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# The impact of migration on wages in Costa Rica

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# Abstract

In recent years, Costa Rica has experienced greater international migration from neighboring countries due to political, economic, and social reasons, raising discussions on the impact of migration on wages of native Costa Rican workers. This article is the first that disentangles the impact of migration on wages for native Costa Ricans from the impact for settled immigrants by analyzing the effect within groups of education, experience, and regions and controlling for unobserved heterogeneity. We find that on average, there is a significant negative effect of recent immigration on the wages of established immigrants, but no significant effect on the wages of natives over the period from 2012 to 2019. The outcomes hold when using different units of analysis and identification strategies.

Keywords: immigration, wages, labor markets, Costa Rica

# 1. Introduction

Migratory flows within Latin America have increased significantly in recent decades, marked first and foremost by the exodus of Venezuelans, which intensified since 2015. Although the majority of immigrants go to the countries of the southern cone, the highest proportion of migrant workers over the total labor force is hosted in Costa Rica, reaching 11.3 per cent in 2019.<sup>1</sup> The impact that migratory flows have on the Costa Rican labor market is an understudied topic, which, as in many other migration corridors in the region, is partly due to restrictions in the availability of adequate data for empirical analysis.

The objective of this article is to contribute to the literature on south–south migration by providing a short-term analysis on the impact of migration flows on wages in Costa Rica. For this purpose, we use data from the Continuous Labor Force Survey (Encuesta Contínua de Empleo, ECE)<sup>2</sup> over the period from 2012 to 2019. Our estimations cover a short period, during which the combined impact of increased political unrest in the

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neighboring Nicaragua and stricter immigration policies in the USA, fostered higher immigration flows to Costa Rica.

We argue that in Costa Rica, the elasticity of substitution is higher between recent immigrants and previous immigrants than between immigrants and natives. In this line, we follow the work of Manacorda, Manning and Wadsworth (2012), who find a lower rate of substitution between natives and recent immigrants than between natives and all immigrants for the UK.<sup>3</sup> This article suggests that the biggest negative effect of new migration waves is on the wages of previous immigrants.

To capture this effect, we first estimate the impact of immigration on the real hourly wages of Costa Rican workers, and then focus on the effect of new migration on the wages of immigrant workers who have been in the country for more than one year. In line with economic theory, in the short run, we expect immigration to lower the wage of similarly skilled workers but we rule out major adjustments in technology and education as a response to migration (National Academies of Sciences, Engineering, and Medicine 2017). The short-term effect on wages is however expected to vanish over time, once capital-stock adjustments take place (Borjas 2003)

The empirical approach consists of estimating the effect of the variation in immigrant flows on wages across education–experience cells at a national level following Borjas (2003), termed as the national skill-cell approach, and also across cells of education–experience–region by including the regional dimension in the line of Card (2001)<sup>4</sup> and Edo and Rapoport (2019), the so-called mixture approach.<sup>5</sup> We include as a robustness check estimates using sectors instead of regions, in order to investigate whether there is a diffusion effect across them. We use for the analysis the six official planning regions of Costa Rica, which are available in the ECE. (Central, Chorotega, Pacífico Central, Brunca, Huetar Caribe y Huetar Norte). We control for endogeneity of immigration with a shiftshare instrument that uses the past settlements of immigrants from the same country of origin, as done by Edo and Rapoport (2019), Biavaschi et al (2018), and Mayda, Peri and Steingress (2022).

The main results are twofold. First, no significant effect of immigration on Costa Ricans wages is found. Second, we do find a negative effect of recent migration on migrant workers that have been living more than one year in the country. Specifically, we find that an immigrant flow that increases the number of workers in a given skill group by 10 per cent leads, ceteris paribus, to a decrease of 2.2 per cent in the real wage of settled immigrant workers, with comparable skills and in the same regional labor market. The negative effect is mainly present when using the mixture approach, but not robust when using the national skill-cell approach.

These results are conceptually consistent with the literature in that the coefficient of the mixture approach (by groups of education–experience–region) is lower in magnitude than in the national skill-cell approach (education–experience) due to the attenuation bias that arises when using samples and cells with a small amount of observations (Aydemir and Borjas 2011). When using the IV approach, the estimated effect is larger in magnitude (more negative) than its Ordinary Least Squares (OLS) counterpart, providing evidence of an upward bias due to the self-selection of immigrants to labor markets with higher wages. We also find weak significant evidence for downgrading in that we obtain a negative coefficient of both high- and low-skilled recent migration on earlier immigrants'

wages, suggesting that immigrants first come to occupy jobs that require lower skills than those that they have and thus swell the labor supply in the low-skilled sector.

The remainder of the article is organized as follows. Section 2 presents a brief literature review on challenges on estimating the impact of immigration on wages. Section 3 describes the data and variables used. Section 4 outlines the empirical strategy and the main results are presented and discussed in Section 5. Finally, Section 6 concludes with a summary of the main findings and a few suggestions for further research.

# 2. Empirical challenges on estimating the impact of immigration on wages

This section exclusively focuses on closely related empirical research that investigates the effect of immigration on employment and wages. This has been a topic widely studied in the economic literature, with most applications focusing primarily on south-north migration. As indicated by Dustmann, Schönberg and Stuhler (2016), studies can be classified into three groups: the pure 'spatial correlation' approach (Altonji and Card 1991), the 'national skill-cell approach' (Borjas 2003), and the mixture approach (Card 2001; Edo and Rapoport 2019). The pure spatial correlation approach identifies the effect of immigration on wages of workers using variation in the total immigrant flow across regions. Borjas (2003) argues that the spatial correlation approach neglects the so-called 'diffusion effect' and underestimates the impact of immigration on labor market outcomes at the national level (see also: Borjas 2006, 2014; Ortega and Verdugo 2016). More specifically, the 'diffusion effect' refers to the fact that in the face of increased labor competition linked to immigration, natives may decide to move to places with better job prospects or to occupations in which they have comparative advantages vis-à-vis immigrants. Therefore, Borjas (2003) excludes the regional dimension and analyzes the impact of immigration at the national level using a skill-cell approach, where skill groups are created by assigning workers to groups of education and experience. The mixture approach uses variation in immigrant inflows both across skill groups and across geographical areas, where geographical areas are intended to define sub-national labor markets (Dustmann, Schönberg and Stuhler 2016).

Estimations using the national skill-cell approach and the spatial or the mixture approach often lead to divergent results, with the former showing mainly a negative effect of immigration on average wages and the latter leading frequently to non-significant effects. According to Edo and Rapoport (2019) the zero effect is linked to the three main econometric problems that arise when estimating the labor market effects of immigration, that is, endogeneity, diffusion and labor market rigidities. Endogeneity arises if the location choice of new immigrants is driven by labor market conditions, making them settle in regions where wages have the highest growth rates, and thus mixing the effect of immigration on wages with the effect of economic conditions on attracting immigrants (Dustmann, Fabbri and Preston 2005; Llull 2018). Endogeneity is usually addressed with an instrumental variable (IV) strategy, that uses data on the distribution of immigrants across geographical regions by country of origin (Card 2001).

Clemens and Hunt (2019) re-estimate the results of some of the most well-known studies on the impact of refugee migration on the labor market, in order to provide an answer to the divergences in the results. The authors point out that estimations are highly sensitive to the inclusion or exclusion of population subgroups and to changes in the samples over time. In addition, they question the validity of using an instrument based on the initial distribution of immigrants, given that the native population of each region changes little in the short term, so that the instrument and the endogenous variable have a common divisor that induces correlations between the endogenous variable and the instrument. Their in-depth reassessment of different studies, including those by Card (1990) and Borjas and Monras (2017) on the Marielito Boat Lift-the largest migration wave of Cubans to the city of Miami—leads to the conclusion that there is little or no wage impact of large refugee waves on wages. Along the same lines, Peri and Yasenov (2019), who also reexamined the effect of the Cuban migration wave to Miami using a synthetic method, find no statistical evidence of a negative effect on wages. These authors show that the use of small samples makes the results particularly fragile and suggests using extensive sets of robustness tests in such cases. Another important constraint is given by the size of the geographic areas used for the analysis. The smaller the geographic areas, the less negative is the effect of immigration on wages. This attenuation bias effect arises when the variable of interest is measured with data from probabilistic samples and by small geographic areas, making estimations highly susceptible to measurement errors and attenuating the real impact of immigration on wages (Aydemir and Borjas 2011). The use of survey data carries the risk of attenuation bias as the share of immigrants in the selected skill-experience-region cell is calculated using a sample of workers and not the universe, and hence, they could contain a small number of workers per cell.

