00	111.03
Observations	488,365	488,365	488,365	488,365	488,365	488,365
<b>Panel B: Medium skilled</b>						
Share of immigrants	-0.004** (0.002)	-0.004** (0.002)	-0.004** (0.002)	-0.004** (0.002)	-0.008 (0.005)	-0.008* (0.004)
F-statistic	95.14	95.19	95.14	95.19	95.14	95.19
Observations	487,605	487,605	487,605	487,605	487,605	487,605
<b>Panel C: High skilled</b>						
Share of immigrants	-0.001 (0.001)	0.001 (0.001)	-0.001 (0.002)	0.000 (0.001)	0.001 (0.006)	0.006 (0.005)
F-statistic	106.42	106.43	106.42	106.43	106.42	106.43
Observations	156,516	156,516	156,516	156,516	156,516	156,516
Individual controls	No	Yes	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. Women who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

## 5.2 Family responsibilities: Women with children

Women who have greater family responsibilities, such as childcare, are often the ones who face the greatest restrictions to participating in the labor market. For this reason, a drop in the price of domestic service may benefit them more than those women who do not have these responsibilities (Farré et al., 2011; Barone and Mocetti, 2011). To evaluate this channel, we restricted the sample to those Colombian women who have at least one dependent child who is 5 years old or younger.

In this group, for low- and medium-skilled women, we find similar, although slightly higher, results than those found in the total sample. However, for high-skilled women, we find positive and significant results. This result is consistent for all dimensions of the female labor supply.

Our estimates based on GEIH indicate a labor force participation and rate of employment of high-skilled women with children in 2013 (the baseline period) close to 88% and 83%, respec-

tively. Therefore, considering an average increase in the share of Venezuelan immigrants in the 2013-2019 period of 3 p.p. and the coefficients of Table 4, our estimates show a positive effect in the labor force participation and the rate of employment of high-skilled women close to 1% and 2.5%, respectively, relative to the baseline (2013).

Table 4: Effect of immigration on the labor supply by level of qualification with 5-year-old children

	Labor force participation		Employed		Hours (logs)	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: Low skilled</b>						
Share of immigrants	-0.011** (0.004)	-0.012*** (0.004)	-0.011** (0.004)	-0.011** (0.004)	-0.028* (0.014)	-0.031* (0.015)
F-statistic	112.73	112.87	112.73	112.87	112.73	112.87
Observations	75,269	75,269	75,269	75,269	75,269	75,269
<b>Panel B: Medium skilled</b>						
Share of immigrants	-0.004* (0.002)	-0.005* (0.003)	-0.006*** (0.002)	-0.006*** (0.002)	-0.014** (0.005)	-0.014** (0.006)
F-statistic	92.08	92.17	92.08	92.17	92.08	92.17
Observations	128,582	128,582	128,582	128,582	128,582	128,582
<b>Panel C: High skilled</b>						
Share of immigrants	0.003** (0.001)	0.003** (0.002)	0.007*** (0.001)	0.007*** (0.002)	0.032*** (0.006)	0.033*** (0.006)
F-statistic	100.26	100.28	100.26	100.28	100.26	100.28
Observations	34,270	34,270	34,270	34,270	34,270	34,270
Individual controls	No	Yes	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. Women who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

These findings are consistent with the channel associated with domestic service. The main beneficiaries of a drop in the price of this service are the most qualified women and those who must dedicate more time to the household (Farré et al., 2011; Barone and Mocetti, 2011; Forlani et al., 2015).

In the following section we will present different results that allow us to explain the mechanisms behind the results presented above. In particular, we will evaluate whether the increase

in the hours worked by high-skilled women is due to a reduction in the price of domestic service, and not to other complementarities between natives and immigrants.

## 6 Mechanisms

In this section we show evidence that supports the channel associated with domestic service. First, we look at how the arrival of Venezuelan forced migrants affected the domestic service labor market. We find an increase in the probability of being employed in this sector (Table 5). Also, since this service is labor-intensive, a drop in the wages received can translate into a reduction in its market price. We observe that, given an increase of one percentage point in the proportion of immigrants, the hourly wage of domestic service falls by 3.1%, on average.<sup>5</sup>

Given a fall in the price of domestic service, it is expected that native women will have greater incentives to hire this service. To evaluate this possibility, we take advantage of the fact that the GEIH allows us to identify those households that have a person dedicated to domestic chores. Panel B of Table 5 shows the main results on the probability of hiring live-in domestic service in the household. Both for high-skilled women in general and for those high-skilled women with dependent children, we found a significant increase in the probability of hiring such service.

