BANCO CENTRAL DE RESERVA DEL PERÚ

The Impact of Venezuelan Immigration on Employment and Wages: the Peruvian Case

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The Impact of Venezuelan Immigration on Employment and Wages: the Peruvian Case[*]

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Abstract

This document estimates the short-term impact of the recent Venezuelan immigration wave on employment and wages among Peruvian workers in Lima and Callao. Using monthly information from the *Encuesta Permanente de Empleo* (EPE) for 2016-2018, we find that an immigration shock equivalent to 1 percent of the labor force reduces the probability of staying employed and labor income mostly in a specific group of workers. In particular, the group most exposed to immigration is females aged 14-24 years with low education levels. However, the share of this group in the total number of workers in Lima and Callao is small (2.9%). Additionally, immigrants' expenditure in Lima may have contributed 0.33 percentage points to GDP growth in 2018.

Keywords: Immigrant workers; employment; wages.

JEL Classification Numbers: J61, E24.

1 Introduction

In recent years Venezuela has struggled with a severe economic crisis, as reflected by a 33% per capita GDP contraction between 2010-2017 (IMF World Economic Outlook, 2018). This unleashed a massive migration to other countries: as of November 2018, an estimated 3 million Venezuelans (7% of the population) had fled the country.[1]

Peru, a geographical neighbor of Venezuela, has experienced a substantial immigration flow since 2016. According to data from the *Superintendencia Nacional de Migraciones* (Peru's National Immigration Agency, MIGRACIONES), it intensified in 2018, when 568 thousand Venezuelans set foot in Peru between January-September.[2] Although the newly arrived residents account for a small fraction of the domestic labor force, they represent a sizable share of the annual inflow of workers joining Peru's labor market. Furthermore, our estimates suggest that the inflow of Venezuelan immigrants in 2018 was equal to the flow of native workers joining the labor force, and at least twice the flow of native labor market participants in Lima and the adjacent port of Callao in 2018. We also estimate that both jurisdictions absorbed around 80% of Venezuelan immigrants in recent years.

The aim of this research is identifying the effect of Venezuelan immigration on labor market outcomes in Lima-Callao using information from the *Encuesta Permanente de Empleo* (Permanent Employment Survey, EPE by its initials in Spanish) and MIGRACIONES. Our estimates suggest that immigration reduced both Peruvians' likelihood of remaining employed and their main labor income. Results are heterogeneous across population groups and the impact is strongest among unskilled women aged 14-24 years.

This paper contributes to the literature on the economic impact of immigration in developing countries. Although migration episodes in developed economies are well documented, very few migratory processes have occurred in developing economies where the average educational level is higher among immigrants than among native workers.

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[1]https://www.acnur.org/noticias/press/2018/11/5be443b54/la-cifra-de-personas-refugiadas-e-inmigrantes-venezolanas-alcanza-los-3.html

[2]https://www.migraciones.gob.pe/index.php/estadisticas$_2$/

This document continues as follows: section 2 is a brief literature review on immigration and section 3 highlights the main characteristics of the Venezuelan migration in Peru. Section 4 provides details of the identification strategy and the data used to identify the impact of immigration on employment and wages. Finally, section 5 reports our main results and section 6 concludes.

2   Effect of immigration in employment and wages

One of the main concerns about immigration processes is to what extent they affect local workers. In this regard, the literature finds that immigration has a nearly negligible impact on employment and wages (Borjas (1994); Hanson (2008); Kerr and Kerr (2011); Longhi et al (2010)). However, an immigration episode may have significant effects on labor market outcomes, depending on the socioeconomic features of native workers (age, education, etc.) and the specific industries targeted. For example, in the case of the U.S., Borjas et al (2011) find evidence of perfect substitution between immigrants and low-skilled native workers. In contrast, Ottaviano and Peri (2012) argue that substitution between immigrants and locals workers is imperfect.

The discussion on the degree of labor substitution between local and immigrant workers often overlooks the legal status of the latter. For example, Böhme and Kups (2017) argue that legal requirements may hinder immigrants' access to certain jobs. Therefore, the degree to which undocumented immigrants are able to compete with documented immigrants and nationals depends on the monitoring costs borne by the authorities. In fact, Kossoudji and Cobb-Clark (2002) report that the wage gap between documented and undocumented immigrants is around 24% on average.

It is commonly assumed that undocumented immigrants initially work in the informal sector of the economy. However, Venturini (1999) shows that the share of informal employment in Italy is similar for native and immigrant workers. Due to a lack of administrative

capacity, weak border controls, and the size of the informal sector in developing countries, the extent to which immigrants' legal status matters remains unclear.

2.1 Effect of immigration in developing countries

The effect of immigration on labor market outcomes in developing economies has been scarcely documented. Although previous research has mainly suggested that immigration has no significant impact on nationals' employment or wages, evidence remains inconclusive. On one hand, Gindling (2009) finds a slightly negative impact of Nicaraguan immigration on wages of low-skilled women in Costa Rica; however, he does not find a significant effect on men's salaries. On the other hand, Del Carpio and Wagner (2015) find a positive and significant impact of Syrian immigration on nationals' wages and employment in Turkey; nonetheless, they report a negative impact for less educated workers. Additionally, Tan and Gibson (2013) find that female participation in Malaysian labor force increased between 13 and 26 percentage points due to the inflow of Indonesian female immigrants employed as house workers.
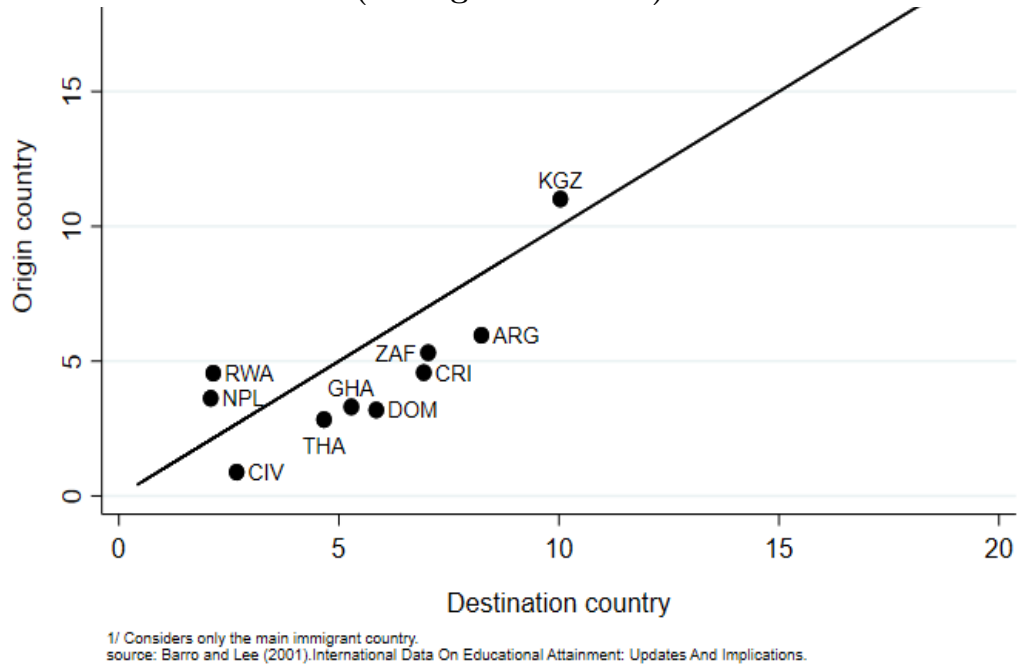
Recently, a report by the Organization for Economic Co-operation and Development (OECD) and the International Labor Organization (ILO), OECD/ILO (2018), documented the impact of immigration on both employment and wages in ten developing countries.[3] At the national level, the report finds that the employment-to-native population ratio decreased in four cases, but the unemployment rate did not increase in any case. Regarding labor income, there is no evidence that wages decreased during the migratory process, but actually increased in the case of Rwanda.[4] At the regional level, the employment-to-native population ratio decreased in three countries and increased in another three. Finally, the report shows

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[3]The destination and origin countries (in brackets, sorted by relevance) are: Argentina (Paraguay, Bolivia, Peru, and Chile), Costa Rica (Nicaragua), Ivory Coast (Burkina Faso and Mali), Dominican Republic (Haiti), Ghana (Togo, Burkina Faso, Nigeria, and Ivory Coast), Kyrgyzstan (Russia and Ukraine), Nepal (India and Bhutan), Rwanda (Democratic Republic of Congo, Uganda, Burundi, and Tanzania), South Africa (Zimbabwe, Mozambique, Lesotho, and the UK), and Thailand (Myanmar, Lao PDR, and Cambodia)

[4]Data were available for only eight of the ten developing countries in the sample for testing the impact of immigration on salaries.

Figure 1: Average years of education in origin and destination countries 1/
(average 1980-2010)

1/ Considers only the main immigrant country.
source: Barro and Lee (2001).International Data On Educational Attainment: Updates And Implications.

a positive impact of immigration on wages in two out of eight cases, with a statistically negative effect only in one of them.

2.1.1 The human capital of immigrants

Migration episodes generally meet the well-established pattern whereby migrants relocate from less-educated countries to higher-educated ones. Figure 1 compares average years of education in origin and destination countries for the ten migratory processes studied by OECD/ILO (2018). On average, nationals are more educated than immigrants in up to seven cases.[5]

As noticed by Chiswick and Miller (2008), immigrants' skills and occupations may not be ideally matched in the destination country due to lack of official transcripts and academic certifications. As a result, it is likely that highly qualified immigrants end up competing

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[5]It should be noticed that the immigrant population is a self-selected subset of the total population; therefore, their average years of education do not necessarily equate the country-wide level of education. In that sense, this computation is only an approximation.

with low-skilled native workers. Moreover, this mismatch could explain the positive impact on native workers' wages (Dustmann et al (2012)). Given that high-skilled immigrants raise average productivity and output, higher income increases the demand for goods produced by high-skilled native workers.

