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**Article**

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ORIGINAL ARTICLE

Open Access



# Living with the neighbors: the effect of Venezuelan forced migration on the labor market in Colombia

Leonardo Peñaloza-Pacheco \*

## Abstract

I estimate the effect of the Venezuelan exodus on the Colombian labor market. The economic and social crisis in Venezuela triggered one of the most important migratory exoduses in recent decades: more than 4 million Venezuelans left their country and close to 1.8 million arrived in Colombia. I show that an increase in 1 p.p of labor supply due the migratory flow caused a decline in hourly wages in Colombia of 0.4% and a negative effect of 0.1 p.p. on the employment rate of low-skilled workers. The drop in wages was greater for men, low-skilled and informal workers.

**Keywords:** Migration, Wages, Colombia, Venezuela

**JEL Classification:** J31, J61, F22

## 1 Introduction

The Venezuelan migratory exodus is one of the most important episodes of forced migration in the world: about 4.5 million of Venezuelans left their country and moved elsewhere<sup>1</sup> (UNHCR 2019). The most common destination for departing Venezuelan migrants is Colombia. According to official statistics, there were nearly 1.8 million of Venezuelans living in Colombia in 2019, as a consequence of the Venezuelan economic and political crisis, which represents an increase in the share of Venezuelans living in Colombia relative to the national population from 0.07% in 2015 to 3.6% approximately in 2019.

<sup>1</sup> To put it in context, this number represents about 67% of the total number of displaced people from Syria, which is the most important recent episode of forced displacement in the world (UNHCR 2019). Thus, the Venezuelan migratory exodus became the second largest in recent times.

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This significant episode of migration represents a challenge to policymakers who seek to understand and quantify the potential economic and social effects of such a massive inflow of immigrants, especially for host countries like Colombia.

In this paper, I exploit the Venezuelan exodus in order to understand the migratory episode's effect on the Colombian labor market. I implement a differences-in-differences methodology and conduct my analysis by considering the level of exposure across Colombian departments to this exogenous labor supply shock, before and after 2016 (i.e. 2013-2019). In 2016 a significant and unexpected migratory influx of Venezuelans to Colombia took place when the borders between the two countries were reopened after nearly a year of closure.

My estimates suggest that the intensification of the migratory flow of Venezuelans beginning in mid-2016 generated a significant drop in aggregate wages and in the employment rate of low-skilled workers in Colombia. An increase in 1 percentage point (p.p.) of the labor force due to the inflow of Venezuelans generated a 0.4% decrease in wages and a 0.1 p.p. decrease in employment for low-skilled workers; this effect on employment represent a decrease of 0.18% relative to the average employment

rate of low-skilled Colombian workers in 2015, before the Venezuelan exodus. When I estimate these effects for Colombian departments located on the border with Venezuela (La Guajira and Norte de Santander), results illustrate that the declines in wages and employment for all workers were approximately 10% and 3.4 p.p. (a decrease of 5.6% on employment relative to 2015 average employment), respectively, after the border was re-opened.

In order to estimate the effect of migration on these two border departments, I construct a control group using three departments of Colombia that were not strongly affected by immigration and displayed, on average, similar trends in terms of labor market variables and had similar socio-demographic characteristics prior to the border re-opening. To provide robustness to these results, I implement a Synthetic Control Method and calculate the same differences-in-differences estimations considering different combinations of departments of Colombia as control groups.

I also estimate heterogeneous effects by sex, level of qualification, labor formality and considering whether the individuals were natives or not. I find that, in aggregate, the deterioration in wages was higher for men compared to women and much stronger for low-skilled workers. Moreover, the decline in wages was greater for informal workers but there are not important differences between natives and non-natives; the only exception is that I find a statistically significant increase in the informality rate among non-natives in Colombia.

This paper contributes to a growing literature on massive flows of forced migration, mainly refugees, that take place between developing countries. In general, most of the papers that have taken up this topic have analyzed the flow of migrants from developing countries to developed countries (see, for example Card 1990; Hunt 1992; Borjas 2003, 2017; Foged and Peri 2016, among others).

In cases of developing-developed migration, immigrants that enter the labor market in the receiving country are often quite different from the workforce already settled there, and the impact that immigrants have on receiving labor markets is related to the differences (or similarities) in characteristics between migrants and natives and the capacity of the economy to absorb the new labor force.<sup>2</sup> In this paper, however, I analyze the impact of a migratory flow between two developing countries (Colombia

and Venezuela) that, due to their history, are very similar in social and demographic terms. Given this, a greater substitutability between migrant labor and native workers would be expected, resulting in a deterioration of the labor market conditions in the host country.

In the literature on migration between developing countries, one of the most recent episodes of massive forced migration is the one spurred by the Syrian conflict. Some papers have analyzed this massive migration and the effects on the bordering countries' labor market, especially in Jordan and Turkey. Results show a negative effect of migration on wages, an increase in informality, and a decrease in hours worked in Jordan for economic immigrants (Malaeb et al. 2018). On the other hand, evidence also indicates an increase in the unemployment rate, informal employment and a drop in the labor force participation in Turkey mainly concentrated on non-native workers due to the Syrian exodus (Cengiz and Tekgüç 2018; Tumen 2016).

The work most closely related to this paper is Caruso et al. (2019). In their paper, the authors analyze the 2013-2017 period and implement an instrumental variable strategy in order to estimate the effect of the Venezuelan exodus on the Colombian labor market. They find that a 1 p.p. increase in immigration from Venezuela generated a decrease in wages of about 7.6%, which represents a significantly high labor demand elasticity. They also find that the effect was stronger for informal workers in urban areas. Finally, according to their estimates, a 1 p.p. increase in the share of Venezuelan immigration reduced the employment rate for Colombian workers in urban areas by 2.3 p.p. In contrast to findings in Caruso et al. (2019), my estimates suggest that the negative effects of immigration on wages and employment were significantly lower than their estimates. Results presented in this paper are more consistent with earlier papers that have estimated the effects of refugee waves on the labor market.<sup>3</sup>

Three main points distinguish this work from Caruso et al. (2019): First, while Caruso et al. (2019) use household surveys to estimate the inflow of immigrants from Venezuela, I use administrative information from the Migration Unit in Colombia (UAEMC). This dataset indicates a higher value of the labor supply shock and, thus, a significantly lower labor demand elasticity. According to their estimates, migrant working-age population (those between 15-64 years old), represents a 0.6% of

<sup>2</sup> Perhaps one of the most influential papers on forced migration is David Card's 1990 paper estimating the effect of the arrival of Marielitos on the labor market of Miami in the United States. Card (1990) argues that this inflow of immigrants (that increased labor supply in Miami by approximately 7%) had no significant effect on the labor market in Miami because the economy was able to quickly absorb the labor supply and avoid a short-term adjustment in wages. Borjas (2003, 2017) discusses Card's results by arguing that workers with similar education but with different levels of experience are not perfect substitutes. Thus, his analyses are based on skill groups defined in terms of educational attainment and work experience.

<sup>3</sup> For instance, for United States, Altonji and Card (1991) find that an increase in the labor supply caused by immigration reduced wages of low-skilled workers by 1.2%, on average. Furthermore, for Germany, Dustmann et al. (2017) find that 1 p.p. increase in the labor supply reduced wages of low-skilled young workers by 0.56% and total wages by 0.13%. Finally, for the case of Colombia, Morales (2018) finds that 1 p.p. increase in the labor supply due to internal displacement in Colombia reduced wages of workers on hosting localities by 1.4% in the short-run, on average. For an extensive review of estimated effects of immigration on wages see, for example, Dustmann et al. (2016).

the native working-age population in 2017 (the last year of their sample with the highest number of Venezuelan immigrants), which is the main reason explaining why their results are significantly large. Specifically, according to the same administrative information from UAEMC and data from DANE in which my estimates are based, in 2017-2019 the share of immigrants relative to the labor force in Colombia was 1.7%-5.4%.

Second, another advantage of this paper compared to that of Caruso et al. (2019), refers to the fact that, since they use an IV approach, according to Lozano and Steinberger (2012) the effect when using instrumental variables is more a Local Average Treatment Effect (LATE) which requires stronger assumptions of the instrumental variable to ensure external validity of the estimates. Therefore, the estimated effects in this work using a difference-in-differences methodology allow for an interpretation of the average treatment effect for the entire sample under study.

Finally, while Caruso et al. (2019) estimate the effect of Venezuelan migration on the labor market in Colombia for the period 2013-2017, I analyze the period from 2013-2019. This is very important considering that, according to UAEMC, the number of Venezuelans in Colombia in 2017 was 22.8% of the number settled there by 2019. In fact, UAEMC official statistics indicate that during the period after 2017 until 2019—not taken into consideration in Caruso et al. (2019)—the number of Venezuelans in Colombia increased by 339% from 403,702 in 2017 to 1,771,237 in 2019. As the migratory episode under study is one of forced migration, an analysis of a longer time period like the one carried out in this paper is crucial to estimating the effect of the Venezuelan exodus on the Colombian labor market. My estimates reveal that the effects found by Caruso et al. (2019) were consolidated in the Colombian labor market over time and were not explained by a labor market overreaction in the very short-term.

Another paper related to this one is the work of Bahar et al. (2020). In that paper, the authors analyze the effect of a massive regularization program implemented by the Colombian government in 2018 that granted work permits to about half a million undocumented Venezuelan immigrants. By implementing a difference-in-difference methodology, they find that the regularization program had a slightly negative effect on formal employment for Colombian workers, especially of high-skilled and female workers. Moreover, Bahar et al. (2020) also find that the regularization program had a positive effect on the formal employment rate of Venezuelan workers in Colombia. The estimates of Bahar et al. (2020) and those presented in this paper are different in the sense that they analyze the effect of a regularization program and not the Venezuelan exodus per se.

The rest of the paper is organized as follows: Sect. 2 discusses background information regarding previous internal migratory episodes in Colombia and the Venezuelan exodus. Section 3 introduces the data and some descriptive statistics. In Sect. 4, the identification strategy and methodology are outlined, then the aggregate and heterogeneous estimates are presented. Section 5 presents robustness exercises and, additionally, discusses several potential threats to the identification strategy. Finally, Sect. 6 concludes.

## 2 Background

### 2.1 Violence and previous forced internal displacement episodes in Colombia

Migration is not a new phenomenon in Colombia: forced internal migration has played a very important role in the last 60 years (UNHCR 2019). During these years, the country has seen internal conflicts caused by different illegal armed groups. Leftist guerrillas emerged in the mid-20th century and, over the following decades, internal conflicts intensified due to the involvement of drug cartels and paramilitary groups (Grupo de Memoria Histórica 2013).

This violence meant that some urban and rural localities were victims of attacks perpetrated by guerrillas and paramilitaries: massacres, kidnappings, homicides, and temporary takeovers of municipalities were some of the violent strategies implemented by these illegal groups (Gaviria 2000; Calderón-Mejía and Ibáñez 2016; Grupo de Memoria Histórica 2013). All these episodes of criminality and internal conflict pushed the inhabitants of the most affected areas of Colombia to leave their hometowns; they became a displaced population.

According to UNHCR (2019), Colombia has the highest number of internally displaced persons –IDPs– in the world (8 million of people by 2019 – about 15% of the population in Colombia). These large flows of IDPs have affected welfare and labor markets in receiving regions.

For example, Calderón-Mejía and Ibáñez (2016) and Morales (2018) study the effect of IDPs in Colombia and find that these frequent episodes affected the labor market, especially for unskilled and vulnerable workers. According to the authors, internal displacement in Colombia generated a drop in wages in the receiving cities due to labor market rigidities and increased out-migration in IDP destination municipalities, particularly for high-skilled workers who appear to be more mobile.

Information from CEDES (Universidad de los Andes) presented in Fig. 4 in Appendix shows that internal displacement in Colombia has been significantly reduced in the 2002-2018 period by more than 80%. Nevertheless, there is a new concern in Colombia related to forced migration that is receiving much attention from the

government and the international community: the Venezuelan exodus.

Historically, Colombia and Venezuela have had important cultural and historical ties. These bonds have generated a constant flow of immigrants from Colombia to Venezuela and vice versa (Fig. 5 in Appendix). According to data from the 2005 Census in Colombia, there were 37,350 Venezuelans living in Colombia, which represented approximately 0.2% of the labor force that year (see Table 3 in Appendix). The departments where the participation of Venezuelans in relation to the local labor force was highest were Vichada (2%), Arauca (1.6%) and Norte de Santander (1.5%), which are on the Colombia-Venezuela border.

Table 3 also shows that the number of non-Venezuelan immigrants who were settled in Colombia in 2005 was 72,621, which represents a 0.4% of the labor force in Colombia in that year. This information shows that Colombia, in the last decade, was not a country in which there were many immigrants settled in relation to the local population. We can also see that, although in absolute values there seems to be a slightly positive correlation between the total number of Venezuelan and non-Venezuelan immigrants in 2005 in each department, when we normalize these values by the size of the local labor force the data suggest that there is no actual correlation between the two variables.

Recently, due to the political and economic crisis in Venezuela that has generated high levels of insecurity, an increase in social vulnerability and a drop in GDP of 62.2% in the 2013-2019 period in that country (Crasto and Álvarez 2017; ECLAC 2019), the inflow of individuals from Venezuela has increased dramatically in just 5 years, reaching more than 1.8 million people entering from Venezuela.

This new episode of forced migration represents a challenge for local authorities and the labor market. Although Colombia has historically been a country with forced internal migration, empirical evidence presented above suggests that local economies were not strong enough to absorb the incoming labor force and that, in this type of episode, the most affected individuals tend to be low-income and less-skilled.

## 2.2 The Venezuelan Exodus towards Colombia

In 1999, when President Hugo Chávez was elected in Venezuela, Venezuelans began to live through disruptive political and economic episodes that have dramatically changed their quality of life. Chávez's government implemented several populist policies, financing them with resources from the boom period of commodity prices (such as oil, the main commodity produced in Venezuela), during the 2000s.

However, when world commodity prices fell, economic activity and the stability of the Venezuelan economy

suffered tremendously. This situation continued when Nicolás Maduro became president of Venezuela in 2013. Since that year, economic activity in Venezuela has dropped significantly, food shortages began to emerge in the country, and the inflation rate grew exponentially, generating social distress and monetary and financial instability (Crasto and Álvarez 2017; Roza and Vargas 2021).

In addition, security in Venezuela has worsened significantly during the 2000s and the 2010s. There has been a significant increase in violent deaths, political prisoners and political persecution, among other human rights violations (UN Human Rights 2019). This whole situation has generated a very important mass exodus of Venezuelans who have had to leave their country to seek a new future in other countries, mainly in Latin America and the Caribbean (Crasto and Álvarez 2017).