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<sup>5</sup> Tables A8 and A9 show first-stage estimates for regressions on mechanisms.

Table 5: Effect of Immigration on wages and domestic service employment

	Domestic service employment		Domestic service wage	
	(1)	(2)	(3)	(4)
<b>Panel A: Domestic service</b>				
Share of immigrants	0.000 (0.000)	0.001** (0.000)	-0.031*** (0.007)	-0.031*** (0.006)
F-statistic	100.47	100.49	98.85	98.95
Observations	1,012,797	1,012,797	75,996	75,996
	High skilled		High skilled - children	
	(1)	(2)	(3)	(4)
<b>Panel B: Domestic service hiring</b>				
Share of immigrants	0.002** (0.001)	0.002** (0.001)	0.003* (0.001)	0.003* (0.001)
F-statistic	106.42	106.43	100.26	100.28
Observations	156,516	156,516	34,270	34,270
Individual controls	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: In Panel A the estimates correspond to the total number of women between 18 and 64 years of age. In Panel B, the estimates are restricted to native women of the same age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicator variable that reflects whether the person has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

On the other hand, as we have argued, an increase in the number of working hours would be associated with a drop in the number of hours of housework. For this reason, we study whether the arrival of migrants affected the hours dedicated to unpaid domestic work by native women. Although the coefficients go in the expected direction, there does not seem to be significant effects in this dimension for the total number of women (Table 6). However, for those women who have young children, we observe that, given an increase of 1 percentage point in the proportion of Venezuelan immigrants, there is a reduction in the hours dedicated to childcare of 4.8%. In this sense, there is a reduction in the hours dedicated to household chores, which appear to be replaced, at least partially, by a greater number of hours in the labor market.



Table 6: Effect of Immigration on household work hours - Women

	Total hours		Childcare		House chores	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: High-Skilled</b>						
Share of immigrants	-0.005 (0.019)	-0.006 (0.019)	-0.015 (0.016)	-0.013 (0.016)	-0.000 (0.016)	-0.002 (0.016)
F-statistic	106.42	106.42	106.46	106.46	106.40	106.40
Observations	156,516	156,516	156,433	156,433	156,493	156,493
<b>Panel B: High-skilled - children</b>						
Share of immigrants	-0.023 (0.021)	-0.024 (0.021)	-0.048* (0.027)	-0.048* (0.026)	-0.007 (0.017)	-0.008 (0.016)
F-statistic	100.26	100.28	100.39	100.41	100.20	100.22
Observations	34,270	34,270	34,212	34,212	34,265	34,265
Individual controls	No	Yes	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

The evidence we have shown in this section is consistent with the fact that the results found in the labor market for high-skilled native women are associated with a reduction in the price of domestic service. In particular, we found significant reductions in the domestic service sector wages, which can translate into a reduction in its price. In turn, we found evidence, albeit limited, that domestic service hiring increased. Regarding the hours dedicated to the home, there are significant drops in the time dedicated to childcare in the home, mainly for women with dependent children.

## 7 Robustness checks

Finally, as a robustness exercise we study how men react to the migratory flow. This robustness check allows us to evaluate different possibilities. First, high-skilled women could be spending more time in the labor market because their partners have lost their jobs. On the other hand, since men do not tend to restrict their labor supply by carrying out tasks in the home, it is possible that the channel associated with domestic service will have partial, or no, consequences

for them.<sup>6</sup>

Table 7: Effect of immigration on labor supply by qualification level - Men

	Labor force participation		Employed		Hours (logs)	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: Low skilled</b>						
Share of immigrants	-0.002*** (0.001)	-0.002*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.005 (0.003)	-0.005 (0.004)
F-statistic	110.87	110.88	110.87	110.88	110.87	110.88
Observations	387,214	387,214	387,214	387,214	387,214	387,214
<b>Panel B: Medium skilled</b>						
Share of immigrants	-0.001* (0.001)	-0.001 (0.001)	-0.003** (0.001)	-0.003** (0.001)	-0.009 (0.006)	-0.008 (0.005)
F-statistic	95.68	95.68	95.68	95.68	95.68	95.68
Observations	349,686	349,686	349,686	349,686	349,686	349,686
<b>Panel C: High skilled</b>						
Share of immigrants	-0.001 (0.001)	-0.001 (0.001)	-0.003 (0.002)	-0.002 (0.002)	-0.007 (0.007)	-0.006 (0.007)
F-statistic	99.17	99.17	99.17	99.17	99.17	99.17
Observations	115,537	115,537	115,537	115,537	115,537	115,537
Individual controls	No	Yes	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native men between 18 and 64 years of age. Men who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the person has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

We only find negative and significant results in the lower-middle part of the qualification distribution (Table 7). For high-skilled men, although the estimated coefficients are negative, they are not statistically significant. This result suggests that men are not affected by the domestic service channel, consistent with recent evidence (Cortes and Tessada, 2011). Furthermore, in the case of men with dependent children, we also found no evidence that they respond to the drop in the price of domestic service (Table A2).

