Exports "brother-boost": the trade-creation and skill-upgrading effect of Venezuelan forced migration on Colombian manufacturing firms*

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Abstract

This paper studies the impact of a massive skilled labor supply shock on Colombian manufacturing firms' exports, the Venezuelan exodus. We exploit cross-sectional and time variability of Venezuelan forced migrants' settlements in Colombian sub-national areas through an enclave instrumental variables approach to account for the selection of immigrants' location. Using yearly customs data from 2013 to 2019, we find that the Venezuelan migration improved Colombian manufacturing firms' export performance, particularly to high-income countries of the OECD located in North America and low-income countries. This effect was stronger for firms that exported less prior to the exodus (2012). Furthermore, using a detailed yearly panel of manufacturing firms from 2013 to 2019 we identify the potential labor market driving mechanism of the trade-creation effect: immigrants lowered exporting firms' blue-collar wages, and allowed them to upgrade their labor force skill composition, namely firms were able to hire workers more compatible with exports to developed destinations.

JEL Classification: F22, F16, F14, J61, J31.

Keywords: Forced migration, Trade, Skill-upgrading, Colombia, Venezuela.

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1 Introduction

Forced displacement is becoming an alarmingly important phenomenon in developing countries. By the end of 2019, 79.5 million people had been forcibly displaced worldwide; 85% of which were hosted by developing nations (UNHCR, 2019). On the bright side, massive inflows of workers might represent more opportunities for businesses to hire a wider and better variety of skills. If firms could take advantage of this greater availability of labor supply to upgrade their inputs in the production process, this would allow them to improve their export performance.

Due to recent profound political, social and macroeconomic crisis, in 2019 Venezuela was the second country with the highest number of displaced citizens (4.5 millions), while Colombia was the second most important host of displaced immigrants (1.8 millions) receiving only Venezuelan refugees (UNHCR, 2019). This exodus has a particular and novel feature: displaced Venezuelans are, on average, more skilled than local Colombian workers (Caruso et al., 2019; Peñaloza-Pacheco, 2019). These characteristics, along with the fact that Colombia is a developing nation with high levels of vulnerability in the labor market, may translate into different effects and mechanisms to the ones documented in previous work on the effect of migration in developed hosting countries.

Despite the large number of forced migrants from Venezuela to Colombia, a relevant characteristic of this migratory episode was the brief period during which the exodus took place. Since 2016 there has been a spike of the Venezuelan-born forced immigration to Colombia due to the re-opening of Colombian borders in the second half of 2016 after a political conflict between both governments. This makes their arrival a well-defined skilled labor supply shock, and a particularly good context in which to test how this shock could affect firms' export performance.

Few papers study social and economic effects of forced migration between developing countries. Even fewer articles analyze the consequences of displaced immigrants on firms' outcomes and none of them specifically on exports of those firms located in countries receiving refugees.[1]

Hiring workers with certain special skills is essential for exporting manufacturing goods, particularly to developed countries (Verhoogen, 2008; Brambilla et al., 2012; Brambilla and Porto, 2016; Macis and Schivardi, 2016). The products exported to these countries are differentiated and of high relative quality[2], which requires sophisticated white-collar skills that can carry out, for example, management and leadership tasks to efficiently organize the production process, obtain quality certifications, etc. These exports also need more educated blue-collar workers to improve the quality of production tasks, for example, to obtain output with as few defects as possible or to enhance product design (Brambilla et al., 2017; Accetturo et al., 2013).

There is no evidence in the economic literature about the effect of skilled forced migrants on

[1] See for instance Altındağ et al. (2020); Bahar et al. (2021); Del Carpio and Wagner (2015); Caruso et al. (2019); Peñaloza-Pacheco (2019).

[2] Using firm-level trade-transactions data, Bastos and Silva (2010); Manova and Zhang (2012); Martin (2012); and Görg et al. (2017) show that within firms there is a positive correlation between export price and gross domestic product per capita of the destination (in Portugal, China, France, and Hungary, respectively), consistent with the hypothesis of Verhoogen (2008) that individual firms sell higher-quality varieties to consumers more willing to pay for quality.

firms' behavior in developing countries. We fill this gap by studying the Venezuelan forced migration episode in Colombia: two developing economies that due to their geographical proximity have several similar demographic and economic characteristics. This mass exodus provides us with a natural experiment to test how a skilled labor supply shock could impact on the firms' export performance. In terms of the traditional Heckscher-Ohlin model, it is expected that in those Colombian departments (Colombian sub-national administrative units) where more skilled labor settled, the industries that used this type of labor would have a comparative advantage and would export more. We find evidence consistent with this model prediction. We propose a novel mechanism for the migration literature operating behind this trade-creation effect: skill-upgrading of the labor force explained by the exogenous increase in the supply of skilled workers and the lowering of firms' labor costs.[3]

Since migrants may choose their arrival departments and their choices may be correlated with the economic performance of firms inside those areas, we cannot simply compare differences in export outcomes across departments with higher and lower migration levels. Given that the territorial distribution of forced migration is far from being random we instrument the departmental share of Venezuelan immigrants with an enclave instrument based on the distance to the border between Colombia and Venezuela for each department. This instrument exploits the fact that, given the forced nature of the migration, the location of Venezuelan migrants was specially concentrated on departments near the Colombian side of the border with Venezuela (more specifically, Colombian departments near Venezuelan states with historical high population density). This well-known type of instruments have been used in several papers analyzing episodes of forced migration (see, for instance, Del Carpio and Wagner, 2015; Morales, 2018; Caruso et al., 2019).

We document and measure the effects of Venezuelan immigration on Colombian firms' manufacturing exports using detailed customs data collected by DANE (the Colombian national statistics office). Our results show that the arrival of displaced Venezuelan immigrants had a trade-creation effect.

The sudden nature of the exodus, triggered by the re-opening of the borders between Colombia and Venezuela in 2016, determined that this effect was concentrated in firms that already had exporting experience: an increase of 1 percentage point (p.p.) in the share of working-age Venezuelan refugees relative to the local labor force raised the probability of exporting, conditional on having exported the previous year, by 0.9 p.p., on average. The firms that took advantage of the labor market shock were those that had the know-how beforehand on how to export (in fact, we do not find significant results on the probability of exporting without conditioning on having exported in previous years).

In line with this finding, we focus on firms that have exported every year between 2012 and 2019. We find that departments that received the most forced migrants raised total exported value of exporting firms, on average, by 11.4%. More importantly, the trade-creation effect was heterogeneous in terms of export destinations and appeared to be particularly concentrated

[3] As opposed to the traditional channel typically suggested in the economic literature, namely migrants' networks that reduce firms' transaction costs.

in the more developed export destinations: at the intensive margin, exports to high-income and OECD-high-income destinations seem to have increased mainly explained by an increase in the value exported to North American countries; consistently, at the extensive margin, there is evidence of an increase in the probability of exporting to OECD-high-income countries. In addition, at both the intensive and extensive margin there is a trade-creation effect to low-income countries. Moreover, the evidence shows that there was a positive effect in the number of products exported. Finally, we estimate that this trade-creation effect of immigration on Colombian manufacturing firms was higher for those firms with lower pre-shock levels of exports (in 2012) and decreasing along the percentiles of those initial exports levels. This finding is compatible with frictions existing in the Colombian labor market for the regularization of forced migrants. Given that small firms are more likely to hire informal workers, it is possible that they took greater advantage of the trade creation-effect of the exodus.

The fact that the trade-creation effect varies by export destination is consistent with the hypothesis that Venezuelan migration enabled firms to hire workers with skills more "compatible" with exports to developed destinations, with more sophisticated product demands (Verhoogen, 2008; Brambilla et al., 2012; Brambilla and Porto, 2016; Bastos and Silva, 2010). Motivated by these results, we investigate underlying potential mechanisms using detailed data from the Annual Manufacturing Survey carried out by DANE.

We find a fall in blue-collars' wages in exporting manufacturing firms. Furthermore, we find negligible negative effects on employment which become non-statistically significant when trying to discern whether they come from a drop in white- or blue-collar jobs. A potential link between the firms' export performance improvement to developed destinations and the reduction of labor costs could be the skill-upgrading of labor force.[4] Taking advantage of the Technological Development and Innovation Survey (EDIT), which asks questions related to innovation and technology, we study whether the influx of Venezuelan immigrants improved the skill composition within white-collar and blue-collar workers. Our results suggest a positive effect on the proportion of high-skilled workers hired by exporting manufacturing firms in both groups (white- and blue-collar).

A first strand of the literature our work is related to is the study of the trade-creation effect of migration. The papers that explore this research agenda do so in developed countries, in a context of voluntary migration. These papers find a positive effect of this type of migration on international trade and propose a network channel underlying the trade effect: migrants reduce transaction costs of doing business in export destinations (Gould, 1994; Head and Ries, 1998; Peri and Requena-Silvente, 2010; Hiller, 2013).

A second body of literature to which our paper relates to is that of the effect of migration on firm-level outcomes. Several papers study this for developed countries in a context of voluntary migration. A first group of papers highlight the importance of the positive effects skilled migra-

[4] There is a growing strand of the economic literature, according to which there is a positive relationship between international trade and the skill upgrading of the most productive firms. One of the most important works related to this topic in developing countries (Argentina) are that of Bustos (2007, 2011).

tion has on firm performance, such as higher productivity (Beerli et al., 2021; Ottaviano et al., 2018; Mitaritonna et al., 2017; Kerr et al., 2015). A second group of studies analyze the effect of unskilled migration on firms results through lower production costs and skill complementarities at the work place (Dustmann and Glitz, 2015; Malchow-Møller et al., 2012).

In contrast, the only work that, to the best of our knowledge, analyzes how forced migration affects firms' outcomes in a developing country is that of Altındağ et al. (2020). The authors study the effect of the massive episode of Syrian refugees migrating to Turkey. There are two important characteristics that differentiate our work from theirs: (i) while they analyze unskilled forced migration, we study skilled displaced citizens; (ii) the firms analyzed by the authors are highly informal, while ours are formal firms in the manufacturing sector. This determines that they, among other things, do not find any foreign trade effects from refugees (despite finding a reduction in firms' labor costs in the informal sector).

Finally, regarding the Venezuelan exodus, several recent papers have studied how this migratory episode affected the labor market in Colombia. Caruso et al. (2019) and Peñaloza-Pacheco (2019) find a negative effect of Venezuelan immigration on wages in Colombia mainly concentrated on low-skilled and informal employees. Additionally, they do not find any effect on employment.

The remainder of the paper is organized as follows. Section 2 presents the data used to perform our analysis. Then, Section 3 shows some descriptive statistics of Venezuelan migration, manufacturing firms and exports. Section 4 presents the empirical strategy proposed in this paper to estimate the causal effect of the Venezuelan exodus on firms outcomes. Section 5, shows our main results on firms export performance. Section 6 digs deeper into the mechanisms behind the trade-creation effect. In Section 7 we perform some robustness checks. Finally, Section 8 concludes.

2 Data

We use data from different sources and then perform our analysis at the firm level with units treated at the departmental level (Colombian administrative units[5]) focusing on the period 2013 to 2019 in line with data availability.

2.1 Displaced Venezuelans

Data on immigrants stocks at departmental level come from the Colombian household survey carried out by the national statistical institute (DANE): the Great Integrated Household Survey (GEIH for its acronym in Spanish).[6] This information is available since 2013.[7] We consider all

[5] Colombia has 32 departments and a capital district, Bogotá.

[6] The household survey consists of monthly repeated cross-sections that characterize both individual socio-demographics and labor outcomes.

[7] Although the migration module of DANE's household survey is available since 2012, the question about immigrants' country of origin was included since April 2013.

individuals who were born in Venezuela as Venezuelan migrants.[8] As we analyze effects on firms' performance, we will only take into account working age individuals (15-64 years old). We use GEIH's weights to calculate representative shares of Venezuelan immigrants at the department level.

2.2 Exports data

Estimation of firms' exporting performance requires data on their export values, quantities and destinations. Here, we rely on detailed Colombian exports statistics also published by DANE. This data records the total value and quantity of Colombian exports by month, plant, department of origin, destination country and 10-digits NANDINA product classification from 2011 to 2020. With this input, we assembled our yearly panel of exporting establishments between 2012-2019[9] that has plant-level information of the values (fob US dollars) and quantities of the exported products by destination[10] and department of product elaboration. Our unit of observation is, therefore, the plant (or establishment or firm, we use the terms interchangeably) of the department where the good is produced.

We include only establishments that exported every year between 2012-2019 and consider only one plant per company in each department; therefore we work with a balanced panel of exporting firms. We keep only exports of manufactured products[11] and define each firm's industry based on the 3-digit ISIC code with the highest value exported over the 8-year period. We ignore exports to Venezuela (so our results are not driven by network effects of the immigrants with their home country)[12], and exports to Free Trade Zones. Total product values and quantities are noisy in Colombian customs data due to both aggregation and measurement error.[13] To mitigate the impact of these errors, we follow a procedure similar to the one described by Hallak and Schott (2011) and restrict our analysis to relatively large exporters. Namely, we

[8] Although GEIH allows us to identify migrants who have lived in Venezuela in the last 12 months or in the last 5 years, we preferred to define immigrants as Venezuelan born since the latter definition covers the whole stock of forced immigrants. If immigrants were only those individuals who lived in Venezuela in the last 5 years, in 2019 Venezuelans who had arrived in 2013 would not be considered as immigrants, for example.

[9] We consider the year 2012 in order to have firms' covariates prior to the analysis period. For more details, see Section 4.

[10] Actually, we group destinations by per capita income and region, as we will detail in Section 3.2.

[11] We use a crosswalk (provided by DANE) between the product codes of the customs database and the industries coded by ISIC Rev. 4.

[12] In Section 7 we control for pre-exodus bilateral trade between Colombia and Venezuela in our main regressions and our results remain unchanged.

[13] Unit values vary widely for identically classified exports. For example, we found "parts of industrial or laboratory furnaces, including incinerators, other than electric" valued from US$ 99.80 each to US$ 115,901 each in 2013; computer parts valued from US$ 968.26 each to US$ 4,468.93 each in 2017 or Copper Alloy Pipe Fittings valued from US$ 8.13 per kilogram to US$ 12,208.30 per kilogram in 2019. There are two potential underlying causes for the variations in unit values. First, dispersion could result from commodity classifications so broad that the same code could cover products of different types, quality, and intended use. The second cause for the variations could be errors (such as misclassifying the product or entering the wrong quantity or total value) made by the data entry clerk on the customs export declaration (both electronic or lithographic).

eliminate firms that have exported less than 50,000 dollars in any of the years considered (our estimates hold with lower thresholds of annual exports, see Section 7). Also the products with the top and bottom 1 percent unit values are dropped from our sample. We consider only products whose export modality has been either "definitive export of nationally manufactured or produced goods" or "other definitive exports not included in the previous items". Finally, we have 1,156 firms in each year that produce manufacturing exported goods in 16 departments of Colombia.