In August-September of 2015, due to political and security tensions between Colombia and Venezuela, the borders between both countries were closed. After months of negotiations between Venezuelan and Colombian governments, the borders were reopened. The border's reopening on August 13, 2016, together with the ongoing economic and social crisis in Venezuela, led to a massive migration of Venezuelans to Colombia in the second half of 2016; the migration continued over the following years.

In the following subsection I will present information that will allow to understand how Venezuelan forced migrants integrated into the Colombian labor market. Then, in Sect. 3, I will show descriptive statistics to understand the evolution over time of the Venezuelan exodus, the distribution across departments in Colombia and the characteristics of Venezuelan immigrants compared to the local population.

## 2.3 Colombian labor market and the integration of Venezuelan migrants

Colombia, like many countries in Latin America, is characterized by having a large informal labor market. According to data from SEDLAC<sup>4</sup> (CEDLAS and The World Bank), about 34.4% of salaried workers in Colombia were informal in 2018.<sup>5</sup> In addition, SEDLAC data also indicates that the unemployment rate in Colombia is one of the highest in the region, reaching 9.4% in 2019.

Considering that the Venezuelan exodus began in 2016 due to the re-opening of the borders between both countries, the Government of Colombia created special residency status for Venezuelans in order to formalize their legal status. The issuance of this special permit was

<sup>4</sup> Last accessed: January 30, 2021—<https://www.cedlas.econo.unlp.edu.ar/wp/en/estadisticas/sedlac/>.

<sup>5</sup> Workers who stated that they do not have the right to a pension when retiring were considered informal, according to SEDLAC.

carried out in two waves, the first one in January 2017 and the second one in February 2018. This permit, called the Permiso Especial de Permanencia (PEP) allowed Venezuelan individuals with the proper documentation to be part of the formal labor market and to access public services like education and health. Nevertheless, according to official information, only a little more than 180,000 permits were granted to Venezuelan immigrants, leaving the majority of Venezuelans in Colombia with an informal status (Bahar et al. 2020).

In 2018, the government decided to collect information about the undocumented Venezuelans in Colombia and carried out a census called the Registro Administrativo de Migrantes Venezolanos (RAMV); more than 440,000 Venezuelans registered. As Bahar et al. (2020) state, according to the information from RAMV, the majority of registered Venezuelans had completed their secondary education (more than 65%), 73% were working-age individuals, 25% of working-age individuals were unemployed, 89% of them were struggling to receive recognition for their education by local authorities, one third of Venezuelan immigrants surveyed worked in the informal sector, and almost 90% planned to stay in Colombia.

Later, in mid-2018, the Colombian government decided to offer an unexpected massive amnesty to undocumented Venezuelan immigrants who registered in the RAMV, giving them the possibility to apply for a new round of PEP issuance (Bahar et al. 2020). However, despite the Government of Colombia's efforts, UAEMC data suggests that almost 56% of all Venezuelans in Colombia still lacked regular migratory status by the end of 2019, impeding them to access a formal job or other services like health attention and access to education.<sup>6</sup>

The information provided indicates that, despite the efforts of local authorities, a large proportion of working-age Venezuelans are still undocumented and cannot participate in the local formal labor market. Given this, an increase of the labor supply in those departments with high rates of Venezuelan migrants would likely be most dramatically felt in the informal sector.

### 3 Data and descriptive statistics of the Venezuelan migration to Colombia

#### 3.1 Data

To examine the impact of Venezuelan migration on the Colombian labor market, I will use two sources of information: the first source is labor and socioeconomic data for individuals surveyed as part of the Great Integrated Household

Survey (GEIH) conducted by the Colombian National Statistical Office (DANE, by its acronym in Spanish), a nationally representative household survey that is carried out on a monthly-basis in urban and rural areas of Colombia. GEIH is a repeated cross-sectional data source that includes information about labor force, unemployed and inactive individuals, socio-demographic characteristics and, since April 2013, also includes information about migration. Given this, I use data from April 2013 to December 2019, to keep only the native individuals. The sample will be restricted to natives between 15 and 64 years of age, inclusive.<sup>7</sup>

The working database is composed of 3,143,611 observations from 24 departments of Colombia out of a total of 32. Those departments in which, according to Fig. 1, there is no data available (Amazonas, Vaupés, Guainía, Guaviare, Vichada, Arauca, Casanare and San Andrés) are departments in which the GEIH is not carried out with the same periodicity as the rest of the country.<sup>8</sup> Thus, for this reason those departments will not be considered in the analysis. However, according to the last Census in Colombia (2018), the population in those eight departments represents about 3% of the Colombian population because they are mainly rural regions. Therefore, the results presented here should not be affected.

The second source of information is data on the migratory flows of Venezuelans in Colombia by department for the period 2012-2019, obtained from the Migration Unit (Unidad Administrativa Especial de Migración Colombia, UAEMC by its acronym in Spanish) as well as estimations made by the same organism about the number of Venezuelans settled in each department.<sup>9,10</sup>

#### 3.2 Descriptive statistics

Figure 1 shows the share of Venezuelans relative to the local labor force for each department in 2005 and 2019. The 2019 map shows that the intensity of the number of settled Venezuelans was much greater in the departments on the Colombian side of the border. Venezuelans in the

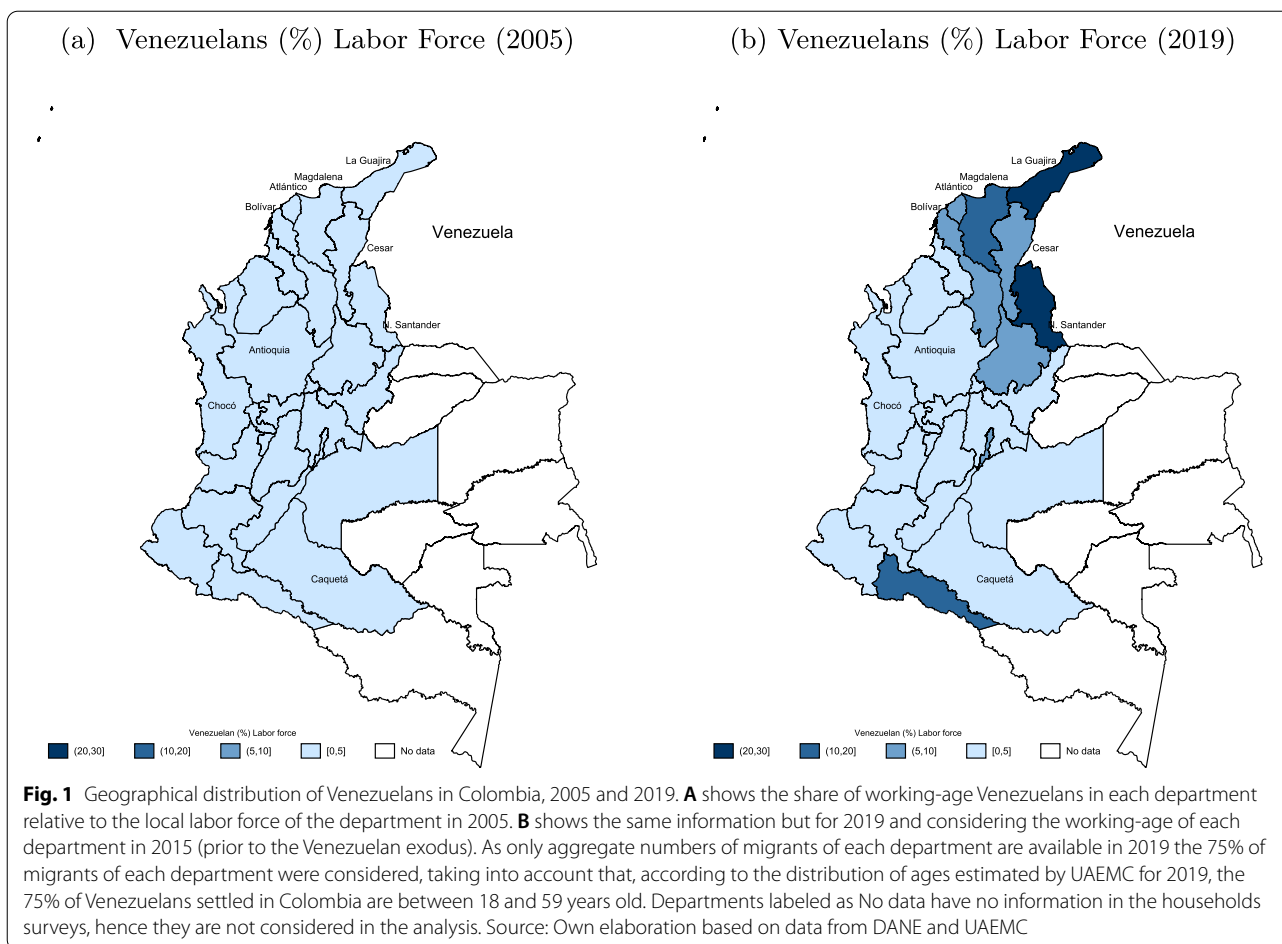
<sup>7</sup> I will not consider individuals with wages higher than the 99th percentile of the hourly wage distribution to avoid outliers in the sample.

<sup>8</sup> In Colombia, a department is the name for a sub-national division similar to, for example, states in the USA.

<sup>9</sup> UAEMC estimates on the number of Venezuelans settled in each department were made based on data from the Sistema de Información de Registro de Extranjeros (SIRE), Permiso Especial de Permanencia (PEP), migratory inflows and the last Census carried out in Colombia (2018).

<sup>10</sup> It is not possible to differentiate between undocumented and documented immigrants in my sample as Bahar et al. (2020) do in their paper, as they rely on confidential information from RAMV. Although the Colombian government implemented a massive regularization program for Venezuelan immigrants in 2018 (see Sect. 2.3), my study consider the total number of Venezuelan immigrants regardless of their legal status in the country. Thus, my estimates provide the aggregate effect of the Venezuelan exodus and not the specific effect of an increase in the number of documented or undocumented immigrants in the labor market.

<sup>6</sup> Regarding this program of massive amnesty to undocumented Venezuelan immigrants, Bahar et al. (2020) find a negative small effect on the formal employment for native individuals. The authors find that the negative effect on the formal employment was higher for Colombian highly educated workers and women. Bahar et al. (2020) also find a positive effect on the formal employment of Venezuelan workers in Colombia.



border departments of Norte de Santander and La Guajira represent about a 23.6% and 24.7% of the 2015 Labor Force (LF), respectively (See also Table 3).

Hence, considering that the border departments of La Guajira and Norte de Santander are the two departments, with available data, most affected by the migration flow of Venezuelans, I will estimate, on the one hand, the aggregate effect of the Venezuelan exodus on the labor market in Colombia and, on the other hand, the impact in those border departments.<sup>11</sup>

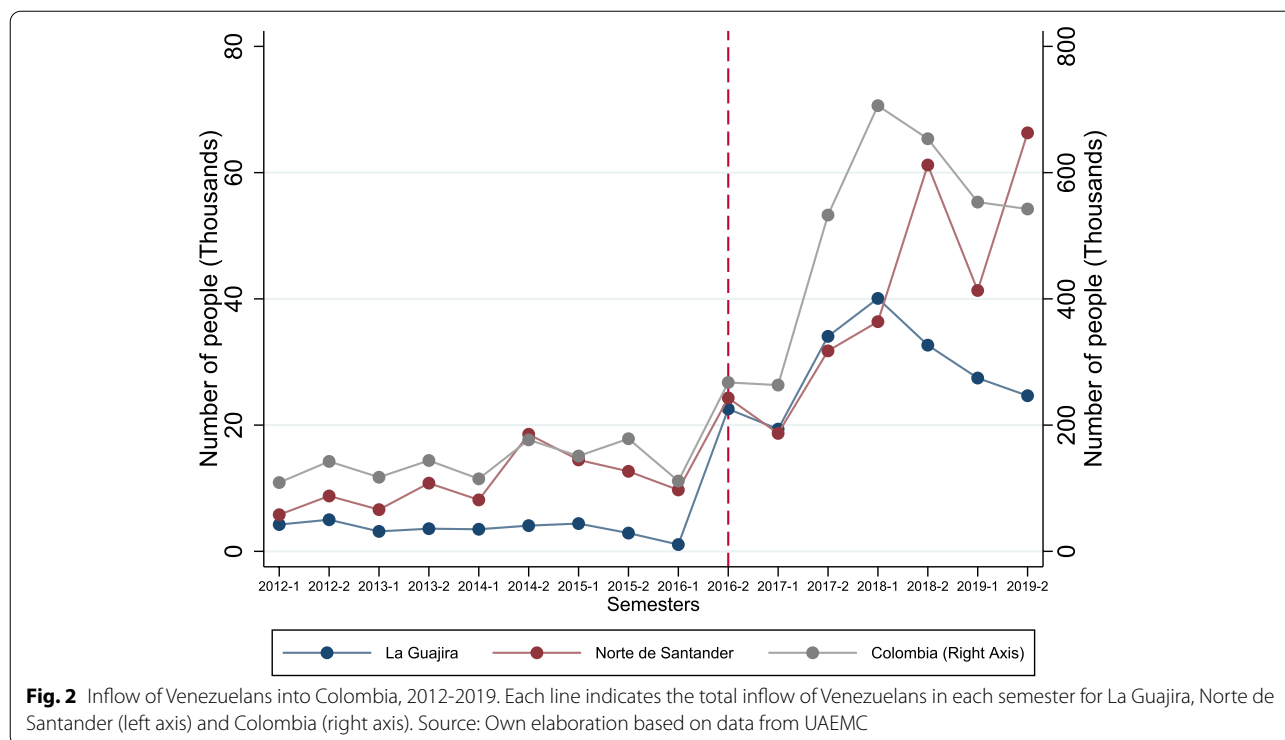
Finally, Fig. 2 shows that, after the re-opening of the borders (the second half-year of 2016), the migratory

flow intensified over the following periods. At the national level, the annual migration flow went from about 250.000 people in 2012 to more than 1 million people in 2019, reaching a peak in 2018 with about 1.3 million Venezuelans entering Colombia. In La Guajira and Norte de Santander, the migratory flow mirrored that at the national level.

### 3.3 Characteristics of Venezuelan migrants

In order to analyze the characteristics of Venezuelan migrants in comparison to native individuals, GEIH socio-demographic information for both groups in 2019 is presented in Table 1. Descriptive statistics of Venezuelans are restricted to individuals who declared that they were born in Venezuela. 50.9% of Venezuelan immigrants are women, which is almost the same proportion in the Colombian population. Venezuelan migrants are younger in comparison to Colombian population in about 6 years. Moreover, the proportion of high-skilled workers among Venezuelan immigrants is almost 7 p.p. higher than Colombian workers.