Finally, most of the literature focuses on analyzing how low-skilled migratory flows affect the female labor supply (Cortes and Tessada, 2011). In some cases, they even focus on low-skilled female migration (Barone and Mocetti, 2011; ?). This is because women with these characteristics usually represent the majority of the workforce in the domestic service sector. In this sense,

<sup>6</sup> Table A10 shows first-stage estimates for regressions of robustness exercise considering men as the group under study

we incorporate these dimensions into the analysis. We modified the proportion of immigrants (equation 2) and the instrument (equation 3) by using low-skilled migrants and then low-skilled female migrants.

Although the first stage is relatively weaker than when we used the total number of migrants, in all cases we found similar results to those of the main analysis (see tables A3, A4, A5 and A6).<sup>7</sup>

## 8 Concluding Remarks

In this paper we showed how forced migration from Venezuela affected the female labor supply in a developing country like Colombia. In particular, we found significant declines in the female labor supply, especially for low-skilled women. This result, which is not highlighted in the previous literature, reflects that there may be competition between natives and migrants for the same jobs.

Nevertheless, we found increases in the labor supply of the most educated women with dependent children. These results are consistent with the channel associated with domestic service. Given a fall in the price of this service, women with a higher opportunity cost of dedicating hours to the home have greater incentives to hire it. At the same time, women with more family responsibilities are the main beneficiaries of being able to access this service at a lower cost.

Our analysis provides relevant information on an under-explored dimension of the effects of immigration on developing countries. The changes in the female labor supply as a result of the decrease in the price of domestic service are only a partial view of the different aspects of the effects of Venezuelan immigration in Colombia. Their study should be further developed in order to be able to make an adequate diagnosis of the consequences in the medium and long term, which will mainly allow for the implementation of effective public policies to compensate those affected and to quantify the welfare gains.

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<sup>7</sup> The first-stages estimates of the robustness exercises are available upon request.

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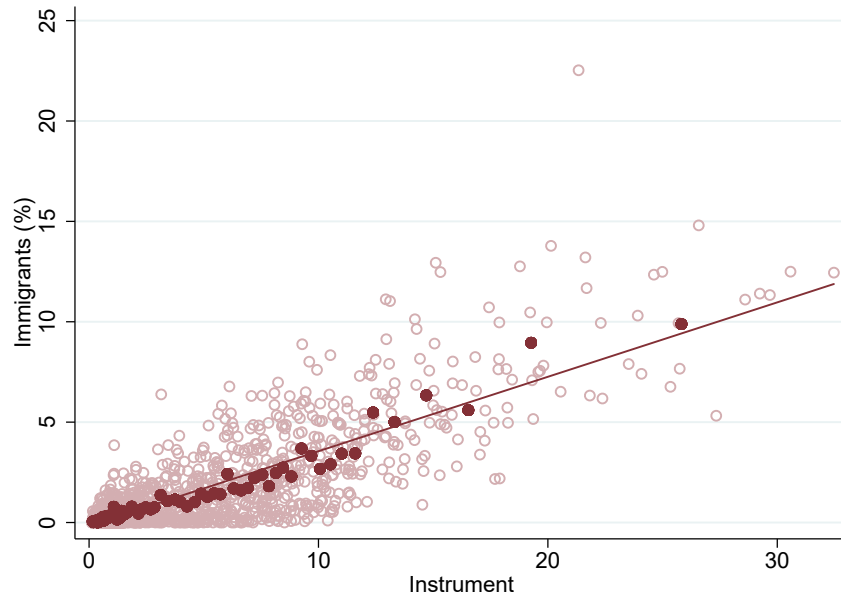
# Appendix