3   Venezuelan migration in Peru

In recent years Venezuela has been struggling with a severe economic crisis. As a geographic neighbor, Peru has experienced a substantial Venezuelan migration wave since 2016. The process intensified in 2018, when more than 568 thousand Venezuelans crossed the Peruvian border between January-September. Although this number of new residents is relatively small as a fraction of the labor force (1.8%) or relative to other migration episodes,[6] it represents an important share of the annual inflow of people joining Peru's labor force. Table 1 shows the annual flow of people for the working-age population (WAP) and the labor force. Regularly, 370 thousand people can potentially join Peru's labor market yearly, out of which 280 thousand actually did in 2017 and 2018 on average. According to the *Instituto Nacional de Estadística e Informática* (National Statistics Institute, INEI from its initials in Spanish), 381 thousand Venezuelans settled in Peru in 2018, of which 319 thousand were 15-64 years old and joined the WAP. In 2018, 584 thousand people seem to have joined the labor force, approximately twice as usual.

The immigration process has been more intense in the capital city of Lima, which produces approximately 50% of GDP. Figure 2 reports the total number of Venezuelan immigrants who are part of the labor force, measured as a share of Lima's total labor force.[7]

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[6]According to the OECD/ILO (2018) report, among developing countries that have experienced immigration processes, the share of immigrants as a percentage of the population in the destination country peaked at 9.6% in the Ivory Coast, followed by Costa Rica (8.8%), South Africa (5.8%), Nepal (1.8%), and Ghana (1.5%).

[7]For constructing this indicator we used the number of Venezuelan immigrants reported by MIGRACIONES; and, based on information from the International Organization for Migration (IOM), we assume that 77% of Venezuelans who visit Peru stay in the country OIM (2017) and 82% settle in Lima. Finally, according to information from (INEI), 83.7% of Venezuelans who settle in Peru become part of the WAP.

Table 1: *Flows of working age population and immigration (Peru)*

	2015	2016	2017	2018
Working Age Population (WAP)	366	367	370	371
Labor Force	102	406	312	247
Workforce	122	278	314	265
Urban Workforce	162	355	332	287
Venezuelans in Peru [1]	2	14	65	381
Venezuelans WAP [2]	1	12	55	319
As a percentage of the stock				
% of the WAP	0,0	0,1	0,3	1,6
% of the labor force	0,0	0,1	0,4	2,2
As a percentage of the flow				
% of the WAP	0,5	3,7	18,5	104,4
% of the labor force	1,3	2,9	17,5	129,1

[1] It is assumed that 77% of Venezuelans who enter Peru stay in the country.
[2] According to an INEI report, 83,7% of Venezuelans who enter the country belong to the WAP.
 Source: INEI - ENAHO.

According to this figure, there was a significant growth in the share of Venezuelan immigrants in the total labor force during the second half of 2017. This share increased from less than 1% in March 2017 to more than 10% in September 2018.

Most Venezuelan immigrants who settled in Peru in recent years initially arrived as tourists. In January 2018, MIGRACIONES reported that 75 thousand Venezuelan citizens were tourists and approximately 25 thousand Venezuelans had a Temporary Permanence Permit (PTP).[8] By August 2018, about 75 thousand Venezuelan citizens already had a

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Of these, we assume that a small share of Venezuelans are studying to complete a tertiary degree or the last years of high school.
[8]https://elcomercio.pe/peru/calidad-turistas-ptp-venezolanos-hay-peru-noticia-491497

Table 2:   Flows of working age population and immigration (Lima)

	2015	2016	2017	2018
Working Age Population (WAP)	130	131	126	117
Labor Force	68	78	89	72
Workforce	69	60	68	65
Venezuelans in Lima [1]	1	11	54	312
Venezuelans WAP [2]	1	10	45	260
As a percentage of the stock				
% of the WAP	0,0	0,1	0,7	4,1
% of the Labor Force	0,0	0,2	1,1	6,0
As a percentage of the flow				
% of the WAP	0,8	7,3	35,3	222,1
% of the Labor Force	1,6	12,1	49,8	358,8

[1] It is assumed that 82% of Venezuelans who settle in Peru live in Lima INEI (2019).
[2] According to the ENPOVE's results, 83,7% of Venezuelans who enter the country become part of the WAP
Note: Data calculated from quarterly series
Source: INEI - EPE.

PTP,[9] compared with one hundred seventy five thousand in December 2008.[10] This forced a significant group of immigrants to work in the informal sector of the economy and/or become self-employed. Indeed, according to a survey conducted by IOM[11], only 9.1% of the interviewed reported having a formal working contract.

Moreover, according to information on Venezuelan immigrants collected by OIM,[12] 51% were employees, 20% were self-employed, and 29% were unemployed or studying during the first half of 2018. Additionally, 62% worked in the commerce sector or activities such as
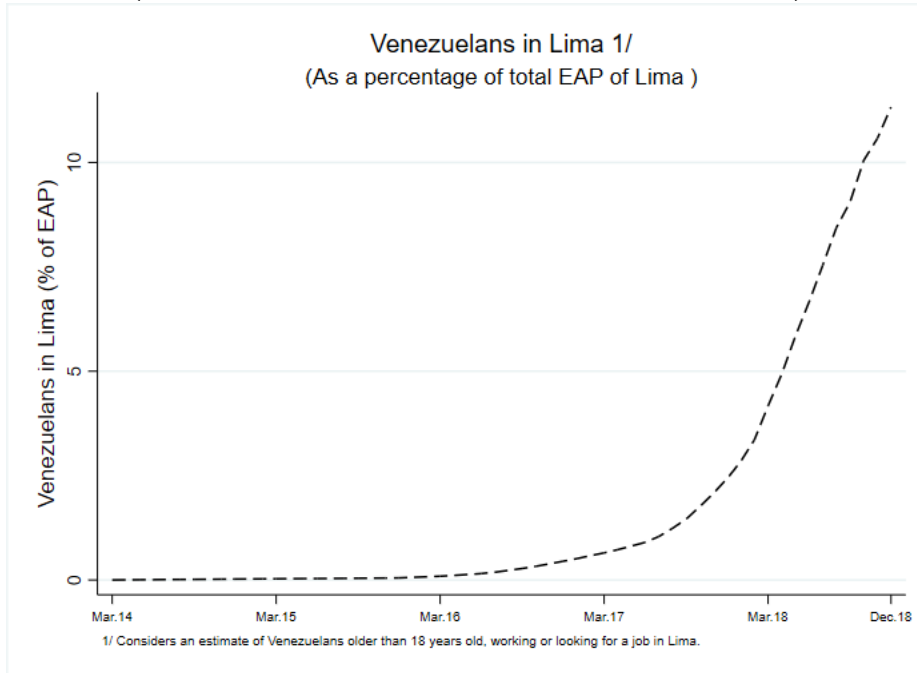
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[9]https://larepublica.pe/sociedad/1305202-venezolanos-peru-75-mil-venezolanos-cuentan-ptp-100-mil-tramite-superintendencia-migraciones

[10]https://peru21.pe/peru/permiso-temporal-permanencia-495-mil-venezolanos-realizaron-gestiones-acogerse-ptp-450876

[11]OIM (2017)

[12]OIM (2018)

Figure 2: Venezuelans in Lima 1/
(as percentage of total labor force in Lima)

Venezuelans in Lima 1/
(As a percentage of total EAP of Lima)

1/ Considers an estimate of Venezuelans older than 18 years old, working or looking for a job in Lima.

Source: EPE, own elaboration

tourism, restaurants, and entertainment; and 9% worked in the construction and manufacturing sectors.[13] According to IOM,[14] 39% of Venezuelan immigrant workers were street vendors, cleaners, food preparation assistants, peons, and other elementary occupations; 30% worked as retail or wholesale sellers, cashiers, chefs, waiters, stylists, and pet care workers, among other similar occupations; and 10% worked as construction and/or electrical workers, artisans, etc. The rest worked as scientific or technical professionals, managers, administrative employees, or other occupations.[15]

On the other hand, migration processes are usually associated with the fact that the average educational attainment of immigrants is lower than that of nationals. However, according to the IOM survey,[16] and in contrast many other migration processes, 65.2% of

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[13]OIM (2018)

[14]OIM (2017)

[15]The results collected from IOM Rounds (1, 2, and 3) are similar to those reported by the 2018 Survey *Encuesta Dirigida a la Poblacion Venezolana en el País* (ENPOVE). Appendix A compares both sources.

[16]OIM (2018)

Venezuelan immigrants in Peru have a tertiary education level, whereas only 30% of Peruvian have this educational attainment.[17] Moreover, only 5% of Venezuelan immigrants have not finished high school, compared to 42.7% of Peruvians.[18] This may imply productivity gains for the Peruvian economy. Based on gross calculations, human capital from the recent immigration would contribute by 0.13 percentage points on average to potential output growth in 2018-2020, while the labor component would do so by 0.37 percentage points (Castellares & Huarancca (2019)). However, we should emphasize that labor misallocation (i.e., immigrants not working in occupations for which they are qualified), can reduce these impacts by half (0.25 percentage points).[19]

Local income and consumption of immigrants

Typically, the literature has analyzed the impact of immigration on employment and wages, but there are also effects on aggregate consumption. Immigrants become an important new group of consumers, who demand services (e.g., housing) and goods (e.g., food).

On the one hand, based on EPE data, Figures 3 and 4 depict the annual percentage change of the average income per semester of total and female formal and informal workers, respectively. The results show that labor income growth in both groups slowed down during 2017; however, the average income of formal workers grew in 2018, whereas informal workers' income decreased during the same period.