Beyond the instrument and sample challenges, the impact of immigration on wages depends to a large extent on whether immigrants are close substitutes or complements of native workers. The higher the elasticity of substitution, the higher the negative effects of immigration on wages and employment of natives, as employers will be indifferent between hiring immigrants or natives (National Academies of Sciences, Engineering, and Medicine 2017). The substitution effect depends also on the downward occupational mobility of the immigrant upon arrival and on the skill mix between immigrants and natives. Empirical evidence shows that immigrants are not perfect substitutes for natives, much less immediately upon arrival in the destination country (Dustmann, Frattini and Preston 2013). Downward occupational mobility translates into lower returns to education for immigrants, as they initially access jobs that require lower qualifications and experience compared to those they would have had if they had remained in their country of origin (Peri and Sparber 2011; Ottaviano and Peri 2012; Dustmann, Schönberg and Stuhler 2016).<sup>6</sup> This, in turn, offsets the expected negative effect of immigration on wages (Peri and Sparber 2009; Amuedo-Dorantes and De La Rica 2011). However, there is empirical evidence showing that the elasticity of substitution may change over time. Using census data that can capture medium- and long-run effects, Ottaviano and Peri (2012) found higher elasticities of substitution between immigrants and natives for the USA than Manacorda, Manning and Wadsworth (2012) did for the UK, suggesting that immigrants become more substitutable with natives as time goes on.

The effect of immigration on wages could also vary by education level or occupational groups. Manacorda, Manning and Wadsworth (2012) show that immigrants in the UK show on average a higher educational attainment than natives. Therefore, immigration reduces returns to university education and has a small negative impact on wages when workers in this educational group are considered. Moreover, Nickell and Saleheen (2017) also study the impact of immigration on wages in the UK, but by occupational groups, arguing that comparisons of education attainment across countries are not accurate due to differences in education systems. The authors find that immigration has a small negative impact on average British wages, but that the biggest impact is within the semiunskilled services occupational group. Dustmann, Frattini and Preston (2013) argue that it is incorrect to assign immigrants to skill groups according to their observed education and experience, as they generally find themselves working in lower-level skill groups due to downgrading. Thus, they allocate immigrants to skill groups according to their observed position in the native wage distribution and find a slightly positive average effect of immigration on wages for the UK. In view of these controverses, we will consider the main alternative empirical approaches to examine the Costa Rican case.

# 3. Immigration in Costa Rica: background and descriptive statistics

Migration within Central America differs from the classical south–north migration in that the countries in this sub-region speak the same language, have similar geographic characteristics, and even share a common colonial history.<sup>7</sup> For this reason, and compared to south–north migration, one could expect a faster integration of immigrants into the labor market and a high rate of substitutability with natives, provided that the skills of immigrants match the needs of the labor market. However, the marked differences in economic, political, and educational levels within the region might not fulfill this expectation. While Panama and Costa Rica are upper-middle-income countries, Honduras and Nicaragua belong to the poorest countries in the world (both classified as Heavily Indebted Poor Countries). Nicaragua has the lowest GDP per capita in the region followed by Honduras, while Honduras has the highest poverty rate (48 per cent) which is about five times the one of Costa Rica (World Bank 2022).<sup>8</sup>

Political and social systems also differ considerably within the region, as well as the spread of social conflict and criminality. In the specific cases of Costa Rica and Nicaragua, political and economic systems evolved quite differently in the twenty century. Nicaragua had long periods of authoritarian dictatorships, and a Civil War by 1978. Political violence, weak democratic processes, and opposition to acting governments frequently dominated the landscape. On the contrary, after a brief Civil War in 1948, Costa Rica stablished a democratic system, adopted a progressive constitution and gradually introduced economic reforms to modernize the country. Costa Rica enjoyed an average economic growth of 3.6 per cent between 2010 and 2019 and benefited from increased foreign direct investment (FDI) after the implementation of the Dominican Republic-Central American Free Trade Agreement (DR-CAFTA). This FDI was flowing largely to

the telecommunication, insurance, and pharmaceutical sectors, specifically for producing electronic components and medical devices (see Koehler-Geib and Sanchez 2015).<sup>9</sup> In this context, we argue that the growing demand for skilled labor has been met to a greater extent by Costa Ricans, who are on average more skilled than immigrants.

Not only economic growth and political stability are outstanding in Costa Rica compared to its peers, but also social systems and educational outcomes, acting as pull factors for migration. The last available Census of Costa Rica is as of 2011, which limits the estimation of recent immigration waves using this source. Thus, immigration can only be approximated using either the Encuesta Nacional de Hogares (ENAHO) or the Encuesta Continua de Empleo (ECE). Since we are mainly interested in capturing the effect of immigration on labor market outcomes, we exploit data from the ECE, a labor survey constructed as a rotating panel which is conducted every quarter, covering the period 2011– 19 that provide us with labor characteristics of the Costa Rican population for 33 quarters. The main purpose of the survey is to collect seasonal data on the main labor market indicators. The survey mainly targets the working-age population.<sup>10</sup>

Descriptive statistics using the ECE, show that the proportion of migrant workers over the total labor force in Costa Rica increased from 9.7 to 11.3 per cent in the eight years of analysis, 2011–19 (Fig. 1). Although this increase seems small at first glance, it refers to a fairly short period of time. Alone the share of Nicaraguans over total migrants increased by about 3 percentage points from 85.4 per cent in 2011 to 88.3 per cent in 2019. Immigrants also come from Panama (3.7 per cent), Colombia (1.7 per cent), El Salvador (1.3 per cent), Honduras and the USA (both 0.9 per cent). All remaining countries, accounting for 3.9 per cent of total immigrants, are grouped in a single category.



**Figure 1.** Proportion of immigrant workers over the total labor force of Costa Rica. *Source:* Own calculations using ECE.

Immigrants are in average far less skilled than Costa Ricans. While the literacy rate among the population aged 25-64 in Costa Rica is 98 per cent, the same rate is only 81 per cent in Nicaragua. Although attendance, coverage and dropout rates in primary education differ little between these two countries, it is in secondary school where the gap opens up. In 2010, Nicaragua had a total net enrolment rate in upper secondary of only 64 per cent compared to 80 per cent in Costa Rica (World Bank 2022). However, the skill gap between natives and immigrants decreased in the period of our analysis. Figure 2 depicts these education differences using ECE data. Overall, the educational attainment of both immigrants and natives has increased over time, with more workers completing secondary and tertiary education. In 2019, only 12 per cent of immigrants had tertiary education, compared to 33 per cent among Costa Ricans. As shown in Panels (a) and (b) of Fig. 2, the educational distribution of new immigrants is very similar to that of settled immigrants, supporting the assumption that they are closer substitutes and compete for the same positions in the labor market. The ECE shows that immigrants are mostly employed in trade (16 per cent), agriculture (15 per cent), domestic services (14 per cent), and construction (10 per cent), with 52 per cent of all immigrants representing women. Most of the immigrants are between 18 and 40 years old and are geographically concentrated in the regions neighboring Nicaragua and in Costa Rica's capital, San José. The geographic distribution of immigrants changes little over time and is concentrated in the areas of greatest economic activity, suggesting a location choice of immigrants driven by networks and labor market conditions.



Figure 2. Education by immigration status. Panel (a) Migrants with more than one year in the country Panel (b) New immigrants Panel (c) Costa Ricans. Source: Own calculations using ECE.