Table A1: Descriptive Statistics of Colombian Women - By level of qualification

	Total	Low-skilled	Medium-skilled	High-skilled
Labor force participation	0.670	0.566	0.711	0.888
Employed	0.587	0.508	0.604	0.807
Hours worked	40.30	37.62	41.83	41.88
Married	0.581	0.644	0.537	0.527
Age	37.99	42.68	33.54	38.71
Years of education	9.612	5.145	11.87	16.86
Hours of domestic work	30.04	33.79	28.97	20.63
With 5-year-old children	0.194	0.187	0.210	0.159
With in-house domestic service	0.0111	0.00945	0.00830	0.0284
Observations	1724838	632393	849136	243117

Notes: The statistics correspond to native and migrant women between 18 and 64 years of age for the entire period analyzed. Low qualification corresponds to incomplete/complete primary, incomplete/complete secondary and incomplete higher qualification and high qualification to complete higher qualification or more. Own elaboration based on data from the GEIH. Married refers to women who are living with a partner.

Figure A1: Relationship between instrument and proportion of immigrants (%)



Note: The figure shows the immigration and instrument values for each department-month-year of the sample. The darkest points correspond to the bincatters of the same variables. Own elaboration based on GEIH data.

Table A2: Effect of immigration on labor supply by skill level with 5-year-old children  
- Men

	Labor force participation		Employed		Hours (logs)	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: Low skilled</b>						
Share of immigrants	-0.001*	-0.001**	-0.001	-0.001	0.003	0.003
	(0.000)	(0.000)	(0.001)	(0.001)	(0.005)	(0.005)
F-statistic	104.73	104.71	104.73	104.71	104.73	104.71
Observations	72,500	72,500	72,500	72,500	72,500	72,500
<b>Panel B: Medium skilled</b>						
Share of immigrants	0.000	0.000	-0.000	-0.000	0.002	0.003
	(0.000)	(0.000)	(0.001)	(0.001)	(0.003)	(0.003)
F-statistic	100.80	100.78	100.80	100.78	100.80	100.78
Observations	94,762	94,762	94,762	94,762	94,762	94,762
<b>Panel C: High skilled</b>						
Share of immigrants	-0.001	-0.001	-0.002	-0.002	-0.007	-0.007
	(0.001)	(0.001)	(0.002)	(0.002)	(0.006)	(0.006)
F-statistic	103.61	103.84	103.61	103.84	103.61	103.84
Observations	25,464	25,464	25,464	25,464	25,464	25,464
Individual controls	No	Yes	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native men between 18 and 64 years of age. Men who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares) and marital status. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.



Table A3: Effect of immigration on the female labor supply - Robustness

	Low-skilled		Low-skilled women	
	(1)	(2)	(3)	(4)
<b>Labor force participation</b>				
Share of immigrants	-0.010*** (0.003)	-0.010*** (0.003)	-0.030*** (0.010)	-0.029*** (0.009)
<b>Employed</b>				
Share of immigrants	-0.010*** (0.003)	-0.010*** (0.002)	-0.030*** (0.008)	-0.030*** (0.006)
<b>Hours (logs)</b>				
Share of immigrants	-0.025*** (0.008)	-0.025*** (0.007)	-0.072*** (0.023)	-0.073*** (0.019)
F-statistic	23.87	23.86	17.06	17.06
Observations	1,132,610	1,132,486	1,132,610	1,132,486
Individual controls	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. Women who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A4: Effect of low-skilled and female low-skilled immigration on female labor supply by qualification level - Robustness check

	Low-skilled			Low-skilled women		
	Labor force participation	Employed	Hours (logs)	Labor force participation	Employed	Hours (logs)
<b>Panel A: Low skilled</b>						
Share of immigrants	-0.017*** (0.004)	-0.016*** (0.003)	-0.042*** (0.010)	-0.050*** (0.012)	-0.046*** (0.009)	-0.121*** (0.027)
F-statistic	26.44	26.44	26.44	18.40	18.40	18.40
Observations	488,365	488,365	488,365	488,365	488,365	488,365
<b>Panel B: Medium skilled</b>						
Share of immigrants	-0.007** (0.003)	-0.008*** (0.002)	-0.016** (0.006)	-0.020** (0.009)	-0.022*** (0.006)	-0.044** (0.017)
F-statistic	23.24	23.24	23.24	16.79	16.79	16.79
Observations	487,605	487,605	487,605	487,605	487,605	487,605
<b>Panel C: High skilled</b>						
Share of immigrants	0.001 (0.002)	0.001 (0.002)	0.011 (0.009)	0.003 (0.004)	0.002 (0.007)	0.031 (0.026)
F-statistic	21.28	21.28	21.28	15.81	15.81	15.81
Observations	156,516	156,516	156,516	156,516	156,516	156,516
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. Women who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A5: Effect of low-skilled and female low-skilled immigration on female labor supply by level of qualification with 5-year-old children - Robustness check