At the same time, considering the information reported by the OIM (2017) and OIM (2018) surveys, immigrant labor income is estimated at around US$ 356 per month on average in those years. Based on this information, the percentage of Venezuelan immigrants who have a job, the remittances sent by immigrants to Venezuela, and other additional
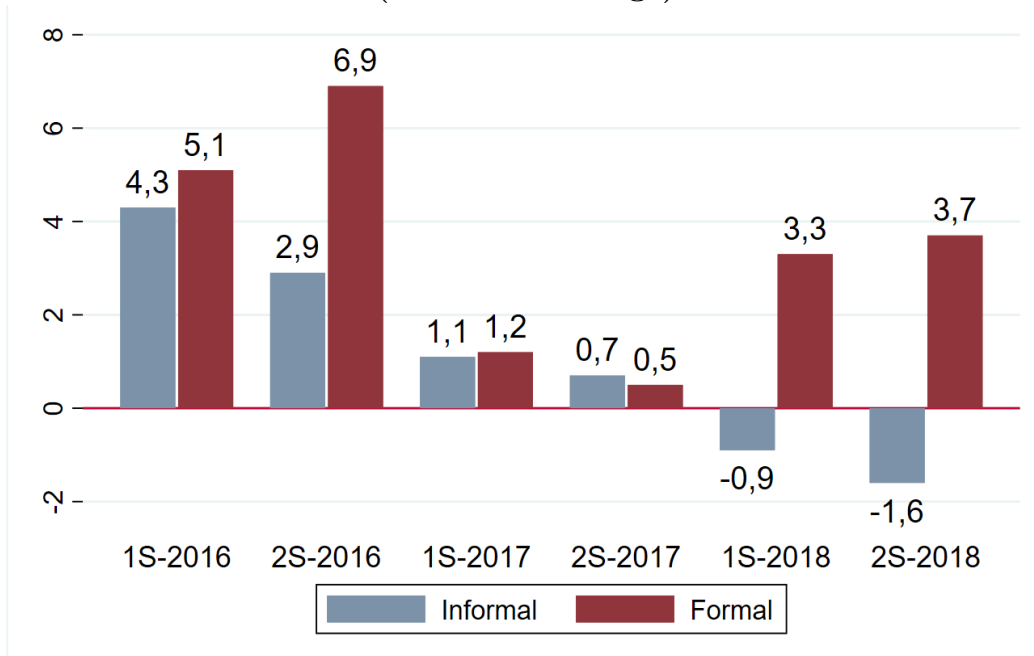
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[17]Source: Enaho 2017.

[18]Source: Enaho 2017.

[19]For these calculations, Castellares & Huarancca (2019) use the production function method of the Ministry of Economy (*Resolución Ministerial No. 024-2016-EF / 15*). This methodology, in addition to the capital stock and employment variables, includes the human capital in a Cobb-Douglas production function. Specifically, it uses the years of education as a proxy of human capital. The authors use as a measure of job inadequacy the wage gap of Venezuelan immigrants with respect to what they could potentially earn in Peru, given their socio-demographic characteristics.

Figure 3: Labor income (primary job)
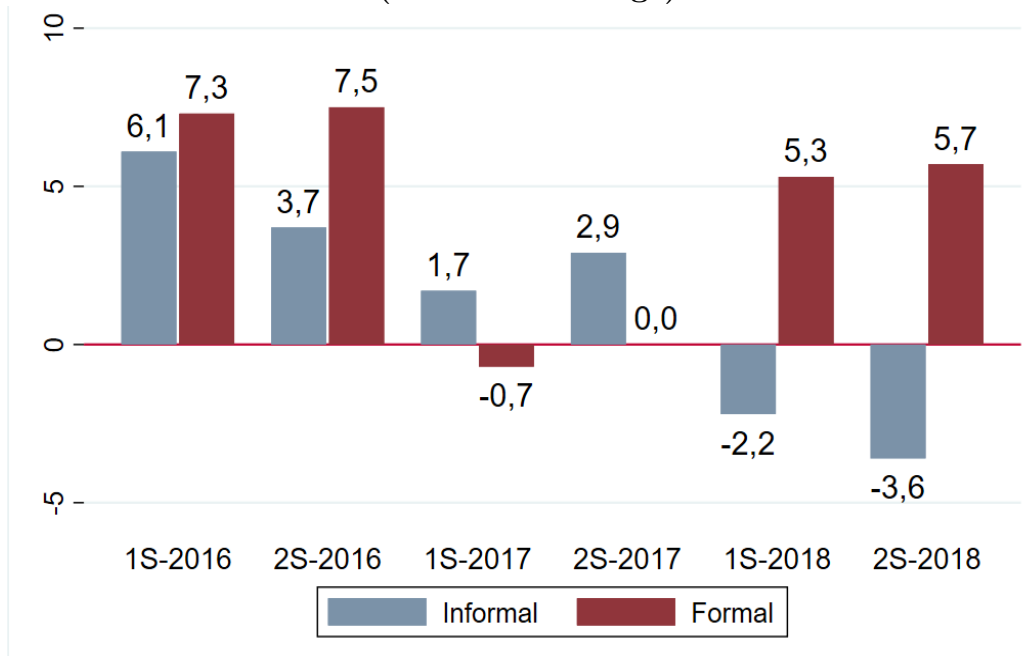(Annual % change)

assumptions,[20] we estimate that 22% of household consumption growth in Lima in 2018 (estimated at 4.1%) is explained by Venezuelan immigrants; see Figure 5. Given that the share of Lima in GDP is approximately 50% and that household expenditure represents 65% of GDP, Venezuelan immigrants in Lima may have contributed 0.33% out of 4% of GDP growth in 2018.

4   Empirical approach: the linear probability model and the Heckman selection model

We use two approaches to estimate the impact of immigration on employment and labor income in Lima-Callao. First, we estimate the probability of being employed after an immi-

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[20]We assume that immigrants earn US$ 356 per month on average, send remittances in the order of US$ 80 per month, and consume all the remaining income. We also assume that Lima's share of aggregate household expenditure is constant and around to 60%.

**Figure 4: Women's labor income of women (primary job)
(Annual % change)**

**Figure 5: Contribution private household expenditure in Lima
(percentage points)**
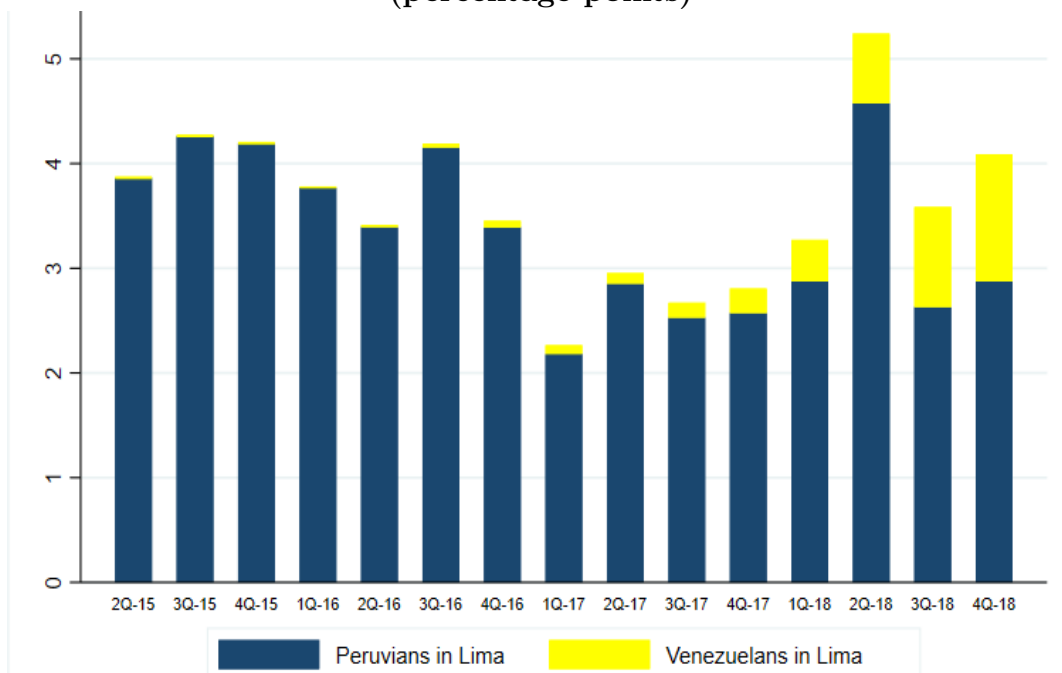
gration *shock*, controlling for time fixed effects and workers' characteristics. Second, we use the Heckman (1979) selection model to estimate the effect of immigrants on income.[21]

4.1 Methodology

Employment

To calculate the impact of immigration on the probability of remaining employed, we estimate the following Linear Probability Model (LPM):

$$Y_{i,t} = \beta X_{i,t} + \gamma \vartheta_t X_{i,t} + \delta \rho_t X_{i,t} + \lambda_i + \varphi_t + \mu_{i,t}, \tag{1}$$

where the dependent variable $Y_{i,t}$ takes the value of 1 if the person is currently working and zero otherwise:

$$Y_{i,t} = \begin{cases} 1 & \text{Occupied} \\ 0 & \text{Otherwise.} \end{cases}$$

Equation 1 includes workers' characteristics in the first period (t), $X_{i,t}$, and their interaction with both the immigration *shock*, ϑ_t, and a measure of the economic cycle, ρ_t, denoted as $\vartheta_t X_{i,t}$ and $\rho_t X_{i,t}$, respectively. These interactions account for differentiated effects of both immigration and the economic cycle across different groups of workers. Finally, to control for time invariant workers' unobservable characteristics and aggregate shocks across time, we include individual and time fixed effects, λ_i, and φ_t, respectively.