Regarding labor market rigidities, Costa Rica has a very complex system with multiple minimum wages defined according to occupational groups and wage categories (Trejos 2014; Gindling, Mossaad and Trejos 2014), which makes it difficult to adjust wages downwards when the labor supply increases. Although language is not a barrier for immigrants coming from Central America, their legal status and the lower quality of education are likely to cause downward occupational mobility. For this reason, we argue that the substitution rate among workers should be higher between low-skilled natives and low-skilled immigrants, and between earlier immigrants and recent immigrants who compete for the same jobs.<sup>11</sup>

As of previous studies on the impact of immigration in Costa Rica, Gindling (2009) was the first author to empirically study the effect of Nicaraguan immigration on earnings in Costa Rica, following the national skill-cell approach of Borjas (2003). The author used selected years from 1997–2004 based on data from the Yearly Household Surveys for Multiple Purposes (EHPM), which was conducted between 1987 and 2009, restricting the analysis to Nicaraguan migration. The study finds an almost zero effect of Nicaraguan migration on earnings with the exception of a negative effect for women with the lowest education level and a positive for secondary complete and university education. A recent paper by Blyde (2020) also restricts the analysis to the impact of Nicaraguan immigrants on Costa Rica labor outcomes but analyses heterogenous impacts of immigrations across skill levels using an augmented version of the mixture approach. The author finds negative elasticities for low-skilled men and women and cross-positive elasticities for high-skilled women.<sup>12</sup>

Our study differs from existing work for Costa Rica in that it estimates both the national skill-cell and the mixture approaches, looks for heterogeneous effects by level of education, and above all evaluates whether there are different effects on the Costa Rican population compared to effects on the wages of established migrants. In addition, we test whether there is a diffusion effect across sectors rather than across regions. When using the mixture approach, we test for an instrument based on the past settlement of immigrants (shift-share approach).

The rationale behind using the national skill-cell approach is that one could expect a stronger native flight response to migration in light of the high share of low-skill jobs and low wages among immigrants, since migrant workers would be ready to work for an even lower wage than natives, creating large incentives for the latter to look for opportunities in sectors demanding higher skills. As shown in Fig. 3 there is a systematic difference between real hourly wages of natives and immigrants, as Costa Ricans have a 47 per cent higher average real hourly wage. On the other hand, we could expect a non-random distribution of immigrants across regions, demonstrated by the high concentration of immigrants in certain regions with better economic prospects, like the central region. This effect can be captured using the mixture approach, that is, by classifying workers among cells of education–experience region and instrumenting immigration, in line with Jaeger, Ruist and Stuhler (2018), Peri (2012) and Borjas (2014). Following Peri and Yasenov (2019), we perform different robustness tests, as we use a survey sample for the analysis.



Figure 3. Real hourly wage of migrant and Costarican workers (in local currency: Costa Rican Colón).

Source: Own calculations using ECE.

# 4. Model specification and empirical strategy

## 4.1. Definition of skill-cell groups

Using data of ECE, we create six categories of education for the empirical analysis: primary incomplete, primary complete, secondary incomplete, secondary complete, university incomplete, and university complete. We define the variable 'years of experience' as the time elapsed since the individual finishes her educational process. Considering that Costa Ricans usually begin primary school at the age of 6, this variable equals actual age minus years of education minus six. We calculate years of experience for individuals aged 16–64 years, and exclude from the sample workers with more than 40 years of experience. Once having individual labor market experience, we create eight groups based on fiveyear intervals of work experience in order to consider that individuals with almost the same years of experience are likely to influence labor market opportunities of their peers (Welch 1979). Regarding the regions, we consider the six Costa Rican administrative areas: Central, Chorotega, Pacífico Central, Brunca, Huetar Caribe, and Huetar Norte. Table 1 shows the descriptive statistics of the main variables of interest for the sample of education–experience–region level in 2011–19.

To analyze the extent to which our estimates could be subject to attenuation bias, we analyze in Table 2 the number of observations per cell in different specifications. Here, we observe that the mixture approach has on average 41 observations per cell (education–experience–region), while the less strict education–experience cell definition has on average

Obs	Mean	SD	Min	Max
2,539	2034.15	1336.32	151.28	15535.33
2,539	16.13	22.31	0	200
2,539	15.86	21.87	0	198
2,539	142.12	103.51	0	630
	Obs 2,539 2,539 2,539 2,539 2,539	Obs         Mean           2,539         2034.15           2,539         16.13           2,539         15.86           2,539         142.12	Obs         Mean         SD           2,539         2034.15         1336.32           2,539         16.13         22.31           2,539         15.86         21.87           2,539         142.12         103.51	ObsMeanSDMin2,5392034.151336.32151.282,53916.1322.3102,53915.8621.8702,539142.12103.510

 
 Table 1. Descriptive statistics of main variables of interest for the sample of education–experience– region–year cells for the period 2011–19

*Note:* Real hourly wages in Costa Rican colones deflated by the consumer price index. *Source:* Own calculations using ECE.

Table 2.	Descriptive statistics:	number of	observations	per cells for	the period 2011–19	,

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Unit of the cell	Cells	Mean	Median	SD	Min	Max
Education-experience	48	236.6	212	147	2	638
Education-experience-region	287	40.7	36	28.4	2	176
Education-experience-sector	406	30.7	14	44.5	2	406

Source: Own calculations using ECE.

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237 observations per cell. Hence, we would expect the coefficients of the experience–cell definition to be less prone to attenuation bias. Finally, the specification with the fewest observations per cell is education–experience–sector with 31 observations per cell on average. Analysis using composite groups of education–experience–region presents some advantages in comparison with using only education–region groups. For example, when analyzing a supply shock generated by an increase in low-skilled immigrants, we need to take into account how the distribution of work experience in the immigrant population contrasts with that of natives. In this case, considering a region with a high influx of immigrants, only a particular segment of natives with tertiary education would be affected if all new immigrants with a similar education were young and hence, had limited experience. In contrast, a completely different segment of natives with the same educational level would be affected if the new immigrants were around 50 years old and with greater experience.

Our variable of interest is constructed as the ratio of immigrants with respect to the total population for each education–experience–group for two subsamples: For native Costa Rican workers and for settled migrant workers. For the latter, we consider migrant workers who have been living more than one year in Costa Rica. More specifically, let us consider a group of workers who have educational level i, experience level j, lives in region r, and is observed in quarter t. For the robustness checks, r is replaced by sectors as explained above.

The measure of the immigrant supply shock for this skill group is:

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$$p_{ijrt} = \frac{M_{ijrt}}{M_{ijrt} + C_{ijrt}} \tag{1}$$

where  $M_{ijrt}$  represents the number of immigrants at quarter t of the specific cell (*i*, *j*, *r*) and  $C_{ijrt}$  represents the number of native Costa Rican workers. This expression represents the immigrant share of the labor force in a concrete education–experience–region group in a given quarter. As a dependent variable, we use the average of logged hourly wage of each group of education–experience–region of the two subsamples of native Costa Rican workers and settled migrant workers. To calculate the averages, we consider the real hourly gross wage of the first and second main jobs.<sup>13</sup> The hourly gross wage is constructed by dividing the monthly gross wage by four and then by the number of weekly hours worked. In addition, to reduce the influence of outliers, we exclude from the sample workers with more than 72 weekly working hours and with real hourly wages higher than 40,000 Colones, values that are implausible for an average worker in Costa Rica. We only consider workers that participate in the labor force, are not enrolled in school and are not self-employed.

The average of logged hourly wage of the whole sample of workers (including both Costa Ricans and immigrants) belonging to some selected education–experience groups in the Central region are shown as an example for descriptive purposes in Table 3. Notice that, as expected, for every educational level, the average of logged hourly wage is higher the work experience. In addition, the average of logged hourly wage of every skill group slightly increased over time. Finally, we observe significant variation in wages by education level. For example, the average of logged hourly wage of the skill group of workers who completed primary education and years of experience in the interval 21–25 was 7.26 in 2019, while for the group of workers who completed a university education with the same years of experience was equal to 8.62 in the same year. This variation in wages by education and experience level support our argument for considering them as separate labor markets, reinforcing the choice of the spatial correlation approach extended by an instrument. A similar pattern is observed for the other five regions of Costa Rica, also when observing results for Costa Rican and settled migrant workers, respectively.

With respect to our target variable, Fig. 4 shows that for the whole sample (including both Costa Rican and settled migrant workers) in the Central Region, there is substantial variation over time in the proportion of immigrants in each educational group depending on the years of experience. The same pattern can be observed for the other five regions of Costa Rica and for the specific proportions in both subsamples of Costa Rican and settled migrant workers. This evidence, together with the information of Table 3, shows that there is substantial variation among education–experience–region groups in both the dependent and independent variables.