2.3 Firm data

To analyze the channels behind the effect of immigrants on exports we use panel data on Colombian manufacturing plants for the period 2012-2019.[14] We use the Colombian Annual Manufacturing Survey (EAM for its acronym in Spanish), a panel of all manufacturing establishments in the country with 10 or more employees, or firms with fewer employees but with revenue above a certain threshold annually updated.[15] Therefore, our unit of observation is, as with the customs database, the plant. The EAM reports employment (broken down into professionals, technicians and technologists; workers and operators; and sales and administration managers and employees), wage bill, and sales, as well as sector identifiers, and an ID of both the company to which the plant belongs to and of the establishment.

As with the customs panel, we keep a balanced panel of firms for the period analyzed. We further drop establishments that vary their geographical location in the period considered and trim our sample by keeping firms with more than 10 employees. We calculate the number of employees and the average wages at the firm level without considering owners or interns. This means that we only take into account permanent staff plus temporary employees both hired directly by the establishment and hired through specialized recruitment companies. As firms report employment and wage payed to different type of workers, we define blue-collar workers to be workers and operators (working on production tasks). White-collar workers are professionals, technicians and technologists (production tasks) plus sales and administration managers and employees (non-production). Finally, our sample consists of 5,269 manufacturing establishments in 21 Colombian departments.

In addition, to study the skill composition of the labor force in each company (part of the mechanisms proposed in this paper, see Section 6), we use the Technological Development and Innovation Survey (EDIT for its acronym in Spanish) which is a survey that asks questions related to innovation, technology and the quality of the productive process for the same universe of manufacturing firms as the EAM. By using EDIT, we are able to merge each of the companies in EAM with the corresponding observations in EDIT. There are two important challenges that we face when using information from EDIT. First, as of today, EDIT is only available until 2018, therefore when analyzing the skill composition of firms' workers we loose the observations of

[14] As with the customs data, our firm panel considers establishments from the year 2012 in order to have firms' covariates prior to the analysis period (for more details, see Section 4).

[15] For example, DANE set US$ 164 million (approximately) in annual revenue as the inclusion threshold in 2016.

2019 that are included in our sample for the rest of the estimates using the EAM. Second, EDIT is not available at the plant level but at the company level, which means that each observation has information on the set of plants that make up the company, such that if the number of establishments is one, the plant coincides with the company. To solve this issue, when using the EDIT, we work with companies that have only one plant and drop those that have more than one plant in the country.

Our EAM sample of 5,269 plants has 4,984 companies: 4,840 single-plant companies and 144 multi-plant companies (dropped in this part of the analysis). Out of these 4,840 single-plant companies we are able to merge 4,783 present in both databases (there are 57 single-plant companies in the EAM that are not present in the EDIT). Finally, we are left with a balanced panel of 4,362 single-plant companies that constitute our sample for studying the skill-composition change within enterprises (88% of the original EAM sample in 21 Colombian departments).[16]

2.4 Controls and instrument data sources

Data used for the controls in the regressions come from two different sources. On the one hand, based on data provided by DANE, we calculate departmental real exchange rates (for more details on the construction of the departmental real exchange rate see Section 4), and also compute departmental shares of skilled workers[17] with data from the household survey. On the other hand, departmental GDP per capita for the year 2000 was provided by CEDE-Universidad de los Andes (Center for Economic Development Studies for its acronym in Spanish).

Finally, the Venezuelan population data in each Venezuelan state[18] required for the construction of our instrument comes from the 1990 Venezuelan population census (Minnesota Population Center, 2020).

We were not allowed to merge the customs and EAM data at the firm level, so we perform our analysis on each survey separately exploiting variability in the Venezuelan immigration patterns at the department-level over time for identification of the causal effect.

3 Descriptive Statistics

3.1 Descriptive Statistics of Venezuelan refugees in Colombia

According to Figure 1, the number of Venezuelans living in Colombia has increased continuously over the period 2013-2019. Venezuelan immigration to Colombia has especially intensified since

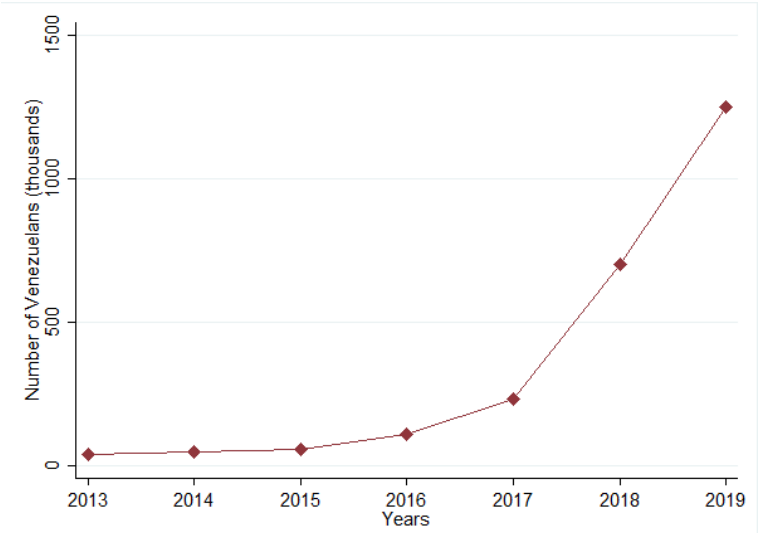
[16] Table B4 in Appendix B shows that there is no difference in the evolution of the variables of interest in the 2013-2018 period, between the original panel of firms we worked with in the EAM and the new panel of firms merged with the EDIT.

[17] We define a worker as being skilled if they finished high-school.

[18] Venezuelan territory is subdivided into 23 states, a Capital District (which includes the city of Caracas), and the Federal Dependencies (made up of islands, islets and keys).

2016, when borders between the two countries were reopened after a year of being closed due to a political crisis between the governments of Colombia and Venezuela.

Figure 1: Venezuelans in Colombia. 2013-2019



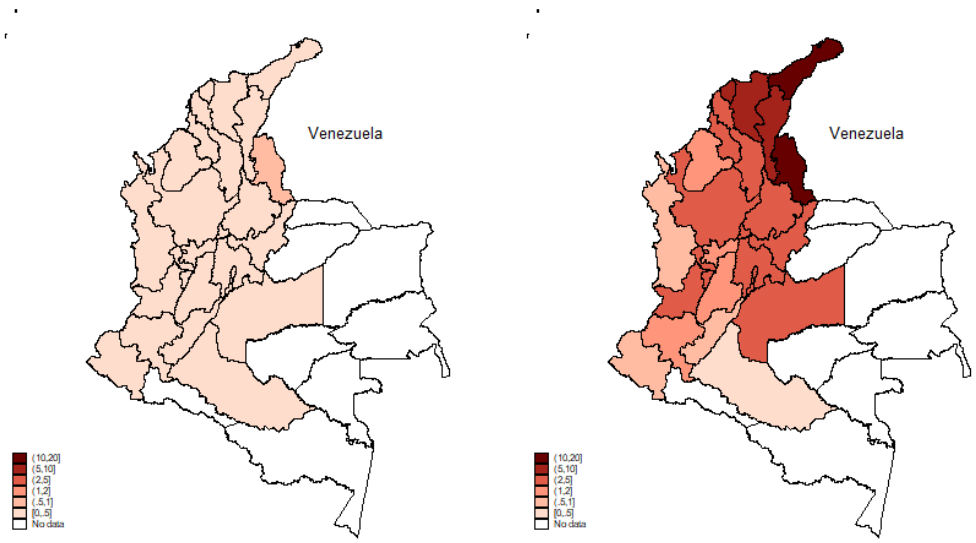
Notes. 2013 is the first year DANE published its household survey migration module with information about the country of origin.
Source. Own elaboration based on data from DANE's GEIH.

Since 2013, when the new president Nicolás Maduro assumed in Venezuela, the government was no longer able to sustain its expenditures due to declining international oil prices (Venezuela's main export commodity) which turned into a deep macroeconomic, social and political crisis. Stagflation and shortages in food and medicinal supplies have led to approximately 4.5 million Venezuelans leaving the country until 2019, being Colombia the host of the vast majority of displaced Venezuelans (1.8 million approximately) (UNHCR, 2019; Caruso et al., 2019; Peñaloza-Pacheco, 2019). As presented in Figure 2, the location pattern of the massive influx of Venezuelan refugees has been heterogeneous across departments where the immigrants were located. First, we can see that the share of working-age Venezuelans compared to the native labor force has increased in almost all Colombian departments. However, this relative increase in labor supply has been strongest in the border departments close to Venezuela such as La Guajira and Norte de Santander.

According to our estimates, in border departments the proportion of Venezuelan labor force relative to native labor force increased by about 10-15 percentage points, which represents a significant labor supply shock that can clearly affect different economic outcomes in those departments where Venezuelan refugees are located.

To identify the effect of the Venezuelan refugees' labor supply shock on the exporting performance of firms in Colombia and the mechanism behind the trade-effect, we exploit this heterogeneity in the location of the refugees across departments and its evolution over time.

Figure 2: Venezuelan Immigration by Department (% Native Labor Force)



(a) 2013 (b) 2019

Notes. We consider as Venezuelan immigrants those individuals born in Venezuela. Departments with no data in the figures are mainly departments in the Amazon with a low population density and small main cities in which data is not available. According to the last available census in Colombia (2018), population in these departments represent less than 3% of the total population in Colombia. We use survey weights to calculate the shares by department.
Source. Own elaboration based on data from DANE's GEIH.

An important feature to consider when analyzing this episode of mass influx of refugees is related to the characteristics of this labor supply shock and, more importantly, how it compares to the local labor force. According to the literature, selection is expected among the immigrants who decide to leave their country. For this reason, although historically socio-demographic characteristics of Colombians and Venezuelans have been similar, we can suspect that the labor supply shock and the conditions in which Venezuelan workers participate in the Colombian labor market may differ significantly from the conditions experienced by Colombian workers.

Table 1 shows descriptive statistics of individual socio-demographic and labor market variables between Venezuelan migrants and natives. Working-age Venezuelans are significantly younger and more educated. In terms of labor market variables, Table 1 further shows that Venezuelan working age individuals are more likely to be unemployed, to work more hours per week, to earn lower average wages and are less likely to be hired in formal employment. All of these characteristics reflect a fact that has been recently analyzed in the economic literature regarding the difficulty that Venezuelan refugees have experienced in achieving acceptable living conditions. Furthermore, Table 1 shows the difficulty refugees have faced when integrating into the formal labor market with the same conditions as native workers despite the 2018 "Special

Permit of Permanence" (Bahar et al., 2021; Caruso et al., 2019; Peñaloza-Pacheco, 2019).[19]

Table 1: Characteristics of Venezuelan and Colombian workers (2019)

	Venezuelan	Colombian	Difference	P-Value	Observations
Male	0.49	0.49	0.00	0.706	508047
Age	30.03	36.49	-6.46	0.000	508047
Years of education	10.33	9.61	0.72	0.001	508011
Unemployment	0.15	0.11	0.04	0.000	360553
Employment	0.68	0.65	0.03	0.012	508047
Hourly wages (logs)	8.04	8.38	-0.34	0.000	293569
Hours worked	49.82	44.58	5.23	0.000	316287
Formality	0.10	0.41	-0.31	0.000	312943
Income per capita (logs)	12.53	12.97	-0.45	0.000	508047
Poverty rate	0.37	0.20	0.17	0.000	508047

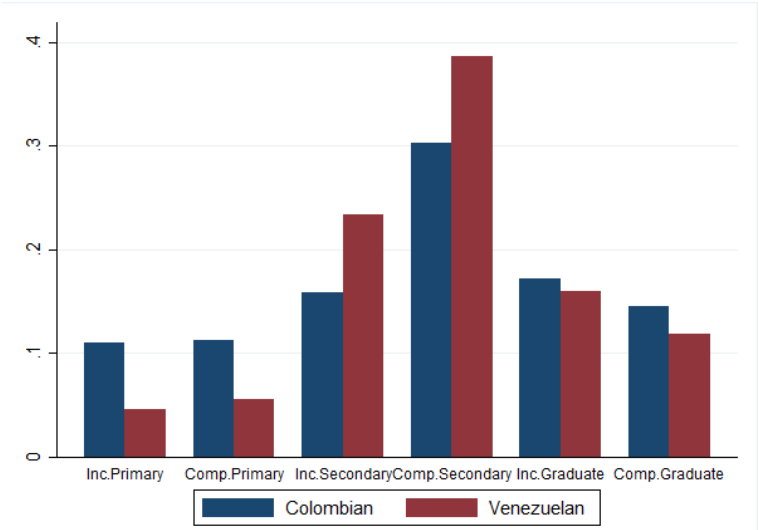
Notes. P-values are for difference between Venezuelan and Colombian averages with clustered standard errors at the departmental level.
Source. Own elaboration based on data from DANE's GEIH.

It is interesting that Venezuelan displaced are significantly more qualified in terms of years of education. Figure 3 plots the share of Colombian and Venezuelan hours worked, by educational attainment in 2019 to look at this phenomenon in more detail. As can be seen, Venezuelan born are mainly intermediate to high skilled: they are over-represented among high-school educated, while being under-represented among the less educated who only have primary education, finally the skill composition is tied (with a slight inclination towards Colombians) among college-educated.

This information suggests that Venezuelan workers are mainly represented among educated workers with at least some secondary education (incomplete or complete) and that, compared to Colombian workers, unskilled Venezuelan workers are less likely to be employed in the labor market. Given this, it is reasonable to think that Venezuelan workers may be playing an important role in the manufacturing labor market. They provide the type of medium-to-high-skilled labor required in the manufacturing sector, which could disproportionately affect manufacturing firms. Thus, through a labor supply shock, displaced Venezuelan immigrants could improve the export performance of Colombian firms by lowering their skilled labor costs and allowing them to carry out a skill upgrading. We will explore this mechanism with more detail in Section 6.

[19] The "Special Permit of Permanence" was a renewable two-years visa that granted the legal right to work and access to basic public services to nearly half a million undocumented Venezuelan migrants in Colombia in August 2018. The program (PEP-RAMV for its acronym in spanish) allows Venezuelan citizens to work, study and develop any type of legal activity within the Colombian territory, as long as they have registered in a nationwide census ran by the Colombian government between April and June 2018 to register all undocumented Venezuelan migrants residing in Colombia. The census registered about 442,000 Venezuelans.

Figure 3: Distribution of hours worked by level of education (2019)



Notes. Each bar represents the share of hours worked by Colombian/Venezuelan workers for each level of education.
Source. Own elaboration based on data from DANE's GEIH.

3.2 Descriptive Statistics of Manufacturing Exports and Firms' Characteristics

In Table 2 we report export values of manufacturing products from Colombian firms exporting every year between 2012-2019 in millions of current dollars. We present exports' destination countries grouped by their geographical region and by their per capita gross national income. We use World Bank classification, grouping high-income countries with upper-middle-income countries together in the "high-income" category and lower-middle-income countries with low-income countries in the "low-income" category. In addition, we show annual export values for high per capita income OECD countries (OECD-High), for Latin American and Caribbean countries (LAC), for the European Union (EU) and for North America (U.S. and Canada). We can observe that, after a spike in 2014, total exports fall until 2016[20] when they rebound and in 2018 they overcome their previous spike (a similar pattern is repeated for all groups of export destinations except for lower-middle and low-income countries). Most of Colombian exports are accounted for by high- and upper-middle-income destinations. These exports are destined to Latin America, and OECD countries, where the U.S. and Canada appear to have the largest share of exports.