Each person interviewed in period t is surveyed again three months later. Assuming that workers' characteristics do not change between periods t and $t + 3$, we have:

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[21]The model proposed by Heckman accounts for the selection or prior decision process that restricts the values of the dependent variable for part of the full sample. In our case, the dependent variable is the wage change of those workers who were actually working during two periods. Nevertheless, we have information for the explanatory variables of all individuals in the sample, whether they work or not.

$$Y_{i,t+3} = \beta X_{i,t} + \gamma \vartheta_{t+3} X_{i,t} + \delta \rho_{t+3} X_{i,t} + \lambda_i + \varphi_{t+3} + \mu_{i,t+3}. \tag{2}$$

By subtracting (1) from (2), we get the following equation when a person holds a job in both periods:

$$1 - 1 = 0 = \Delta\varphi_{t+3} + \gamma\Delta\vartheta_{t+3}X_{i,t} + \delta\Delta\rho_{t+3}X_{i,t} + \Delta\mu_{i,t+3}, \tag{3}$$

However, when a person is employed in the first period and switches to unemployment or inactivity, we have:

$$1 - 0 = 1 = \Delta\varphi_{t+3} + \gamma\Delta\vartheta_{t+3}X_{i,t} + \delta\Delta\rho_{t+3}X_{i,t} + \Delta\mu_{i,t+3}. \tag{4}$$

Finally, we estimate the following equation:

$$\Delta Y_i = \Delta\varphi_{t+3} + \gamma\Delta\vartheta_{t+3}X_{i,t} + \delta\Delta\rho_{t+3}X_{i,t} + \Delta\mu_{i,t+3}, \tag{5}$$

where ΔY_i follows the rule:

$$\Delta Y_i = \begin{cases} 1 & \text{If the individual has a job in both periods.} \\ 0 & \text{If the individual has a job in the first period but becomes unemployed in the second.} \end{cases}$$

In this equation, the γ parameter captures the impact of the immigration *shock*, $\Delta\vartheta_{t+3}$, on workers with characteristics $X_{i,t}$.

Labor Income

To identify the impact of immigrants on labor income, we start from a Mincer equation,[22] where the level of income is determined based on the observable characteristics of individuals after controlling for individual fixed effects, λ_i, and time fixed effects, φ_t. Additionally, we

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[22]Mincer (1974)

include the interactions between the observable characteristics of individuals, $X_{i,t}$, and both the immigration *shock*, $\vartheta_t X_{i,t}$, and the economic cycle, $\rho_t X_{i,t}$. Like in the previous section, we assume that workers' characteristics, $X_{i,t}$, do not vary between the first and second interview (three months later).

$$Y_{i,t} = \lambda_i + \varphi_t + \beta X_{i,t} + \gamma \vartheta_t X_{i,t} + \delta \rho_t X_{i,t} + \mu_{i,t} \tag{6}$$

$$Y_{i,t+3} = \lambda_i + \varphi_{t+3} + \beta X_{i,t} + \gamma \vartheta_{t+3} X_{i,t} + \delta \rho_{t+3} X_{i,t} + \mu_{i,t+3} \tag{7}$$

Subtracting (7) from (6) we get:

$$Y_{i,t+3} - Y_{i,t} = \varphi_{t+3} - \varphi_t + \gamma(\vartheta_{t+3} - \vartheta_t)X_{i,t} + \delta(\rho_{t+3} - \rho_t)X_{i,t} + (\mu_{i,t+3} - \mu_{i,t}). \tag{8}$$

Finally, we estimate the following Heckman equation:

$$\Delta Y_i = Y_{i,t+3} - Y_{i,t} = \Delta\varphi_{t+3} + \gamma\Delta\vartheta_{t+3}X_{i,t} + \delta\Delta\rho_{t+3}X_{i,t} + \Delta\mu_{i,t+3} \tag{9}$$

4.2   Data

We construct the information on labor market transitions from the EPE, which is conducted monthly by INEI. The EPE sample is drawn from Peruvian households located in the Lima-Callao area. The sample includes about 19,200 households with three residents on average, so the number of observations is nearly 57,000 per survey. On average, 40% of the sample is surveyed three months after the first interview, so it is possible to study the transitions between labor statuses between 2016-2018.

Figure 6 reports information by educational attainment and age based on EPE information, which shows that the largest group of workers in the structure of the workforce has at least an incomplete tertiary degree (52%). The share of the surveyed individuals aged

Figure 6: **Employment by age and education level (shares %)**
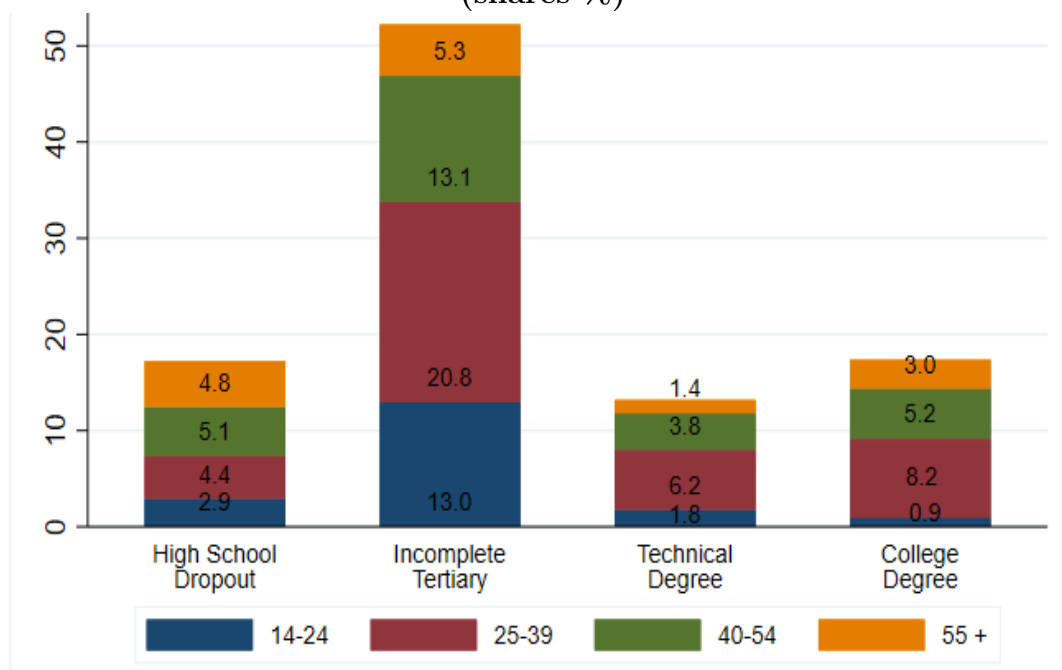
14-24 and 25-39 years with this educational level represents 13% and 20.8% of total workers, respectively. Additionally, only 2.9% and 4.4% of the sample are high school dropouts aged 14-24 and 25-39 years, respectively.

Additionally, according to Figure 7, the group of workers aged 14-24 years, regardless of their education level, as well as workers under 24 years with an incomplete tertiary degree, have an average labor income close to an average Venezuelan immigrant (US$ 356).[23]

It should be mentioned that we exclude self-employed workers from the sample, because the decision to keep working depends mainly on themselves rather than on an employer. We also exclude persons working in the public sector during the first period. We consider that they would be only partially exposed to new competition from immigrant workers.[24]

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[23]The average income was taken from the IOM survey, OIM (2018). We use an exchange rate of S/ 3.34 per U.S. dollar.

[24]Public sector workers would only compete with those immigrants who obtained the official documentation to work. During the period analyzed, a low percentage of immigrants (less than 15%) had a PTP. Unlike the public sector, in the private sector many formal firms can hire workers

Figure 7: Average labor income by age and educational attainment (US$)
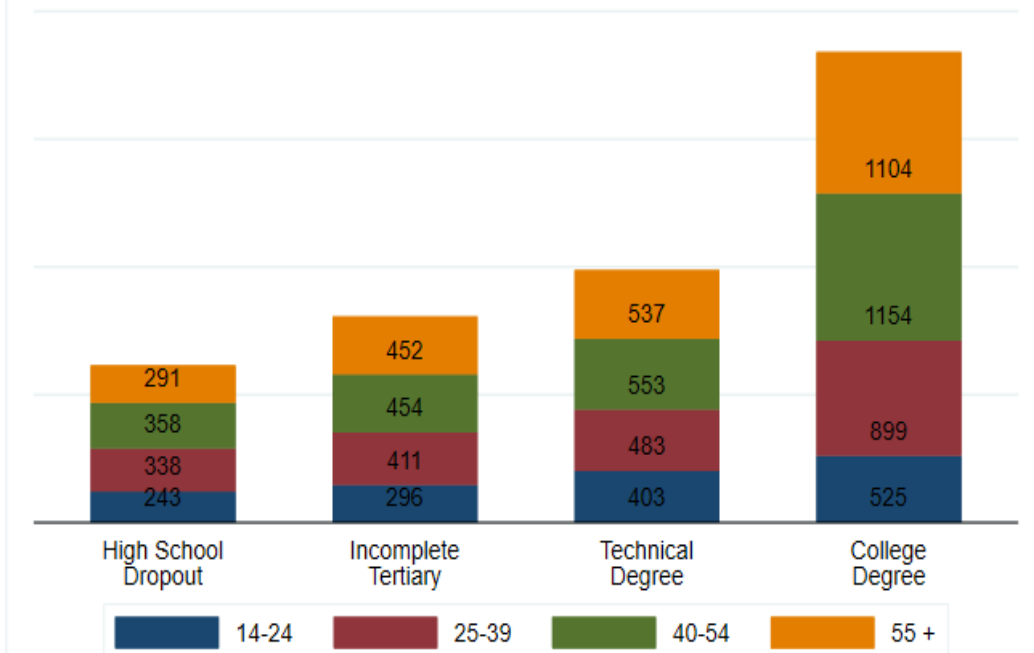
Finally, we eliminate individuals working in primary sectors such as agriculture, fishery, and mining (which represent less than 2% of the total sample). Therefore, the final sample includes workers from four sectors: manufacturing, construction, commerce, and services.

To avoid noise from outliers, we eliminate extreme labor income values considering two criteria: that both the hourly labor income and total labor income are greater than the 99th percentile of their corresponding distributions.

Table 3 reports the main statistics for the individuals in the survey. On average, they are 36 years old and have 13 years of education; and 42% are women.