Before moving to the model specification, we show in Fig. 5 simple correlations between the variables of interest. The scatter diagram illustrates the relationship between the quarterly change in the proportion of immigrants and the quarterly change in logged hourly wages for our sample of education–experience–region groups of both Costa Rican

Educational level	Years of experience	2011	2012	2013	2014	2015	2016	2017	2018	2019
Primary complete	1–5	6,40	6,71	6,58	6,73	6,87	6,96	7,04	7,38	6,81
	6–10	7,05	7,02	6,96	6,88	6,97	7,10	7,08	7,05	7,05
	11-15	7,21	7,02	7,10	7,06	7,17	7,22	7,13	7,18	7,13
	16-20	7,10	7,05	7,16	7,18	7,18	7,22	7,25	7,23	7,20
	21-25	7,16	7,20	7,20	7,15	7,20	7,23	7,26	7,25	7,26
	26-30	7,21	7,12	7,15	7,17	7,21	7,19	7,23	7,25	7,15
	31-35	7,15	7,16	7,07	7,17	7,26	7,21	7,28	7,25	7,22
	36-40	7,15	7,16	7,10	7,14	7,19	7,20	7,19	7,23	7,22
Secondary complete	1–5	7,19	7,18	7,20	7,19	7,20	7,28	7,29	7,28	7,29
	6-10	7,39	7,36	7,35	7,34	7,34	7,38	7,38	7,39	7,40
	11-15	7,53	7,44	7,45	7,48	7,45	7,50	7,46	7,47	7,47
	16-20	7,54	7,53	7,54	7,57	7,54	7,54	7,58	7,54	7,54
	21-25	7,56	7,60	7,58	7,60	7,64	7,65	7,62	7,58	7,59
	26-30	7,62	7,61	7,63	7,66	7,56	7,59	7,63	7,64	7,62
	31-35	7,72	7,72	7,72	7,66	7,68	7,66	7,64	7,62	7,53
	36-40	7,70	7,85	7,85	7,82	7,75	7,78	7,79	7,72	7,62
University complete	1–5	8,02	7,99	7,95	7,96	8,04	7,96	7,95	8,01	8,00
	6-10	8,25	8,24	8,21	8,19	8,17	8,21	8,23	8,19	8,27
	11-15	8,37	8,37	8,37	8,36	8,37	8,41	8,41	8,43	8,41
	16-20	8,42	8,48	8,47	8,43	8,46	8,54	8,48	8,54	8,56
	21-25	8,46	8,55	8,55	8,54	8,54	8,67	8,59	8,58	8,62
	26-30	8,47	8,49	8,55	8,50	8,57	8,64	8,65	8,60	8,65
	31-35	8,63	8,51	8,56	8,51	8,58	8,67	8,54	8,65	8,49
	36-40	8,45	8,47	8,51	8,55	8,62	8,68	8,64	8,59	8,58

Table 3. Average log hourly wage of selected education-experience groups in the region Central

Source: Own calculations using ECE.

and already settled immigrant workers. The resulting negative relationship, which shows the correlation between the variables, will be tested in the following section to disentangle the potential causal effect, after controlling for different types of unobserved heterogeneity and endogeneity.

## 4.2. Model specification

Our baseline model specification is estimated for the period 2012–19 and takes the following form:

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**Figure 4.** Proportion of immigrants by skill group for the period 2011–19 for the region Central. *Source:* Own calculations using ECE.



Figure 5. Scatter diagram relating changes in wages and immigration in Costa Rica, 2011–19. Notes: Values plotted correspond to residuals from regressions of the logged hourly wage and of the immigrant share on vectors of education–experience–region fixed effects, quarter fixed effects, education–year fixed effects, experience–year fixed effects, and region–year fixed effects. These residuals give the log wage or the immigrant share in the specific education–experience–region–quarter cell relative to that group's mean over the sample period, after removing time effects. *Source:* Own calculations using ECE.

$$y_{ijrt} = \beta_0 + \beta_1 p_{ijrt} + \sigma_{ijr} + \phi_t + \gamma_{i,year} + \theta_{j,year} + \lambda_{r,year} + \varepsilon_{ijrt}$$
(2)

where  $y_{ijrt}$  is the log of the real hourly wage and  $p_{ijrt}$  the proportion of migrant workers over the total labor force of a specific skill cell (*i* denotes education attainment, *j* level of

experience, and *r* denotes region at quarter *t* (based on equation 1)). In order to control for the different kinds of unobserved heterogeneity that could bias our estimator, we include different types of fixed effects: education–experience–region fixed effects ( $\sigma_{ijr}$ ), quarter fixed effect ( $\phi_t$ ) that control for differences over time and time-variant-specific shocks of education ( $\gamma_{i, year}$ ), experience ( $\theta_{j, year}$ ), and region ( $\lambda_{r, year}$ ).

Every regression is weighted by the average quantity of workers belonging to each group of education–experience–region. Moreover, at the time of creating the groups, every worker from the original sample was weighted according to the weighting factor of the survey. In each specification, the standard errors are clustered by education–experience–region in order to control for serial correlation and heteroscedasticity. Finally, in order to avoid a problem of overfitting because of excessive fixed effects, we consider years instead of quarters when computing the interactive time-varying fixed effects.

Even if we are controlling for unobservable heterogeneity with the battery of fixed effects, the decision to migrate could be endogenous to the migrant, in the sense that they could migrate to the regions where higher wages are offered. To deal with endogeneity we use the shift-share instrument proposed by Card (2001) and used also by Cortes (2008), Peri (2012), and Borias (2014). We generate an instrument in line with Jaeger, Ruist and Stuhler (2018) and exploit the fact that immigrants may settle near previous immigrants from the same country of origin. Native workers may behave similarly, since the native workers in a specific skill-region group may not be exogenous to current economic effects of immigration, and therefore may internalize the labor market effects of migration moving to other regions, as is well documented in Peri (2012) and Edo and Rapoport (2019). In other words, we use this approach to control the immigrants' choice decision and the subsequent natives' response. To construct the instrument, we use the distribution of immigrants one year before our estimation starts, i.e. in 2011. We consider the six most common nationalities of immigrants in Costa Rica (Honduras, Nicaragua, Panama, El Salvador, Colombia, and the USA) and create an additional category which groups the remaining countries of origin. Hence, our IV takes the following form:

$$\tilde{p}_{ijrt} = \frac{M_{ijrt}}{\tilde{M}_{ijrt} + \tilde{C}_{ijrt}}$$
(3)

where,

$$\tilde{M}_{ijrt} = \sum_{c=1}^{C} \frac{m_{ijr}^c(1stquarter2011)}{m_{ij}^c(1stquarter2011)} * m_{ijt}^c$$

$$\tag{4}$$

In Equation 4,  $m_{ijr}^c(1stquarter2011)$  represents the number of immigrants of the education– experience group (*i*, *j*) in region *r* from country c in 2011;  $m_{ij}^c(1stquarter2011)$  is the number of immigrants of the same education–experience group present in the whole country; and  $m_{ijt}$  is the number of immigrants of the same education–experience group present in the whole country coming from country *c* in the specific quarter *t* (for the years 2012–19). We then sum these shift-share variables for the different origins. For this, we consider the immigrants from Nicaragua, Colombia, El Salvador, Honduras, Panama, the USA, and an additional group with the remaining countries of origin.