[20] The drop in manufacturing exports after 2014 is due to general equilibrium effects of the fall in international commodity prices (mainly oil) and the slowdown in economic activity in the European Union (MinCIT, 2019).

Table 2: Colombian exports by year and destination 2013-2019 (millions USD, exporting firms)

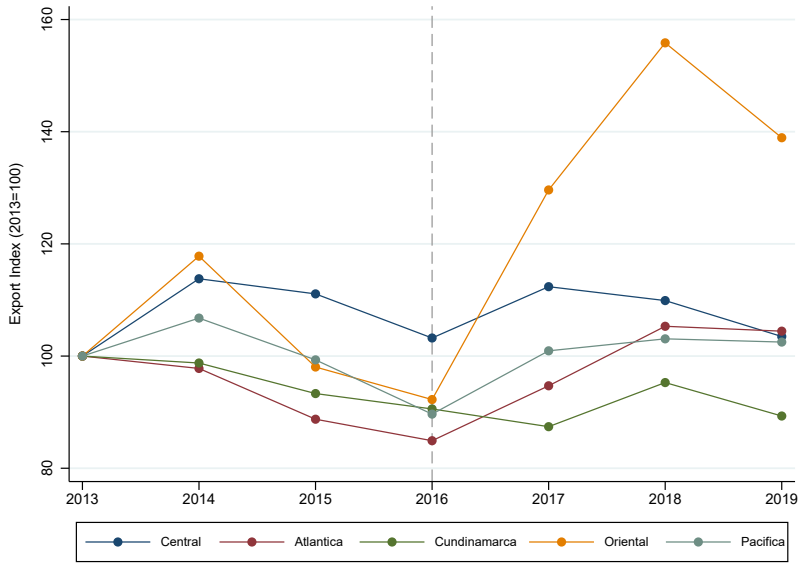
	Total exports	High-Income	OECD-High	Low-Income	LAC	EU	Northamerica
2013	9,086	8,693	3,750	393	4,860	942	1,819
2014	9,626	9,240	4,423	386	4,822	1,079	2,255
2015	8,976	8,628	4,203	348	4,404	973	2,207
2016	8,419	8,020	4,109	399	4,037	971	2,194
2017	9,357	8,893	4,303	464	4,654	1,078	2,267
2018	9,889	9,445	4,395	444	4,942	1,138	2,352
2019	9,496	9,027	4,178	469	4,745	1,033	2,319

Notes. Each cell contains the total value of Colombia's exports in millions of dollars. We consider plants that exported a total minimum value of US$ 50,000 per year in the period 2013-2019 and exported each year throughout 2012-2019. The first column shows the total value exported and the following columns show the total amount for each group of destination countries (defined in the text).

Source. Own elaboration based on customs data from DANE.

According to Figure 4, it is worth noting that although the fall in exports is uniform across Colombian regions between 2014-2016, the pattern of increase in export values is more pronounced in the eastern region ("Región Oriental"), which is located in the border with Venezuela and comprises the departments most affected by the Venezuelan immigration. As the vertical dashed line suggests, the differential increase in the exports index in the eastern region coincides with the re-opening of the borders between Colombia and Venezuela and the subsequent mass exodus of Venezuelan nationals.

Figure 4: Export Index by Region, 2013-2019



Notes. The Central region comprises the departments of Antioquia, Caldas, Risaralda and Tolima; the Atlántica region comprises Atlántico, Bolívar, Córdoba and Magdalena; the Cundinamarca region comprises Bogotá and the department of Cundinamarca; the Oriental region comprises Norte de Santander, Boyacá, Meta and Santander; finally, the Pacífica region comprises Cauca, Nariño and Valle del Cauca. Manufacturing firms exporting each year throughout 2012-2019 with a minimum of US$ 50,000 per year were considered.
Source. Own elaboration based on customs data from DANE.

In addition, in Table 3 we show descriptive statistics on the proportion of firms that export to different groups of destination countries following the same classification presented previously in Table 2. We also present statistics related to the value exported in millions of US dollars in 2019 by establishments, as well as the number of products exported by them. According to our data, on average almost all the manufacturing firms considered, exported their products to at least one high-income country and about 70% of those plants also exported their products to an OECD-high-income country. Furthermore, as expected, the main geographical destination of Colombian manufacturing exports is Latin America, followed by North America and the European Union.

Finally, we can observe that there is a high dispersion of both export values and number of products exported by the firms in our data. Although there are some establishments that export only 23 products or less, 5% of the companies that export the most in terms of products are able to export about 490 different products considering the product codes reported by firms. We can see that the diversification of these exports seems to be lower for products exported to the European Union while, on the other hand, Latin America is the geographical region where

companies export the widest variety of products.

Table 3: Exports of Colombian firms by region - total and along the distributions of exported value and quantity of exported products (exporting firms)

	Total	High-Income	OECD-High	Low-Income	LAC	EU	Northamerica
Panel A. Firms							
N° Firms	1,156	1,155	804	528	1,007	372	596
Share Firms	1.00	1.00	0.70	0.46	0.87	0.32	0.52
Panel B. Exports Value (millions USD - 2019)							
Mean	8.21	7.81	3.61	0.41	4.10	0.89	2.01
p25	0.31	0.29	0.00	0.00	0.11	0.00	0.00
p50	1.00	0.92	0.10	0.00	0.47	0.00	0.00
p75	4.54	4.26	1.25	0.10	1.72	0.04	0.49
p95	37.34	35.45	15.48	1.20	20.35	3.75	8.61
Panel C. Number of products exported (2019)							
Mean	129	120	26	10	105	6	16
p25	23	21	1	1	11	1	1
p50	61	51	6	1	37	1	1
p75	136	132	25	1	109	1	13
p95	493	433	109	49	421	25	73

Notes. We consider Colombian plants that (i) exported at least US$ 50,000 each year between 2013-2019 and (ii) exported every year throughout 2012-2019. In Panel A the first row indicates the number of plants that exported at least once throughout 2013-2019 to each group of destination countries (defined in the text). The second row indicates the share of firms that exported to each group relative to the total. Panel B shows descriptive statistics of total exported value in 2019 by percentiles of total exported value. Panel C depicts the number of exported products in 2019 (measured as the variety of 10-digit exported product codes) by product quantity percentiles.
Source. Own elaboration based on customs data from DANE.

Table 4 presents summary statistics from the balanced panel of firms (Annual Manufacturing Survey, EAM for its acronym in Spanish) for establishments with more than 10 employees broken down between exporting and non-exporting firms. The first three rows describe the export intensity of Colombian firms. Out of 5,269 firm-year observations 49% exported in at least 1 of the 6 years of data[21], while the average share of exporters is 35%. Exports account for 8 percent of sales across all firms (column 1, third row) and 20 percent among the average of 1,818 exporting firm-year observations (column 2). In our sample, all firms employ an average of 107 workers[22] and pay average annual wages of US$7,483[23], while exporters hire on average

[21] In 2014 the EAM did not ask for the exporting status of the firm.
[22] Considering owners, partners and relatives; permanent staff; temporary workers both hired directly by the establishment, and hired through specialized recruitment companies; and apprentices and interns.
[23] Average wage is defined as the total wage bill divided by total employment not taking into account

196 workers and remunerate an average yearly salary of US$9,084. Also, we depict firm size in terms of annual sales: on average exporters in our sample are larger (US$24.3 million) than the average firm (US$12.4 million). Finally, while blue-collar workers account for 62 (51) percent of total employment (wages), they represent 59 (46) percent of exporters' hiring (salaries).

Table 4: Descriptive Statistics from Firm Survey (EAM) - 2013-2019

	All firms	**Exporters**
Exported in a given year	0.35	1.00
Exported at least once during sample period	0.49	1.00
Exports/sales	0.08	0.20
Number of workers	107	196
Annual sales in 100,000 US dollars	124	243
Average annual wage in US dollars	7483.42	9083.89
Share of blue-collar workers	0.62	0.59
Share of wages paid to blue-collar workers	0.51	0.46
Observations	36,883	12,935
Firms	5,269	
Exporting firms (yearly mean)		1,818

Notes. Each cell contains the mean of the referred variable over years 2013-2019 either for exporters or all the firms. We consider (i) a balanced panel of plants throughout 2012-2019; (ii) establishments that do not vary their geographical location (at the department level) in the period considered; and (iii) firms with more than 10 employees. Year 2014 is not considered in the exporters' calculations because in that year the surveyed firms were not asked about their total exported value. Monetary values were calculated at US current dollars.

Source. Own elaboration based on data from DANE's Annual Manufacturing Survey.

3.3 Trends in exports and firms' characteristics

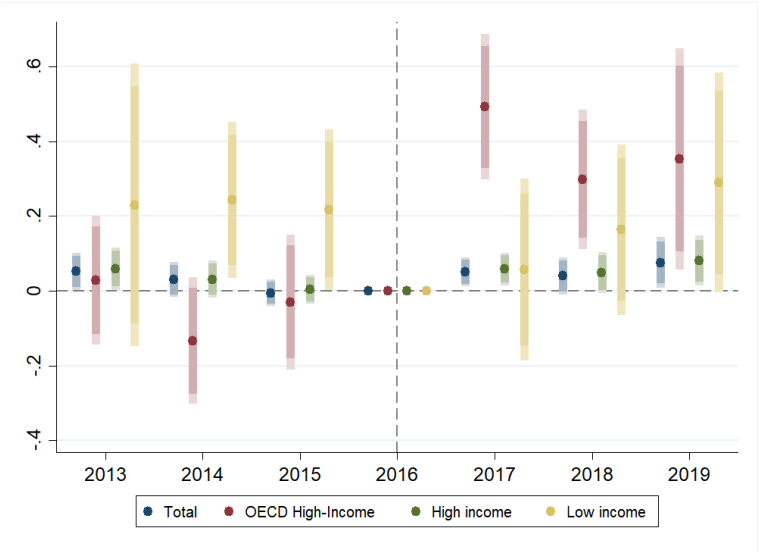
In this section we explore trends in export value and firms' characteristics in the context of the discrete jump in the inflow of Venezuelans displaced by the crisis in their country of origin.

Firstly, we analyze trends in aggregate exports of manufacturing firms by per capita income level of destination countries. Figure 5 shows that before 2016, pre-Venezuelan exodus, the trends in firms' exports were similar. However, after the Colombia-Venezuela borders re-opening (dashed vertical line), there was a significant increase in exports for those plants located in

owners, partners and relatives since they do not have a fixed remuneration.

departments with higher levels of immigration relative to the local labor force. This increase was especially strong for firms exporting to the group of high-income-OECD countries.

Figure 5: Differences in export trends 2013-2019



Notes. The figure shows the coefficient of interactions between annual dummies and the share of Venezuelan immigrants in 2019 for each department. 2016 was considered the base year for the interactions given that in this year borders between Colombia and Venezuela were re-opened boosting the influx of Venezuelans. Firms exporting each year throughout 2012-2019 with a minimum of US$ 50,000 per year were considered. Dependent variables of the regressions: log total exported value and (log of) destination group exported value in US current FOB dollars. The regressions control for firm fixed effects, industry-year fixed effects, region-year fixed effects, the interaction between pre-shock (2012) firm export level and year dummies, the share of skilled workers and the (log) real exchange rate of each department-year, and GDP per capita for the year 2000 of each department interacted with annual dummies. The bars represent the 95 and 90 percent confidence intervals.
Source. Own elaboration based on customs data from DANE.

Next, we analyze whether there were any differences in the evolution of firms' characteristics before the re-opening of borders in mid-2016 between those firms located closest to the border with Venezuela (oriental region) and those in the rest of Colombia. Table 5 shows that annual changes in firms' characteristics in the oriental region were not different from the evolution of those variables in the rest of the country. This suggests that pre-exodus firms' characteristics evolution was balanced across the country.

Table 5: Average pre-exodus yearly change in firms' characteristics

Average 2013-2015 annual change	Rest of the Country	Oriental Region	Difference	P-value
Total employment	0.109	0.117	0.008	0.777
Total white-collar employment	0.228	0.267	0.040	0.482
Total blue-collar employment	0.117	0.127	0.010	0.642
Average wage	0.076	0.079	0.004	0.600
Average white-collar wage	0.118	0.118	-0.000	0.997
Average blue-collar wage	0.084	0.078	-0.006	0.586
Sales in thousand pesos	0.362	0.430	0.068	0.601
Observations	5,358	394	5,752	

Notes. Average annual changes computed with clustered standard errors at the department level. P-values are for difference between firms located in the oriental region (closest to the border with Venezuela) vs. the rest of Colombia.
Source. Own elaboration based on data from DANE's Annual Manufacturing survey.

4 Empirical Strategy

To study the effect of Venezuelan displaced immigration on Colombian firms' outcomes we estimate the following equation:

$$Y_{ijdrt} = \beta M_{drt} + X'_{drt}\omega + \phi_i^{2012}\psi_t + \alpha_i + \lambda_{rt} + \pi_{jt} + \epsilon_{ijdrt} \quad (1)$$

Where Y_{ijdrt} is the outcome variable for firm i of industry j, in department d, region r and year t. Firm's outcomes studied in this paper are: value exported, probability of exporting, number of exported products, average wages, employment, and share of high-skill degrees among groups of workers.

Our main variable of interest is M_{drt}: the number of Venezuelan displaced normalized by the working-age population of department d, located at region r in year t (i.e. the Venezuelan immigration share).

X_{drt} is a vector of departmental controls that includes the log of departmental real exchange rate[24], the share of skilled workers at the departmental level, and pre-shock departmental GDP per capita for the year 2000 interacted with year dummies to flexibly control for differential trends in terms of income levels that may be correlated both with migrant settlements and firm performance. For example, areas with lower income levels before the migration shock could have been disproportionately (and differentially) affected by the economic crisis in Venezuela, which would have influenced the economic performance of those departments and modified firms' outcomes through a channel other than migration. In addition, higher departmental pre-shock

[24] Calculated as follows: $RER_{dt} = \frac{NER_t^{US-C} \times CPI_t^{US}}{CPI_{dt}}$, where NER_t^{US-C} is the nominal exchange rate between the US dollar and the Colombian peso in year t, CPI_t^{US} is the consumer price index (CPI) of the US in t, and CPI_{dt} is the CPI of each Colombian department d in period t.

GDP per capita could be associated with increasing trends in economic activity that would simultaneously benefit firms' export performance and attract a greater number of Venezuelan migrants. If income level heterogeneities affected firms' outcomes through its effect on departments' economic performance, then our results would be biased.

Furthermore, there might be factors that simultaneously determine the export performance of firms (or other firms' outcomes analyzed in the mechanisms) and the choice of the destination department of the forcibly displaced Venezuelans. For example, pre-exodus productivity shocks or cost shocks that persist over time in certain Colombian firms could attract more displaced immigrants to certain departments with more successful firms than to others. To control for these unobserved pre-shock differences in initial conditions we include $\phi_i^{2012}\psi_t$ which is the interaction between a pre-shock firm-level variable with year dummies (to allow for variability of this control over time).[25] These firm-level variables are the 2012 export level of firm i in the case of the customs data and the 2012 sales amount of firm i in the EAM (both in logs).