<sup>11</sup> There are other departments on the Colombian side of the border between the two countries, such as Cesar, Boyacá, Arauca, Vichada and Guainía. However, in the case of Cesar and Boyacá, there are no border crossings between Colombia and Venezuela because the geographic boundary is a non-transitable forested area. In Arauca, Vichada and Guainía there are border crossings between both countries, however, as mentioned above, these departments are not surveyed in the GEIH with the same periodicity as the rest of the country's departments. Nevertheless, according to information from UAEMC, 97% of land migratory inflows from Venezuela to Colombia in the 2016-2019 period occurred through the border crossings of Norte de Santander and La Guajira, while only 3% occurred at the border crossings of Arauca, Vichada and Guainía.



A priori this information would suggest a greater labor supply shock in the high-skilled labor market considering that it is expected that these immigrants compete for jobs with qualified workers. However, as Dustmann et al. (2013) suggest, there are some situations in which high-skilled migrants compete for jobs in the low-skilled labor market because they have to adapt themselves to the new place where they arrive and find barriers in the labor market. These barriers impede them to work in a job with the same characteristics in which they would work if they were in their country of origin. For instance, as mentioned above, according to information from RAMV, 89% of Venezuelans surveyed were struggling to have their education certificates recognized by local authorities, leaving them unable to compete with high-skilled native workers (Bahar et al. 2020).

On the other hand, Table 1 shows that the unemployment rate is greater for Venezuelan individuals, as is informality, which is around 28 p.p higher than the informality rate among Colombian workers. Finally, there is a significant proportion of Venezuelan migrants working in the Commerce and Construction sectors, while the rate of employment is much lower in the Skilled Services sector.

The information presented above allows us to confirm that after the reopening of the border, there has been a significant increase in the flow of Venezuelan migrants to Colombia. They mostly settled in Colombian

departments close to the border. In addition, this inflow of Venezuelans would have mainly affected the informal labor market. Although these are skilled individuals, the increase in labor supply was probably stronger in the labor market for less skilled individuals, due to labor market barriers that prevent qualified Venezuelan immigrants from accessing high-skilled jobs.

## 4 Effect of Venezuelan migration on the labor market of Colombia

### 4.1 Identification strategy and methodology

In order to identify the effect of the migratory exodus of Venezuelans on the labor market in Colombia, I analyze the evolution of wages, employment, informality and unemployment, before and after the re-opening of the borders between the two countries. Additionally, I compare the evolution of the most affected departments in Colombia by the migration flow with those departments that were not greatly affected.

Given the practical impossibility of having a counterfactual that allows one to compare what the evolution of the variables of interest would have been in the absence of the labor supply shock, the literature offers different methodologies to approximate the causal impact of the shock under study.

I will use two approaches based on the same methodology. First, I will estimate the effects of migration considering the intensity of the treatment (labor supply shock)



**Table 1** Descriptive Statistics—Venezuelans and Colombians 2019

	Venezuelans			Colombians		
	Mean	Standard Deviation	Observations	Mean	Standard Deviation	Observations
All						
Female	0.509	0.500	18,310	0.513	0.500	463,460
Age	29.96	10.26	18,310	36.32	13.92	463,460
Single	0.377	0.485	18,310	0.470	0.499	463,460
Inactivity	0.211	0.408	18,310	0.289	0.453	463,460
Unemployment	0.158	0.365	14,291	0.117	0.321	319,630
High-Skilled	0.623	0.485	18,310	0.555	0.497	463,460
Employed						
Informality	0.786	0.410	11,964	0.503	0.500	277,626
Construction	0.119	0.324	11,964	0.071	0.257	277,626
Commerce	0.460	0.498	11,964	0.256	0.437	277,626
Skilled Services	0.047	0.212	11,964	0.093	0.291	277,626

Venezuelans are those individuals who declared that they were born in Venezuela. High-Skilled refers to those individuals with at least 11 years of formal education. Workers were considered informal if they met any of the following conditions: (i) salaried workers who do not contribute to a pension fund through payroll deductions made by the hiring company or made by the employee voluntarily; (ii) non-professional self-employed workers (i.e., with less than tertiary or university studies); (iii) unpaid family workers. The rest of the employed were considered formal. Source: Own elaboration based on data from GEIH—DANE

on each department after the re-opening of the borders. This intensity will be calculated considering the share of Venezuelans in 2019 (according to UAEMC data) in relation to the local labor force in each department in 2015, which is a year before the massive inflow of Venezuelans.

Although the proportion of Venezuelan immigrants in each department is not random, I analyze if there are significant different trends in terms of wages, employment, unemployment, and informality across departments by estimating a regression for each outcome variable on the interactions between year-month dummies and the share of Venezuelans in each department in 2019. Figure 10 in Appendix shows that there are no significant differences in trends of any outcome variable under analysis between all departments in Colombia before the re-opening of the borders (vertical dashed line).

Second, after estimating the average effect for the whole country, I will also estimate the effects on the labor market just for the border departments of La Guajira and Norte de Santander. These two departments were selected because they were the most affected by Venezuelan immigration. I estimate the impact of the mass exodus in the treatment departments taking as a control group the departments of Antioquia, Caquetá, and Chocó. Figure 10 shows that trends in hourly wages (in logs), employment, unemployment and the informality rate were similar for the proposed treatment and control groups prior to re-opening of the borders.

In addition to the measure of parallel-trends, the selection of Antioquia, Caquetá and Chocó as the control group was also based on the fact that they are not on the border. As a result, it is expected that the reopening of the

Colombian-Venezuelan border and the subsequent migratory flow would not significantly affect the labor market in these departments (see Table 3 of Appendix). Finally, Table 4 of Appendix shows that, in general, differences in pre-treatment characteristics of La Guajira and Norte de Santander and the control group are not statistically significant.

To determine the effect of the increase in the labor supply on the Colombian labor market, I estimate the following regressions:

$$Y_{idt} = \alpha_1 + \delta_1(S_d \times Post_t) + Z'_{idt}\theta + \pi_d + \sigma_t + \mu_{idt} \quad (1)$$

$$Y_{idt} = \alpha_2 + \delta_2(T_d \times Post_t) + Z'_{idt}\theta + \pi_d + \sigma_t + \mu_{idt} \quad (2)$$

The variable  $Y_{idt}$  denotes the outcome of interest of individual  $i$  from department  $d$  and period  $t$ ,  $\pi_d$  and  $\sigma_t$  are department and year-month fixed effects, respectively. Finally, the vector  $Z_{idt}$  controls for heterogeneities among individuals that could bias the estimates: sex, linear and squared age and years of education, whether individual  $i$  lives in urban or rural area, marital status and the economic industry to which individual  $i$  belongs (i.e. industry fixed-effects) for those cases in which the sample is conformed by employed individuals. For both equations, the variable  $Post_t$  takes a value equal to 1 if individual  $i$  belongs to a year-month after the re-opening of the borders and 0 otherwise.

For equation (1), variable  $S_d$  is the share of Venezuelan migrants that are in each department in 2019, according to estimates from UAEMC relative to the local labor

force in 2015, prior to the re-opening of the borders.<sup>12</sup> On the other hand, for equation (2), variable  $T_d$  takes a value equal to 1 if department  $d$  is La Guajira or Norte de Santander and 0 if department  $d$  belongs to the control group.  $\delta_1$  and  $\delta_2$  are the coefficients of interest.

Finally, standard errors are clustered at the department level to allow for serial correlation between the individuals of the same department. Given that there are few departments under analysis when differences-in-differences methodology is implemented (especially for the dichotomous treatment), I estimate more conservative errors by implementing the wild bootstrap-t method (Cameron et al. 2008; Webb 2014). In the results presented below, I will show the standard errors calculated by clustering at department level and the p-values based on wild bootstrap-t standard errors. However, there is not much difference in the results.

## 4.2 Results

Top panel of Table 2 shows the estimated coefficient  $\delta_1$ , when considering the share of immigrants for each department as the variable of interest. On the other hand, bottom panel indicates the estimates considering as treated department La Guajira and Norte de Santander ( $\delta_2$ ).

I find that an increase in 1 p.p. in the share of Venezuelans caused a decrease in Colombian hourly wages of about 0.4%. The estimated effect for La Guajira and Norte de Santander reflects an average decline of approximately 10% in hourly wages. Thus, considering a net labor supply shock in La Guajira and Norte de Santander of about 24% (Table 3 of Appendix), a labor demand elasticity of about -0.42 is estimated.

Then, I consider outcome variables related to employment, unemployment and informality for the period 2013-2019.<sup>13</sup> In the case of these results, I include an additional row as a reference that indicates the mean value of the dependent variable in 2015 (before the exodus) for the whole country in the case of the continuous

<sup>12</sup> This specification provides the estimated effect of the share of Venezuelan immigrants in each department on the local labor market. Although I am using the final share in 2019, the estimated effect also captures the impact in previous years, even when some of the Venezuelans had not yet arrived in the department.

<sup>13</sup> The employment dependent variable is a binary variable that takes a value equal to 1 if individuals belong to the working age population and are employed, and 0 if they belong to the working age population and are not employed. The unemployment variable is also a binary variable, and the sample is restricted, as usual, to the labor force, i.e., those who are active in the labor market. Finally, workers are considered informal if they meet any of the following conditions: (i) they are salaried workers who do not contribute to a pension fund through payroll deductions made by the hiring company or made by the employee voluntarily; (ii) they are non-professional self-employed workers (i.e., with less than tertiary or university studies); (iii) they are unpaid family workers. All other employed workers were considered formally employed. Thus, the definition of informality used in this paper emphasizes the labor rights of employees and their level of vulnerability in the labor market.

treatment and for La Guajira and Norte de Santander in the case of the binary treatment; I will refer to these reference means as the 2015 baseline values.

Table 2 shows that the Venezuelan migratory flow had a negative effect on employment rate in the labor market in Colombia and the border departments (although the effect is not statistically significant for the Colombian estimates when I consider more conservative standard errors given a p-value of 0.136). In the case of the border departments, I find that a 1 p.p. increase in the share of Venezuelan immigrants reduced the employment rate by 3.4 p.p., which represents a decrease of 5.6% relative to the 2015 baseline value. Table 2 also shows that this negative effect translated into an increase in the unemployment rate in Colombia. According to these estimates, an increase in 1 p.p. in the share of Venezuelans increased the unemployment rate by approximately 0.1 p.p. This variation in the unemployment rate represents an increase of 0.8% relative to the 2015 baseline values of the dependent variable. Finally, aggregate estimates for Colombia and the border departments do not seem to show any statistically-significant effect on informality rate.<sup>14</sup>

## 4.3 Heterogeneous effects

This section will present the effects of the migratory exodus on the Colombian labor market by level of qualification, labor formality, gender and considering whether the individuals were natives or non-natives. In the proceeding analysis, I will consider interactions of the treatment effect with the characteristics of heterogeneity, in order to determine whether the effect of the Venezuelan exodus presents a statistically-significant difference among the subgroups analyzed. The equations used to estimate each of the effects are the following:

$$Y_{idt} = \alpha_1 + \delta_1(S_d \times Post_t) + \psi_1(S_d \times Post_t \times H_{idt}) + \tau(\pi_d \times H_{idt}) + \lambda(\sigma_t \times H_{idt}) + Z'_{idt}\theta + \pi_d + \sigma_t + \mu_{idt} \quad (3)$$

$$Y_{idt} = \alpha_2 + \delta_2(T_d \times Post_t) + \psi_2(T_d \times Post_t \times H_{idt}) + \tau(\pi_d \times H_{idt}) + \lambda(\sigma_t \times H_{idt}) + Z'_{idt}\theta + \pi_d + \sigma_t + \mu_{idt} \quad (4)$$

To examine effects according to qualification, variable  $H$  is equal to 1 if the individual is high-skilled<sup>15</sup> (0 otherwise); to analyze the labor market effects by gender

<sup>14</sup> All results hold when running the regressions excluding potentially endogenous controls (years of education, marital status and urban/rural housing dummy indicator). Results are available upon request from the author. I thank the editor for this suggestion.

<sup>15</sup> Low-skilled were defined as those individuals who had not completed secondary education (i.e. less than 11 years of education); high-skilled individuals were defined as those who had more than or equal to 11 years of education.

**Table 2** Effects on the labor market

	Hourly wages (logs)	Employment	Unemployment	Informality
Migration effect ( $S_d$ )	− 0.004*** (0.001)	− 0.001*** (0.000)	0.001** (0.000)	0.000 (0.000)
P-value wild bootstrap SE	[0.041]	[0.136]	[0.092]	[0.484]
Observations	1,901,208	3,143,611	2,175,205	1,901,208
R2	0.366	0.240	0.055	0.375
Mean Dep. variable		0.615	0.119	0.509
Individual controls	Yes	Yes	Yes	Yes
Department and time FE	Yes	Yes	Yes	Yes
Migration effect ( $T_d$ )	− 0.100*** (0.016)	− 0.034*** (0.004)	0.015 (0.007)	0.009 (0.011)
P-value wild bootstrap SE	[0.044]	[0.026]	[0.130]	[0.594]
Observations	387,434	673,471	452,691	387,434
R2	0.384	0.239	0.063	0.417
Mean Dep. variable		0.606	0.134	0.597
Individual controls	Yes	Yes	Yes	Yes
Department and time FE	Yes	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap-t standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013-2019. The individual controls include characteristics related to the sex of the individual, years of education (linear and squared), the linear and squared age, whether they live in an urban or rural area and marital status. Individual controls also include industry-fixed effect when the sample is restricted to employed individuals. Source: Own elaboration based on the GEIH-DANE

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

$H$  is equal to 1 for women (0 otherwise), to examine the effects by labor formality  $H$  is equal to 1 for formal workers (0 otherwise) and, finally, to estimate the effect between native and non-native individuals  $H$  is equal to 1 for non-native individuals (0 otherwise).<sup>16</sup>

The interaction between the department fixed effects and subgroups variable ( $\pi_d \times H_{idt}$ ) allows us to control for shocks on each subgroup that are constant over time but different across departments. The fifth element of the equations ( $\sigma_t \times H_{idt}$ ) captures differentials across time among the subgroups analyzed, but which remain constant between departments. The rest of the variables are the same as those specified in Eqs. (1) and (2).

$\delta_1$  and  $\delta_2$  would indicate the increase of labor supply's effect on the labor market of the base subgroup; the coefficients  $\psi_1$  and  $\psi_2$  would indicate the difference in the migration's effect between one of the previously mentioned subgroups and the corresponding base subgroup. Tables 5 and 6 in Appendix present the estimated effects of immigration on wages, employment, unemployment, and informality in Colombia, considering the level of qualification of workers.

<sup>16</sup> I considered as non-natives in the sample those who reported being born in a country other than Colombia and who have been living in Colombia for at least the last 5 years (long-term non-natives) and left out of my sample those who reported that they were living in a different country one year ago (recent non-natives) and, therefore, are more likely to be part of the wave of Venezuelan migration under study.