We also create a shift-share component for Costa Rican workers, which is defined as:

$$\tilde{C}_{ijrt} = \frac{c_{ijr}(1stquarter2011)}{c_{ij}(1stquarter2011)} * c_{ijt}$$
(5)

Here,  $c_{ijr}$  (1stquarter2011) represents the number of natives of the education–experience group (*i*, *j*) living in region r in 2011;  $c_{ij}$ (1stquarter2011) represents the quantity of natives of the same education–experience group present in the whole country; and  $c_{ijt}$  represents the quantity of natives of the same education–experience group living in the whole country in the specific quarter *t* (for the years 2012–19). We estimate this new model using a Two-Stage Least Squares estimator (2SLS), where the first and second stages take the following form,

First stage:

$$p_{ijrt} = \beta_0 + \beta_1 \tilde{p}_{ijrt} + \sigma_{ijr} + \phi_t + \gamma_{it} + \theta_{jt} + \lambda_{rt} + \tau_{ijrt}$$
(6)

Second stage:

$$y_{ijrt} = \beta_0 + \beta_1 \hat{p}_{ijrt} + \sigma_{ijr} + \phi_t + \gamma_{it} + \theta_{jt} + \lambda_{rt} + \mu_{ijrt}$$
(7)

Additionally, in order to differentiate the effect by the immigrants' skill level, we split our explanatory variable into two: One representing the share of high-skilled immigrants in each education–experience region cell and the other representing the share of low skill immigrants in the same cell. In each case, workers who at least finished high school are considered highskilled and the rest as low-skilled. In line with Mayda, Peri and Steingress (2022), we also constructed an IV for high-skilled and low-skilled workers, respectively, and we proceed to instrument them separately. Therefore, the second-stage regression turns into:

$$y_{ijrt} = \beta_0 + \beta_1 \hat{p} h_{ijrt} + \beta_2 \hat{p} l_{ijrt} + \sigma_{ijr} + \phi_t + \gamma_{it} + \theta_{jt} + \lambda_{rt} + \phi_{ijrt}$$
(8)

We test for the validity of our IV approach by examining the results of the first-stage estimations in each estimated model. More specifically, we check the actual correlation of the instrument with the explanatory variable of interest, as well as the value of the *F*-test robust to autocorrelation and heteroskedasticity. The results of the first stage for the sample of Costa Rican workers in Table A.1 show positive and statistically significant coefficients for the past settlement variables, and the *F*-test is higher than 10 in all the regressions. Hence, we confirm that the instrument is not weak. Furthermore, for the sample of immigrant workers, we found similar results, which are shown in Table A.2. In order to fulfill the exclusion restriction, the IV should only affect real wages through its effect on the share of immigrants, but not on wages. This means that if the location selected by immigrants in the base period taken for the instrument (2011) was due to specific labor demand shocks, these should not be persistent in subsequent years (2012–19). Due to the short time period, this would not be a reasonable assumption.

background of the country indicates that there were no major labor market developments in 2011 that could have attracted an additional volume of immigrants or a change in their geographical distribution. In any case, it can be assumed that there are two important effects that could have influenced immigration with a significant time lag: the global economic crisis of 2009, which also affected US imports and thus Central American economies due to the fall in exports to the USA, and the increase in foreign investment in anticipation of the entry into force of various trade agreements in Costa Rica between 2000 and 2009.

## 5. Results

#### 5.1 Main estimations

We first present results on the impact of migration on real hourly wages of Costa Rican workers (Table 4) and then the effects of new immigration on wages of settled migrant workers (Table 5). Columns 1 and 2 of Table 4 show the results of the estimation using

 Table 4. Estimations of the impact of migration on the log of real hourly wages of Costa Rican workers (in cells of education-experience and education-experience-region)

	(1)	(2)	(3)	(4)	(5)	(6)
Cells method	Educ-Exper	Educ-Exper	· Educ–Exper-	- Educ-Exper-	- Educ–Exper-	– Educ–Exper–
	(OLS)	(OLS)	Region	Region	Region	Region
	. ,		(OLS)	(OLS)	(IV)	(IV)
	b/se	b/se	b/se	b/se	b/se	b/se
Total migration	0.016		0.004		0.050	
	(0.073)		(0.027)		(0.063)	
H. skill migration		-0.032		-0.018		-0.115
		(0.089)		(0.052)		(0.150)
L. skill migration		0.037		0.014		0.110*
		(0.095)		(0.031)		(0.066)
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Educ  imes Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Exper $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region $\times$ Year FE	E No	No	Yes	Yes	Yes	Yes
Observations	1,509	1,509	8,763	8,763	8,656	8,656
$R^2$	0.990	0.990	0.938	0.938	0.939	0.939

\*Stands for significance at the 0.1 level.

Cluster SE in parenthesis.

Source: Own calculations using ECE.

	(1)	(2)	(3)	(4)	(5)	(6)
Cells method	Educ–	Educ–	Educ-Exper-	Educ–Exper–	Educ–Exper–	Educ-Exper-
	Exper	Exper	Region	Region	Region	Region
	(OLS)	(OLS)	(OLS)	(OLS)	(IV)	(IV)
	b/se	b/se	b/se	b/se	b/se	b/se
Total migration	-0.309*	:	-0.164**		-0.346**	
	(0.171)		(0.065)		(0.175)	
H. skill migration		-0.873*		-0.353*		-1.160
		(0.492)		(0.187)		(0.741)
L. skill migration		-0.114		-0.113*		-0.205
		(0.158)		(0.063)		(0.141)
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Educ  imes Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Exper $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region $\times$ Year FE	No	No	Yes	Yes	Yes	Yes
Observations	1,271	1,271	5,567	5,567	4,187	4,187
$R^2$	0.814	0.814	0.591	0.591	0.596	0.595

 
 Table 5. Estimations of the impact of immigration on the log of real hourly wages of settled migrant workers (in cells of education-experience and education-experience-region)

\*\*Stands for significance at the 0.05 level and

\*at the 0.1 level.

Cluster SE in parenthesis.

Source: Own calculations using ECE.

the education–experience cells (national correlation approach), with the only difference that the model in Column 2 splits migration by high and low skilled. In both models, the coefficients lack statistical significance. The effect of total migration is positive and close to zero (Column 1). When differentiating between low and high-skill migration (Column 2), the coefficient of high-skill migration is negative and that of low-skill migration is positive, both close to zero. This pattern holds for the estimations using education–experience–region cells as shown in Columns 3–6. In Columns 3–4 estimations are conducted using OLS and in Columns 5–6 the IVs approach. The results are similar to those for the cells including only education–experience: the coefficients are not statistically significant at conventional levels and the coefficient signs remain unchanged. Specifications include different types of fixed effects to control for time-constant unobserved heterogeneity of the cell (Cell FE), common shocks (Quarter FE), and time-variant-specific shocks of educational groups (Educ×year FE), experience groups (Exper×year FE), and regions (Region×year FE).<sup>14</sup> Overall, these results show that there is no effect of migration on the wages of Costa Rican workers.

In contrast, Table 5 shows a consistent negative effect of migration on wages of settled immigrants. Specifically, the coefficient is equal to -0.164 in the OLS estimation using education–experience–region cells (Column 3) and doubles in the same specification but using the IV procedure. In both cases, the coefficients are significant at 5 per cent level. The national correlation approach goes in the same line, but it is significant only at the 10 per cent level (Column 1).

These results are conceptually consistent with the literature. First, the OLS coefficient of the education–experience–region specification (Column 3 of Table 5) is lower in magnitude than in the education–experience specification due to the attenuation bias reported by Aydemir and Borjas (2011); and second, the coefficient of the IV specification is much larger in magnitude (more negative) than its OLS counterpart, giving evidence of the presence of an upward bias due to the self-selection of immigrants to labor markets with higher wages. It is worth noting that although the coefficients obtained when considering high- and low-skilled migration are not significant (or i.e. only at 10 per cent), the signs in all models are negative, suggesting that both types of migration have a negative effect on the wages of immigrants who have been in the country for more than one year. This clearly supports the downgrading hypothesis, in which immigrants first come to occupy jobs that require lower skills than they have and thus swell the labor supply in the low-skilled sector.

To interpret the findings for settled migrant workers, we apply the formula of equation 10 in Appendix 1 to obtain the marginal effects attributed to an increase in the labor supply due to a migration shock. By evaluating the ratio immigrants/Costa Ricans at their means we obtained a wage elasticity of 0.22, which means that a 10 per cent supply shock (i.e. an immigrant flow that increases the number of workers in the skill group by 10 per cent) leads ceteris paribus to a decrease of 2.2 per cent in the real wage of settled migrant workers with comparable skills and in the same regional labor market on average. It is worth noting that the coefficients corresponding to the impact of migration on wages of settled migrants coming from the OLS national skill-cell approach and the IV mixture approach are similar. However, the latter is significant at 5 per cent level since its magnitude is 14.8 per cent higher than the former, which is only significant at the 10 per cent level.