Finally, α_i, λ_{rt}, and π_{jt} are firm, region-year[26] and industry-year fixed effects respectively, and control for specific shocks in the dependent variable for each firm[27], region-year and industry-year. Standard errors are clustered at the department-year level to account for potential serial correlation within departments in each year (in line with the level at which our independent variable of interest and instrument -see below- vary).

Identification comes from variation between the departmental shares of Venezuelan immigrants relative to the local labor force and average departmental firms' outcomes. Furthermore, by using firm level data (instead of departmental aggregate data), we take advantage of the variation at the firm level to analyze the firm probability of exporting and heterogeneous outcomes in terms of pre-shock firms' export performance (when analyzing outcomes conditional on exporting), and exporting status (when analyzing mechanisms with all manufacturing firms).

Time-varying components that we cannot account for might affect both the geographic location pattern of the displaced Venezuelans and firms behavior. Refugees, for instance, might choose to move to areas where local businesses are more prosperous, which would lead us to overestimate the effects of refugees on firms' outcomes. Thus, to account for the possibility that the allocation of Venezuelan immigrants was not random, we use an instrumental variable approach to instrument the share of Venezuelan immigrants in each Colombian department. The instrument is a well-known enclave instrument that has been used in several papers analyzing episodes of forced migration (see, for instance, Del Carpio and Wagner, 2015; Morales, 2018; Caruso et al., 2019). This instrument exploits the fact that given the forced nature of the migration, the location of Venezuelan migrants was specially concentrated on departments near to the Colombian side of the border with Venezuela. Thus, travel distance from the Venezuelan

[25] We prefer to include these pre-shock firm-level controls rather than contemporary ones such as sales or number of employees, because they could be endogenous to the labor supply shock of Venezuelan immigrants.

[26] Each region is a group of departments defined by DANE (see footnote of Figure 4).

[27] Considering that we are studying a short period of time, it is expected that firm-level characteristics could remain constant over time, so they would be captured by our firm fixed-effects, thus validating our empirical strategy.

state from which the displaced is fleeing to each potential Colombian destination department, is a key determinant of the refugee location decisions. Formally:

$$IV_{drt} = V_t \sum_s \frac{\alpha_s^{1990}}{K_{drs}} \tag{2}$$

where V_t is the stock of Venezuelan immigrants living in Colombia in year t and provides our IV time variation. This component is orthogonal to the differences in the share of Venezuelans across Colombian departments. The discrete jump in the inflow of Venezuelans between 2015 and 2018 (Figure 1) was due to events occurring in Venezuela: the macroeconomic, social, and political crisis.

α_s^{1990} is the share of Venezuelans living in Venezuelan State s according to 1990 Venezuelan census (pre-crisis and prior to the emergence of *Chavismo* to power) and K_{drs} is the driving-distance in kilometers between Colombian department d in region r and Venezuelan State s.[28] This ratio provides our instrument with variability at the department level. The hyperbolic functional form of the driving-distance weights departments in Colombia closer to states in Venezuela (i.e. closer to the Colombia-Venezuela border) with a much higher importance than those farther away. So, respectively in the analysis of export performance and mechanisms, our instrument gathers departmental variability from 384 (16 departments with manufacturing exported goods producers and 24 Venezuelan states) and 504 (21 departments with manufacturing goods producers and 24 Venezuelan states) driving-distance destination-origin pairs.

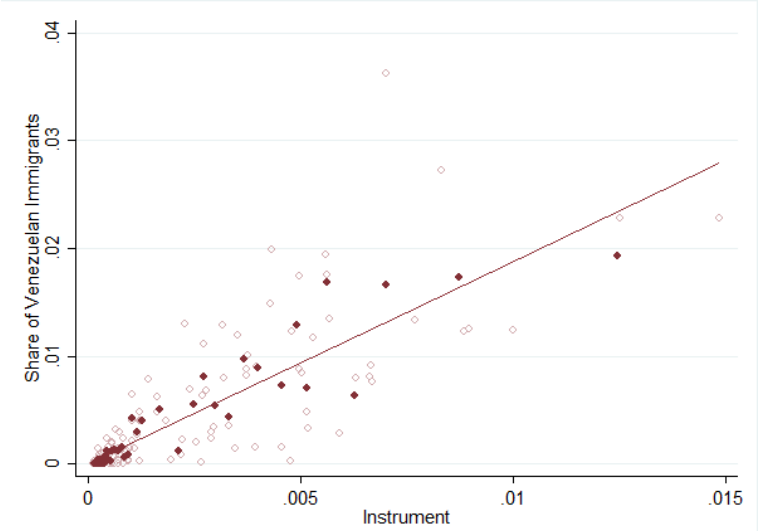
The intuition behind the instrument is that those Colombian departments located near to the border with Venezuela and, specifically, near to Venezuelan States with historically high population density, are expected to face higher immigration than those departments located far away from the borders (conditional on controls in equation 1).

The key threat to the validity of any distance-based instrument is that districts that are close to a border crossing may systematically differ from those further away. We are able to deal with this concern by, as discussed above, controlling for pre-shock departmental characteristics interacted with year dummies and specific regional trends. The identifying assumption of the instrument, once departmental characteristics and fixed effects are included, is that the location of displaced immigrants depends on the travel distance from various states of Venezuela. In Section 7 we also show that our results are robust to the inclusion of 2010 departmental volumes of trade to control for some direct economic impact of Venezuelan crisis on different departments of Colombia and to multiple exercises in which we exclude departments of Colombia one by one from our sample. Additionally, we change our instrument by other seven potential variants, considering alternatives to K_{drs} and α_s^{1990} and taking into account a shift-share type instrument (Card, 2001). Our results remain robust to these changes too.

[28] Driving-distance is estimated by implementing Stata command *georoute* written by Weber and Péclat (2017) which also provides information about the travel-time between Colombian departments and Venezuelan States. Results remain unchanged when calculating driving distances with Google Maps and when travel time is considered instead of driving-distance in the instrument construction. See Section 7.

Figure 6 shows the first-stage correlation between the enclave instrument and the share of Venezuelan immigrants which appears to be strong, supporting the relevance condition of the instrumental variable approach proposed in this paper. The instrument is significant at the one percent significance level in every specification that we estimated and the F-statistic is well above the standard levels.[29]

Figure 6: Enclave instrument first stage correlation



Notes. The figure shows the binscatter of the relationship between the share of Venezuelan immigrants (stock of venezuelan immigrants normalized by each department's working-age population) and the estimated instrument for each department-year. We calculate the value of the instrument following equation 2.

Source. Own elaboration based on data from DANE.

5 Results

The first outcome we analyze is the impact of displaced migrants on the probability that a Colombian firm exports. Table 6 presents our estimates of equation 1 for all the firms that exported at least once in the panel of customs data.[30] Columns (1) and (2) show results on the effect of an 1 percentage point (p.p.) increase in the share of Venezuelans relative to the departmental labor force on the probability of exporting. Our estimates show no statistically significant effect on the probability of exporting. However, when estimating the probability

[29] First stage estimates are shown in Panel A and B of Table A1.

[30] While the Colombian customs panel of exporting firms is unbalanced as it only shows data for firms if they exported in a given year, we balance the panel by completing our export status dummy in the years in which each plant did not export. We further complete year-by-year data for department-level averages of our main variable of interest as well as for our departmental controls. Unfortunately, we cannot control for firm-level pre-shock trends in this specification since this information is not available for all 4,435 firms that exported at least once over our sample period (2012-2019).

of exporting conditional on having exported in the previous year (columns 3 and 4), we find that a 1 p.p. rise in the share of Venezuelans relative to the local labor force increases the probability of exporting by 0.8 to 0.9 p.p. on average for firms producing in the most affected departments.[31] These results are consistent with the fact that the Venezuelan labor supply shock was of a large magnitude and occurred in a very short period of time. Exporting is a complex activity that requires knowledge about many of the characteristics of the demand and an adequate production of the exported goods to meet this demand. Thus, firms that had no experience exporting did not have time to learn how to do so. In contrast, those that did export already had the know-how and were favored by changes in wages and a labor force more compatible with export activity (see more results and mechanisms below).[32] In the remainder of the paper we will consider firms that exported throughout the whole period of analysis (2013-2019 plus 2012 to have pre-exodus firm conditions). In addition to the econometric reasons for balancing the panel (firm selective attrition problems), the results found in Table 6 indicate that a trade-creation effect of Venezuelan migration is expected to be found especially in those firms with exporting experience.

[31] We obtain a similar result when analyzing the probability of exporting to groups of destination countries classified by their per capita income. As Appendix A shows in Table A2, there is no significant effect of the Venezuelan exodus on the probability of exporting to high-income, low-income o OECD-high-income countries. However, the probability of exporting becomes significant and positive for high-income and OECD-high-income countries when conditioning on firms having exported to any destination in the previous period, as Table A3 depicts. We will discus this heterogeneity below.

[32] Consistent with this, when conditioning on having exported the previous two years, our estimates yield a higher probability of exporting. Results are available upon request.

Table 6: Effect of immigration on probability of exporting (all firms)

	OLS			
	$Exp_t = 1$		$Exp_t = 1 \mid Exp_{t-1} = 1$	
Share of Immigrants	0.003	0.000	0.009**	0.006**
	(0.005)	(0.005)	(0.004)	(0.003)
	IV			
	$Exp_t = 1$		$Exp_t = 1 \mid Exp_{t-1} = 1$	
Share of Immigrants	0.001	0.002	0.008*	0.009***
	(0.006)	(0.006)	(0.004)	(0.003)
F-statistic	120.23	342.10	120.23	342.10
Number of firms	4,435	4,435	4,435	4,435
Observations	31,045	31,045	31,045	31,045
Firm FE	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes
Department controls	No	Yes	No	Yes

Notes. Dependent variable for regressions in columns (1) and (2) is a dummy of exporting status. The outcome variable for columns (3) and (4) is an export status dummy that equals 1 if the firm exports in year t *and* it exported to any destination in $t-1$. Firms that exported at least once and had a minimum of US$ 50,000 exported for any year in the period 2012-2019 were considered. Information on exporting status, industry indicator and departmental averages was balanced for the years in which each firm did not export. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry fixed effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. ***, **, * denote significance at the 1, 5, 10 percent significance level.

Source. Own elaboration based on customs data from DANE.

Therefore, Table 7 shows our estimates of the impact of the Venezuelan displaced exodus on the value exported considering only firms that exported every year throughout the entire period of analysis. Considering our preferred specification (Column 3, Panel with IV estimates), we found that an increase in 1 p.p. in the share of Venezuelan immigrants in the labor market caused a positive effect on manufacturing firms' exported value of about 11.4%.[33] Additionally, considering that IV estimates are higher than those of OLS, our results suggest that the OLS coefficients may be a lower bound of the real effect of Venezuelan immigration: Venezuelan immigrants are mostly located in departments closer to the Colombia-Venezuela border, which are departments with lower levels of exports. This endogeneity concern is solved both through the

[33] First stage estimates for the results analysis are shown in Panel A of Table A1.

instrumental variables strategy implemented and the covariates we control for in the regression.

Table 7: Effect of immigration on exports (conditional on exporting every year)

	OLS		
	(1)	(2)	(3)
Share of Immigrants	0.048*	0.016	0.047
	(0.027)	(0.027)	(0.029)
	IV		
Share of Immigrants	0.121***	0.090***	0.114***
	(0.031)	(0.032)	(0.022)
F-statistic	53.31	53.28	186.83
Number of firms	1,156	1,156	1,156
Observations	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes
Region × year	Yes	Yes	Yes
Firm initial cond. × year	No	Yes	Yes
Department controls	No	No	Yes

Notes. Dependent variable: log total exported value in US current FOB dollars (2013-2019). Firms exporting every year throughout 2012-2019 with a minimum of US$ 50,000 per year were considered. Firm initial condition is log exports in 2012. Department controls include the share of skilled workers, the (log) real exchange rate of each department-year, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry fixed effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. ***, **, * denote significance at the 1, 5, 10 percent significance level.
Source. Own elaboration based on customs data from DANE.

To put it in relative terms: in the Oriental region, where most Venezuelans were located, during 2013-2019 the share of migration had an average annual increase close to 1 p.p. while the value exported grew, on average, at an annual rate of 18%. Therefore, taking as a reference our estimates according to which an increase of 1 p.p. represents an increase in export value of 11.4%, we could say that approximately 2/3 of the growth in exports in this region is explained by the Venezuelan migration shock.

Considering the destination countries for exports, in Table 8 we present estimates that take into account the income level of importing countries, as well as their geographical region. Our estimates suggest that the positive effect on exports was driven by exports to High-income countries (column 1), particularly those high-income countries that belong to the OECD (abbreviated as "OECD" in column 2, hereafter we will refer to the group of high per capita income OECD

countries as "OECD") and exports to low-income countries (column 3). Our results indicate that, on average, the effect on exports to OECD countries and low-income countries were more than three times the aggregate effect presented above in Table 7. On average, our estimates suggest that an increase in the share of Venezuelan immigrants of 1 p.p. had a positive effect on exports to OECD and low-income countries close to 49.3% and 36.9%, respectively. Furthermore, the effect on OECD countries appears to be driven by a 28.8% (column 6) rise in the value exported to North America (Canada and the U.S.).

Table 8: Effect of immigration on exported value by income group and region (conditional on exporting every year)

	OLS					
	(1) High-Income	(2) OECD	(3) Low-Income	(4) LAC	(5) EU	(6) N. America
Share of Immigrants	0.050*	0.363***	0.046	-0.082	0.154*	0.152
	(0.028)	(0.123)	(0.133)	(0.074)	(0.089)	(0.124)
	IV					
Share of Immigrants	0.113***	0.493***	0.369***	0.063	0.094	0.288**
	(0.023)	(0.133)	(0.124)	(0.079)	(0.103)	(0.130)
F-statistic	186.83	186.83	186.83	186.83	186.83	186.83
Number of firms	1,156	1,156	1,156	1,156	1,156	1,156
Observations	8,092	8,092	8,092	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Dependent variable: log exported value to each destination group in US current FOB dollars (2013-2019). "OECD" stands for high per capita income countries of the OECD. Firms exporting each year throughout 2012-2019 with a minimum of US$ 50,000 per year were considered. Firm initial condition is log exports in 2012. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry fixed effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. ***, **, * denote significance at the 1, 5, 10 percent significance level.
Source. Own elaboration based on customs data from DANE.

Although the coefficients of the effect of migration on exports to OECD countries and to low-income countries would seem to indicate a similar effect in relative terms, it is important to dimension the export values in terms of how much each destination represents in Colombia's total

exports. In 2013, on average, according to our sample each Colombian department exported a total of 568 million dollars. Of this total, 95.7% was destined to high-income countries and only 4.3% to low-income countries. In turn, of the total exports, 41.3%, on average, went to OECD member countries.