According to Table 5, an increase in 1 p.p. in the share of Venezuelan immigrants caused a decline of wages of about 0.6% for low-skilled workers. However, this effect is 0.3 p.p. lower (and non-statistically significant with more conservative standard errors) for those workers classified as high-skilled. In the case of employment and unemployment, Table 6 shows that both low- and high-skilled workers were similarly affected in the labor market, although the effect was not statistically significant for high-skilled workers when considering more conservative standard errors. In the case of informality rate, there is an increase in the informality rate of low-skilled workers explained by the Venezuelan exodus of 0.1 p.p., which represents an increase of 0.12% relative to the 2015 base-line values.

Moreover, when I consider only the border departments of La Guajira and Norte de Santander, according to the information provided in Table 5, the decline in wages was greater for low-skilled workers as compared to high-skilled ones. Low-skilled employees suffered a decline in wages, on average, 5.4 p.p. greater than that experienced by high-skilled workers. The results presented in Table 5 suggest that, although migrants may have high levels of qualification, they work in low-skilled jobs, generating a pressure on wages in those segments of the labor market. Finally, the effects in terms of employment and informality for the border departments (Table 6) were also in the same direction than for the rest of the country, although

now the difference between low-skilled and high-skilled workers in terms of informality is not statistically significant and the decline in employment for low- and high-skilled workers was negative and statistically significant. However, the effect on unemployment was much stronger for high-skilled workers in the border departments compared to low-skilled workers, and this difference is statistically significant.

When considering labor formality, Table 5 shows that, on average, an increase in 1 p.p. of immigration from Venezuela generated a drop in wages among informal workers of about 0.5%. However, the decline in wages was about 0.2% for formal workers and is not statistically significant under more conservative standard errors. On the other hand, for the case of La Guajira and Norte de Santander, informal workers' wages fell by approximately 12.2% due to the Venezuelan exodus and there is no statistically significant difference with formal workers. The magnitude and direction of the coefficients presented are consistent with what would be expected given that the population of informal workers is more vulnerable to an increase in the labor supply due to the challenges faced by Venezuelan immigrants to formalize their migratory situation.

Table 5 and 6 also show estimates of the effect of the Venezuelan exodus on the labor market in Colombia by gender. Results indicate a stronger decline in the hourly wage and employment for men compared to women across the country. The stronger declines for men would be consistent with a traditional role assignment within households: male labor supply would increase at a greater rate as compared to women, thus producing a more important wage and employment decline for male workers. However, this differential effect is not statistically significant for the border departments' sample and for any of the other labor market variables.

A negative effect on employment is consistent with a reduction in wages in the labor market. For workers in Colombia, a drop in wages reduces the opportunity cost of staying at home, meaning that workers who were on the borderline between entering the labor market or not decided to reduce their labor supply. In addition, the positive effect on unemployment is also consistent with higher competition in the labor market.

Results shown so far are consistent with findings by Pedrazzi and Peñaloza-Pacheco (2020) and Caruso et al. (2019). In the first paper, the authors estimate a negative effect of the Venezuelan exodus on the labor supply of low-skilled women. On the other hand, Caruso et al. (2019) find a negative effect on aggregate wages and employment in urban areas as a consequence of the Venezuelan migration: they find that an increase in the share of Venezuelan immigrants of 1 p.p., reduced

employment in urban areas by 2 p.p. and overall wages by 7.6%, approximately. Estimates presented in Tables 2 and 6 indicate that the effects found by Caruso et al. (2019) were not merely relevant in the very short-term, but lasted over time and were consolidated at least until 2019, especially for low-skilled workers. However, it is worth mentioning some comments on the differences in the effects estimated by their work and mine.

There are two major differences beyond the methodology applied in both papers that could explain the differences in the estimated values: time span and sources of information. In the case of the estimates of Caruso et al. (2019), as was mentioned before, the authors only consider the 2013-2017 period, thus the first possibility is that the differences in terms of the magnitude of the results could be related with the fact that their time period is shorter and then could be capturing an overreaction of the labor market immediately after the re-opening of the borders in 2016. To rule out this possibility, I restricted my sample to the same period analyzed by Caruso et al. (2019) and estimated the same effect on the labor market. Results are presented in Table 8 of Appendix.

As can be seen, the effects I had found for the period 2013-2019 remain almost unchanged when removing the years 2018-2019 from the sample; the only exceptions are the effects on employment and informality in the border departments. There I do not find a statistically significant negative effect on employment and there seems to be a positive effect on the informality rate. This exercise indicates that, on the one hand, the negative effect of the Venezuelan exodus on wages was consolidated over time and was not a short-term overreaction of the Colombian labor market and, on the other hand, that the negative effect on employment on the border departments was stronger the longer the period of time since the beginning of the migratory exodus.

A second alternative that could explain the differences could be the sources of information and the estimated magnitude of the labor supply shock. In their paper, Caruso et al. (2019) estimate a share of working-age Venezuelan immigrants in 2017 close to 0.6% based on household surveys, which is almost a tenth compared to my estimates for 2019 based on administrative data from UAEMC and significantly lower compared to my estimates based on the same administrative data in 2017 and 2018 relative to the labor force (1.7% and 4.8%, respectively). This large difference would explain why my estimates on wages and the rest of the variables are significantly lower compared to theirs. Considering this, the argument in this part of the paper is that the differences in the estimations are more related to the estimated number of immigrants due to the nature of the data sources than to the methodology and/or time period considered in the analysis.

Finally, in Table 7 of Appendix I show heterogeneous effects of the Venezuelan exodus on the Colombian labor market between natives and non-natives individuals. The results in Table 7 of Appendix suggest that, for the whole country, the effect on wages was basically the same for natives and non-natives, although for the latter group the effect becomes non-significant when considering more conservative standard errors. There is no differential effect on employment and unemployment for both groups. The only exception to this pattern is the estimated effect on informality for non-natives. I estimate that a 1 p.p. increase in the share of Venezuelan immigrants relative to the local labor force increased by 0.3 p.p. the likelihood of being informal for non-natives, which represent a 0.6% increase relative to the 2015 baseline values of informality rate for this group; this effect was not statistically significant for natives.

On the other hand, when analyzing the effect on the border departments a similar pattern can be seen compared to the estimates for Colombia. However, in these departments there was no statistically significant effect on labor informality of non-natives nor a significant effect on the unemployment rate in either group.

## 5 Robustness analysis

In this section I will present robustness exercises to verify the consistency of the estimated effects on the labor markets of La Guajira and Norte de Santander. On the other hand, I will also discuss several potential threats related to the identification strategy proposed in this paper.

### 5.1 Synthetic control method

To provide robustness to the estimated effects of the Venezuelan exodus on the border departments presented above, I first build a control group through the Synthetic Control Methodology (SCM), as developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010). Under this strategy, a control group is constructed using Colombian departments that were not significantly affected by the migratory flow. The SCM is employed by determining an optimal linear combination of the control units (here, departments not strongly affected by Venezuelan migration) according to a determined weight. Then, a synthetic control unit serves as a counterfactual from which comparisons can be made (For a more detailed explanation of the SCM, see Appendix).

Given that the donor pool of potential controls groups must be conformed by departments that were not significantly affected by the Venezuelan exodus, I restricted the sample to those departments that in 2019 had a share of Venezuelan migration of less than 5%, according to Table 3 in Appendix. In other words, I excluded Atlántico, Bogotá, Bolívar, Cesar, Cundinamarca, Magdalena and Santander from the donor pool.

To estimate the weights, it was necessary to specify a set of variables that predict the hourly wage, the employment, unemployment, and informality rates. I selected predictors of the outcome variables at the departmental level: the proportion of workers in different sectors of the economy and the proportion of high-skilled workers in each department. In addition, for estimates related with the hourly wage, I also included the unemployment rate and informality rate as predictors.<sup>17</sup> The values of vector  $W^*$  are shown in Table 9 of Appendix.

Once the optimal weights have been calculated, the value of the synthetic variable of interest can be computed; the results are shown in Fig. 3. Estimates show very similar hourly wage trends and values between the treatment unit and the synthetic control unit prior to the Venezuelan exodus.<sup>18</sup> However, after the re-opening of the border, the hourly wage of the treatment unit fell sharply while the hourly wage of the synthetic control did not, maintaining a post-treatment gap that did not exist in the pre-opening border period.

For employment, Fig. 3 shows that there is an important decrease in the employment rate for border departments relative to the synthetic control. These estimates are consistent with results presented previously. Figure 3 also shows an increase in the labor informality of the border departments explained by the Venezuelan exodus which goes in the same direction compared to previous estimates (although in results of Table 2 the effect in informality was not statistically significant).

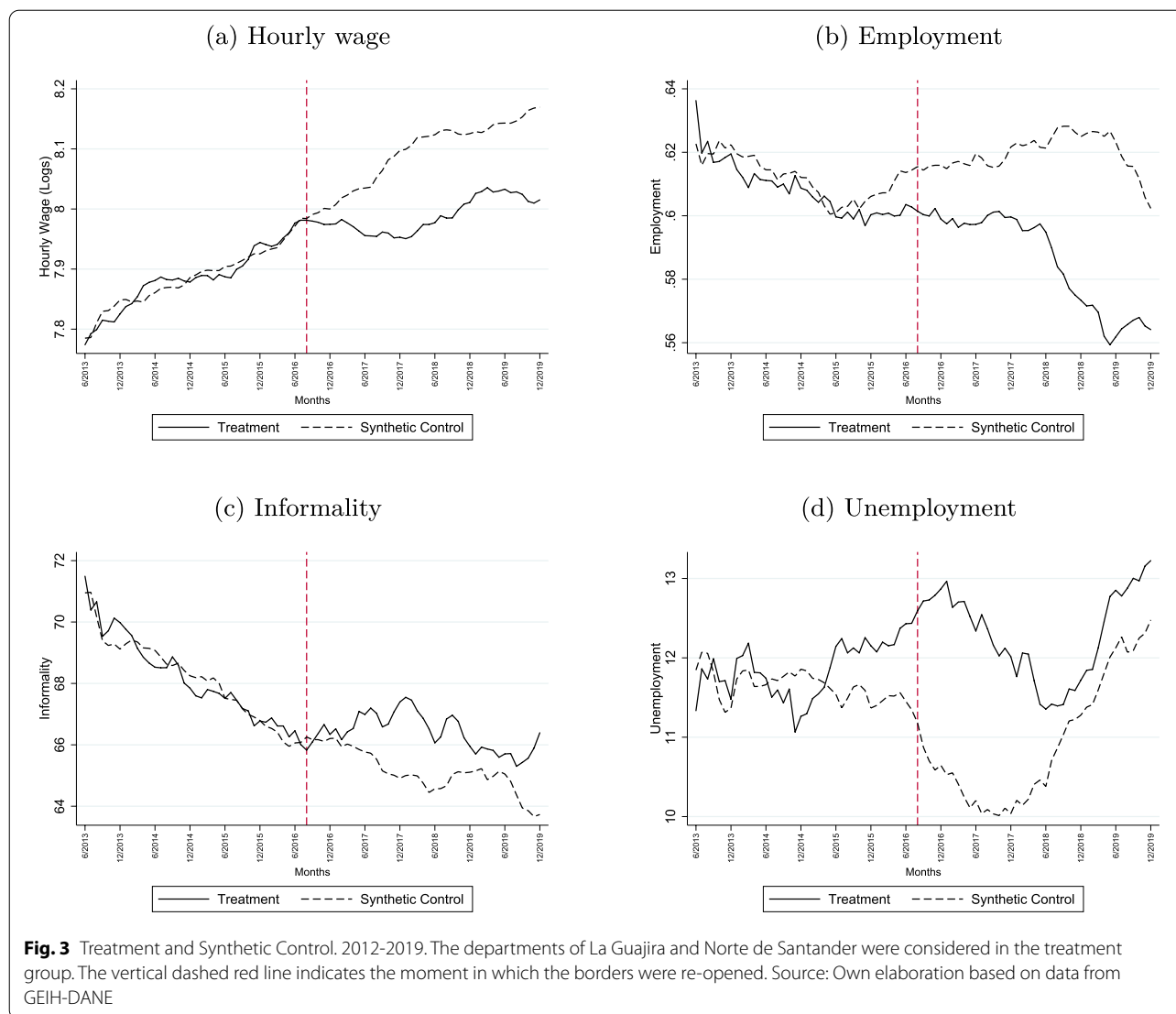
Finally, there does not appear to be an effect on border departments' unemployment rates, which is robust with estimates presented above. When placed in comparison, the predictors values of treatment and the synthetic control departments are significantly similar, indicating that the synthetic control and the treatment group fit well.<sup>19</sup>

By calculating the differences between the average pre-treatment and post-treatment value of the variables for both groups and then the differences-in-differences between the two groups, I find that the average estimated causal effect was an approximate decline of 10% in the hourly wage for the treatment group; the decline in the employment rate was nearly 3 p.p and the rise in the informality rate was 1.3 p.p. These results are similar to those obtained in the estimates of differences-in-differences.

<sup>17</sup> Considering that the data are on a monthly basis, the hourly wage, employment, unemployment and informality series have a considerable noise over time that is explained, in part, by the seasonal component of these variables. To solve this, I calculated a 12-month moving-average for each variable in order to work with smoothed series.

<sup>18</sup> For this analysis, and given that the SCM allows only one unit to be considered as treatment, La Guajira and Norte de Santander were considered as a single unit, estimating the average outcome variable for the population of the two departments as if they were the same.

<sup>19</sup> Tables available upon request.



In order to verify the robustness of the results obtained by using SCM, following Abadie and Gardeazabal (2003) and Abadie et al. (2010), I calculated the ratios between the Mean Square Predicted Error (MSPE)<sup>20</sup> post-treatment and pre-treatment, considering La Guajira and Norte de Santander as treatment departments and, additionally, considering the non-affected departments as placebos. This analysis serves as a measure of the reliability of the SCM estimates.

Figure 11 in Appendix shows the distribution of these ratios. When La Guajira and Norte de Santander are considered, the ratios are larger than any of the other ratios calculated as placebos for all the variables under study, except for the unemployment rate, for which there was

no significant effect. These results indicate that, no matter which non-strongly affected department is considered, La Guajira and Norte de Santander are the only departments for which there was a significantly strong effect on wages, employment and informality.

### 5.2 Changing the control group

Despite the robustness exercise using a SCM approach, a valid criticism of the difference-in-differences results for departments of La Guajira and Norte de Santander is that they rely on the arbitrary selection of Antioquia, Caquetá and Chocó as a control group. Following Borjas (2017), an alternative way to determine if the estimates presented above depend exclusively to the choice of a control group is by running the same differences-in-differences regressions for every potential control group resulting from the

<sup>20</sup> The Mean Square Prediction Error (MSPE) is defined as the square difference between the outcome of the treatment group and the synthetic control group.

combination of three different non-affected departments of Colombia.