Table 3: Descriptive statistics

Variable	Observations	Media	Est. Dev.	Mín.	Máx.
Age	16307	36,75	13,79	14	89
Years of education	16307	12,92	2,99	0	19
Female	16307	0,42	0,49	0	1

Additionally, out of those individuals who had a job when they were first interviewed, 18.2% worked in commerce, 10.0% in construction, 19.5% in manufacturing, and 52.3% in the services sector, respectively.

Table 4: Descriptive statistics: sectors

| Sector	Observation	Participation
Commerce	2676	0,18
Construction	1465	0,10
Manufacturing	2871	0,20
Services	7678	0,52

Figure 8 reports the average unconditional probability of employment loss for different age groups and educational attainment levels between 2014-2016.[25] According to this figure, the group of workers aged 14-24 years without a high school degree has the highest probability of becoming unemployed (20%), followed by the group with an incomplete tertiary degree (13%). For the same age group, workers with technical or college degrees are less likely to lose their jobs (close to 5%). More generally, the probability of losing a job decreases as age increases.

Our measure of an immigration *shock* is constructed using the MIGRACIONES database and adopting the assumptions detailed in section 3. The immigration *shock* is defined as the share of the estimated Venezuelan immigrants in the labor force of Lima-Callao. Therefore, we use the three-month change of this indicator in the regressions. Finally, we use the seasonally adjusted domestic demand (absorption) change as a proxy of the economic cycle.

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[25]We use a methodology based on Shimer (2012) to estimate the probability of employment loss. The number of employees in the period $t + 1$ is made up of the number of employees from the previous period who did not lose their jobs $e_{t+1} = (1 - s_t)e_t$ plus those who managed to get a job during the last month (e_{t+1}^s). The separation rate is calculated as $s_t = 1 - \dfrac{e_{t+1} - e_{t+1}^s}{e_t}$.

Figure 8: **Probability of employment loss**
(2014-2016)
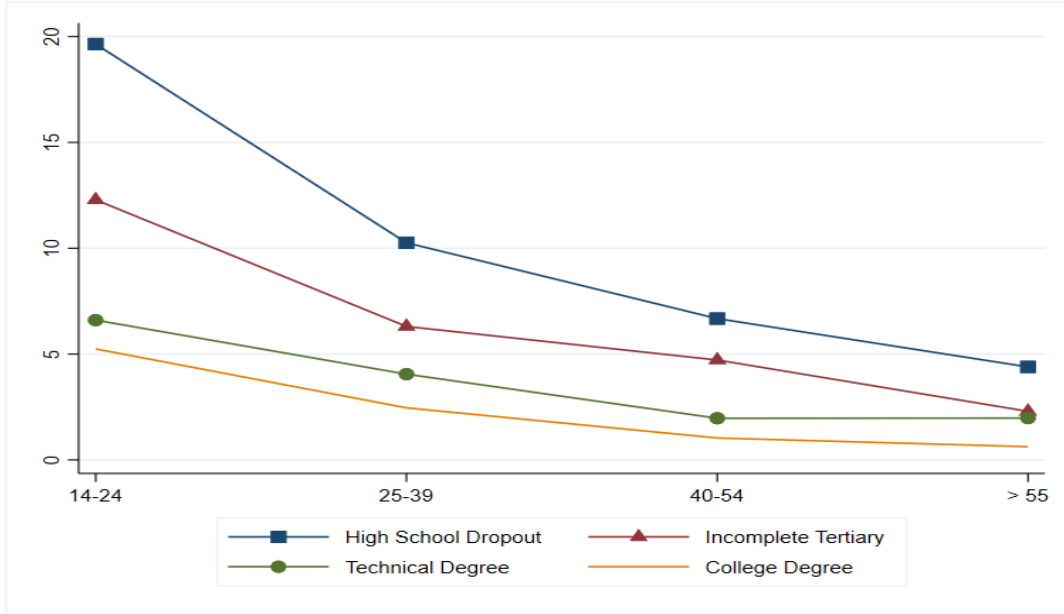
5 Results

5.1 Employment

Table 5 reports the estimates for equation 5. According to the results in column (1), immigration reduces women's probability of staying employed (relative to men) by 2.9%. Additionally, the probability of employment loss is 4.1% higher for persons aged 14-24 years than for the base and omitted category (workers older than 55). In contrast, persons aged 14-24 and 40-54 years are more likely to stay employed in the face of increased immigration than workers older than 55. Considering worker's education level, high school dropout workers or those with incomplete tertiary education have 6.1% and 3.6% less chances, respectively, of staying employed than workers with a college degree (a category we omit in the regression). Finally, the probability of employment loss for workers in the construction, commerce, and services sectors is 2.5%, 1.6% and 2.3% higher than for workers in the manufacturing sector, respectively, due to an increased immigrant share in Lima's labor force.

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Column (2) of Table 5 accounts for the possibility of heterogeneous effects from economic activity on different worker groups (column 2b). Even though the inclusion of time fixed effects in equation 5 controls for aggregate shocks common to all workers, it does not do so for differentiated effects on each group of workers. The results reported in column (2a) are similar to those found previously, although the probabilities for different groups are, on average and in absolute terms, slightly lower.

Although the results reported in Table 5 identify heterogeneous effects of immigration on different age or education groups, it is possible that workers of the same age, but with different levels of education, can also be affected differently by immigration.

Table 6 reports the immigration impacts on groups with different age and education levels. According to these estimates, persons aged 14-24 years with incomplete high school or incomplete tertiary education would be the most affected by the Venezuelan immigration, followed by the group of workers older than 55 with the lowest education levels. Similar to the results reported in Table 5, women, relative to men, would be more affected by higher immigration (2.2%). Finally, and similar to the results reported in Table 5, workers in the construction, services, and commerce sectors have a greater probability of employment loss compared to those in the manufacturing sector (the base category).

5.1.1 Impacts on specific groups

Women

We can calculate workers' probability change of staying employed relative to the base category using the coefficients in Table 5.[26] Therefore, the impacts shown in Table 5 must be interpreted with respect to 55-year-old male workers in the manufacturing sector with a college degree.

Based on the estimates in column (2) of Table 5, Figure 9 shows heterogeneous impacts

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[26]To identify the coefficients of equation 5, a specific value of each variable is chosen as the base category. In this case, we assume that the base category is made up of men aged 55 years and older with a college degree.

Table 5: **Impact of migration on employment: specification (1)**

Dependent variable:
Change in employment status 1=employed, 0 =not employed.

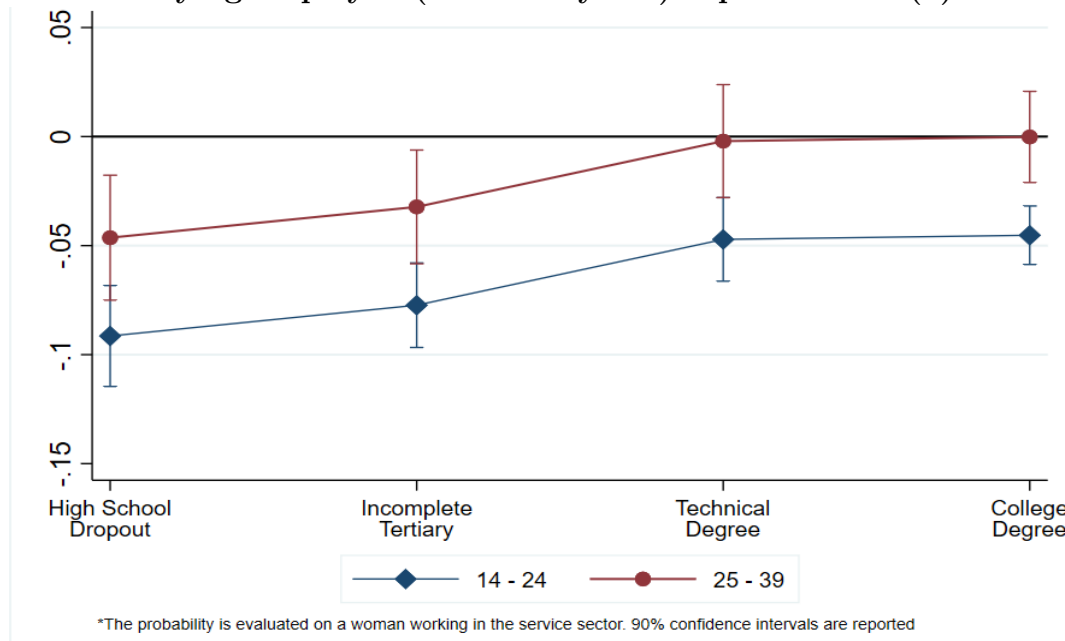| Variables	(1) Migration	(2) Migration	Economic Cycle
Female ×	-0.029***	-0.022***	-0.012*
	(0.005)	(0.006)	(0.006)
14-24 years ×	-0.041***	-0.027**	-0.023**
	(0.009)	(0.011)	(0.011)
25-39 years ×	0.021***	0.018**	0.005
	(0.007)	(0.009)	(0.008)
40-54 years ×	0.031***	0.023**	0.013
	(0.008)	(0.009)	(0.009)
HS dropout or lower level ×	-0.061***	-0.046***	-0.025**
	(0.008)	(0.010)	(0.011)
Incomplete tertiary ×	-0.036***	-0.032***	-0.007
	(0.005)	(0.007)	(0.007)
Technical degree ×	-0.001	-0.002	0.001
	(0.006)	(0.007)	(0.008)
Construction Sector ×	-0.025***	-0.025***	
	(0.008)	(0.008)	
Commerce Sector ×	-0.016**	-0.017**	
	(0.007)	(0.007)	
Service Sector ×	-0.023***	-0.023***	
	(0.006)	(0.006)	
Constant	0.901***		0.923***
	(0.014)		(0.018)
Observations	16,307		16,307
R-square	0.033		0.036

Robust standard errors in parentheses.
***,**, * denote levels of significance at 1 %,5 % and 10 %, respectively.