Now, we calculate that between 2013-2019 Venezuelan migration allowed an increase in millions of dollars of exports to OECD countries about 12 times greater than exports to low-income countries (considering the estimated coefficients of Table 8, and the fact that between 2013 and 2019, on average, the share of Venezuelan migrants increased 3.6 p.p.). In other words, although the coefficients may be similar in magnitude for exports to developed and low-income countries, the value exported to the latter group of countries is so small that the aggregate effect of migration would appear to be negligible. Thus, the increase in exports of Colombian manufacturing firms to higher-income countries becomes more relevant.

While the previous two tables provided information on the intensive margin of exports, which indicate the effect of immigrants on the value exported by firms, in Table 9 we estimate the effect of Venezuelan immigration on the extensive margin, which is the probability that plants exported to a given group of countries. Since we restrict our sample to establishments that exported in all the years analyzed, in Table 9 we estimate whether firms that already exported (regardless of destination) did so to OECD countries, low-income countries or countries belonging to Latin America and the Caribbean (LAC), the European Union or North America. We do not asses export status to high-income countries because in our period of analysis, among the firms that exported every year, they exported at least once to a high per capita income country (see Table 3).

Our estimates suggest that the trade-creating effect of immigration increased the likelihood that firms would export to OECD countries, as well as to low-income countries. While the effect on the likelihood of exporting to OECD countries was an increase of about 3.7 p.p., this effect was close to 3.4 p.p. for low-income countries. Furthermore, if we consider the geographical region of the destination countries, we find that there is no significant effect on the probability of plants exporting to the EU, LAC or North American countries.

Table 9: Effect of immigration on the probability of exporting by income group and region (conditional on exporting every year)

	OLS				
	(1) OECD	(2) Low-Income	(3) LAC	(4) EU	(5) N. America
Share of Immigrants	0.029***	0.010	-0.005	0.014*	0.008
	(0.011)	(0.010)	(0.006)	(0.008)	(0.009)
	IV				
Share of Immigrants	0.037***	0.034***	0.005	0.005	0.014
	(0.014)	(0.011)	(0.007)	(0.010)	(0.009)
F-statistic	186.83	186.83	186.83	186.83	186.83
Number of firms	1,156	1,156	1,156	1,156	1,156
Observations	8,092	8,092	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes

Notes. Dependent variable: indicator variable for exporting status that equals 1 if the firm exported at least one dollar to one of the countries belonging to each group (2013-2019). High-income countries not considered because every firm exported at least one dollar per year to one high per capita income country. "OECD" stands for high per capita income countries of the OECD. Firms exporting each year throughout 2012-2019 with a minimum of US$ 50,000 per year were considered. Firm initial condition is log exports in 2012. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry fixed effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. ***, **, * denote significance at the 1, 5, 10 percent significance level.

Source. Own elaboration based on customs data from DANE.

On the other hand, another important result that may indicate a trade-creation effect of immigration on firms is related to the number of different products they export. To analyze this outcome, we consider the number of different product codes for each firm and year. The results presented in Table 10 show that, on average, the effect of Venezuelan immigration was especially positive and statistically significant for those exports to high-income and OECD countries. The magnitudes of the effects suggest an increase of about 3.1%, and 8.1% in the number of different products exported to high-income, and OECD countries, respectively. This positive effect appears to be mainly explained by a rise of 9.0% in the number of products exported to North America. Additionally, the table shows an increase in the number of exported products

to low-income countries of 4.5%.

Table 10: Effect of immigration on number of products exported (conditional on exporting every year)

	OLS					
	(1) High-Income	(2) OECD	(3) Low-Income	(4) LAC	(5) EU	(6) N. America
Share of Immigrants	-0.009	0.045	0.013	-0.039	-0.000	0.047*
	(0.018)	(0.032)	(0.022)	(0.029)	(0.034)	(0.028)
	IV					
Share of Immigrants	0.031**	0.081**	0.045**	-0.019	-0.015	0.090***
	(0.015)	(0.036)	(0.020)	(0.023)	(0.026)	(0.030)
F-statistic	186.83	186.83	186.83	186.83	186.83	186.83
Number of firms	1,156	1,156	1,156	1,156	1,156	1,156
Observations	8,092	8,092	8,092	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes

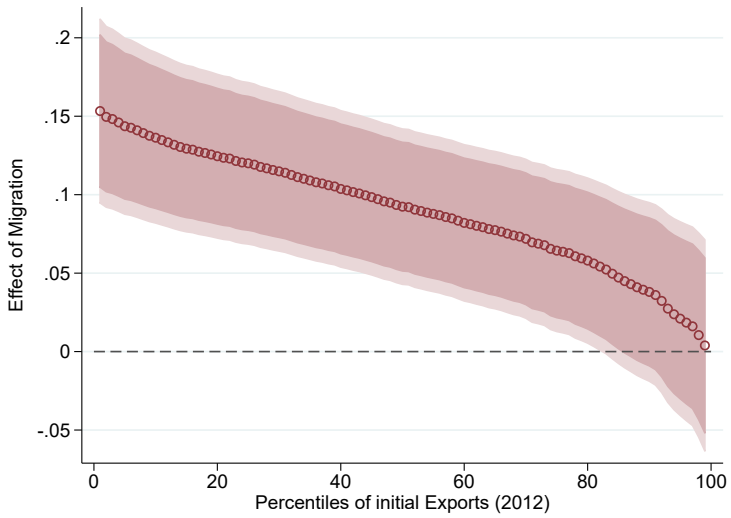
Notes. Dependent variable: number of 10-digits product codes exported to each destination group (2013-2019). "OECD" stands for high per capita income countries of the OECD. Firms exporting each year throughout 2012-2019 with a minimum of US$ 50,000 per year were considered. Firm initial condition is log exports in 2012. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry fixed effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. ***, **, * denote significance at the 1, 5, 10 percent significance level.
Source. Own elaboration based on customs data from DANE.

Finally, we examine whether the effect of Venezuelan immigration was heterogeneous on firms of different sizes that could take differential advantage of the Venezuelan exodus and its economic consequences. To carry out this analysis, we included an interaction term between the immigrant share and the log of exports of each firm in 2012 (before the mass exodus) in equation 1. In Figure 7 these results are shown for each percentile of initial exports. We observe that the lower the level of initial firms' exports, the greater the estimated effect of immigration on the exported value. This indicates that, those plants that were smaller in terms of their integration into the global economy were the ones that could take most advantage of the immigration shock. Thus, as Venezuelan immigrants seem to help firms that initially exported less to export more, immigration would promote convergence of firms' exports.

These results are consistent with the fact that Venezuelan immigrants were not able to regularize their migration status in Colombia until mid-2018 when the government implemented

the PEP-RAMV program; therefore the labor supply shock due to the Venezuelan exodus was mainly concentrated in the informal labor market (Bahar et al., 2021). Small firms are more likely to hire informal workers, then it is expected that these smaller firms could take a greater advantage of the Venezuelan migratory exodus and its consequences in the labor market. According to GEIH for our sample period, on average, Venezuelan employees working in manufacturing firms with 10 or less employees have a 95% likelihood to be hired in informal conditions, whereas that share is close to 35% for those Venezuelan workers employed in firms with more than 20 employees.

Figure 7: Effect on immigration by initial level of exports (conditional on exporting every year)



Notes. For the construction of the figure, equation 1 was estimated by adding the interaction between the share of Venezuelans of each year-department with the log of exports of each firm in 2012. This interaction was instrumented with the interaction between our enclave instrument for each year-department with the log of each establishment's exports in 2012. Subsequently, the estimated effect was calculated for each percentile of the (log) value exported in 2012. In this estimation we did not control for the interaction between the firm initial condition (exports in 2012 in the case of the customs data, as mentioned in Section 4) and year dummies.
Source. Own elaboration based on customs data from DANE.

In conclusion, the evidence presented would seem to indicate that the arrival of displaced Venezuelan immigrants had a trade-creation effect. The sudden nature of the exodus, reinforced by the re-opening of the borders between Colombia and Venezuela in 2016, determined that this effect was concentrated in firms that already had exporting experience. More importantly, the trade-creation effect was heterogeneous in terms of export destinations and appeared to be particularly concentrated in high-income countries: at the intensive margin, exports to high-

income and OECD destinations seem to have increased mainly explained by an increase in the value exported to North American countries; consistently, at the extensive margin, there is evidence of an increase in the probability of exporting to OECD countries. In addition, at both the intensive and extensive margin there is a trade-creation effect to low-income countries. Finally, the evidence shows that there was an increase in the number of products exported to low-income and both high-income and OECD countries (again explained by North America).

The fact that the trade-creation effect varies by export destination is consistent with the hypothesis that Venezuelan immigrant workers enabled firms to hire workers with skills more "compatible" with exports to developed destinations (with more sophisticated product demands) (Verhoogen, 2008; Brambilla et al., 2012; Brambilla and Porto, 2016; Bastos and Silva, 2010).

As suggested by the descriptive statistics (see Section 3.1), Venezuelan workers entering Colombia are, on average, more educated than the Colombian labor force. Particularly they are over-represented among intermediate-skilled workers (see Figure 3). Furthermore, as recent studies analyzing the impact of the Venezuelan exodus on the labor market point out, the mass migration had a significant negative effect on wages (Caruso et al., 2019; Peñaloza-Pacheco, 2019). So, consistently with the hypothesis just put forward, Venezuelan immigration could have lowered labor costs allowing firms to replace blue-collar workers (more likely to be in the middle-skilled segment) with other ones with the required skills to increase exports to high-income and OECD countries. This phenomenon is commonly referred to in the economic literature as skill upgrading (Bustos, 2007). However, we cannot rule out the possibility that the cheapening of labor costs might also have promoted the skill upgrading of white-collar workers due to complementarities between both type of workers.[34]

In the following section we will try to disentangle whether the evidence provided by the manufacturing firms' survey is consistent with this proposed mechanism to explain the trade-creation effect.

6 Mechanism

In this section we will try to shed light on the potential mechanisms underlying the trade-creation effect using the Encuesta Anual Manufacturera (Colombian Annual Manufacturing Survey, EAM for its acronym in Spanish) over the years 2012-2019 in order to specifically analyze the manufacturing firms' universe.

Table 11 shows IV-estimates of the effect of 1 p.p. departmental increase in the share of Venezuelan immigrants relative to local labor force on firm's average annual wages.[35] This departmental increase in displaced immigrants has no effect on average wages of manufacturing workers (column 1). However, the analysis of the heterogeneous effect of the arrival of immi-

[34] It is beyond the scope of this paper to analyze whether the substitution of skilled workers was done for any worker regardless of their nationality or whether the replacement was done for Venezuelan workers.

[35] First stage estimates for the mechanisms analysis are shown in Panel B of Table A1.

grants on pre-exodus exporting and non-exporting firms (column 2)[36] reveals one of the main characteristics of the potential mechanism operating behind the trade-creation effect: the influx of forcibly displaced immigrants had a negative effect of 0.6% on overall average wages of firms that exported in 2012 (Panel [a]+[b]).[37]

More importantly, the EAM allows us to split average wages between those paid to white- and blue-collar workers. Columns (3) and (4) show that there was no effect of Venezuelan immigration on white-collars' average wages. However, relative to non-exporting firms, exporters experienced an extra fall in blue-collar average wages due to immigration of 0.6 p.p. (column 6, Panel [b]). This means that there was a reduction in wages of these workers in exporting firms: a raise of 1 p.p. in the share of Venezuelans relative to the local labor force lowered blue-collars' average wages in 2012 exporting firms by 0.8% on average in the most affected departments, as Panel [a]+[b] of Column (6) depicts.

Together, columns 2, 4 and 6 (interaction with Exp_{2012}) allow us to infer that the Venezuelan migratory exodus had a negative effect on average wages paid by exporting firms in the most affected departments. This effect stemmed from a drop in the wages of blue-collar workers in exporting firms (while there was no wage effect on white-collar workers in either exporting or non-exporting firms).

[36] We carried out this analysis by adding in equation 1 an interaction term between a dummy of firm exporting status in 2012 and the share of Venezuelans in each department-year. This interaction was instrumented with the interaction between this indicator variable and our enclave instrument for each department-year. We consider this dummy of exporting in 2012 as an heterogeneous effect between exporting and non-exporting firms. Our estimates indicate that those firms that exported in 2012 are 66% more likely to export at least once in the following years. We do not use a contemporaneous export dummy because it may be endogenous to the migration shock. Furthermore, by controlling in our main estimates for firm size (measured in logs of sales) we gain more confidence that the 2012 export dummy is capturing the exporting status of the firm and not firm size.

[37] Relative to a non-statistically significant baseline effect on wages in non-exporting firms in 2012 (Column 2, Panel [a]), on average, an increase in the share of immigrants by 1 p.p. generated exporters paying a significantly lower wage by 0.4 p.p. compared to non-exporters in the departments most affected by migration (Column (2), Panel [b]).

Table 11: Channels - IV estimates on firms' average wages

	All		White-collar		Blue-collar	
	(1)	(2)	(3)	(4)	(5)	(6)
[a] Share of immigrants	-0.003	-0.002	0.004	0.004	-0.003	-0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
[b] Immig. x Exp_{2012}		-0.004**		-0.002		-0.006***
		(0.002)		(0.003)		(0.002)
[a] + [b]		-0.006		0.003		-0.008
P-value		[0.057]		[0.608]		[0.019]
F-Statistic	209.22	105.84	209.22	105.84	209.22	105.84
Number of firms	5,269	5,269	5,269	5,269	5,269	5,269
Observations	36,883	36,883	36,883	36,883	36,883	36,883
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Columns 1-6 are IV regressions. Dependent variables in second stage: log average wages (columns 1-2), log average wages of white-collar workers (columns 3-4), and log average wages of blue-collar workers (columns 5-6). Balanced panel of firms (2012-2019). We excluded owners and interns from calculations. The share of Venezuelan immigrants in each Colombian department is instrumented through our enclave instrument (see Section 4). The product between the department-year share of Venezuelans and the 2012 export dummy (Panel [b]) is instrumented with our enclave instrument multiplied by the same 2012 export dummy. Firm initial condition is log of sales in 2012. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. P-value of the linear combination of exporting and non-exporting firms' coefficients in brackets (Panel [a]+[b]). ***, **, and * denote significance at the 1, 5, and 10 percent significance level.
Source. Own elaboration based on data from DANE's Annual Manufacturing Survey.