The same departments included in the donor pool when the SCM was implemented were considered in potential control groups. According to this criterion, there are 15 departments with available data that qualify as control departments; thus, there are 455 different potential control groups to estimate differences-in-differences, each constructed with a combination of three different departments.

The distribution of the estimated effects for the whole sample is presented in Fig. 12 of Appendix for each of the variables of interest. The distributions of the effects are consistent with the previously-presented findings.

### 5.3 Additional threats to the identification strategy

Given the identification strategy of this paper, there are some concerns that should be taken into consideration so as to be confident that these results are not driven by other factors unrelated to the Venezuelan exodus. In this subsection, I will discuss these potential threats.<sup>21</sup>

#### 5.3.1 Macroeconomic concerns

First, we must consider the possibility that negative effects in the labor market in La Guajira, Norte de Santander and in Colombia as a whole occurred as a result of the macroeconomic crisis in Venezuela rather than migration. Given that the absorption capacity of the Venezuelan economy fell, international trade with Colombia has probably also declined; this would primarily affect the border economies of La Guajira and Norte de Santander. In addition, bilateral trade between the two countries, as well as economic activity could have been negatively affected by the closure of the borders between both countries. In this subsection I present evidence related to these concerns.

As ECLAC (2019) states, the GDP of Venezuela fell for seven consecutive years from 2013 to 2019, accumulating a contraction of GDP of approximately 62.2% during that period. Therefore, if the decline in the labor market following the re-opening of the border had been generated from a drop in demand by the Venezuelan economy, then the labor market variables under study would have also been negatively affected during the years prior to the beginning of the Venezuelan exodus, which are beyond the scope of the treatment period.

In order to verify that the labor market was not affected due to the economic crises in Venezuela, I present the real GDP and the Added Value of the Commercial and Services Sector of Colombia and the border departments for the period analyzed (Fig. 6 of Appendix). As can be seen,

economic activity in these departments did not decrease after the reopening of the borders. In addition, Commercial Sector activity (which accounts for 30% of employment in the border departments, see Table 4 of Appendix) did not decline after the re-opening of the borders; thus, it seems reasonable to assume a stable labor demand during this period.

Finally, an additional concern is that, due to the economic crisis in Venezuela and the closing of the border between the two countries, bilateral trade could have been negatively affected reducing the labor demand of local firms, especially in the border departments on the Colombian side, and generating a decline in wages and employment rates.

It is important to consider that bilateral trade between Colombia and Venezuela has fallen dramatically in recent decades. According to DANE, the volume imported from Venezuela to Colombia represented 14% of total imports in 2000, however in 2010 this number fell to 1.65%; in 2015, it was only 1.45%. Exports to Venezuela followed a similar pattern, going from representing 1.6% of the total volume exported in 2000 to representing only 0.73% in 2019.

To analyze the 2010-2019 period, Fig. 7 of Appendix shows information on trade volume (exports and imports) by destination (to Venezuela and the rest of the world) for La Guajira, Norte de Santander, and Colombia as a whole. We can see that exports to Venezuela have been decreasing in the last decade even before the beginning of the Venezuelan exodus. Furthermore, although exports in Colombia and border departments fell between 2015 and 2016, the amount exported to the rest of the world recovered significantly over the following years, more than offsetting the decline in exports to Venezuela.

In relation to imports from Venezuela to border departments, the bottom panel of Fig. 7 shows a similar pattern. If Colombia as a whole is considered, it can be seen that imports from Venezuela do not represent a significant volume in relation to imports from the rest of the world.

To be more certain that trade does not play an important role in the estimates presented above I include total bilateral trade (exports and imports volumes) between each department of Colombia and Venezuela in 2010, as an additional control variable, and interact it with year-month fixed-effects to flexibly control for different trends over time explained by the exposure to bilateral trade with Venezuela. Results are presented in Table 10 and 11 in Appendix. Both tables show that results are robust to the inclusion of this control for both specifications.

#### 5.3.2 Peace deal between FARC and Colombian Government

In 2012, the FARC (Fuerzas Armadas Revolucionarias de Colombia) and the Government of Colombia officially began peace negotiations, marking the cessation of a

<sup>21</sup> I am very grateful to an anonymous referee for suggesting the robustness checks made in this subsection.

60-year internal conflict between the leftist guerrilla and the Colombian State. In 2016, both parties finally reached an agreement; the guerrilla committed to complete disarmament in exchange for justice, truth, reparations for victims and political participation, among other agreed points.

As the peace deal was signed in 2016, it is possible that this ceasefire might have affected internal migration of Colombian individuals, and that such an internal migration may have correlated with Venezuelan immigration, confounding the estimated effects of the Venezuelan exodus with those of the potential internal migration of Colombian people.

Nevertheless, Fig. 8 of [Appendix](#) indicates that the share of internal Colombian migrants in the border departments and the whole country has remain relatively constant in the period 2013-2019. In fact, Fig. 8 shows that, after the peace deal there was a decline in the share of internal immigrants relative to the local population. In absolute numbers, the bottom graphs of Fig. 8 show that the reduction in the number of internal immigrants in border departments since 2016 is close to 40%.

Given this, it is unlikely that the effects on the labor market in Colombia and in the border departments were driven by native internal migration between Colombian departments following the peace deal between the FARC and the Colombian government.

### **5.3.3 Spillover effects of the Venezuelan exodus on the migration decisions of Colombians on the border**

An additional concern relates to the possibility that the massive influx of Venezuelans affected the migration decisions of native individuals by motivating them to migrate out of the most affected departments. Figure 9 of [Appendix](#) shows that, on average, in the 2016-2019 period, there was a significant increase of about 40% in the number of Colombians from border departments moving to the rest of Colombia relative to the 2013-2015 period.

Despite these numbers, the emigration response does not represent a real threat to the identification strategy proposed in this paper. If we consider that this increase in the number of migrants departing from border departments was due to the Venezuelan exodus, the estimates presented in this paper would represent a lower bound. In short, if there was a flow of individuals from the departments most affected by the Venezuelan exodus to less-affected departments (for instance, those in the control group), it means that, in the absence of that internal

migratory flow, the labor supply in the most affected regions would have been greater and the estimated effect would possibly be even larger than that presented here.

## **6 Concluding remarks**

In this paper I presented estimates of the impact of Venezuelan immigration on the Colombian labor market after the re-opening of the border between the two countries in 2016. Specifically, I estimated effects on wages, employment, unemployment and informality. The results showed that, on average, a 1 p.p. increase in the labor force as a consequence of the massive inflow of Venezuelans generated a decrease in wages of about 0.4% and a decrease in employment of 0.1 p.p. for low-skilled workers which represents a decrease of 0.18% relative to the average employment rate of low-skilled Colombian workers in 2015, before the Venezuelan exodus. When I focused on the border departments of La Guajira and Norte de Santander, I found a 10% reduction in wages and a 3.4 p.p. decrease in total employment, which represents a 5.6% negative effect on employment relative to 2015.

These estimates indicated a stronger decline in wages for men, low-skilled and informal workers in Colombia. The analysis presented in this paper is robust to different specifications and to multiple estimations that tested the causal effect of the migratory flow as a labor supply shock on the labor market.

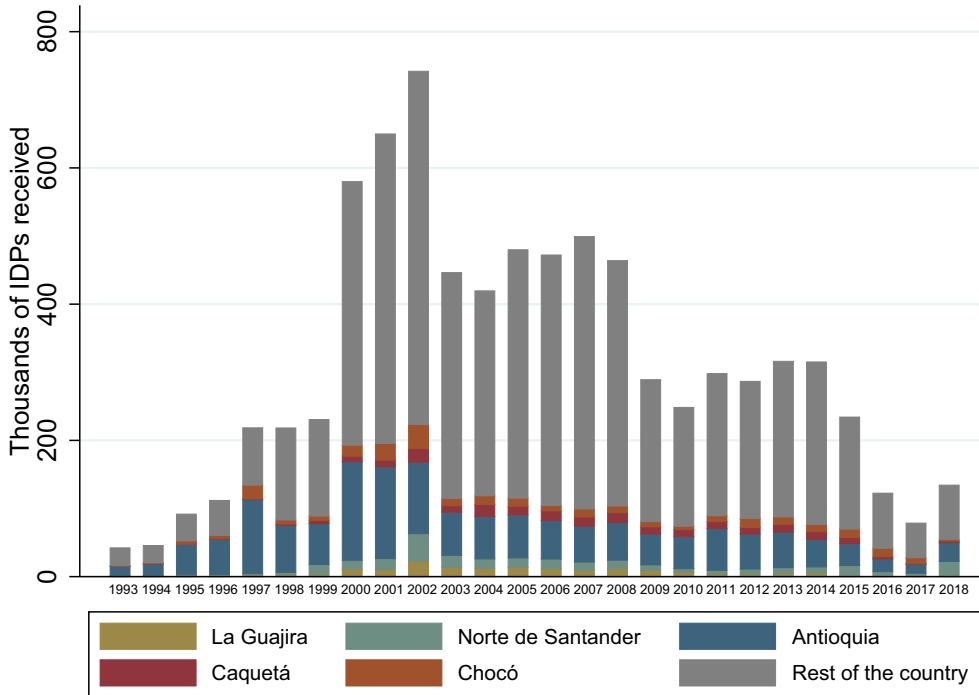
Considering these results and the social and economic vulnerability of the regions that have been most affected by the Venezuelan exodus, it is important to implement public policies that mitigate these negative effects. Integration and regularization policies for Venezuelan immigrants would be crucial to take advantage of the potential gains from the Venezuelan exodus in terms of human capital. These kind of policies might help Venezuelan immigrants to access public services such as education and health, as well as to integrate themselves into the formal economy.

If the negative effect on labor market variables for informal and/or less qualified workers continues, it would be expected that, in the medium and long term, the effects on inequality and poverty would be significant. This type of analysis, however, is beyond the scope of this paper and should be the subject of future research.

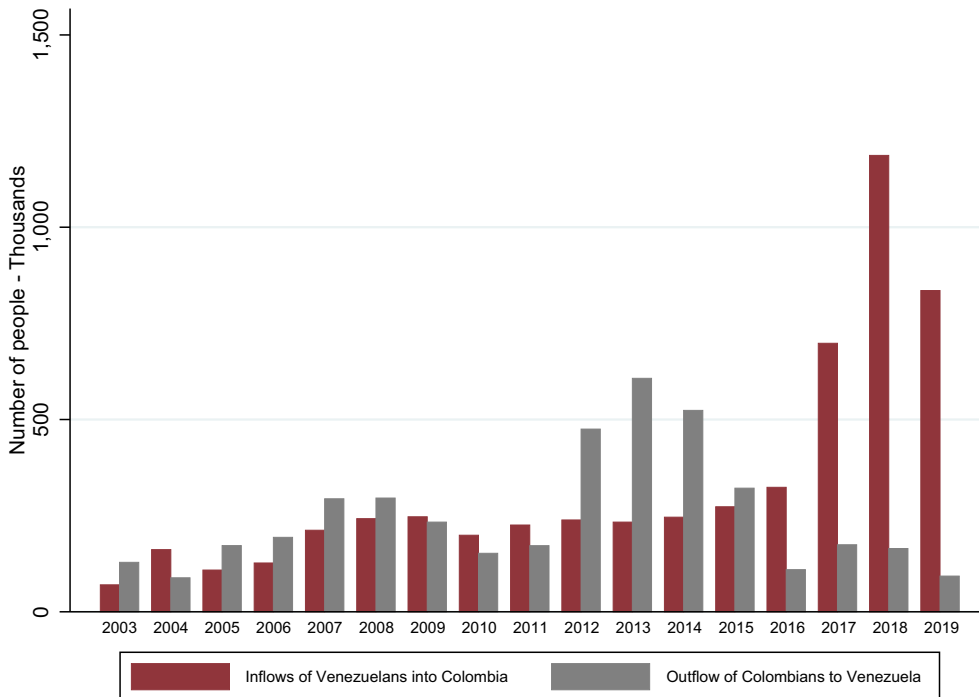
## **Appendices**

See Figs. 4, 5, 6, 7, 8, 9, 10, 11 and 12 and Tables 3, 4, 5, 6, 7, 8, 9, 10 and 11.