#### 5.2 Robustness checks: effects by sector and by education levels

For our research question, is relevant to disentangle in which specific labor markets new immigrants are potentially competing (or not) with natives and settled immigrants. We already saw a competition effect on skill-regional labor markets for the case of settled migrant workers. To verify if there is another dimension in which migration-induced labor market competition could be occurring, we replicate the estimations of Tables 4 and 5 for cells of education–experience–sector. Specifically, competition at the industry level could produce differing labor market conditions and immigrant shares across industries. The sectors reported in our sample and their corresponding ISIC rev. four two-digit sectoral classification are shown in Table 6. We aggregated the sectors in wider categories in order to minimize the attenuation bias due to the potentially small cell size.

Table 7 reports this new estimations for the sample of Costa Rican workers (Columns 1–4) and settled migrant workers (Columns 5–8). Here, the IV approach based on the

ISIC rev 4. Code	Sectoral classification used in the article
47-47, 55-56	Commerce
97-98	Domestic service
69-75, 86-88, 90-93, 77-82, 84, 85, 94-96, 99	Other personal services
49-53, 58-63	Transport and communication
35, 36-39	Electricity, gas, and water
05-09, 10-33	Manufacturing and mining
68, 64-66	Finance and real estate
41-43	Construction
01-03	Agriculture

Table 6. Sectoral classification used in the article and its ISIC rev 4. equivalence

*Notes*: The original sectoral aggregation of the ECE database corresponds to the sectors reported in the following format: 'sector x-sector y' in the first column. The sectors reported without the '-' were classified in a disaggregated format in the ECE database (e.g. sectors 99, 35, and 68). *Source*: Own calculations using ECE.

past settlement of immigrants from the same country of origin is adapted to the sectoral labor markets by replacing the regional dimension with the sectoral one when constructing the instrument. The results show that there are no statistically significant effects, however, a negative correlation is found between migration and wages of settled immigrants, which is in line with our main results. It is important to mention that these estimations might suffer from a strong attenuation bias due to the small number of observations per cell (an average of 30.07 according to Table 2).

It could be also the case that migration flows affect workers differently depending on their educational level. To address this issue, we re-estimated the models with a set of interactions. We interact our migrant share with dummy variables of 'primary incomplete', 'primary complete', 'secondary incomplete', 'secondary complete', 'university incomplete', and 'university complete'. We also address the endogeneity issue in this specification, by using IVs generated as interactions of each educational dummy variable with the past settlement instrument used in the previous section. The heterogeneous effects on Costa Ricans and migrant workers are highly sensitive to changes in the specification and hence are nonrobust. Results are available in Table 8.

# 6. Conclusion

In this article, we empirically investigate the effect of immigration differentially on the wages of Costa Rican natives and earlier immigrants. We assume that in Costa Rica the elasticity of substitution is higher between recent immigrants and established immigrants than between recent immigrants and natives. The main reason for this assumption is based on the similarity of qualifications among immigrants and the fact that Costa Rican natives have a higher quality education system than their neighboring countries, from

Table 7. Estimations of the	impact of immigr	ation on wages of (	Costa Rican and s	ettled immigrant v	vorkers (in cells	s of education-	-experience–s	ector)
	(1) Costa Ricans (OLS) b/se	(2) Costa Ricans (OLS) b/se	(3) Costa Ricans (IV) b/se	(4) Costa Ricans (IV) b/se	(5) Migrants (OLS) b/se	(6) Migrants (OLS) b/se	(7) Migrants (IV) b/se	(8) Migrants (IV) b/se
Total migration	0.008 (0.023)		0.103 (0.094)		-0.037 (0.054)		-0.002 (0.183)	
High-skilled migration		0.003 (0.044)		0.029 (0.223)		-0.111 (0.117)		-0.096 (0.692)
Low-skilled migration		0.010 (0.026)		0.121 (0.103)		-0.013 (0.060)		0.017 (0.162)
Cell FE	Yes	Yes	No	No	Yes	Yes	No	No
Quarter FE	Yes	Yes	No	No	Yes	Yes	No	No
Education $\times$ Year FE	Yes	Yes	No	No	Yes	Yes	No	No
Experience $\times$ Year FE	Yes	Yes	No	No	Yes	Yes	No	No
Sector $\times$ Year FE	Yes	Yes	No	No	Yes	Yes	No	No
Observations $R^2$	11,599 0.934	11,599 0.934	10,561 0.940	10,561 0.940	5,936 0.738	5,936 0.738	4,076 0.774	4,076 0.774
**** stands for significant at th *** at the 0.05 level and	e 0.01 level							

at the 0.1 level and "at the 0.1 level.

Cluster SE in parenthesis.

Source: Own calculations using ECE.

	(1) Costa Ricans (OLS) b/se	(2) Costa Ricans (IV) b/se	(3) Immigrants (OLS) b/se	(4) Immigrants (IV) b/se
Primary incomplete	0.060	0.090	-0.017	0.166
	(0.051)	(0.105)	(0.055)	(0.117)
Primary complete	0.005	0.060	-0.252	-0.367
	(0.044)	(0.114)	(0.175)	(0.295)
Secondary incomplete	-0.057	0.233*	-0.152	-0.711*
	(0.051)	(0.125)	(0.130)	(0.391)
Secondary complete	0.028	-0.034	-0.234	-0.293
	(0.072)	(0.117)	(0.234)	(0.493)
University incomplete	-0.032	0.035	$-0.451^{**}$	-3.107
	(0.125)	(0.754)	(0.223)	(2.380)
University complete	-0.084	-0.410	-0.508	-2.545
	(0.092)	(0.362)	(0.532)	(2.147)
Cell FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Education $\times$ Year FE	Yes	Yes	Yes	Yes
Experience Education $\times$ Year FE	Yes	Yes	Yes	Yes
Region Education $\times$ Year FE	Yes	Yes	Yes	Yes
Observations	8,763	8,656	5,567	4,187
$R^2$	0.938	0.939	0.591	0.594

 Table 8. Heterogeneous effects of immigration on wages by educational level (in cells of education-experience and education-experience-region)

\*\*\* stands for significant at the 0.01 level

\*\* at the 0.05 level and

\*at the 0.1 level.

Cluster SE in parenthesis.

Source: Own calculations using ECE.

which the vast majority of migrants come. To capture this effect, we first estimate the impact of immigration on the real hourly wages of Costa Rican workers, and then focus on the effect of new immigration on the wages of immigrant workers who have been in the country for more than one year. We contribute to the literature on south–south migration by providing a short-run analysis that uses the two best-known empirical approaches in the literature: the national skill-cell approach, i.e. grouping workers by education and experience, and the mixture approach that uses education–experience–region cells. We use labor force survey data (ECE) from 2012 to 2019 for the estimates and also test whether there are heterogeneous effects by education level. We investigate whether there is a

diffusion effect across sectors rather than across regions. In both cases, we control for endogeneity using an instrument based on the previous settlement of immigrants (shiftshare approach).

We find no evidence of an inverse relationship between immigration and the wage of Costa Rican workers. The same result is obtained if we analyze the possible impact across sectors. Unlike much of the literature where the analysis between education–experience–region cells tends to be clustered around zero and the national skill-cell approach tends to obtain a negative result, in this analysis there is no divergence in the results, even when controlling for endogeneity with a shift-share instrument. Two possible explanations are plausible: the existing minimum wage system in Costa Rica, which applies more to the formal sector and where higher skills are required, may prevent adjustments from being made through wages, but instead of it through employment. The second explanation is that the Costa Rican economy was expanding in a way that allowed immigrant labor to be absorbed by the new (labor) demand without affecting wages. Furthermore, the fact that we do not find an impact if we consider education–experience–sector cells could be related to a segmentation of the labor market, in which Costa Ricans and immigrants predominantly work in different sectors without substantial sectoral reallocation over time.

The effect among immigrants is different. The effect of recent immigration on the wages of immigrant workers who have been living in the country for more than one year is negative, supporting the hypothesis that the substitution rate among immigrants is higher than between natives and immigrants. Using the mixture approach and controlling for endogeneity, we find that a 10 per cent supply shock (i.e. an inflow of immigrants that increases the number of workers in the skill group by 10 per cent) leads ceteris paribus to an average decrease of 2.2 per cent in the real wage of immigrant workers already living in the country, who have comparable skills and are in the same regional labor market.

These results are conceptually consistent with the literature in that the coefficient of the mixture approach (by groups of education–experience–region) without controlling for endogeneity is lower in magnitude than in the national skill-cell approach (education–experience), due to the attenuation bias that arises when using samples and cells with a small amount of observations (Aydemir and Borjas 2011).