Table 12 depicts the effect of Venezuelan immigration on firms' employment. The table shows that there was a slight fall of 0.6% in the average number of workers hired by firms (Column 1). According to Column (2) there appears to be a decrease in employment in 2012 exporters (1% decline, Panel [a]+[b]) in response to an 1 p.p. increase in Venezuelan immigration relative to the local labor force. The effect seems to be relatively small, so our estimates cannot tell apart if it comes from a fall in employment of white- or blue-collar workers: all estimates are very small and not statistically different from zero (Columns 3-6). These results are consistent with those found by the literature studying labor market effects of the Venezuelan exodus:

although immigrants caused wages to fall, no effect on employment was found (Caruso et al., 2019; Peñaloza-Pacheco, 2019).[38]

Table 12: Channels - IV estimates on employment

	All		White-collar		Blue-collar	
	(1)	(2)	(3)	(4)	(5)	(6)
[a] Share of immigrants	-0.006*	-0.004	-0.001	0.000	-0.002	-0.001
	(0.004)	(0.004)	(0.007)	(0.007)	(0.004)	(0.004)
[b] Immig. x Exp_{2012}		-0.005**		-0.004		-0.006
		(0.002)		(0.004)		(0.004)
[a] + [b]		-0.010		-0.003		-0.006
P-value		[0.008]		[0.639]		[0.259]
F-statistic	209.22	105.84	209.22	105.84	209.22	105.84
Number of firms	5,269	5,269	5,269	5,269	5,269	5,269
Observations	36,883	36,883	36,883	36,883	36,883	36,883
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Columns 1-6 are IV regressions. Dependent variables in second stage: log of number of workers (columns 1-2), log number of white-collar workers (columns 3-4) and log number of blue-collar workers (columns 5-6). Balanced panel of firms (2012-2019). We excluded owners and interns from calculations. The share of Venezuelan immigrants in each Colombian department is instrumented through our enclave instrument (see Section 4). The product between the department-year share of Venezuelans and the 2012 export dummy (Panel [b]) is instrumented with our enclave instrument multiplied by the same 2012 export dummy. Firm initial condition is log of sales in 2012. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. P-value of the linear combination of exporting and non-exporting firms' coefficients in brackets (Panel [a]+[b]). ***, **, and * denote significance at the 1, 5, and 10 percent significance level.
Source. Own elaboration based on data from DANE's Annual Manufacturing Survey.

Taken together, columns 2, 4 and 6 of Tables 11 and 12 (interaction with pre-exodus exporting status) allow us to infer two results that could be related to the trade-creation effect.

[38] These results are also in line with the fact that the PEP program (the largest migratory amnesty program offered to undocumented migrants in Colombia), which was expected to have a greater impact on manufacturing firms because it gave undocumented immigrants the possibility of working in the formal sector, had only negligible effects on formal employment (negative for Colombian highly educated and female workers and positive for Venezuelan workers) (Bahar et al., 2021).

On the one hand, the arrival of immigrants exerted downward pressure on wages paid to blue-collar workers in exporting firms, which was reflected in an average drop in wages paid by firms connected to the global economy. On the other hand, the exodus had no (or negligible) effects on blue- and white-collar employment, both for exporting and non-exporting firms.

The fall in wages could have allowed manufacturing exporting plants to replace (there is no employment effect) their labor force with more skilled blue-collar workers who are more compatible with exports to high per capita income destinations. In addition, due to complementarities between blue- and white-collar workers when performing tasks related to the exporting activity, lower labor costs could have improved the quality of all labor inputs in the production process, thus positively affecting firms' performance in the international market.

Considering this hypothesis, we should be able to distinguish an improvement in the quality of labor hired by manufacturing firms in Colombia, that is, a higher participation of skilled workers in both the blue-collar and white-collar groups.

The EAM does not have a question about the level of education of workers in the firms. However, we can examine the hypothesis proposed with the Technological Development and Innovation Survey (EDIT for its acronym in Spanish) which asks questions related to innovation, skills and technology for the EAM's manufacturing firms. As mentioned in Section 2, we are left with a balanced panel of 4,362 single-plant companies after merging the EDIT with the EAM.

One of the most important advantages of the EDIT is that it asks about the number of workers that companies have according to their level of education. With this in mind, we divide the number of workers in each firm as follows: we consider as blue-collar workers those with complete secondary education or less (i.e., primary education or no education at all); hereafter we will refer to these workers as unskilled employees. As white-collar workers we will consider those employees with more than complete secondary education (i.e., technicians, technologists, professionals, professionals with a specialization, and professionals with a masters or PhD degree); hereafter we will refer to these workers as skilled employees. To verify the accuracy of this classification, in Figure A1 we show the binscatter of the number of white/blue collar workers in each firm according to EAM and the number of skilled/unskilled workers according to EDIT, respectively. As can be seen, there is a strong positive relationship between the two variables, with the slope of the linear regression for both estimates close to 1. This exercise indicates that our classification of skilled and unskilled workers as white-collar and blue-collar workers by EDIT's educational level is a good proxy.

Once we divide the number of workers from EDIT into skilled and unskilled workers and relate these groups to white-collar and blue-collar workers, respectively, we analyze the effect of the Venezuelan exodus on the skill composition within each of the two groups (white-collar and blue-collar). According to our hypothesis, it is expected that lower employee hiring costs due to the increased supply of highly skilled labor in Colombia will allow firms to improve their skill composition and hire more skilled workers in each group, which is usually referred in the literature as skill-upgrading (Bustos, 2007). Thus, skill upgrading could positively affect the quality of exporting firms' production processes, improving their export performance and working as an important mechanism underlying the trade-creation effect of the Venezuelan

migration presented above.

To estimate whether there was skill upgrading of the labor force for white-collar and blue-collar workers, we will define the proportion of high quality workers for each group as follows:

$$WC^{HQ} = \frac{W^s}{W^s + W^u} \tag{3}$$

$$BC^{HQ} = \frac{B^s}{B^s + B^u} \tag{4}$$

Where WC^{HQ} is the proportion of high-quality white-collar workers and BC^{HQ} is the proportion of high-quality blue-collar workers. We define W^s as the total number of workers with a university degree or higher (postgraduate) and W^u as the total number of workers with more than completed secondary and less than a university degree, i.e., technicians and technologists (tertiary degree). Finally, we define B^s as the number of workers with completed secondary and B^u as the total number of workers with less than completed secondary (i.e., completed primary or no formal education). We will consider as skill upgrading within white-collar workers an increase in the share of high quality white-collar workers (WC^{HQ}), i.e., an increase in the share of the most skilled workers among those with high levels of education. On the other hand, we will refer to a skill upgrade within blue-collar workers as an increase in high-quality blue-collar workers (BC^{HQ}), i.e., an increase in the share of higher-skilled workers among those with low levels of education.

Then, we estimate the same regressions presented above but changing the dependent variable to WC^{HQ} and BC^{HQ}. The results are presented in the Table 13.[39] According to our estimates, the influx of Venezuelans in Colombia had a positive effect on the skill composition within white-collar and blue-collar workers by increasing the proportion of workers with the highest level of education within each group (with some heterogeneities, though). We can see that a 1 p.p. increase in the proportion of Venezuelan immigrants relative to the local labor force increases the proportion of high-quality white-collar workers, on average, by 1.2 p.p. for our entire sample and by 1 p.p. for exporting firms. On the other hand, we find that the positive effect of the Venezuelan exodus in the share of high-quality blue-collar workers is present only in exporting firms: on average, our estimates indicate an increase in the share of high-quality blue-collar workers of 1 p.p. explained by a 1 p.p. increase in the share of Venezuelan immigrants.

These results are consistent with the channel presented in this paper: the increase in the skilled labor supply due to the Venezuelan exodus decreased the price of hiring more skilled white-collar and blue-collar workers for manufacturing firms, especially blue-collar workers in exporting firms (the wage effect would seem to be concentrated in this segment). In summary, lower labor costs in the departments most affected by migration could have improved the competitiveness of exporting companies, allowing them to improve the quality of their labor inputs and, therefore, their export performance.

[39] In order to balance the panel of manufacturing firms, we drop from our sample those firms that reported 0 white-collar or blue-collars workers in at least one year of the period under study.

Table 13: Channels - IV estimates on skill upgrading

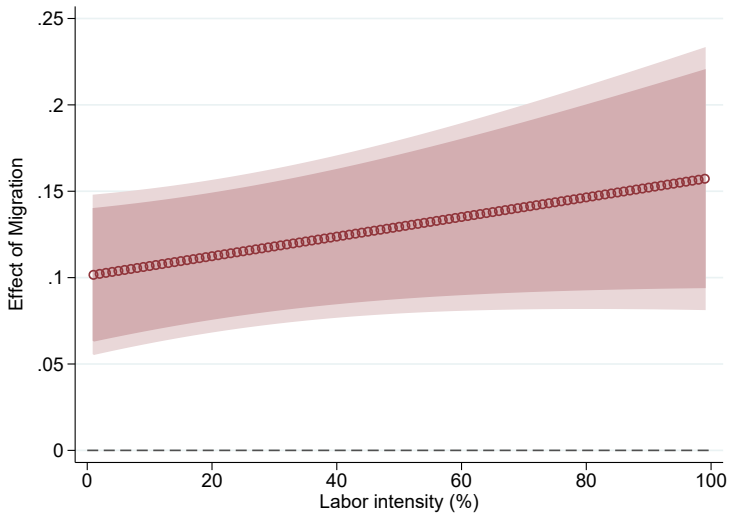
	White-collar		Blue-collar	
	(1)	(2)	(3)	(4)
[a] Share of immigrants	0.012***	0.013***	0.006	0.004
	(0.004)	(0.005)	(0.004)	(0.004)
[b] Immig. x Exp_{2012}		-0.003		0.006**
		(0.002)		(0.003)
[a] + [b]		0.010		0.010
P-value		[0.035]		[0.015]
F-statistic	169.02	89.17	169.02	89.17
Number of firms	4,362	4,362	4,362	4,362
Observations	26,172	26,172	26,172	26,172
Firm FE	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes

Notes. Columns 1-4 are IV regressions. Dependent variables in second stage: share of workers with university studies or higher relative to workers with more than complete secondary (columns 1-2) and share of workers with complete secondary relative to workers with complete secondary, primary studies or none official education (columns 3-4). Balanced panel of firms (2012-2019). We excluded owners and interns from calculations. The share of Venezuelan immigrants in each Colombian department is instrumented through our enclave instrument (see Section 4). The product between the department-year share of Venezuelans and the 2012 export dummy (Panel [b]) is instrumented with our enclave instrument multiplied by the same 2012 export dummy. Firm initial condition is log of sales in 2012. Department controls include the share of skilled workers, the (log) real exchange rate, and GDP per capita for the year 2000 of each department interacted with annual dummies. Industry fixed effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. P-value of the linear combination of exporting and non-exporting firms' coefficients in brackets (Panel [a]+[b]). ***, **, and * denote significance at the 1, 5, and 10 percent significance level.
Source. Own elaboration based on data from DANE's EAM and EDIT.

Finally, it is expected that if the mechanism explaining the trade creation effect operates through the lowering of wages and the skill-upgrading of white- and blue-collar workers, then the positive effect on exports should be stronger for more labor-intensive industries. In Figure 8, we present estimates of the effect of the Venezuelan exodus considering the labor intensity for each 4-digit Colombian manufacturing industries. Using the EAM, we calculate the labor intensity (the share that the wage bill has between the wage bill and fixed assets value) of the industries at

4-digits ISIC before the Venezuelan exodus (in 2012). Then, we considered this industry-labor-intensity index in the customs database by including an interaction term between the share of Venezuelan immigrants in local labor markets and the industry index in equation 1. This allows us to explore the impact of forced migration on total exports by percentiles of industrial average labor intensity. The figure is consistent with our hypothesis of labor competitiveness: the more labor-intensive the industry in which the firm produces, the greater the effect of Venezuelan immigration on exported value.

Figure 8: Effect on exported value by labor intensity of industry (conditional on exporting every year)



Notes. For the construction of the figure, equation 1 was estimated by adding the interaction between the share of Venezualan immigrants of each year-department with our 2012 industry labor intensity index (see text) for each 4-digit industry of ISIC Rev.4. This interaction was instrumented with the interaction between the 2012 industrial labor intensity index and the instrument for each year-department.
Source. Own elaboration based on customs data and Annual Manufacturing Survey from DANE.

Taken together, these findings could account for the trade-creation effect of the Venezuelan immigration. The fall in blue-collars' wages in the Colombian departments most affected by the labor supply shock would have eased labor costs for exporting firms, especially in more labor-intensive goods manufacturing. As Venezuelans are more skilled than locals and over-represented among the high-school educated (see Section 3.1), they would have cheapened skilled labor force particularly in the blue-collar segment. This would have allowed firms to hire workers more compatible with exporting to developed countries (skill-upgrading of both blue- and white-collar due to complementarities in the production process).[40]

[40] Therefore, two hypotheses can be put forward as to how workers are replaced by others with greater export-compatible skills. On the one hand, firms could replace workers regardless of their nationality and, on the other hand, it could be the case that Colombian workers are replaced by Venezuelan workers.

7 Robustness checks and threats to the identification strategy

7.1 Robustness checks: changing the instrument

In this section, we perform several robustness exercises to provide further evidence of the mechanisms suggested in this paper and more confidence about the empirical strategy implemented. First, we estimate our main results by changing the instrumental variable proposed in equation 2. To conduct these exercises, we consider a set of seven additional instruments usually used in the literature: five of them with an intuition similar to the one proposed in equation 2, i.e. considering the distance (or travel time) between each Colombian department and the Venezuelan states, and two of them that will consider the previous distribution of Venezuelan immigrants in Colombia in the past (Card, 2001).

The first five instruments are a transformation of the equation 2 considering one of the following variations: i) changing the variable K_{drs} by a new variable T_{drs} that represents the travel time from the department d in the region r of Colombia to the Venezuelan state s under normal conditions (hereafter we will refer to this variation as the "time" variation); ii) by changing the variable α_s, which represents the proportion of Venezuelans in each Venezuelan state, to the variable ω_s, which represents the proportion of Colombian immigrants living in each Venezuelan state s (we will refer to this variation as the "network" variation); iii) the last modification of our instrumental variable will come from the source on which we rely to calculate the distance between each Colombian department and each Venezuelan state: instead of considering the distance calculated by the Stata command *Georoute*, we will consider the distance calculated using Google Maps.

The "time" and Google Maps variations are changes in the instrumental variable that are based on the source on which we rely to construct our instrumental variable that do not affect the general intuition of the instrument, however the "network" variation does change the interpretation of the instrument: when the instrument was constructed by considering the variable α_s (i.e. the proportion of Venezuelans in each Venezuelan state prior to the migratory exodus), the intuition was that we expected that those Colombian departments closer (in terms of distance or travel time), on average, to the Venezuelan states with a higher level of population density, would receive a greater number of Venezuelan immigrants. On the other hand, when the instrument is constructed considering the variable ω_s (i.e. the proportion of Colombians in each Venezuelan state s), the intuition is more related to a "network" argument. In short, it is expected that those Colombian departments located closer to Venezuelan states with a higher proportion of Colombians (ω_s), will receive a larger number of Venezuelan immigrants because of the networks created between the Colombians and Venezuelan while living together in the Venezuelan state s, making it "easier" for them to migrate to Colombia and settle there.

Taking these three variations into account, we were able to construct five instruments:

It is beyond the scope of the paper, given the data we have, to answer this question. The evidence we have could be consistent with both hypotheses.

Distance-Density-Google instrument, Distance-Network-Google instrument, Distance-Network Georoute instrument, Time-Density-Georoute instrument and Time-Network-Georoute instrument.