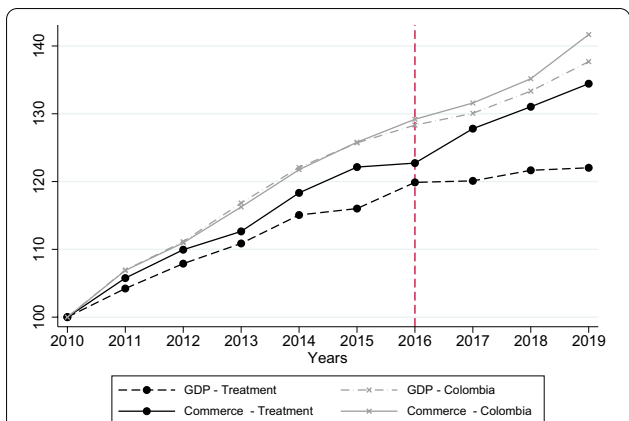




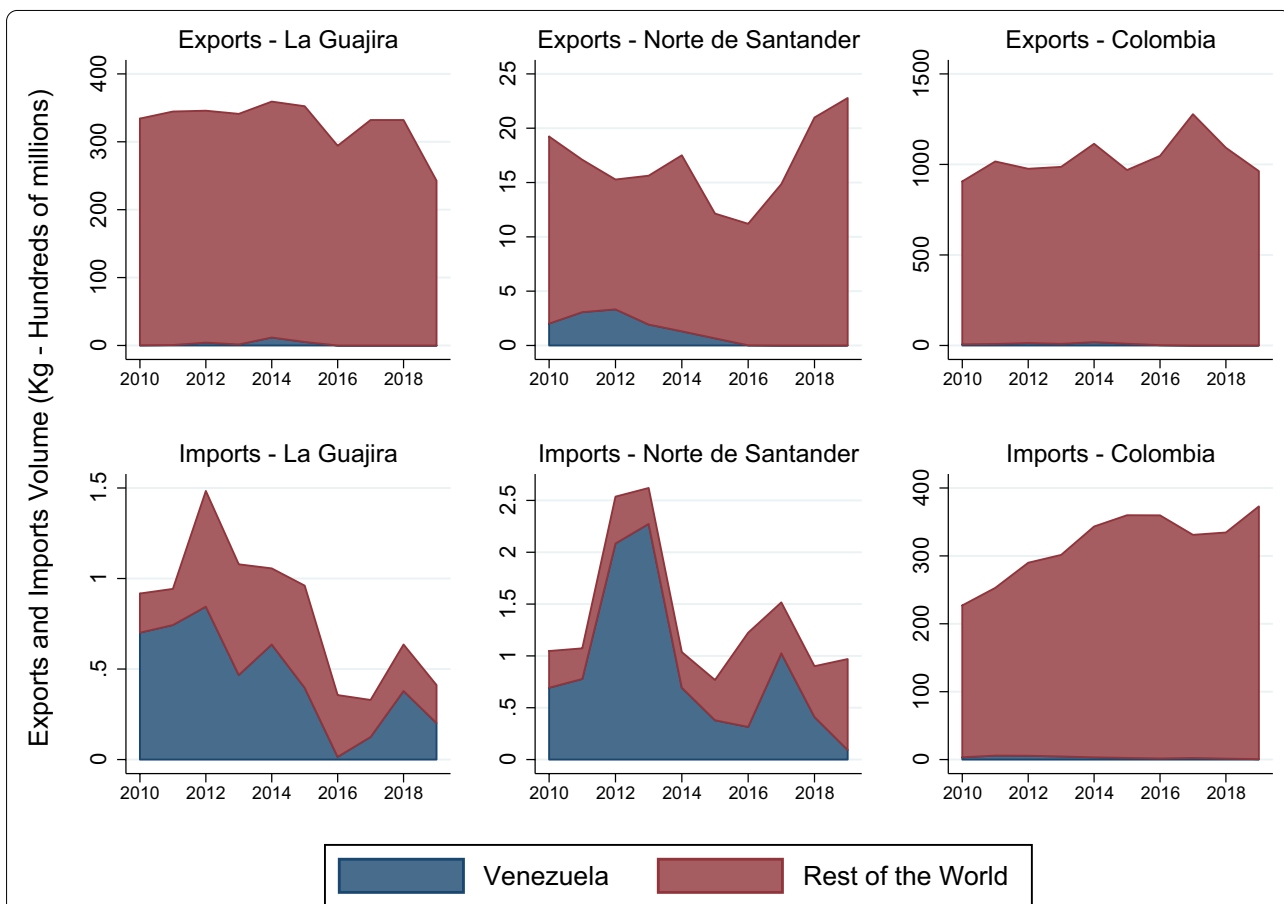
**Fig. 4** Internally displaced persons in Colombia by destination, 1993-2018. Each bar shows the number of IDP received each year. Source: Own elaboration based on data from CEDE—Universidad de los Andes



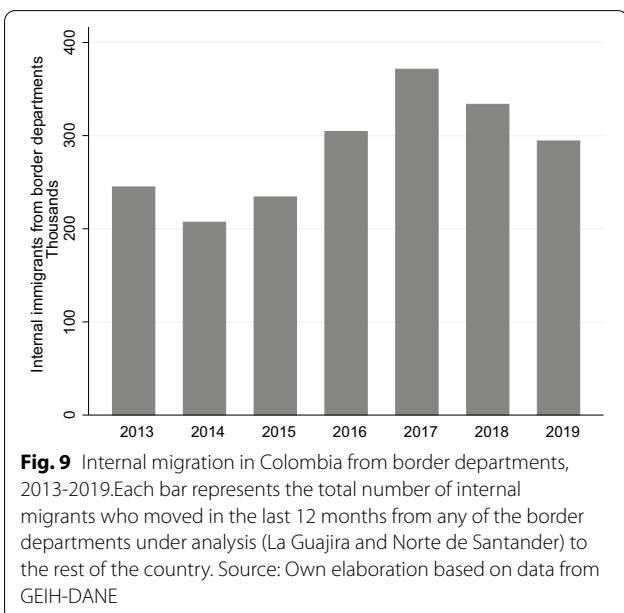
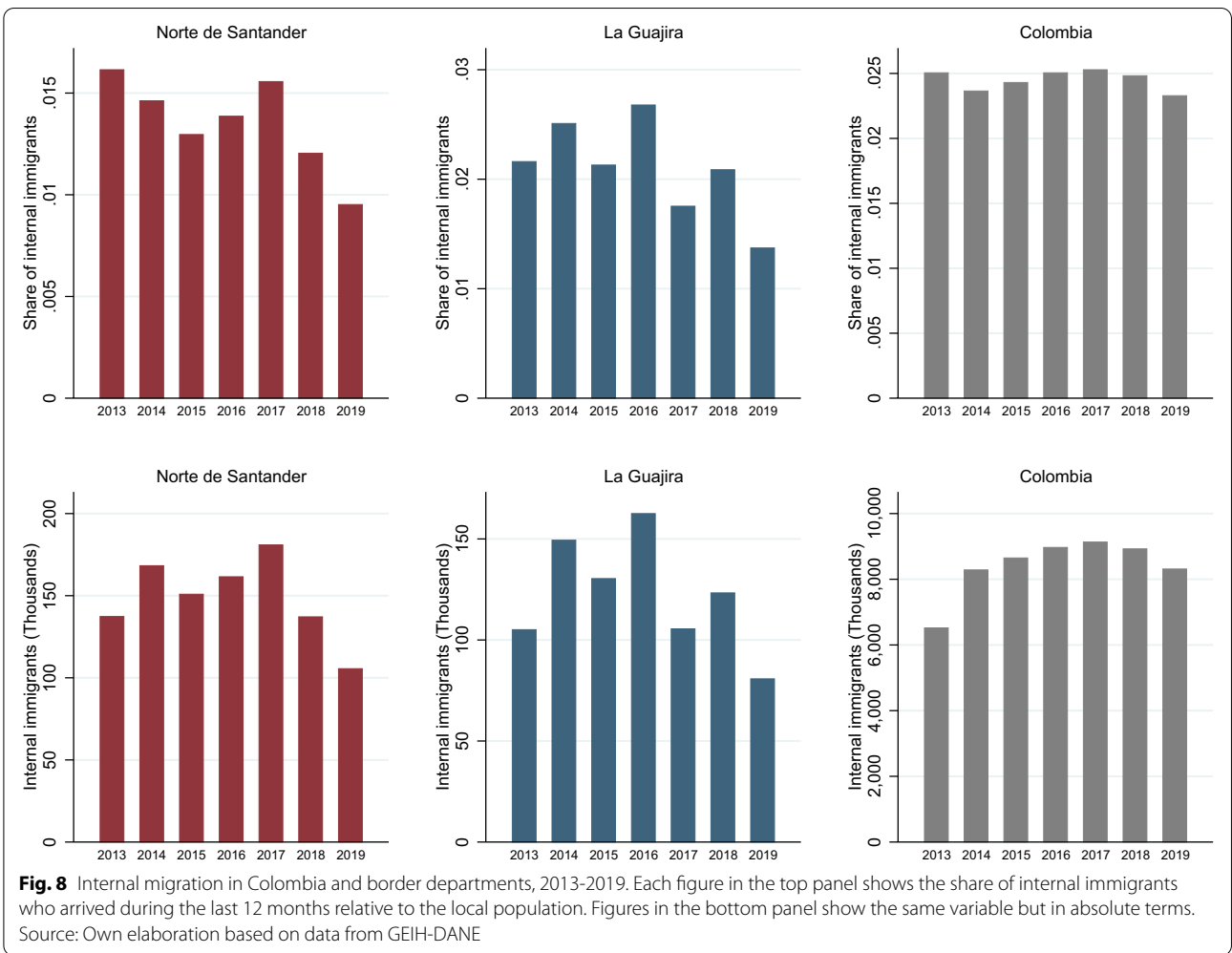
**Fig. 5** Historical migratory movement between Colombia and Venezuela, 2003-2018. Source: Own elaboration based on data from DANE and UAEMC

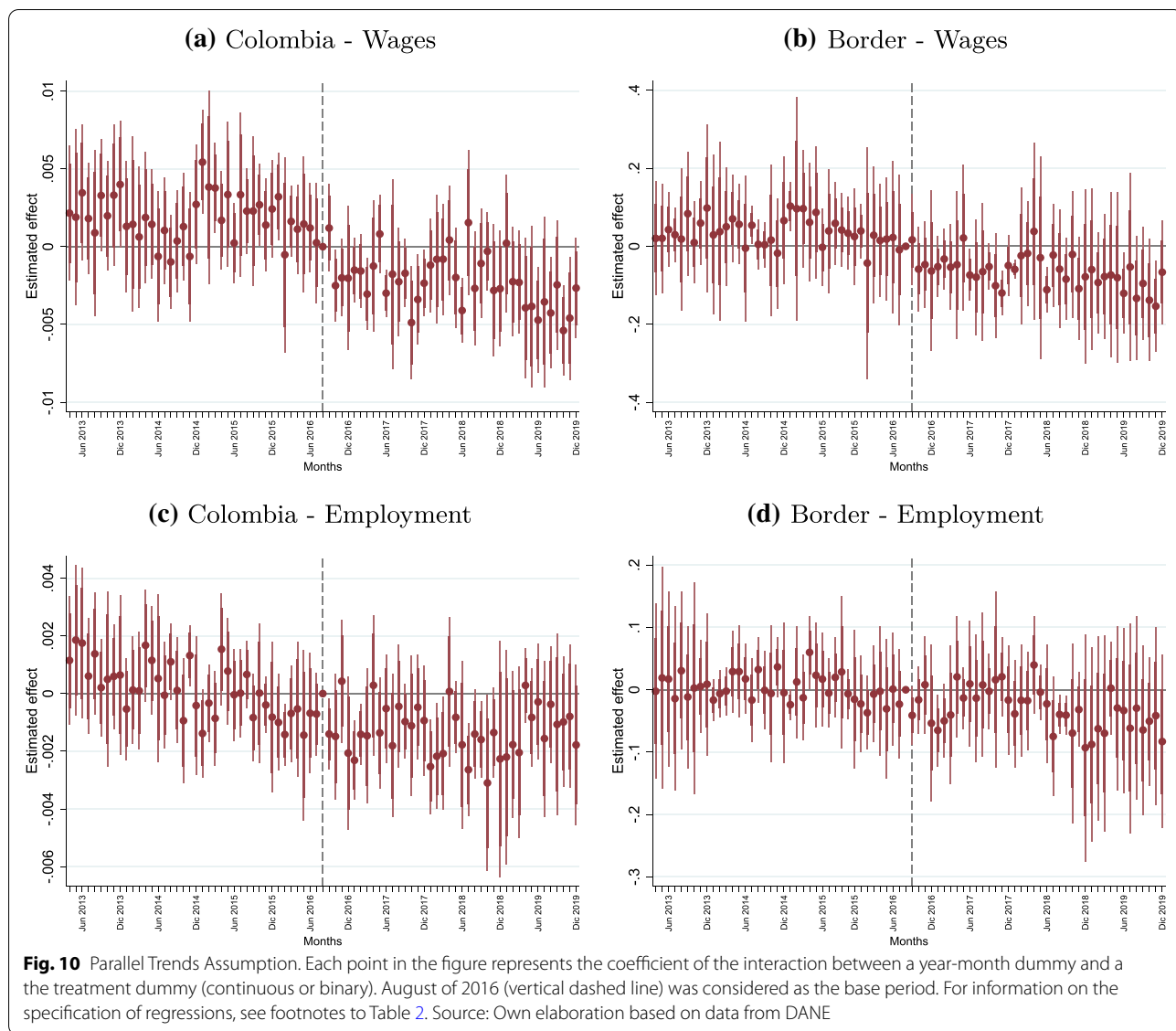


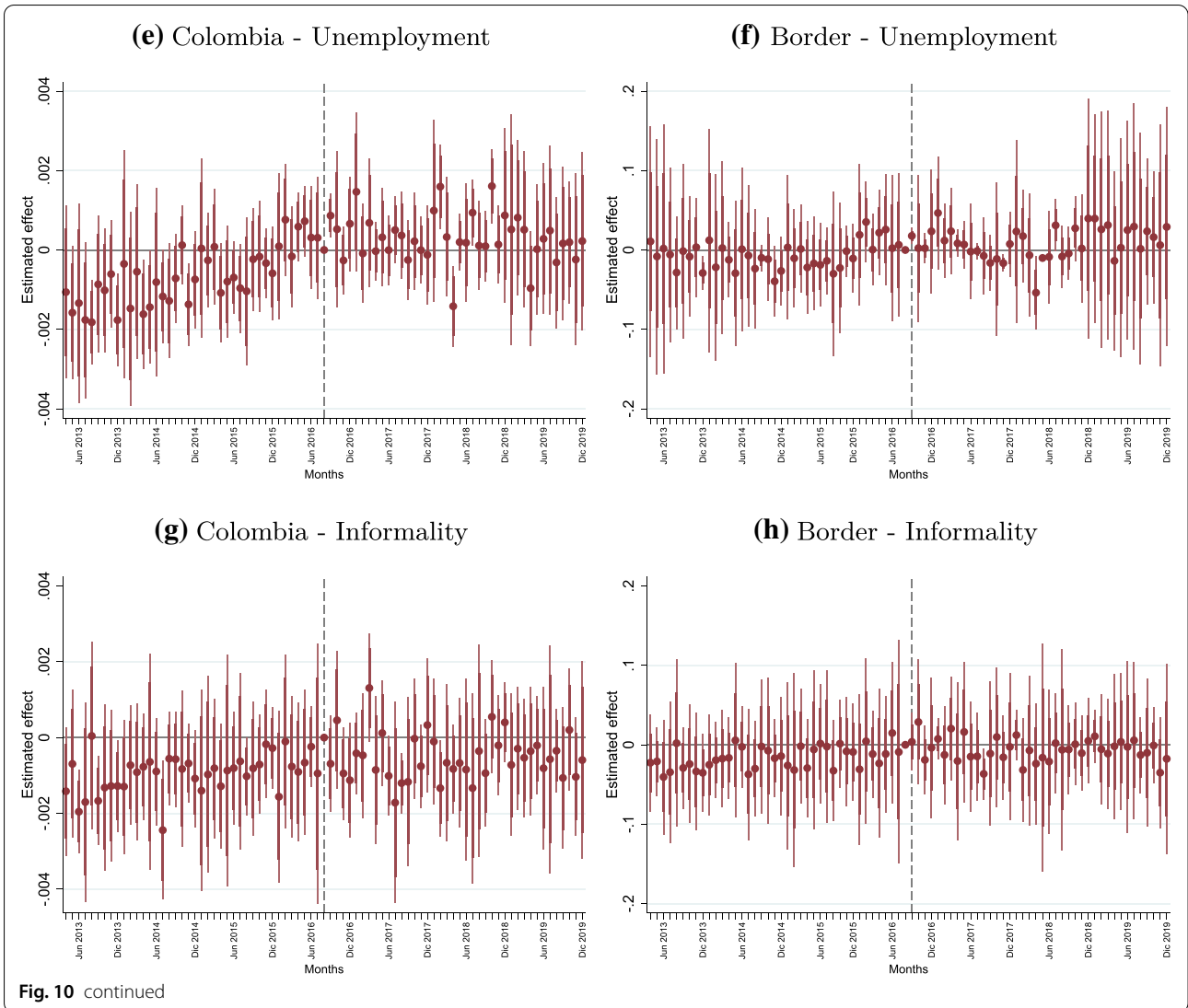
**Fig. 6** GDP and Commerce Added Value 2010-2019. Each line indicates an index (2010=100) of the evolution of the real value of the GDP and the Value Added of the Commerce Sector. The Treatment Group refers to La Guajira and Norte de Santander. Source: Own elaboration based on data from DANE