The coefficient of the specification that controls for endogeneity using the past settlement distribution of immigrants is much larger in magnitude (more negative) than its OLS counterpart, giving evidence of the presence of an upward bias due to the selfselection of immigrants to labor markets with higher wages. We also find weak significant evidence for downgrading in that we obtain a negative coefficient of both high and lowskilled recent migration on earlier immigrants wages, suggesting that immigrants first come to occupy jobs that require lower skills than those that they have and thus swell the labor supply in the low-skilled sector.

The results of the article offer some insightful implications. From a policy perspective, countries experiencing south–south migration might focus on attenuate the deterioration of living standards of settled migrants due to recent migration shocks. For instance, temporary conditional cash transfers complemented with training policies could alleviate the most urgent short-term deprivations of affected migrants while increasing their wages via

productivity gains. In addition, some interesting methodological improvements can be explored in further research. First, correcting the instrument in the line of Clements (2019) would provide a further robustness check to the instrument used. Second, considering the occupational instead of the skill dimension in the line of Dustmann, Frattini and Preston (2013) would more precisely address the dimension in which the labor market competition occurs, this given that immigrants have a strong tendency to downgrade and work in occupations far below their skills.

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# Notes

- Immigration to Costa Rica increased in recent decades, following a considerable drop from 1950 through 1980. While in 1984 only 3.7 per cent of the population was foreign-born, in 2000 that proportion had increased to 6.3 per cent and in 2011 to 8.4 per cent (INEC 2011). Not only the share but also the composition by source country changed significantly. While in 1984 there were only 45,918 Nicaraguans living in Costa Rica (1.9 per cent of all migrants), that number increased to 284,766 in 2011, making approximately 73 per cent of the total number of immigrants. However, not only Nicaraguan migration increased, but also migration from other Central American countries (Guatemala, Honduras, and El Salvador).
- 2. ECE: Encuesta Continua de Hogares, which provides the most recent methodologically consistent data that focus on labor market outcomes.
- 3. Manacorda et al. (2012) also shows that elasticities of substitution are not homogeneous across groups and that new immigration has heterogeneous impacts on natives and already settled up immigrants. Furthermore, the degree of substitution also changes by age. See also the National Academics Report on the extent that prior immigrants are often the closest substitutes for new immigrants, and thus are most likely to experience higher competition and negative effects on employment and wages (National Academies of Sciences, 2017).
- 4. Card (2001) uses a mixture approach but constructing cells of occupation–region and not education–experience–region like Edo and Rapoport (2019).
- 5. See Dustmann, Schönberg and Stuhler (2016) for a full discussion on the different approaches.
- 6. In the long run, firms would adapt their technology towards one that is more intensive in the most abundant labor factor resulting from immigration: labor (Beaudry and Green 2005). Empirical evidence supporting the effect on the output mix and on technology adoption hypotheses has been reported for the USA by Hanson and

Slaughter (2002), Lewis (2011), and Beaudry Doms and Lewis (2010), for Spain by Gonzalez and Ortega (2011), and for Germany by Dustmann, Frattini and Preston (2013).

- 7. Central America consists of seven countries: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. It is bordered by Mexico to the north and Colombia to the south. As of 2020, the total population was close to 49.7 million habitants, out of whom about 30.4 per cent lived below the \$5.50 a day (2011 PPP) poverty rate.
- 8. Poverty headcount ratio at \$5.50 a day (2011 PPP) (per cent of population). *Source:* World Bank, WDI.
- 9. DR-CAFTA liberalized trade between Central America, i.e. Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and the Dominican Republic on the one side and the USA on the other. The treaty came into force on 1 January 2009, after being ratified in 2017 following a national referendum.
- 10. The sampling frame of the ECE is based on the 2011 Census. The ECE has geographic coverage at the national level, for the rural urban divide and for the planning regions of Costa Rica (Central, Chorotega, Pacífico Central, Brunca, Huetar Caribe y Huetar Norte).
- 11. If, in addition, migrants do not speak the language of the destination country, as is often the case in south-north migration, imperfect substitutability is even greater, as documented by Dustmann, Frattini and Preston (2013) for the UK. In this case, an immigration shock may induce native workers to shift from manual to communication-intensive tasks as a rational response to avoid competitive pressures on wages and capitalize on their language advantage.
- 12. A recent study by Caruso, Canon and Mueller (2021) tackling the effect of Venezuelan migration to Colombia use the 'spatial correlation' approach and a shift-share instrument accounting for the distance between each Venezuelan province and the Colombian departments where immigrants arrive. This study finds a sizable short-term negative and statistically significant effect on Colombian informal sector workers living in urban areas, that interestingly occurs through occupational downgrading of native workers natives as they are only able to get jobs in activities below their qualifications once migrants enter the labor market.
- 13. Wages are deflated using the consumer price index coming from the International Financial Statistics of the International Monetary Fund database, which uses 2016 as the base year.
- 14. From a methodological point of view, and according to Abadie (2020), it is important to report findings showing non-significant effects, since they bear relevant information that could be even more valuable than the expected significant effects. This would be particularly true in empirical contexts like the one in our setting, with large datasets and some theoretical and empirical evidence that suggests the absence of the expected effect.

# References

- Abadie, A. (2020) 'Statistical Nonsignificance in Empirical Economics', American Economic Review: Insights, 2/2: 193–208.
- Altonji, J. G. and Card, D. (1991) 'The Effects of Immigration on the Labor Market Outcomes of Less-skilled Natives', in Abowd, J. M. and Freeman, R. B. (eds.) *Immigration, Trade and the Labor Market*, pp. 201–234. Chicago: University of Chicago Press.
- Amuedo-Dorantes, C. and De La Rica, S. (2011) 'Complements or Substitutes? Task Specialization by Gender and Nativity in Spain', *Labour Economics*, 18/5: 697–707.
- Aydemir, A. and Borjas, G. J. (2011) 'Attenuation Bias in Measuring the Wage Impact of Immigration', *Journal of Labor Economics*, 29/1: 69–112.
- Beaudry, P. and Green, D. A. (2005) 'Changes in US Wages, 1976–2000: Ongoing Skill Bias or Major Technological Change?', *Journal of Labor Economics*, 23/3: 609–48.
- —, Doms, M. and Lewis, E. (2010) 'Should the Personal Computer Be Considered a Technological Revolution? Evidence from US Metropolitan Areas', *Journal of Political Economy*, 118/5: 988–1036.
- Biavaschi, C. et al. (2018) 'South-South Migration and the Labor Market: Evidence from South Africa', *Journal of Economic Geography*, 18/4: 823–53.
- Blyde, J. S. (2020) Heterogeneous Labor Impacts of Migration Across Skill Groups: The Case of Costa Rica, IDB Working Paper Series IDB-WP 1145.
- Borjas, G. J. (2003) 'The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market', *The Quarterly Journal of Economics*, 118/4: 1335–74.
- (2006) 'Native Internal Migration and the Labor Market Impact of Immigration', *Journal of Human Resources*, XLI/2: 221–58.
- (2014) Immigration Economics. Cambridge, MA: Harvard University Press.
- and Monras, J. (2017) 'The Labour Market Consequences of Refugee Supply Shocks', *Economic Policy*, 32/91: 361–413.
- Card, D. (2001) 'Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration', *Journal of Labor Economics*, 19/1: 22–64.
- (1990) 'The Impact of the Mariel Boatlift on the Miami Labor Market', *Ilr Review*, 43/2: 245–57.
- Caruso, G., Canon, C. G. and Mueller, V. (2021) 'Spillover Effects of the Venezuelan Crisis: Migration Impacts in Colombia', *Oxford Economic Papers*, 73/2: 771–95.
- Clemens, M. A. and Hunt, J. (2019) 'The Labor Market Effects of Refugee Waves: Reconciling Conflicting Results', *ILR Review*, 72/4: 818–57.
- Cortes, P. (2008) 'The Effect of Low-Skilled Immigration on U.S. Prices: Evidence from CPI Data', *Journal of Political Economy*, 116/3: 381–422.
- Dustmann, C., Fabbri, F. and Preston, I. (2005) 'The Impact of Immigration on the British Labour Market', *The Economic Journal*, 115/507: F324–41.
- —, Frattini, T. and —— (2013) 'The Effect of Immigration along the Distribution of Wages', *The Review of Economic Studies*, 80/1: 145–73.
- —, Schönberg, U. and Stuhler, J. (2016) 'The Impact of Immigration: Why Do Studies Reach Such Different Results?', *Journal of Economic Perspectives*, 30/4: 31–56.