Table 6: **Impact of migration on employment: specification (2)**

Dependent variable: change in employment status 1=employed, 0 =not employed.				
Variables	14-24 years	25-39 years	40-55 years	+55
HS dropout or lower level × Migration ×	-0.092***	0.000	-0.014	-0.060**
	(0.028)	(0.020)	(0.020)	(0.023)
Incomplete tertiary × Migration ×	-0.060***	-0.005	-0.004	-0.012
	(0.017)	(0.016)	(0.016)	(0.018)
Technical degree × Migration ×	0.032*	0.007	0.021	0.006
	(0.017)	(0.016)	(0.017)	(0.023)
College degree × Migration ×	0.045**	0.019	0.029*	
	(0.020)	(0.016)	(0.016)	
Female × Migration				-0.022***
				(0.006)
Construction Sector × Migration				-0.027***
				(0.008)
Commerce Sector × Migration				-0.015**
				(0.007)
Service Sector × Migration				-0.022***
				(0.006)
Constant				0.913***
				(0.024)
Observations				16,307

Robust standard errors in parentheses. ***,**, * denote levels of significance at 1 %,5 % and 10 %, respectively. The regression include time fixed effects.

Figure 9: **Impact of Venezuelan immigration on women's probability of staying employed (under 40 years). Specification (1)**

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported
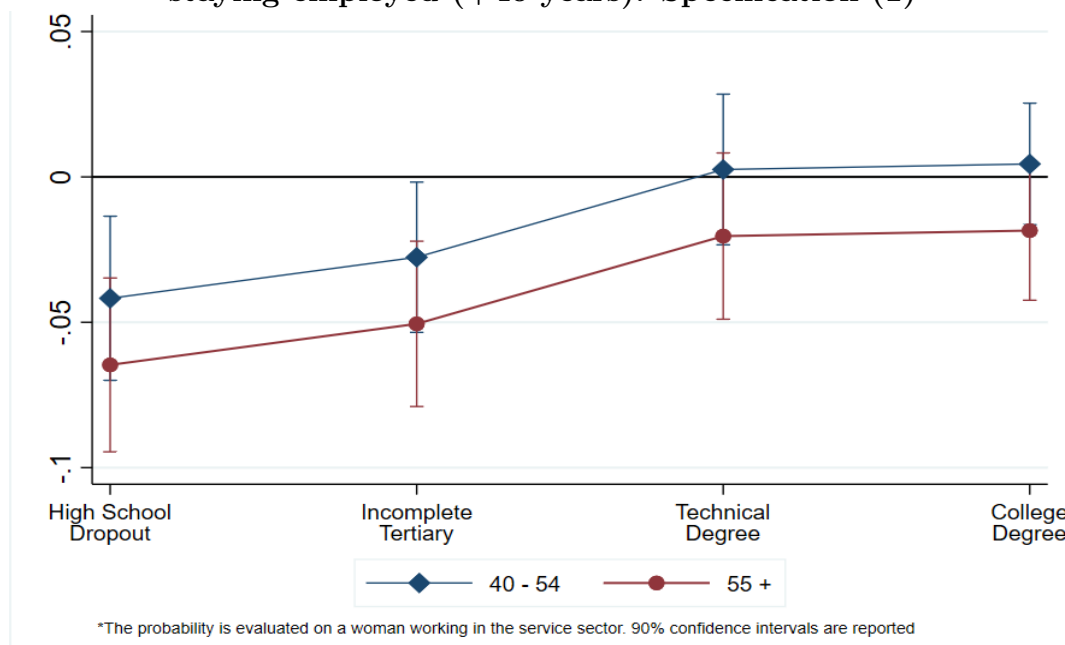
from an immigration *shock* equivalent to one percentage point of the labor force on women's probability of staying employed, for different age and education levels. The probability of staying employed decreases for women aged 14-24 years, and decreases even more for high school dropout workers (-9.1%). We find a similar result for female workers aged 25-39 (-4.6%). However, we do not find a statistically significant impact on those with technical or college degrees.

Similarly, although to a lesser extent than for workers aged 14-24 years old group of workers, Figure 10 shows that women's probability of staying employed also decreases for women over 55 years and for all educational groups. Finally, for female workers aged 40-54 years, similar to the group aged 25-39 years (Figure 9) and with an educational attainment lower than college level, the probability of staying employed also decreases.

Table 6 reports the estimates from including as explanatory variables the interactions between education level and age, shown in Table 5, to verify the consistency of our previous

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Figure 10: **Impact of Venezuelan immigration on women's probability of staying employed (+40 years). Specification (1)**

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported

results.[27] Based on the estimates reported in Table 6, Figure 11 also shows that the probability of staying employed decreases, although by -14.3%, for females aged 14-24 years with the lowest educational level; and -11.1% for those who have an incomplete tertiary education level. Likewise, these changes in probability are lower in absolute value (5.5%) for women aged 25-39 years without a tertiary degree. Finally, and similar to the results reported in Figure 10, Figure 12 shows that for women over 55 years the probability of staying employed decreases, as well as for women aged 40-54 years with an education level lower than a tertiary degree, after an immigration shock.[28]

Informality

In this subsection we assess whether the immigration impact on the probability of staying employed varies if workers belong to the formal or informal sector of the economy.[29] To do

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[27]We construct 16 groups combining 4 age groups and 4 education groups. The base category is made up of males aged 55 years or older with a college degree.

[28]Additionally, as a robustness exercise, we estimate the same regression but considering different shares of Venezuelan immigrants established in Lima, which vary between 70%-90% of total Venezuelan visitors. The results, available upon request, are not significantly different from those reported here.

[29]Formal employees are defined as those with health insurance paid for by employers and provided by

Figure 11: Impact of Venezuelan immigration on women's probability of staying employed (under 40 years). Specification (2)

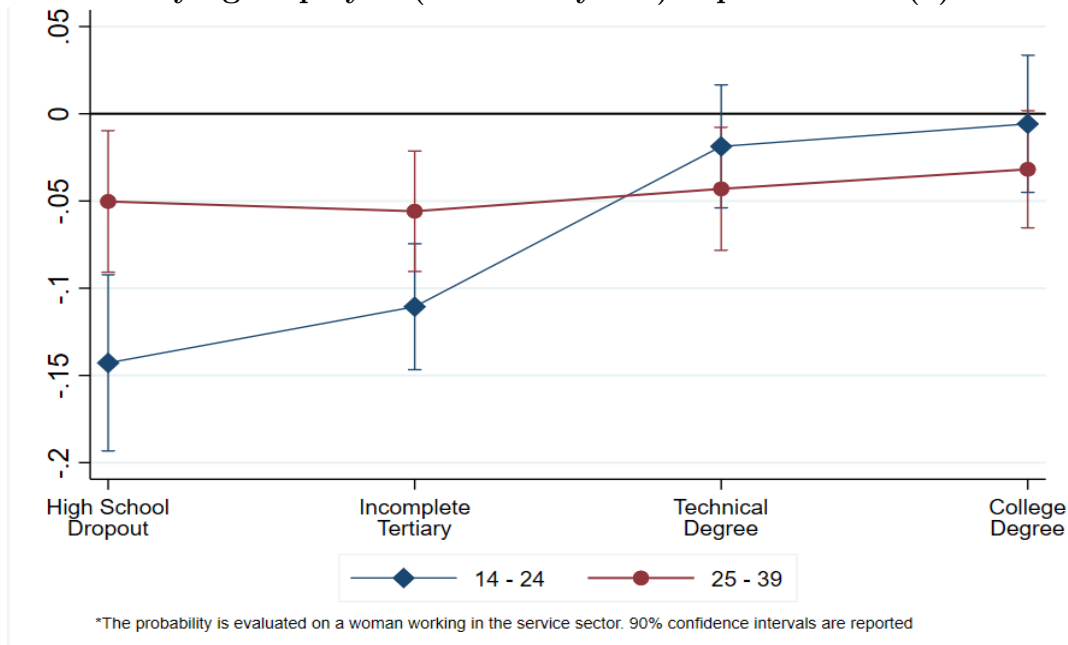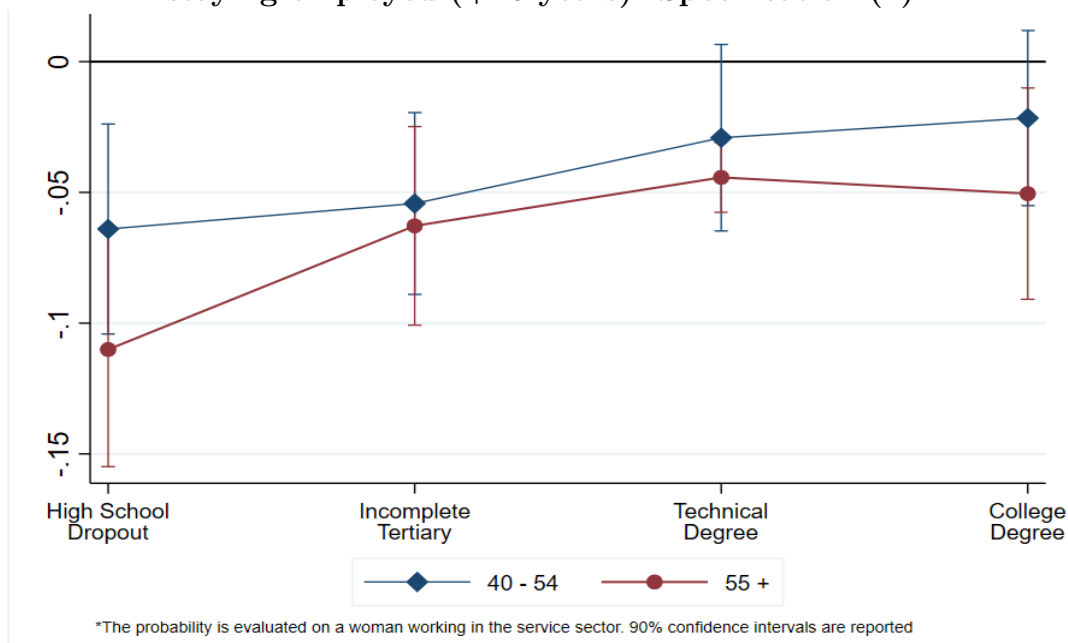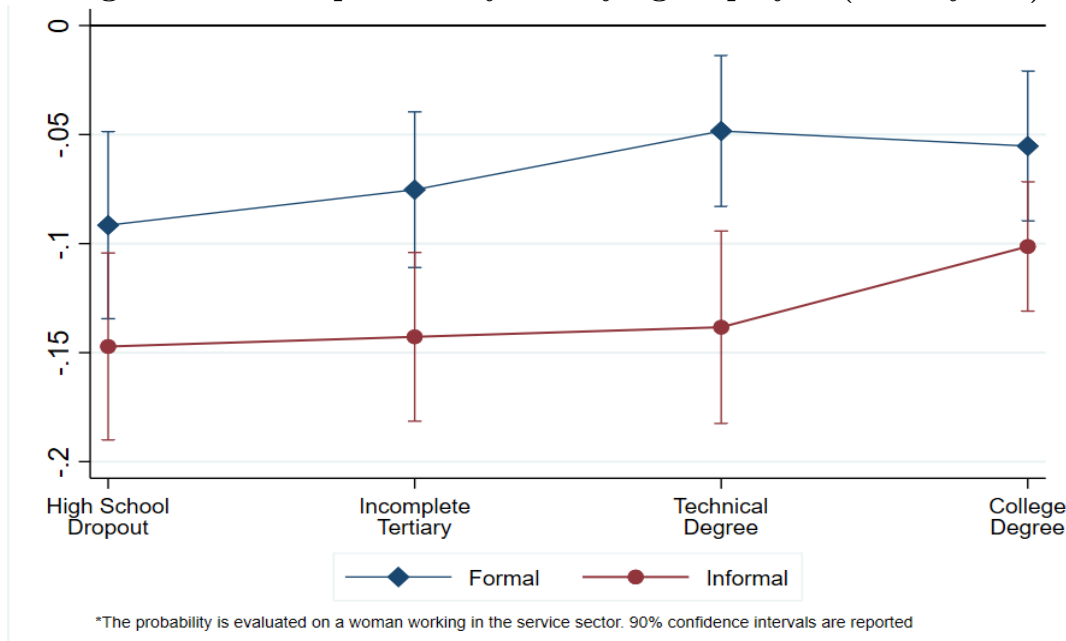*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported

Figure 12: Impact of Venezuelan immigration on women's probability of staying employed (+40 years). Specification (2)

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported

Figure 13: Impact of Venezuelan immigration on informality: change in women's probability of staying employed (14-24 years).

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported

this, we modify the specification in Table 5, including an additional variable that takes a value of 1 if the employee is an informal worker and zero otherwise. Figure 13 reports that the impact of immigrants is greater for female workers aged 14-24 years who work in the informal sector (-14.7%) compared to those in the formal sector (-9.2%). These heterogeneous impacts are statistically different for women with technical degrees working in the informal rather than in the formal sector. We find similar qualitative results for women aged 25-39 years (Figure 14).

However, we should point out that using the specification in Table 6 we do not find differentiated impacts among females working in the informal rather than in the formal sector, except for women aged 14-24 years with incomplete tertiary education.

Peru's national health service (EsSalud) and/or private service providers (EPS).

Figure 14: **Impact of Venezuelan immigration on informality: change in women's probability of staying employed (25-39 years).**
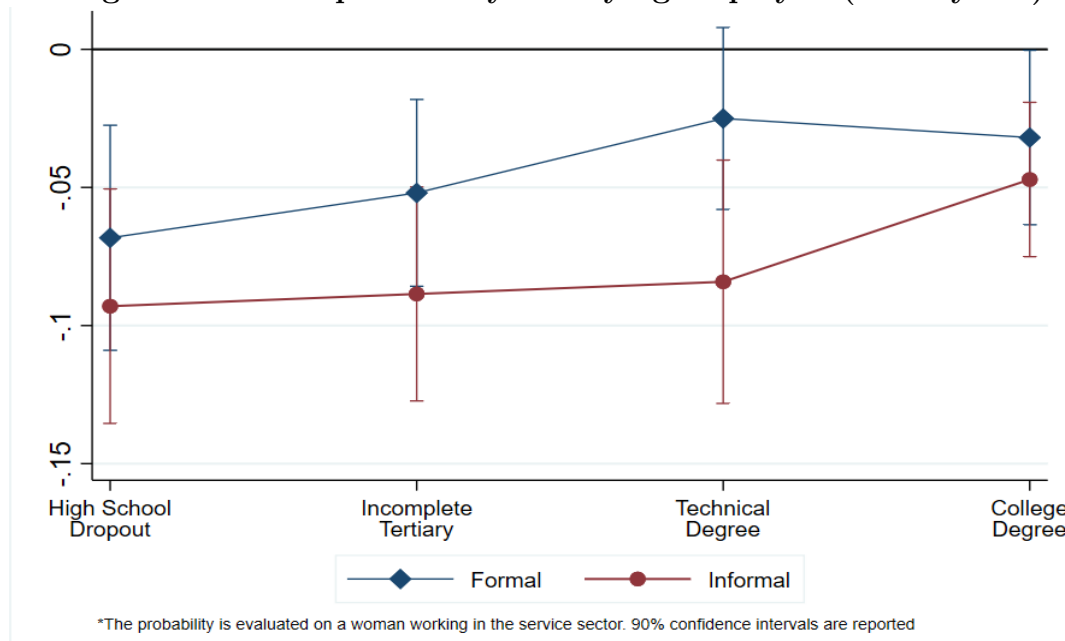
5.2   Income

Table 7 reports, based on Heckman's two-step model, the second-step estimates of equation 9. The first block of results reported in column (1) uses the change in the hourly labor income (in logs) from the primary job as dependent variable. According to the results, an increase in the proportion of immigrants equivalent to one percentage point of the Lima-Callao labor force reduces women's income more than men's. Likewise, higher immigration also reduces the hourly labor income of high school dropout workers relative to those with a college degree (base category). Under this specification, we do not find statistically significant impacts of immigration on other groups of workers relative to the base category. The second block of results uses the change in workers' total hourly labor income (including secondary jobs) as a dependent variable. Under this specification, there are no statistically significant heterogeneous effects from Venezuelan immigration. One tentative explanation behind this result may be that workers might be taking additional jobs to compensate the labor income reduction caused by immigration.

Table 7: **Impact of Venezuelan immigration on wages: specification (1)**

Dependent variable: wage change

	Primary Labor Income		Total Labor Income	
	Migration	Economic Cycle	Migration	Economic Cycle
Female ×	-0.019**	0.009	-0.017*	0.001
	(0.009)	(0.008)	(0.009)	(0.008)
14-24 years ×	-0.008	0.010	-0.016	0.006
	(0.017)	(0.015)	(0.017)	(0.015)
25-39 years ×	0.010	0.016	0.002	0.012
	(0.015)	(0.014)	(0.015)	(0.014)
40-54 years ×	0.007	0.021	0.003	0.011
	(0.016)	(0.015)	(0.016)	(0.015)
HS dropout or lower level ×	-0.040**	0.044***	-0.029*	0.039**
	(0.018)	(0.016)	(0.018)	(0.016)
Incomplete tertiary ×	-0.016	0.023*	-0.015	0.025**
	(0.013)	(0.012)	(0.013)	(0.012)
Technical degree ×	0.005	0.017	0.008	0.018
	(0.015)	(0.015)	(0.016)	(0.015)
Construction Sector ×	-0.019		-0.016	
	(0.013)		(0.013)	
Commerce Sector ×	0.018*		0.025**	
	(0.010)		(0.010)	
Service sector ×	0.009		0.012	
	(0.009)		(0.009)	
Constant		-0.025		-0.015
		(0.030)		(0.030)
Observations		13,839		13,839

Robust standard errors in parentheses. ***,**, * denote levels of significance at 1 %,5 % and 10 %,respectively. All regressions include time fixed effects.

Similarly to Table 5, Table 8 reports the estimates of the Heckman (second-step) equation, but considering groups of workers with different age and education levels. According to the results, a larger immigration reduces the labor income of workers aged 14-24 years and 55 years or older, both with incomplete higher education. All these results are relative to the impacts on the labor income of the base category, made up of workers aged 55 years or older with a college degree.

Table 8: **Impact of Venezuelan immigration on wages: specification (2)**

Dependent variable: wage change

	14-24 years	25-39 years	40-55 years	+55 years
HS dropout or lower level × Migration ×	-0.147***	-0.050	-0.049	-0.088*
	(0.050)	(0.038)	(0.034)	(0.047)
Incomplete tertiary × Migration ×	-0.058*	-0.043	-0.047	-0.070**
	(0.031)	(0.030)	(0.031)	(0.033)
Technical degree × Migration ×	-0.010	-0.022	-0.055	-0.001
	(0.038)	(0.032)	(0.034)	(0.055)
College degree × Migration ×	-0.045	-0.035	-0.020	
	(0.055)	(0.032)	(0.037)	
Female × Migration				-0.019**
				(0.009)
Construction Sector × Migration				-0.020
				(0.013)
Commerce Sector × Migration				0.018*
				(0.010)
Service sector × Migration				0.009
				(0.009)
Constant				-0.002
				(0.049)
Observations				13,839

Robust standard errors in parentheses. ***,**, * denote levels of significance at 1 %,5 % and 10 %,respectively. The regression includes time fixed effects.

5.2.1 Marginal Impacts

Based on the estimates in Table 8, Figures 15 and 16 show the impact of an increase in the number of immigrants, equivalent to one percentage point of the labor force, on the total and primary job hourly labor income, respectively, of women under 40 years of age. The results show that the income of high school dropout female workers under 25 years of age decreases by 14.7% and 11.6%, respectively. Additionally, Figure 17 reports a negative and statistically significant impact (10%) on the primary labor income of women aged 55 years and older with a tertiary education.