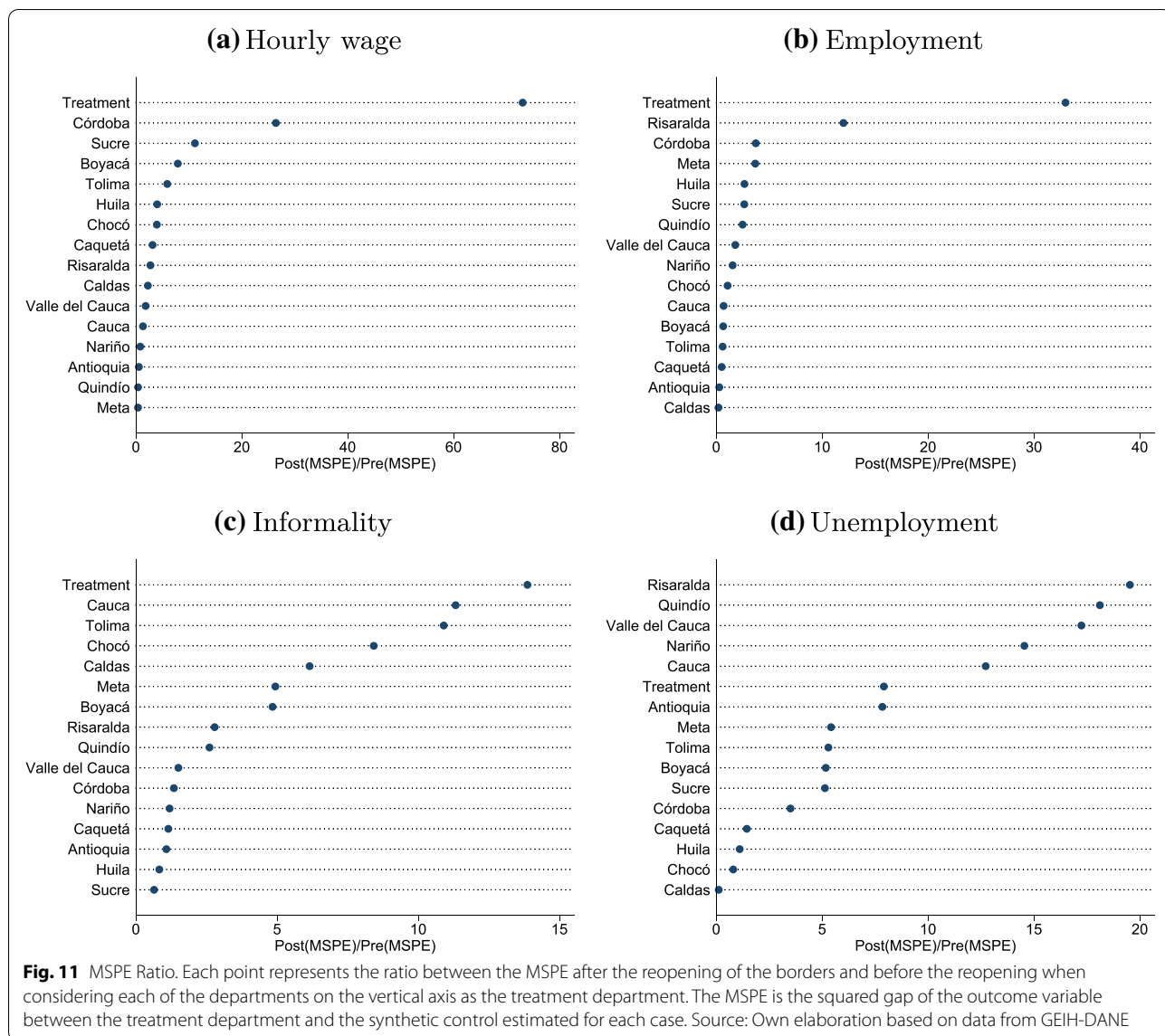


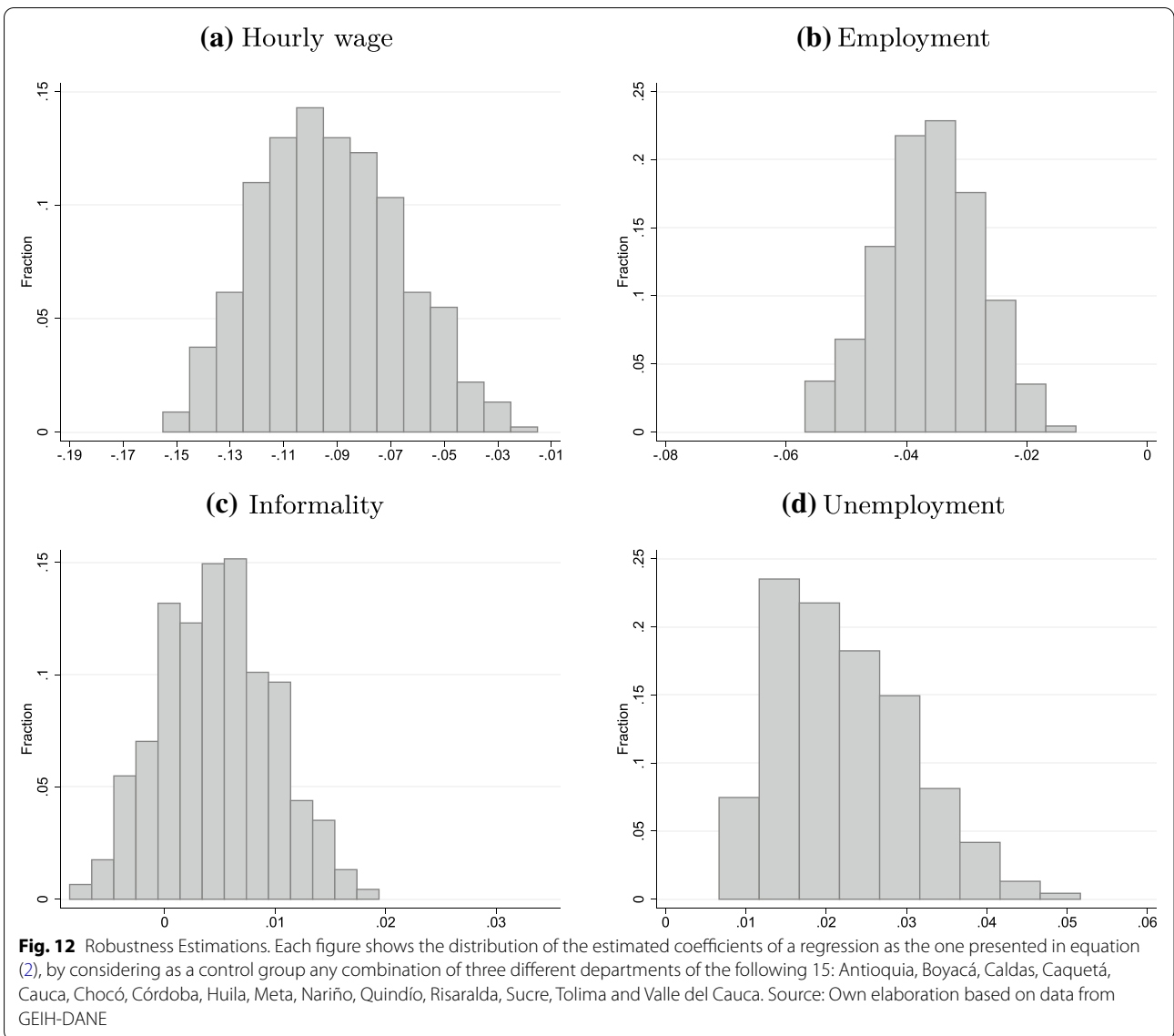
**Fig. 7** Trade by destination, 2010-2019. Each figure above shows the volume (in Kg) exported from La Guajira, Norte de Santander and Colombia to the rest of the world (maroon area) and Venezuela (blue area). The figures at the bottom are similar but consider imports rather than exports. Source: Own elaboration based on data from DANE











**Table 3** Migratory Flow in Colombia as a share of the labor force

	2005					2015-2019		
	Labor force (LF)	Venezuelans	Other immigrants	Venezuelans/LF	Non-Venezuelans/LF	Labor force 2015	Venezuelans 2019	Venezuelans/LF
Amazonas	10,047	2	935	0.000	0.093	12,596	722	0.057
Antioquia	2,563,318	2655	9140	0.001	0.004	3,287,528	115,453	0.035
Arauca	26,070	422	140	0.016	0.005	32,685	33,972	1.039
Atlántico	880,267	3984	3012	0.005	0.003	1,234,920	120,985	0.098
Bogotá DC	3,555,862	4578	25,817	0.001	0.007	4,601,922	257,377	0.056
Bolívar	741,311	3898	2312	0.005	0.003	969,306	61,704	0.064
Boyacá	579,314	304	494	0.001	0.001	646,601	12,367	0.019
Caldas	450,376	138	865	0.000	0.002	456,819	5384	0.012
Caquetá	172,875	17	95	0.000	0.001	197,355	512	0.003
Casanare	55,322	97	105	0.002	0.002	69,360	16,274	0.235
Cauca	646,298	167	852	0.000	0.001	655,057	6020	0.009
Cesar	343,161	957	329	0.003	0.001	439,399	41,983	0.096
Chocó	189,451	24	244	0.000	0.001	174,973	591	0.003
Córdoba	648,561	1219	417	0.002	0.001	822,044	10,447	0.013
Cundinamarca	1,064,388	556	2127	0.001	0.002	1,419,360	70,874	0.050
Guainía	3,989	8	113	0.002	0.028	5,001	4742	0.948
Guaviare	18,131	0	69	0.000	0.004	22,732	275	0.012
Huila	434,442	70	519	0.000	0.001	579,500	3647	0.006
La Guajira	254,610	1138	540	0.004	0.002	467,280	115,200	0.247
Magdalena	420,249	1369	632	0.003	0.002	538,445	66,960	0.124
Meta	366,250	197	524	0.001	0.001	478,891	5680	0.012
Nariño	726,674	80	3591	0.000	0.005	947,293	10,370	0.011
Norte de Santander	549,764	8303	694	0.015	0.001	630,383	148,484	0.236
Putumayo	13,198	4	1373	0.000	0.104	16,547	2576	0.156
Quindío	256,212	197	1115	0.001	0.004	290,187	6525	0.022
Risaralda	431,187	409	2231	0.001	0.005	486,798	15,278	0.031
San Andrés	23,928	25	673	0.001	0.028	30,000	270	0.009
Santander	1,018,210	2283	479	0.002	0.001	1,152,800	81,461	0.071
Sucre	289,358	1290	212	0.004	0.001	381,853	17,304	0.045
Tolima	646,367	191	751	0.000	0.001	765,391	7273	0.010
Valle del Cauca	2,122,481	2664	11,113	0.001	0.005	2,521,853	67,843	0.027
Vaupés	4,609	2	55	0.000	0.012	5778	56	0.010
Vichada	5,038	102	53	0.020	0.011	6316	2934	0.465
Total	19,511,316	37,350	72,621	0.002	0.004	24,346,973	1,311,537	0.054

The labor force of Cundinamarca for year 2015, corresponds to that of 2012. To include only Venezuelans who could potentially be part of the labor force by 2019, 75% of migrants in each department were considered, given that, at the national level, according to the UAEMC, 75% of all Venezuelan individuals in Colombia were between 15 and 59 years of age. Due to lack of data availability, the labor force in 2005 was estimated for the departments of Amazonas, Arauca, Casanare, Guainía, Guaviare, Putumayo, San Andrés, Vaupés and Vichada, assuming that the labor force growth rate between 2005-2015 for those departments was equal to the average growth rate for the rest of the departments with available data. Source: Own elaboration based on data from DANE and UAEMC



**Table 4** Pre-treatment balance of characteristics

Variables	Control mean	Treatment mean	Difference	P-value
Hourly wage (log)	8.173	8.017	-0.156	(0.080)
Years of education	9.458	9.194	-0.264	(0.644)
Age	35.005	35.045	0.040	(0.975)
Gender (Men)	0.442	0.454	0.012	(0.404)
Single	0.524	0.471	-0.053	(0.200)
Monthly hours	188.06	183.27	-4.794	(0.224)
Employment	0.570	0.611	0.041	(0.568)
Unemployment	0.141	0.134	-0.006	(0.862)
Informality	0.477	0.603	0.126	(0.225)
Primary activities	0.088	0.087	-0.001	(0.977)
Low-tech industry	0.072	0.078	0.006	(0.850)
High-tech industry	0.056	0.032	-0.024	(0.360)
Construction	0.070	0.067	-0.003	(0.664)
Commerce	0.280	0.295	0.015	(0.493)
Skilled services	0.091	0.065	-0.026	(0.311)
Observations	209,795	131,070	340,865	

P-values based on robust and clustered standard errors at department level in parentheses. The observations correspond to the period before the re-opening of the borders (April 2013-July 2016). Treatment group: La Guajira and Norte de Santander; Control group: Antioquia, Caquetá and Chocó. Source: Own elaboration based on the GEIH-DANE

**Table 5** Heterogeneous effects on wages

	(1)	(2)	(3)
[a] Migration effect ( $S_D$ )	- 0.006*** (0.001)	- 0.005*** (0.001)	- 0.005*** (0.001)
[b] Migration effect ( $S_D$ ) x High-skilled			
[b] Migration effect ( $S_D$ ) x Formal	0.003***	0.003*** (0.001)	
[b] Migration Effect ( $S_D$ ) x Women			0.001** (0.001)
P-Value wild bootstrap SE-[a]	[0.010]	[0.031]	
[a] + [b]	- 0.003** [0.120]	- 0.002** [0.112]	- 0.003*** [0.075]
P-Value wild bootstrap SE-[a] + [b]	1,901,208	1,901,208	1,901,208
Observations	0.369	0.391	0.367
R2	- 0.133*** (0.025)	- 0.122** (0.027)	- 0.107*** (0.019)
[a] Migration Eeffect ( $T_D$ )	0.054* (0.022)		
[b] Migration effect ( $T_D$ ) x High-skilled			
[b] Migration effect ( $T_D$ ) x Formal		0.052 (0.028)	
[b] Migration effect ( $T_D$ ) x Women			0.015 (0.012)
P-value wild bootstrap SE-[a]	[0.077]	[0.078]	[0.065]
[a] + [b]	-0.079***	-0.070**	-0.092***
P-value wild bootstrap SE-[a] + [b]	[0.093]	[0.170]	[0.027]
Observations	387,434	387,434	387,434
R2	0.388	0.410	0.385
Individual controls	Yes	Yes	Yes
Department and Time FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013-2019. For information on the specification of regressions, see footnotes to Table 2. Source: Own elaboration based on the GEIH-DANE