	Low-skilled			Low-skilled women		
	Labor force participation	Employed	Hours (logs)	Labor force participation	Employed	Hours (logs)
<b>Panel A: Low skilled</b>						
Share of immigrants	-0.022** (0.009)	-0.022** (0.009)	-0.058* (0.032)	-0.065** (0.027)	-0.063** (0.028)	-0.169* (0.092)
F-statistic	24.50	24.50	24.50	16.53	16.53	16.53
Observations	75,269	75,269	75,269	75,269	75,269	75,269
<b>Panel B: Medium skilled</b>						
Share of immigrants	-0.009* (0.005)	-0.011*** (0.002)	-0.026*** (0.009)	-0.025* (0.014)	-0.029*** (0.007)	-0.071** (0.027)
F-statistic	21.07	21.07	21.07	16.20	16.20	16.20
Observations	128,582	128,582	128,582	128,582	128,582	128,582
<b>Panel C: High skilled</b>						
Share of immigrants	0.005* (0.003)	0.012*** (0.004)	0.056*** (0.013)	0.014* (0.008)	0.034*** (0.011)	0.157*** (0.038)
F-statistic	21.84	21.84	21.84	17.24	17.24	17.24
Observations	34,270	34,270	34,270	34,270	34,270	34,270
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. Women who report zero hours worked are included in the intensive margin. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A6: Effect of low-skilled and female low-skilled immigration on women's domestic work hours - Robustness check

	Low-skilled			Low-skilled women		
	Total hours	Childcare	House chores	Total hours	Childcare	House chores
<b>Panel A: High-Skilled</b>						
Share of immigrants	-0.043 (0.088)	-0.088 (0.064)	-0.011 (0.079)	-0.016 (0.031)	-0.031 (0.024)	-0.005 (0.027)
F-statistic	15.81	15.81	15.80	21.28	21.28	21.27
Observations	156,516	156,433	156,493	156,516	156,433	156,493
<b>Panel B: High-skilled - children</b>						
Share of immigrants	-0.113 (0.084)	-0.228** (0.099)	-0.031 (0.071)	-0.113 (0.084)	-0.226** (0.101)	-0.033 (0.070)
F-statistic	17.24	17.25	17.22	17.41	17.41	17.38
Observations	34,270	34,212	34,265	34,270	34,212	34,265
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A7: First stages of labor market estimates - Women

	Total	No children			With children		
		Low-skilled	Medim-skilled	High-skilled	Low-skilled	Medim-skilled	High-skilled
Instrument	0.005*** (0.001)	0.005*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.005*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
F-statistic	104.38	111.03	95.19	106.43	112.87	92.17	100.28
Observations	1,132,486	488,365	487,605	156,516	75,269	128,582	34,270
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A8: First stages of housework estimates - High-skilled women

	No children		With children	
	(1)	(2)	(3)	(4)
Instrument	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
F-statistic	106.46	106.48	100.39	100.41
Observations	156,433	156,433	34,212	34,212
Individual controls	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A9: First stages - Domestic service sector

	Domestic service employment		Domestic service wage	
	(1)	(2)	(3)	(4)
Instrument	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
F-statistic	100.47	100.49	98.85	98.95
Observations	1,012,797	1,012,797	75,996	75,996
	High skilled		High skilled - children	
	(1)	(2)	(3)	(4)
Instrument	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
F-statistic	106.42	106.43	100.26	100.28
Observations	156,516	156,516	34,270	34,270
Individual controls	No	Yes	No	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.

Table A10: First stages of labor market estimates - Men

	No children			With children		
	Low-skilled	Medim-skilled	High-skilled	Low-skilled	Medim-skilled	High-skilled
Instrument	0.005*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.005*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
F-statistic	110.88	95.68	99.17	104.71	100.78	103.84
Observations	387,214	349,686	115,537	72,500	94,762	25,464
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes

\*\*\* Significant at 1%; \*\* significant at 5%; \*significant at 10%.

Notes: The estimates are for native women between 18 and 64 years of age. All estimates include fixed effects at the department and region-month level. Individual controls include age and years of education (and their squares), marital status, and an indicative variable that reflects whether the woman has a dependent child under five years of age. Robust standard errors clustered at the department level are reported in parentheses. F-statistic is the Kleibergen-Paap weak instrument F-statistic. Own elaboration based on GEIH data.