In addition, we also estimate our main results by completely changing the enclave instrument of the equation 2 to the traditional *shift-share* instrument considered in the migration and trade economics literature (Card, 2001). We calculate the *shift-share* instrument as follows:

$$SS_{drt} = \frac{V_t}{P_{drt}} z_{dr}^{u} \tag{5}$$

where V_t is the stock of Venezuelan immigrants in Colombia in period t, P_{drt} is the Colombian labor force in department d, region r and period t and, finally, z_{dr}^{u} is the share of Venezuelan immigrants living in each Colombian department d in region r in year u. For this instrument we will consider two variations that will rely on the year u of equation 5. First, we will estimate the *shift-share* instrument considering the Venezuelan share of immigrants living in each Colombian department in 2005 (i.e. $u = 2005$), then we will estimate the instrument with the Venezuelan share of immigrants in each department in 1993 (i.e. $u = 1993$). The intuition of this *shift-share* instrument is based on a network argument: it is expected that those departments with a higher proportion of Venezuelan immigrants in the past (in our case 1993 and 2005) will receive a greater number of Venezuelan migrants in the present, given that the networks and relations with Venezuelans already settled there could facilitate the adaptation process of these incoming immigrants.

Therefore, we re-estimate our main results of the effect of the Venezuelan exodus on the value exported (in logarithms) of Colombian manufacturing firms (in total and for each destination group estimated previously) by considering each of the seven instrumental variables described above. Each point estimate is shown in Figure B1 in the Appendix. As we can observe, our estimates remain strongly robust to any of the variations in the instruments, thus providing evidence that our estimates do not depend on the choice of the instrumental variable.

7.2 Robustness checks: excluding main departments

An additional concern might be that our estimations are mostly concentrated in one of Colombia's bigger and more developed departments, i.e. Bogotá, Antioquia, Valle del Cauca or Atlántico, which account for about 81% of all manufacturing firms in our sample. In order to ensure that our estimates are not driven exclusively by one of these departments, but by the aggregate effect of Venezuelan immigration in all Colombian departments, we re-estimate our main results by sequentially excluding each of these departments. The results are shown in Figure B2 in the Appendix. As can be seen, our estimates are clearly robust to the exclusion of any of these main Colombian departments.

7.3 Robustness checks: variation in firms' size constraint

To check whether our results depend on the threshold chosen in terms of the minimum value exported per year (US$50,000), we re-estimate our main export effects by changing this threshold progressively up to the value of US$10,000, which represents the average wage paid to workers in exporting manufacturing firms according to the Table 2. As can be seen in Table B1 in the Appendix, our estimates are robust to the change of this threshold and they are hold even for the most flexible restriction of US$10,000.

7.4 Potential threats to the identification strategy: Bilateral trade between Colombia and Venezuela

Another concern that could threaten our identification strategy could be related to the fact that companies located in the departments closest to the Colombia-Venezuela border could be strongly affected by the Venezuelan economic crisis and the fall in aggregate demand in that country. For example, it could be the case that the fall in Venezuelan activity could negatively affect the labor market and the economy of the Colombian departments closest to the border, reducing labor demand and wages in these departments, which could improve the competitiveness of firms through this channel instead of the migration channel. To address this concern, we re-estimate our main results by including an additional control in our econometric specification: we include the initial level of trade volume (exports and imports) between each Colombian department and Venezuela in 2010 (before the mass exodus) interacting with year dummies. This additional control allows us to control for differential trends across each department considering previous exposure to international trade with Venezuela and the neighboring country's economy. The results in Appendix Table B2 show that our estimates are not affected by the inclusion of this additional control, providing additional evidence in line with the mechanisms proposed above.

7.5 Potential threats to the identification strategy: Free Trade Agreements in the analyzed period

Finally, an additional threat to our identification strategy could be that our estimated effects are not explained by the migratory exodus of Venezuelans but by the free trade agreements that the Colombian government has signed in the 2010s with several groups of countries. Specifically, according to MinCIT (2019), between 2011 and 2016 the Colombian government signed free trade agreements with Canada and the European Free Trade Association (EFTA) in 2011, the United States and Venezuela in 2012, the European Union in 2013 and, finally, with Costa Rica, the Pacific Alliance and South Korea in 2016. These free trade agreements could positively have affected the export performance of Colombian firms, which might be a potential confounding factor for our estimates. To solve this potential problem, we include as a control in our estimates the total value of trade (exports and imports) in 2010 (i.e., before our period of analysis)

between each department of Colombia, from DANE information, and each of these country groups separately, interacting with year dummy variables, as we did in Table B2.

These interactions allow us to control for possible different trends and time-varying shocks that differ between departments depending on their previous level of trade exposure with each of these groups of countries. The results are presented in Table B3. Our estimates remain robust to the inclusion of these additional controls, which provide evidence supporting that the positive effect on the export performance of manufacturing firms that we found earlier was explained by the Venezuelan exodus and the upgrading of the labor force hired by Colombian firms.

8 Concluding remarks

We analyzed the effects of a large labor supply shock caused by Venezuelan forced migration on the exporting performance of manufacturing firms in Colombia. To that end, we exploited the heterogeneity of Venezuelan forced migrants settlements' location in the Colombian departments and their evolution over time through an enclave instrument that takes advantage of driving-distances between neighboring districts and the forced nature of the migration episode. We find a significant trade-creation effect of the Venezuelan exodus, both in the extensive and intensive margins, primarily to OECD and North American countries on exporting firms. The effect is stronger for firms that exported less prior to the exodus.

We further explored the potential channels that could explain these findings. In the more affected departments, exporting firms faced a drop in their blue-collar workers wages. Furthermore, we found negligible negative effects on employment that became non-statistically significant when we tried to discern whether they came from blue- or white-collar workers. Likewise, this labor costs reduction allowed firms to skill-upgrade their workforce. This is consistent with firms being able to hire workers more compatible with exports to developed destinations due to cheaper blue-collar labor.

The mechanisms found are new to the trade-migration literature and reconcile the labor market effects found by previous works with international trade effects in a context of forced migration.

In light of the evidence presented in this paper, it is expected that Colombian exporting firms benefiting from the Venezuelan exodus (and, potentially, the most productive ones) may have significant improvements in the quality of their exported products and greater differentiation in the set of products offered to the international market. These topics are beyond the scope of this paper and should be studied in greater depth in future research projects.

References

Accetturo, A., Bugamelli, M., and Lamorgese, A. R. (2013). Skill Upgrading and Exports. *Economics Letters*, 121(3):417–420.

Altındağ, O., Bakış, O., and Rozo, S. V. (2020). Blessing or Burden? Impacts of Refugees on Businesses and the Informal Economy. *Journal of Development Economics*, 146:102490.

Bahar, D., Ibáñez, A. M., and Rozo, S. V. (2021). Give me your Tired and your Poor: Impact of a Large-scale Amnesty Program for Undocumented Refugees. *Journal of Development Economics*, 151:102652.

Bastos, P. and Silva, J. (2010). The Quality of a Firm's Exports: Where you Export to Matters. *Journal of International Economics*, 82(2):99–111.

Beerli, A., Ruffner, J., Siegenthaler, M., and Peri, G. (2021). The Abolition of Immigration Restrictions and the Performance of Firms and Workers: Evidence from Switzerland. *American Economic Review*, 111(3):976–1012.

Brambilla, I., Lederman, D., and Porto, G. (2012). Exports, Export Destinations, and Skills. *American Economic Review*, 102(7):3406–38.

Brambilla, I., Lederman, D., and Porto, G. (2017). Exporters, Engineers, and Blue-collar Workers. *The World Bank Economic Review*, 30(Supplement_1):S126–S136.

Brambilla, I. and Porto, G. G. (2016). High-income Export Destinations, Quality and Wages. *Journal of International Economics*, 98:21–35.

Bustos, P. (2007). The impact of trade on technology and skill upgrading: Evidence from argentina. *Universitat Pompeu Fabra*.

Bustos, P. (2011). Trade liberalization, exports, and technology upgrading: Evidence on the impact of mercosur on argentinian firms. *American economic review*, 101(1):304–40.

Card, D. (2001). Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration. *Journal of Labor Economics*, 19(1):22–64.

Caruso, G., Canon, C. G., and Mueller, V. (2019). Spillover Effects of the Venezuelan Crisis: Migration Impacts in Colombia. *Oxford Economic Papers*.

Del Carpio, X. V. and Wagner, M. (2015). The Impact of Syrian Refugees on the Turkish Labor Market. *World Bank Policy Research Paper, No. 7402*.

Dustmann, C. and Glitz, A. (2015). How do industries and firms respond to changes in local labor supply? *Journal of Labor Economics*, 33(3):711–750.

Görg, H., Halpern, L., and Muraközy, B. (2017). Why do Within-firm–product Export Prices Differ Across Markets? Evidence from Hungary. *The World Economy*, 40(6):1233–1246.

Gould, D. M. (1994). Immigrant Links to the Home Country: Empirical Implications for US Bilateral Trade Flows. *The Review of Economics and Statistics*, pages 302–316.

Hallak, J. C. and Schott, P. K. (2011). Estimating Cross-country Differences In Product Quality. *The Quarterly journal of economics*, 126(1):417–474.

Head, K. and Ries, J. (1998). Immigration and Trade Creation: Econometric Evidence from Canada. *Canadian journal of economics*, pages 47–62.

Hiller, S. (2013). Does Immigrant Employment Matter for Export Sales? Evidence from Denmark. *Review of World Economics*, 149(2):369–394.

Kerr, S. P., Kerr, W. R., and Lincoln, W. F. (2015). Skilled Immigration and the Employment Structures of US Firms. *Journal of Labor Economics*, 33(S1):S147–S186.

Lewis, E. (2011). Immigration, Skill Mix, and Capital Skill Complementarity. *The Quarterly Journal of Economics*, 126(2):1029–1069.

Macis, M. and Schivardi, F. (2016). Exports and Wages: Rent Sharing, Workforce Composition, or Returns to Skills? *Journal of Labor Economics*, 34(4):945–978.

Malchow-Møller, N., Munch, J. R., and Skaksen, J. R. (2012). Do Immigrants Affect Firm-specific Wages? *The Scandinavian Journal of Economics*, 114(4):1267–1295.

Manova, K. and Zhang, Z. (2012). Export Prices Across Firms and Destinations. *The Quarterly Journal of Economics*, 127(1):379–436.

Martin, J. (2012). Markups, Quality, and Transport Costs. *European Economic Review*, 56(4):777–791.

MinCIT (2019). Informe sobre los Acuerdos Comerciales Vigentes de Colombia. Available at: http://www.tlc.gov.co/temas-de-interes/informe-sobre-el-desarrollo-avance-y-consolidacion/documentos/ley-1868-informe-2019.aspx (Last accessed: May 28, 2021). *Ministry of Commerce, Industry and Tourism - Colombia.*

Minnesota Population Center (2020). Integrated Public Use Microdata Series, International: Version 7.3 [dataset]. *Minneapolis, MN: IPUMS 2020.*

Mitaritonna, C., Orefice, G., and Peri, G. (2017). Immigrants and Firms' Outcomes: Evidence from France. *European Economic Review*, 96:62–82.

Morales, J. S. (2018). The Impact of Internal Displacement on Destination Communities: Evidence from the Colombian Conflict. *Journal of Development Economics*, 131:132–150.

Ottaviano, G. I. P., Peri, G., and Wright, G. C. (2018). Immigration, Trade and Productivity in Services: Evidence from UK Firms. *Journal of International Economics*, 112:88–108.

Peñaloza-Pacheco, L. (2019). Living with the Neighbors: the Effect of Venezuelan Forced Migration on Wages in Colombia. *CEDLAS Working Papers, No. 248*.

Peri, G. and Requena-Silvente, F. (2010). The Trade Creation Effect of Immigrants: Evidence from the Remarkable Case of Spain. *Canadian Journal of Economics/Revue canadienne d'économique*, 43(4):1433–1459.

Peri, G. and Sparber, C. (2009). Task Specialization, Immigration, and Wages. *American Economic Journal: Applied Economics*, 1(3):135–69.

Rozo, S. V. and Vargas, J. F. (2021). Brothers or Invaders? How Crisis-driven Migrants Shape Voting Behavior. *Journal of Development Economics*, 150:102636.

UNHCR (2019). Global Trends: Forced Displacement in 2019. *Technical Report, The UN Refugee Agency*.

Verhoogen, E. A. (2008). Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector. *The Quarterly Journal of Economics*, 123(2):489–530.

Weber, S. and Péclat, M. (2017). A Simple Command to Calculate Travel Distance and Travel Time. *The Stata Journal*, 17(4):962–971.

Appendix A

Table A1: First stages estimates

	Panel A: Export First Stage		
	(1)	(2)	(3)
Instrument	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.000)
F-statistic	53.31	53.28	186.83
Number of firms	1,156	1,156	1,156
Observations	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes
Region × year	Yes	Yes	Yes
Firm initial cond. × year	No	Yes	Yes
Department controls	No	No	Yes
	Panel B: Mechanisms First Stage		
	(1)	(2)	(3)
Instrument	0.005***	0.005***	0.006***
	(0.001)	(0.001)	(0.000)
F-statistic	73.15	71.78	209.22
Number of firms	5,269	5,269	5,269
Observations	36,883	36,883	36,883
Firm FE	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes
Region × year	Yes	Yes	Yes
Firm initial cond. × year	No	Yes	Yes
Department controls	No	No	Yes

Notes. The dependent is the share of Venezuelan immigrants relative to the local labor force. Panel A corresponds to the estimates from the first stage of the regressions on firms' exports. Panel B corresponds to the estimates from the first stage of the regressions on the mechanisms. Panel A: Firms with a minimum of US $50,000 exported for each year in the period 2012-2019 were considered. Department controls include the share of skilled workers, the real (log) exchange rate for each department-year, and GDP per capita for the year 2000 for each department interacted with annual dummies. Panel B: The initial firm condition is the logarithm of sales in 2012. Department controls are the same as in Panel A. Industry effects are defined at the two-digit level. Standard errors clustered at the department-year level in parentheses. ***, **, * denote significance at the 1, 5, 10 percent significance level.

Source. Own elaboration based on customs data and the Annual Manufacturing Survey from DANE.

Table A2: Effect of immigration on probability of exporting by income level of destination

	OLS		
	High income	OECD	Low income
Share of Immigrants	0.000	0.005	-0.004**
	(0.005)	(0.003)	(0.002)
	IV		
	High income	OECD	Low income
Share of Immigrants	0.001	0.004	-0.002
	(0.007)	(0.003)	(0.002)
F-statistic	342.10	342.10	342.10
Number of firms	4,435	4,435	4,435
Observations	31,045	31,045	31,045
Firm FE	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes
Region × year	Yes	Yes	Yes
Department controls	Yes	Yes	Yes

Notes. Firms with a minimum of US$50,000 exported for each year in the period 2012-2019 were considered. Regional controls include the proportion of skilled workers and the real exchange rate (log) of each department-year. Economic controls include the unemployment rate, the informality rate, the proportion of employees in low-tech manufacturing, in the rest of manufacturing, in retailing, and the GDP per capita of each department in 2000 interacted with annual dummies.