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

**Table 6** Heterogeneous effects on the labor market

	Employment	Unemployment	Informality	Employment	Unemployment	Informality
[a] Migration effect ( $S_D$ )	-0.001*** (0.000)	0.001** (0.000)	0.001*** (0.000)	-0.002*** (0.000)	0.001*** (0.000)	0.001 (0.000)
[b] Migration effect ( $S_D$ ) × High-skilled	0.000 (0.000)	0.000 (0.000)	-0.001* (0.000)			
[b] Migration effect ( $S_D$ ) × Women				0.000* (0.000)	0.000 (0.000)	-0.000 (0.000)
P-value wild bootstrap SE—[a]	[0.076]	[0.088]	[0.022]	[0.076]	[0.095]	[0.243]
[a] + [b]	-0.001** [0.170]	0.001** [0.155]	0.000 [0.704]	-0.001** [0.179]	0.001** [0.115]	0.000 [0.724]
P-value wild bootstrap SE—[a] + [b]	0.559	0.095	0.806	0.735	0.092	0.507
Mean Dep. Variable—[a]	0.660	0.135	0.312	0.515	0.150	0.511
Mean Dep. variable—[a] + [b]	3,143,611	2,175,205	1,901,208	3,143,611	2,175,205	1,901,208
Observations	-0.030*** (0.005)	0.008 (0.005)	0.019** (0.007)	-0.037*** (0.005)	0.017** (0.005)	0.009 (0.009)
[a] Migration effect ( $T_D$ )	-0.003 (0.006)	0.011** (0.003)	-0.010 (0.010)			
[b] Migration effect ( $T_D$ ) × High-skilled						
[b] Migration effect ( $T_D$ ) × Women				0.006 (0.005)	-0.003 (0.006)	0.001 (0.005)
P-value wild bootstrap SE—[a]	[0.022]	[0.171]	[0.045]	[0.020]	[0.045]	[0.557]
[a] + [b]	-0.0033*** [0.012]	0.019* [0.052]	0.009 [0.605]	-0.031*** [0.030]	0.014 [0.530]	0.010 [0.622]
P-value wild bootstrap SE—[a] + [b]	0.560	0.112	0.896	0.728	0.111	0.624
Mean Dep. variable—[a]	0.649	0.151	0.355	0.504	0.161	0.564
Mean Dep. variable—[a] + [b]	673,471	452,691	387,434	673,471	452,691	387,434
Observations	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Department and Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap-t standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013-2019. For information on the specification of regressions, see footnotes to Table 2. Mean Dep. Variable—[a] refers to the base group considered as reference and Mean Dep. Variable—[a] + [b] refers to the interaction group. Source: Own elaboration based on the GEIH-DANE

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

**Table 7** Effects on the labor market—Natives and non-natives

	Hourly wages (logs)	Employment	Unemployment	Informality	Hourly wages (logs)	Employment	Unemployment	Informality
[a] Migration effect ( $S_d$ )	− 0.004*** (0.001)	− 0.001*** (0.000)	0.001** (0.000)	0.000 (0.000)				
[b] Migration effect ( $S_d$ ) × Non-natives	0.000 (0.002)	− 0.000 (0.002)	− 0.001 (0.001)	0.002** (0.001)				
[a] Migration effect ( $T_d$ )					− 0.100*** (0.016)	− 0.034*** (0.004)	0.015 (0.007)	0.009 (0.011)
[b] Migration effect ( $T_d$ ) × Non-natives					0.016 (0.029)	0.043 (0.051)	−0.016 (0.038)	0.027 (0.026)
P-value wild bootstrap SE—Natives	[0.041]	[0.136]	[0.092]	[0.484]	[0.043]	[0.026]	[0.131]	[0.595]
[a] + [b] Effect on Non-natives	− 0.004* [0.180]	− 0.002 [0.843]	0.000 [0.947]	0.003*** [0.093]	−0.084* [0.332]	0.009 [0.836]	− 0.001 [0.974]	0.037* [0.329]
Mean Dep. variable—Natives		0.615	0.119	0.509		0.606	0.134	0.597
Mean Dep. variable—Non-natives		0.592	0.138	0.528		0.528	0.203	0.745
Observations	1,905,361	3,150,714	2,179,996	1,905,361	388,653	675,605	454,132	388,653
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department and time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap-t standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013-2019. For information on the specification of regressions, see footnotes to Table 2. Source: Own elaboration based on the GEIH-DANE

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

**Table 8** Effects on the labor market until December 2017

	Hourly wages (logs)	Employment	Unemployment	Informality
Migration effect ( $S_d$ )	− 0.004*** (0.001)	− 0.001** (0.001)	0.001** (0.000)	0.000 (0.000)
P-value wild bootstrap SE	[0.040]	[0.096]	[0.069]	[0.205]
Mean Dep. variable		0.615	0.120	0.510
Observations	1,354,448	2,229,261	1,546,771	1,354,448
Migration effect ( $T_d$ )	−0.089*** (0.015)	− 0.017 (0.010)	0.012 (0.012)	0.012* (0.005)
P-value wild bootstrap SE	[0.073]	[0.217]	[0.427]	[0.042]
Mean Dep. variable		0.605	0.134	0.597
Observations	278,001	478,379	323,488	278,001
Individual controls	Yes	Yes	Yes	Yes
Department and Time FE	Yes	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap-t standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013-2017. For information on the specification of regressions, see footnotes to Table 2. Source: Own elaboration based on the GEIH-DANE

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

**Table 9** Weights—synthetic control method

	Employment	Informality	Unemployment	Wages
Antioquia	0.018	0.000	0.000	0.000
Boyacá	0.000	0.000	0.000	0.000
Caldas	0.000	0.000	0.000	0.000
Caquetá	0.000	0.096	0.157	0.068
Cauca	0.000	0.000	0.000	0.000
Chocó	0.021	0.000	0.000	0.103
Córdoba	0.000	0.235	0.000	0.000
Huila	0.000	0.000	0.000	0.000
Meta	0.000	0.000	0.000	0.000
Nariño	0.000	0.000	0.168	0.000
Quindío	0.169	0.122	0.000	0.313
Risaralda	0.000	0.087	0.228	0.000
Sucre	0.792	0.322	0.000	0.474
Tolima	0.000	0.138	0.446	0.018
Valle del Cauca	0.000	0.000	0.000	0.024

Source: Own elaboration based on the GEIH-DANE

**Table 10** Effects on wages—Robustness exercise

	(1)	(2)	(3)	(4)
[a] Migration Effect ( $S_d$ )	− 0.005*** (0.001)	− 0.007*** (0.001)	− 0.006*** (0.001)	− 0.005*** (0.001)
[b] Migration Effect ( $S_d$ ) × High-skilled		0.003*** (0.001)		
[b] Migration effect ( $S_d$ ) × Formal			0.003*** (0.001)	
[b] Migration effect ( $S_d$ ) × Women				0.001** (0.001)
P-value wild bootstrap SE—[a]	[0.012]	[0.008]	[0.012]	[0.012]
[a] + [b]		−0.004***	−0.003***	−0.004***
P-Value wild bootstrap SE—[a] + [b]		[0.036]	[0.039]	[0.027]
Observations	1,901,208	1,901,208	1,901,208	1,901,208
R2	0.366	0.369	0.391	0.367
[a] Migration effect ( $T_d$ )	−0.120*** (0.001)	−0.158*** (0.016)	−0.152*** (0.019)	−0.127*** (0.005)
[b] Migration effect ( $T_d$ ) × High-skilled		0.060* (0.022)		
[b] Migration effect ( $T_d$ ) × Formal			0.066* (0.027)	
[b] Migration effect ( $T_d$ ) × Women				0.016 (0.012)
P-value wild bootstrap SE—[a]	[0.021]	[0.061]	[0.063]	[0.012]
[a] + [b]		−0.098***	−0.086***	−0.112***
P-value wild bootstrap SE—[a] + [b]		[0.027]	[0.063]	[0.021]
Observations	387,434	387,434	387,434	387,434
R2	0.385	0.389	0.411	0.385
Individual Ccontrols	Yes	Yes	Yes	Yes
Department and time FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
2010 trade volume × Time FE	Yes	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap-t standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013–2019. The 2010 Trade Volume × Time FE corresponds to the total bilateral trade between each department of Colombia in the sample and Venezuela in 2010 interacted with year-month dummy variables. For information on the specification of regressions, see footnotes to Table 2. Source: Own elaboration based on the GEIH-DANE

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

**Table 11** Effects on the labor market—Robustness exercise

	Employment	Unemployment	Informality	Employment	Unemployment	Informality	Employment	Unemployment	Informality
[a] Migration Effect ( $S_d$ )	− 0.002*** (0.000)	0.001** (0.000)	0.000 (0.001)	− 0.002*** (0.000)	0.001** (0.000)	0.001*** (0.000)	− 0.002*** (0.000)	0.001** (0.000)	0.001 (0.001)
[b] Migration Effect ( $S_d$ ) × High-Skilled				0.000 (0.000)	0.000 (0.000)	− 0.001* (0.000)			
[b] Migration Effect ( $S_d$ ) × Women							0.000* (0.000)	0.000 (0.000)	− 0.000 (0.000)
P-Value wild bootstrap SE—[a]	[0.043]	[0.054]	[0.469]	[0.032]	[0.088]	[0.026]	[0.023]	[0.068]	[0.206]
[a] + [b]				− 0.002*** (0.107)	0.001** (0.101)	0.000 (0.566)	− 0.002*** (0.106)	0.001** (0.067)	0.000 (0.637)
P-Value wild bootstrap SE—[a] + [b]									
Mean Dep. Variable—[a]	0.615	0.119	0.509	0.559	0.095	0.806	0.735	0.092	0.507
Mean Dep. Variable—[a] + [b]				0.660	0.135	0.312	0.515	0.150	0.511
Observations	3,143,611	2,175,205	1,901,208	3,143,611	2,175,205	1,901,208	3,143,611	2,175,205	1,901,208
[a] Migration Effect ( $T_d$ )	− 0.033*** (0.004)	0.017* (0.007)	0.011 (0.012)	− 0.029*** (0.005)	0.009 (0.004)	0.023*** (0.005)	− 0.037*** (0.004)	0.019** (0.005)	0.011 (0.008)
[b] Migration Effect ( $T_d$ ) × High-skilled				− 0.002 (0.006)	0.010* (0.004)	− 0.012 (0.010)			
[b] Migration Effect ( $T_d$ ) × Women							0.006 (0.005)	− 0.003 (0.006)	0.001 (0.005)
P-Value wild bootstrap SE—[a]	[0.118]	[0.364]	[0.597]	[0.033]	[0.091]	[0.070]	[0.036]	[0.060]	[0.435]
[a] + [b]				− 0.031*** (0.025)	0.019* (0.201)	0.012 (0.562)	− 0.031*** (0.073)	0.015 (0.450)	0.012 (0.591)
P-Value wild bootstrap SE—[a] + [b]									
Mean Dep. Variable—[a]	0.606	0.134	0.597	0.560	0.112	0.896	0.728	0.111	0.624
Mean Dep. Variable—[a] + [b]				0.649	0.151	0.355	0.504	0.161	0.564
Observations	673,471	452,691	387,434	673,471	452,691	387,434	673,471	452,691	387,434
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department and Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2010 Trade Volume × Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust and clustered standard errors at department level in parentheses and P-values based on wild bootstrap-t standard errors with a 6-point distribution as in Webb (2014) are in square brackets. The observations correspond to the period 2013-2019. The 2010 Trade Volume × Time FE corresponds to the total bilateral trade between each department of Colombia in the sample and Venezuela in 2010 interacted with year-month dummy variables. For information on the specification of regressions, see footnotes to Table 2. Mean Dep. Variable—[a] refers to the base group considered as reference and Mean Dep. Variable—[a]+[b] refers to the interaction group. Source: Own elaboration based on the GEIH-DANE

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

## Descriptive figures

## Descriptive statistics

## Heterogeneous effects and robustness checks

### Synthetic control methodology

The key to this methodology is to determine the optimal weight to be attributed to each of the departments not affected by migration so as to perform the linear combination and obtain the unit of comparison. In line with Gardeazabal et al. (2010) and Abadie et al. (2010), the analytically-solved problem is based on selecting a vector  $W^*$  of weights that minimize the expression given by:

$$W^* = \text{*arg min}_w (X_1 - X_0 W)' V (X_1 - X_0 W) \quad (5)$$

Subject to:

$$w_j \geq 0 (j = 1, 2, \dots, J) \quad w_1 + w_2 + \dots + w_J = 1 \quad (5.1)$$

where  $J$  denotes the number of control units available. In our analysis, these are the control departments that were not strongly affected by the migratory flow.  $W = (w_1, \dots, w_J)$  is a non-negative vector of weights for each of the available control units, the sum of which must be 1.  $X_1$  is a vector of dimensions  $(K \times 1)$  where  $K$  refers to pre-treatment relevant characteristics of the treated unit and  $X_0$  is a  $(K \times J)$  matrix that contains the same values for the same  $K$  variables but for the  $J$  potential units of control under analysis. Finally,  $V$  is a diagonal matrix with non-negative components in which the relative importance of each of the selected characteristics as determinants of the variable of interest is specified.

When the expression is minimized, subject to the restrictions presented above, the vector  $W^*$  of optimal weights will be determined, which, if multiplied by the matrix  $X_0$ , will permit one to find the values of the weighted variables included in  $X_0$  for the counterfactual unit of comparison.

With  $Y_1$  defined as a  $(T \times 1)$  vector that contains the values of the variable of interest for the treatment unit and  $Y_0$  as a  $(T \times J)$  matrix with the values of the outcome but for all potential control units considered, the value of the synthetic variable of interest can be calculated. The vector of synthetic variables can be determined by  $Y_1^* = Y_0 W^*$ . By comparing  $Y_1$  with  $Y_1^*$ , the causal effect of the increase in labor supply on the variable of interest in La Guajira and Norte de Santander can be estimated.

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### Author contributions

All authors read and approved the final manuscript.

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### Availability of data and materials

The processed datasets used during the current study are available from the corresponding author upon request.

### Declaration

#### Competing interests

The author declares that he has no competing interests.

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