- Edo, A. and Rapoport, H. (2019) 'Minimum Wages and the Labor Market Effects of Immigration', *Labour Economics*, 61: 101753.
- Gindling, T. (2009) 'South-South Migration: The Impact of Nicaraguan Immigrants on Earnings, Inequality and Poverty in Costa Rica', *World Development*, 37/1: 116–26.

—, Mossaad, N. and Trejos, J. D. (2014) The Consequences of Increased Enforcement of Legal Minimum Wages in a Developing Country: An Evaluation of the Impact of the Campaña Nacional De Salarios Mínimos in Costa Rica, IZA Discussion Paper No. 8253.

- Gonzalez, L. and Ortega, F. (2011) 'How Do Very Open Economies Adjust to Large Immigration Flows? Evidence from Spanish Regions', *Labour Economics*, 18/1: 57–70.
- Hanson, G. H. and Slaughter, M. J. (2002) 'Labor-Market Adjustment in Open Economies: Evidence from US States', *Journal of International Economics*, 57/1: 3–29.
- INEC. Instituto Nacional de Estadística y Censos. (2011) Censo 2011. Población Total nacida en el Extranjero por Zona y Sexo, según País de Nacimiento y año de Llegada al País. <a href="https://www.inec.cr/poblacion/migracion">https://www.inec.cr/poblacion/migracion</a> (30 January 2022, date last accessed).
- Jaeger, D. A., Ruist, J. and Stuhler, J. (2018) *Shift-Share Instruments and the Impact of Immigration*, IZA Discussion Papers 11307, Institute of Labor Economics (IZA).
- Koehler-Geib, F. and Sanchez, S. M. (2015) *Costa Rica Five Years after CAFTA-DR*. Washington, DC: The World Bank.
- Lewis, E. (2011) 'Immigration, Skill Mix, and Capital Skill Complementarity', *The Quarterly Journal of Economics*, 126/2: 1029–69.
- Llull, J. (2018) 'The Effect of Immigration on Wages: Exploiting Exogenous Variation at the National Level', *Journal of Human Resources*, 53/3: 608–62.
- Manacorda, M., Manning, A. and Wadsworth, J. (2012) 'The Impact Immigration on the Structure of Wages: Theory and Evidence from Britain', *Journal of the European Economic Association*, 10/1: 120–51.
- Mayda, A. M., Peri, G. and Steingress, W. (2022) 'The Political Impact of Immigration: Evidence from the United States', *American Economic Journal: Applied Economics*, 14/1: 358–89.
- National Academies of Sciences, Engineering, and Medicine (2017) *The Economic and Fiscal Consequences of Immigration*. Washington, DC: The National Academies Press.
- Nickell, S. and Saleheen, J. (2017) 'The Impact of EU and Non-EU Immigration on British Wages', *IZA Journal of Migration and Development*, 7/1: 2–28.
- Ortega, J. and Verdugo, G. (2016) *Moving Up or Down? Immigration and the Selection of Natives across Occupations and Locations*, IZA Discussion Papers 10303, Institute of Labor Economics (IZA).
- Ottaviano, G. I. P. and Peri, G. (2012) 'Rethinking the Effect of Immigration on Wages', *Journal of the European Economic Association*, 10/1: 152–97.
- Peri, G. (2012) 'The Effect of Immigration on Productivity: Evidence from U.S. States', *Review of Economics and Statistics*, 94/1: 348–58.
- and Sparber, C. (2009) 'Task Specialization, Immigration, and Wages', *American Economic Journal: Applied Economics*, 1/3: 135–69.
  - (2011) 'Assessing Inherent Model Bias: An Application to Native Displacement in Response to Immigration', *Journal of Urban Economics*, 69/1: 82–91.

— and Yasenov, V. (2019) 'The Labor Market Effects of a Refugee Wave: Synthetic Control Method Meets the Mariel Boatlift', *Journal of Human Resources*, 54/2: 267–309.

- Trejos, J. D. (2014) 'Costa Rica: Un esfuerzo para mejorar la aplicación de los salarios mínimos', in A. Marinakis (ed.) *Incumplimiento Con El Salario Mínimo En América Latina*, (pp 111–172). Santiago: Organización Internacional del Trabajo.
- Welch, F. (1979) 'Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust', Journal of Political Economy, 87/5, Part 2: S65–97.
- World Bank (2022) *World Development Indicators*. Washington, D.C: The World Bank Group. https://databank.worldbank.org/home (12 Februar 2022, date last accessed).

# Appendix 1 1.1 Calculation of marginal effects

To interpret the final coefficient, we must convert it to an elasticity which represents the per cent change in wages with respect to a per cent change in labor supply originated by the migration flow. Let us define, for example,  $m_{ijrt} = \frac{M_{ijrt}}{C_{ijrt}}$  as the percentage increase in labor supply attributable to immigration. Then, the final effect of migration on the wage of native Costa Ricans is estimated as follows: We have that:

$$p_{ijrt} = \frac{M_{ijrt}}{M_{ijrt} + C_{ijrt}} = \frac{\frac{M_{ijrt}}{C_{ijrt}}}{\frac{M_{ijrt}}{C_{ijrt}} + 1} = \frac{1}{1 + \frac{C_{ijrt}}{M_{ijrt}}} = \frac{1}{1 + \frac{1}{m_{ijrt}}}$$
(9)

Then, according to the chain rule:

$$\frac{d\log y_{ijrt}}{dm_{ijrt}} = \frac{d\log y_{ijrt}}{dp_{ijrt}} \frac{dp_{ijrt}}{dm_{ijrt}} = \frac{\beta_1}{\left(1 + m_{ijrt}\right)^2}$$
(10)

Where  $\beta_1$  is the coefficient of our regression and  $m_{ijrt}$  is evaluated at the means.

# 1.2 First-stage regressions

**Table A.1.** Fixed effect first-stage estimations of the impact of the past settlement instruments on total migration and by skill level on Costa Rican workers (in cells of education–experience–region)

	(1) Proportion of migrants b/se	(2) Proportion of high skilled migrants b/se	(3) Proportion of low skilled migrants b/se
Pastsettlement_Instrument	0.672***		
	(0.050)		
Pastsettlement_InsHighskill		0.441***	-0.001
		(0.046)	(0.006)
Pastsettlement_InsLowskill		0.003	0.826***
		(0.005)	(0.067)
Quarter FE	Yes	Yes	Yes
Education $\times$ Year FE	Yes	Yes	Yes
Experience $ imes$ Year FE	Yes	Yes	Yes
Region $\times$ Year FE	Yes	Yes	Yes
Observations	8656	8656	8656
F-test robust	8.826	11.16	22.21
$R^2$	0.144	0.0962	0.177

\*\*\*\* stands for significant at the 0.01 level.

Cluster SE at the cell level in parenthesis.

(1)	(2)	(3)
Proportion of	Proportion of high-	Proportion of low-
migrants	skilled migrants	skilled migrants
b/se	b/se	b/se
0.734***		
(0.052)		
l	0.432***	-0.005
	(0.047)	(0.012)
	-0.004	0.846***
	(0.005)	(0.058)
Yes	Yes	Yes
4,187	4,187	4,187
55.65	46.25	87.65
0.221	0.162	0.246
	(1) Proportion of migrants b/se 0.734*** (0.052) Yes Yes Yes Yes Yes Yes 4,187 55.65 0.221	(1)       (2)         Proportion of Proportion of high- migrants       skilled migrants         b/se       b/se         0.734***       (0.052)         0.432***       (0.047)         -0.004       (0.005)         Yes       Yes         4,187       4,187         55.65       46.25         0.221       0.162

**Table A.2.** Fixed effect first-stage estimations of the impact of the past settlement instruments on total migration and by skill level on Immigrant workers (in cells of education–experience–region)

\*\*\* stands for significant at the 0.01 level.

Cluster SE at the cell level in parenthesis.