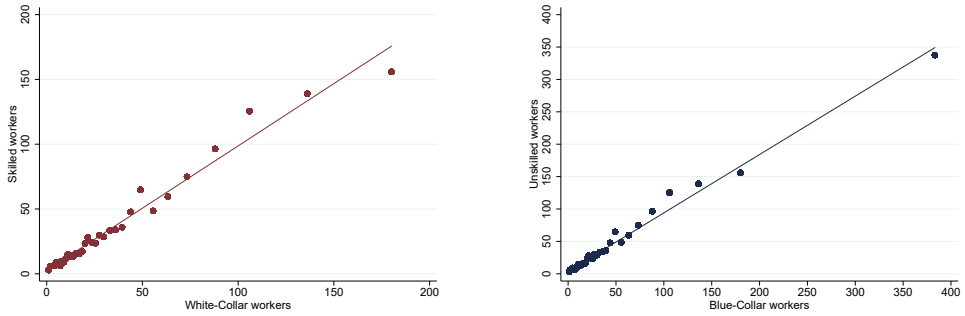
Source. Own elaboration based on data from DANE.

Table A3: Effect of immigration on probability of exporting given that the firm exported in $t-1$ by income level of destination

	OLS		
	High income	OECD	Low income
Share of Immigrants	0.007***	0.007***	-0.003**
	(0.002)	(0.002)	(0.002)
	IV		
	High income	OECD	Low income
Share of Immigrants	0.009***	0.008***	-0.002
	(0.003)	(0.002)	(0.002)
F-statistic	342.10	342.10	342.10
Number of firms	4,435	4,435	4,435
Observations	31,045	31,045	31,045
Firm FE	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes
Region × year	Yes	Yes	Yes
Department controls	Yes	Yes	Yes

Notes. The outcome variable is an export status dummy that equals 1 if the firm exports to any of the destination groups in year t *and* it exported to any destination in $t-1$. Firms with a minimum of US$50,000 exported for each year in the period 2012-2019 were considered. Regional controls include the proportion of skilled workers and the real exchange rate (log) of each department-year. Economic controls include the unemployment rate, the informality rate, the proportion of employees in low-tech manufacturing, in the rest of manufacturing, in retailing, and the GDP per capita of each department in 2000 interacted with annual dummies.
Source. Own elaboration based on data from DANE.

Figure A1: Relationship between number of white/blue collar and skilled/unskilled workers



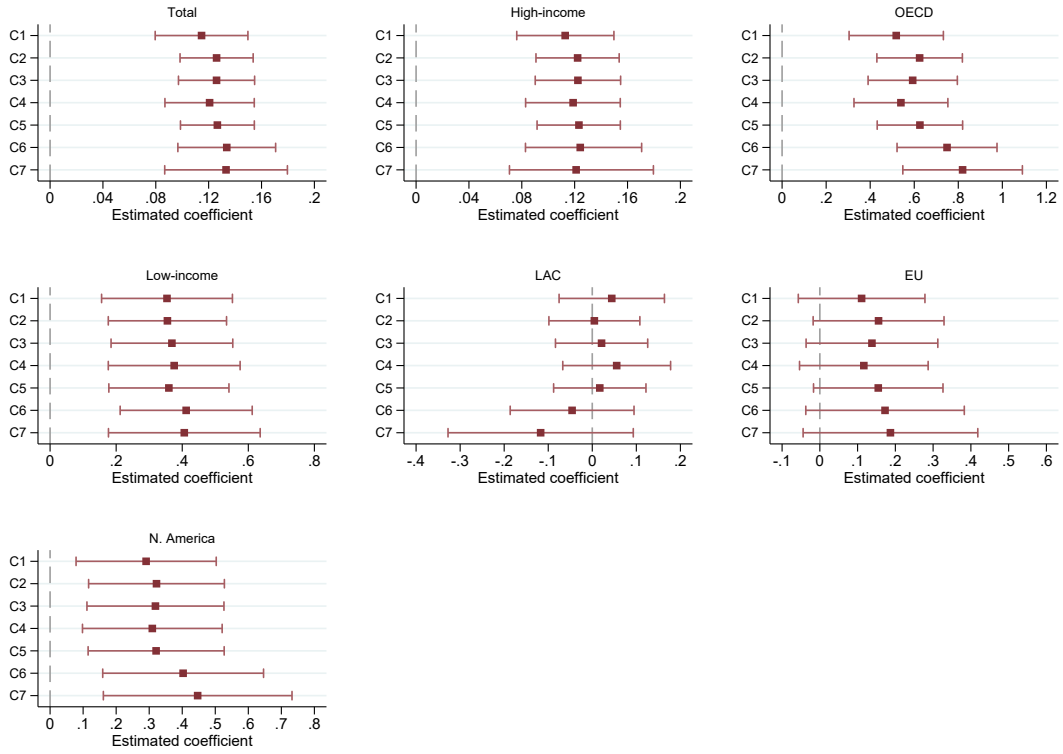
(a) White collars and Skilled workers (b) Blue collars and Unskilled workers

Notes. The figures show the relationship between the number of skilled/unskilled workers and white/blue collars in 2013, previous to the migratory exodus of Venezuelans. The number of skilled and unskilled workers were obtained from EDIT-DANE. Skilled workers are defined as those with more than complete secondary (i.e., technicians, technologists, professionals, professionals with a specialization, and professionals with a master's or doctoral degree); unskilled workers are defined as those with complete secondary or less (i.e. complete primary or no formal education). The number of white-collar and blue-collar workers were obtained from EAM-EDIT (See the definition of each category in section 2).

Source. Own elaboration based on data from EDIT-DANE and EAM-DANE.

Appendix B

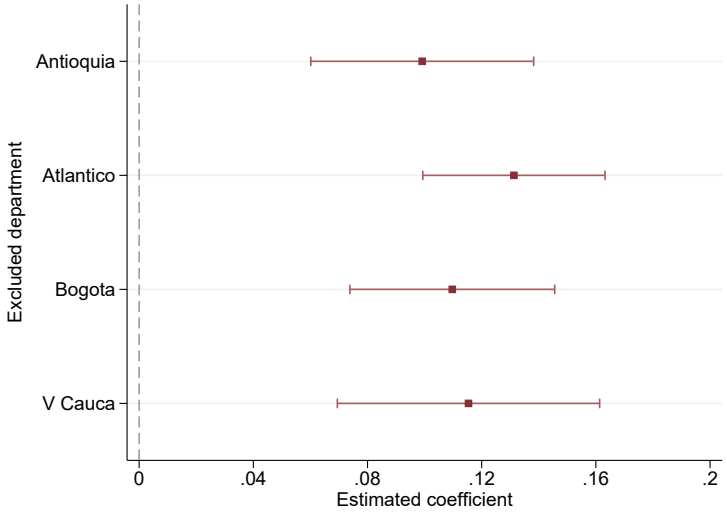
Figure B1: Robustness check - Changing the instrument



Notes. Each point estimate represents the effect of Venezuelan immigration on total exports (log) as in Table 7 but changing the instrumental variable in equation 2 for each of the seven instrumental variables introduced in the robustness section: C1 is the Distance-Density-Google control, C2 the Distance - Network - Google control, C3 the Distance - Network - Georoute control, C4 the Time - Density - Georoute control, C5 the Time - Network - Georoute control, C6 the Shift-share (2005 Census) and C7 is the Shift-share (1993 Census) control. The distance instrumental variables were constructed following the equation 2 and considering the average distance between each Colombian department and the Venezuelan states; the density instruments were constructed considering the proportion of Venezuelans living in each Venezuelan state in the past (before the migration exodus); the Google instruments were implemented by estimating the average distance between each Colombian department and all Venezuelan states with Google Maps instead of the *Georoute* command. Network instruments were constructed by considering the proportion of Colombians living in each Venezuelan state in the past (ω_s) instead of the variable α_s; Time instruments were constructed by considering the travel time, on average, from each Colombian department to all Venezuelan states, calculated with the Stata command *Georoute* command. Finally, the shift-share instruments were constructed by implementing the equation 5 considering the previous proportion of Venezuelan immigrants in each Colombian department in the past (i.e., the years 1993 and 2005). See notes to table 7. The 95 percent confidence interval is reported for each point estimate.

Source: Own elaboration based on data from DANE.

Figure B2: Robustness check - Excluding departments



Notes. Each point estimate represents the effect of Venezuelan immigration on total exports (logs) as in Table 7 but excluding each of the departments included in the vertical axis. See notes to Table 7. 95 percent confidence interval reported for each point estimate.
Source: Own elaboration based on data from DANE.

Table B1: Effect of immigration on exports - Changing the minimum annual export amount

	Minimum annual export amount - US 40.000						
	(1) Total	(2) High-Income	(3) OECD	(4) Low-Income	(5) LAC	(6) EU	(7) N. America
Share of Immigrants	0.116***	0.113***	0.483***	0.365***	0.044	0.103	0.271**
	(0.020)	(0.021)	(0.130)	(0.117)	(0.079)	(0.099)	(0.127)
F-statistic	180.65	180.65	180.65	180.65	180.65	180.65	180.65
Number of firms	1,212	1,212	1,212	1,212	1,212	1,212	1,212
Observations	8,484	8,484	8,484	8,484	8,484	8,484	8,484
	Minimum annual export amount - US 30.000						
Share of Immigrants	0.092***	0.089***	0.450***	0.383***	0.038	0.056	0.210**
	(0.020)	(0.020)	(0.150)	(0.117)	(0.077)	(0.120)	(0.099)
F-statistic	180.03	180.03	180.03	180.03	180.03	180.03	180.03
Number of firms	1,297	1,297	1,297	1,297	1,297	1,297	1,297
Observations	9,079	9,079	9,079	9,079	9,079	9,079	9,079
	Minimum annual export amount - US 20.000						
Share of Immigrants	0.099***	0.095***	0.468***	0.385***	0.033	0.087	0.231**
	(0.021)	(0.021)	(0.145)	(0.116)	(0.073)	(0.114)	(0.097)
F-statistic	178.35	178.35	178.35	178.35	178.35	178.35	178.35
Number of firms	1,388	1,388	1,388	1,388	1,388	1,388	1,388
Observations	9,716	9,716	9,716	9,716	9,716	9,716	9,716
	Minimum annual export amount - US 10.000						
Share of Immigrants	0.068***	0.064***	0.405***	0.337***	0.041	0.053	0.195**
	(0.023)	(0.023)	(0.134)	(0.098)	(0.070)	(0.102)	(0.094)
F-statistic	170.86	170.86	170.86	170.86	170.86	170.86	170.86
Number of firms	1,573	1,573	1,573	1,573	1,573	1,573	1,573
Observations	11,011	11,011	11,011	11,011	11,011	11,011	11,011
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. All regressions include departmental fixed effects. Firms with a minimum of US$40,000, US$30,000 and US$25,000, exported for each year in the period 2012-2019 were considered on the top, middle and bottom panel, respectively. Regional controls include the proportion of skilled workers and the real exchange rate (log) of each department-year. Economic controls include the unemployment rate, the informality rate, the proportion of employees in low-tech manufacturing, in the rest of manufacturing, in retailing, and the GDP per capita of each department in 2000 interacted with annual dummies.

Source. Own elaboration based on data from DANE.

Table B2: Effect of immigration on exports - Controlling by trade between Colombia and Venezuela in 2010

	OLS						
	(1) Total	(2) High-Income	(3) OECD	(4) Low-Income	(5) LAC	(6) EU	(7) N. America
Share of Immigrants	0.069**	0.080**	0.382***	-0.051	-0.055	0.295***	0.149
	(0.032)	(0.032)	(0.133)	(0.132)	(0.081)	(0.088)	(0.133)
	IV						
Share of Immigrants	0.173***	0.181***	0.547***	0.345**	0.158	0.266**	0.334**
	(0.034)	(0.035)	(0.155)	(0.166)	(0.109)	(0.117)	(0.164)
F-statistic	99.09	99.09	99.09	99.09	99.09	99.09	99.09
Number of firms	1,156	1,156	1,156	1,156	1,156	1,156	1,156
Observations	8,092	8,092	8,092	8,092	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trade_{2010} Volume × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. All regressions include departmental fixed effects. Firms with a minimum of US$50,000 exported for each year in the period 2012-2019 were considered. Regional controls include the proportion of skilled workers and the real exchange rate (log) of each department-year. Economic controls include the unemployment rate, the informality rate, the proportion of employees in low-tech manufacturing, in the rest of manufacturing, in retailing, and the GDP per capita of each department in 2000 interacted with annual dummies.

Source. Own elaboration based on data from DANE.

Table B3: Effect of immigration on exports - Controlling by trade in 2010 between Colombia and trading partners with which free trade agreements have been signed

	Including trade volume in 2010 with Europe × Year dummies as an additional control						
	(1) Total	(2) High-Income	(3) OECD	(4) Low-Income	(5) LAC	(6) EU	(7) N. America
Share of Immigrants	0.102***	0.099***	0.487***	0.295***	0.003	0.071	0.218*
	(0.021)	(0.022)	(0.139)	(0.108)	(0.075)	(0.108)	(0.120)
F-statistic	172.05	172.05	172.05	172.05	172.05	172.05	172.05
	Including trade volume in 2010 with USA × Year dummies as an additional control						
Share of Immigrants	0.102***	0.099***	0.493***	0.309**	0.001	0.051	0.230*
	(0.023)	(0.023)	(0.143)	(0.120)	(0.073)	(0.111)	(0.133)
F-statistic	168.01	168.01	168.01	168.01	168.01	168.01	168.01
	Including trade volume in 2010 with Costa Rica × Year dummies as an additional control						
Share of Immigrants	0.119***	0.120***	0.500***	0.346***	0.072	0.130	0.276**
	(0.024)	(0.025)	(0.130)	(0.122)	(0.083)	(0.095)	(0.133)
F-statistic	179.63	179.63	179.63	179.63	179.63	179.63	179.63
	Including trade volume in 2010 with South Korea × Year dummies as an additional control						
Share of Immigrants	0.118***	0.116***	0.500***	0.370***	0.073	0.093	0.280**
	(0.024)	(0.024)	(0.138)	(0.129)	(0.076)	(0.104)	(0.129)
F-statistic	147.13	147.13	147.13	147.13	147.13	147.13	147.13
Number of firms	1,156	1,156	1,156	1,156	1,156	1,156	1,156
Observations	8,092	8,092	8,092	8,092	8,092	8,092	8,092
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trade^{j}_{2010} Volume × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes. All regressions include departmental fixed effects. Firms with a minimum of US$50,000 exported for each year in the period 2012-2019 were considered. Regional controls include the proportion of skilled workers and the real exchange rate (log) of each department-year. Economic controls include the unemployment rate, the informality rate, the proportion of employees in low-tech manufacturing, in the rest of manufacturing, in retailing, and the GDP per capita of each department in 2000 interacted with annual dummies.

Source. Own elaboration based on data from DANE.

Table B4: Average yearly change in firms' characteristics - EAM and EDIT

Average 2013-2018 annual change	EAM	EAM+EDIT	Difference	P-value
Total blue-collar employment	-0.003	-0.003	0.000	0.952
Total employment	0.004	0.004	0.001	0.717
Total white-collar employment	0.016	0.018	0.002	0.378
Average wage	0.056	0.057	0.001	0.530
Average white-collar wage	0.057	0.057	0.000	0.865
Average blue-collar wage	0.052	0.052	0.000	0.931
Sales in thousand pesos	0.034	0.034	-0.000	0.942
Observations	5,269	4,362	9,631	

Source. Own elaboration based on data from DANE's EAM and EDIT.

Notes. Average annual changes computed with robust standard errors. P-values are for difference between firms in the EAM and firms in the EAM and the EDIT.