We also evaluate whether there is a different effect of immigration on labor income of formal and informal workers. To this end, as in the case of employment, we interact the specification in Table 8, distinguishing between formal and informal workers. Point esti-

Figure 15: Impact of Venezuelan immigration on labor income - primary job (women under 40 years)
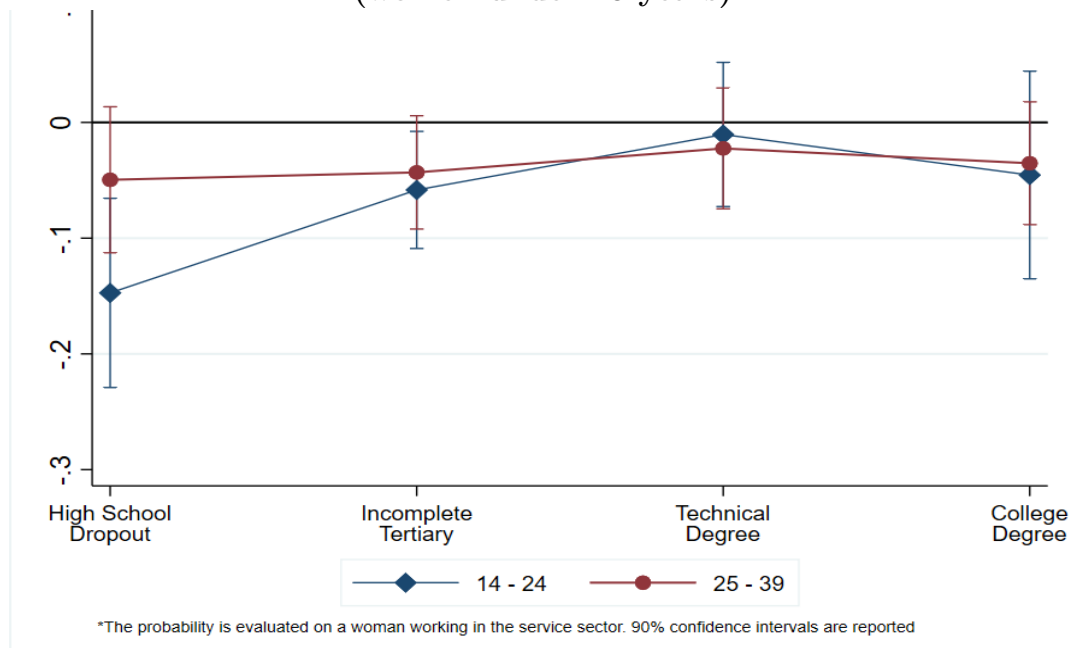

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported

Figure 16: Impact of Venezuelan immigration on total labor income (women under 40 years)

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported
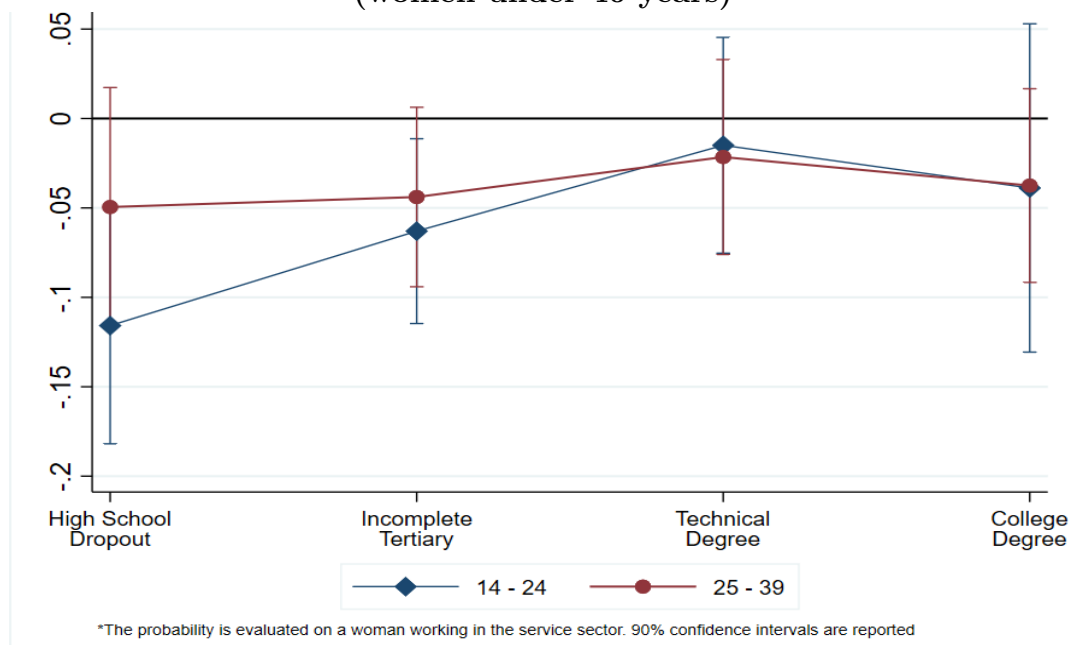
Figure 17: **Impact of Venezuelan immigration on labor income - primary job (women, + 40 years)**

*The probability is evaluated on a woman working in the service sector. 90% confidence intervals are reported
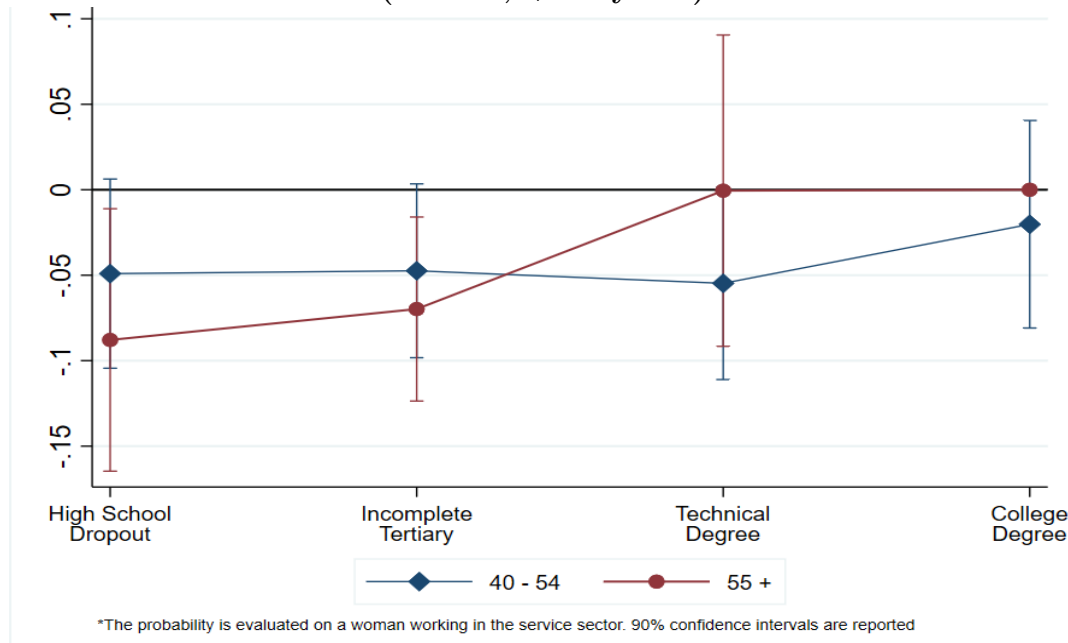
mates (not reported) show that, although the negative impact of immigration on income is greater for informal than for formal workers, the estimates of both groups are not statistically different in the case of high school dropout women under 25 years of age.

6   Conclusions

This paper estimates the impact of Venezuelan immigration on workers' probability of employment loss and labor incomes in Lima, Peru's capital, and the port of Callao. To this end, we use EPE information (2016-2018) and data on the flow of Venezuelan immigrants provided by MIGRACIONES.

We find that an increase in the number of Venezuelan immigrants of one percentage point of the total Lima-Callao labor force (50 thousand workers) affects the probability of employment loss depending on workers' age and education level. Thus, in relative terms, the likelihood of employment loss for a high school dropout female worker aged 14-24 years is

10%-15% higher than for the base category. We also find a negative impact of immigration on workers aged 25-39 years with incomplete tertiary or lower education. Complementary, we find statistically significant effects of immigration on hourly labor income generated by primary jobs, but not on total hourly labor income, for a certain group of workers. Specifically, the hourly labor income of high school dropout workers aged 14-24 years and above 54 years may decrease as the number of immigrants increases.

Additionally, the impact from the immigration-related increase in labor supply on native workers' jobs and wages of local workers can be attenuated by immigrants' higher expenditure. Using information from different surveys and additional calculations, we estimate that the expenditure of Venezuelan immigrants may have accounted for almost 25% of private expenditure growth in Lima-Callao and contributed 0.33 percentage points to GDP growth in 2018. Finally, given that the average educational level is higher among immigrants than among the native-born population, the recent immigration flow may increase productivity and potential output in the medium term.

Finally, it should be noted that, given the magnitude of the recent immigration flow to Peru, it is unlikely that an event similar to the 2018 "immigrant shock" will reappear in the short run.

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A Appendix

Table 9: Characteristics of Venezuelan Immigrants in Peru

	OIM [1]	ENPOVE
Age[2]		
- 18 to 40	83.2	82.0
Education		
-College degree	65.2	57.9
Employment (% of total Venezuelan immigrants)	**71.3**	**73.2**
-Employee	50.9	57.3
-Self employed	20.4	15.9
Unemployment (% of total Venezuelan immigrants)	**28.7**	**26.8**
Economic sector		
-Manufacturing/construction	9.4	15.8
-Commerce, tourism, restaurants, entertainment, others	61.9	57.4
Total	**71.3**	**73.2**
Wages (S/)		
< 656	11.0	12.2
656 - 984	34.0	31.1
984-1968	46.0	51.7
> 1968	5.0	4.9
% under formal contracts	**9.1**	**11.5**

[1] Round 3
[2] As % of population above 18 years of age.