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The distributional effect of a massive exodus in Latin America and the role of downgrading and regularization*

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Abstract

The massive displacement of Venezuelan citizens to Colombia is the second most important episode of forced migration in the world. We study the impact of this demographic shock on the Colombian income distribution exploiting the geographical heterogeneity in the intensity of migration. We use RIF regressions in an instrumental variables approach to account for the non-random pattern of location of immigrants. We find that despite the fact that Venezuelan immigrants are relatively skilled compared to native Colombian workers, the exodus had a larger negative effect on the lower tail of the wage distribution, implying increases in income inequality and poverty. We link this result to a sizeable downgrading of (mostly unregistered) Venezuelan recent migrants who work in more routine tasks and earn lower wages than natives with similar characteristics. We also explore a large regularization program for immigrants and find that it was associated to a reduction in the extent of downgrading, and hence, to a mitigation of the unequalizing impact of the exodus.

JEL Classification: F14, F22, F16, F23, J61, L60.
Keywords: Migration, Income, Inequality, Labor Markets, Downgrading, Colombia, Venezuela.

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1 Introduction

The massive displacement of Venezuelan citizens to Colombia is the second most important episode of forced migration in the world: 4.5 millions Venezuelans left their country due to the social and economic crisis. Colombia is the second most important host of displaced immigrants worldwide, receiving more than 1.8 millions Venezuelan refugees since 2016 (UNHCR, 2019). This massive exodus in such a short period of time is likely to have significant consequences on the labor market and ultimately on the income distribution of the recipient country. While episodes of forced migration can present major challenges for labor markets due to wage pressures in case of competition between migrants and natives, they also offer development opportunities if immigrants are properly integrated into the labor force.

In this paper we study how the Venezuelan exodus affected the income distribution in Colombia, the mechanisms driving these effects, and how these consequences vary depending on whether public policy strategies of integration and regularization of migrants are implemented.

We explore these relevant questions by exploiting the geographical heterogeneity in the settlement patterns of migrants across Colombian regions. In particular, we apply RIF regressions in an instrumental variables approach. RIF regressions allow us to estimate the distributional effects of immigration on natives' per capita and labor income, whereas the IV approach helps us to account for the non-random location pattern of immigrants.

We divide our results into three parts. First, our estimates suggest that the Venezuelan exodus generated unequalizing distributional changes. In particular, we find a larger negative effect in the left tail of the labor income distribution, likely explained by greater competition between migrants and natives in low-income jobs. This effect seems to be inconsistent with the fact that Venezuelan immigrants are, on average, at least as qualified as native Colombian workers, a novel feature with respect to other migration shock episodes such as those in developed countries. If a negative effect on labor income is to be expected, it should be stronger for the more-skilled and better-paid native workers who should face stronger pressure in the labor market.

In the second part of the paper we put forward a fact that could account for these puzzling results: the downgrading of Venezuelan migrants in terms of the tasks they perform and wages they earn. Given the nature of the Venezuelan exodus, immigrants were unable to integrate into the formal labor market and regularize their legal status in Colombia. We show that they participate mainly in the informal labor market, work in more routine tasks occupations and earn lower wages than natives with similar educational and sociodemographic characteristics.

In the last part of the paper we study a public policy that could mitigate the downgrading of Venezuelan migrants, and the consequent unequalizing impact of the forced migration: a large regularization program implemented by the Colombian government in 2018 (PEP-RAMV). According to our estimates, we find that the regularization program had mitigating effects both in terms of wages and the routinization of tasks performed in occupations by skilled Venezuelans. These mitigating effects alleviated the pressure among native workers with lower labor incomes and, therefore, had an equalizing effect on the income distribution, partly offsetting the initial

impact of the migration.

One of the main concerns of the economic literature on migration has been the effect of massive flows of people on the labor market, especially on wages. However, little or no attention has been paid to effects of migration on the whole wage or income distribution, either in developed or developing countries. There are few papers in the economic literature that analyze the effect of migration on inequality; two of them focus on developed countries, such as the United States and the United Kingdom, and one of them on a developing country; Costa Rica. Card (2009) analyzes this important issue in the United States. The author focuses specifically on the effect of U.S. migration on wage inequality. According to his analysis, immigration in recent decades has had minor or negligible effects on wage inequality among natives of different skill groups and on wage variability across skill groups.

In the case of the United Kingdom, Dustmann et al. (2013) analyze the effect of immigration on the wage distribution of native workers. They find that immigrants in the UK tend to downgrade upon arrival. Their estimates show that this downgrading of immigrants has a negative effect on the wages of natives below the 20th percentile of the wage distribution, but has positive effects at the upper part of the distribution.

On the other hand, Gindling (2009) studies the effect of Nicaraguan migration on poverty and inequality in Costa Rica. Following an Oaxaca-Blinder decomposition methodology, the author finds that the returns to education of Nicaraguan immigrants are lower than those of natives. However, the author finds no relationship between Nicaraguan immigration to Costa Rica and inequality or poverty.

Finally, regarding the Venezuelan exodus, several papers have recently analyzed this episode of forced migration and its consequences on the Colombian economy. Caruso et al. (2019), Peñaloza-Pacheco (2019) and Pedrazzi and Peñaloza-Pacheco (2020) analyze the effect of the Venezuelan exodus on the Colombian labor market: the first two find a negative effect on natives' hourly wages, mainly among those low-skilled and informal, while the latter paper finds that the greater competition in the labor market of low-skilled female native workers negatively affected their labor supply and positively affected the labor force participation of high-skilled native women living with children at home due to the cheapening of domestic service caused by the influx of Venezuelan immigrants.

Furthermore, Bahar et al. (2021) analyze the effect of the PEP-RAMV, the regularization program of Venezuelan immigrants implemented by the Colombian government in 2018, on the labor market of natives and Venezuelans. The authors find that the regularization program affected negatively the likelihood of Colombian workers of being employed in the formal sector (particularly for highly educated workers, workers employed in small firms and female workers); however, this effect was positive in the case of Venezuelan workers.

Our paper makes several contributions to the economic literature. First, this is the first study of the distributional effect of a forced migration episode between developing countries with similar sociodemographic characteristics such as Colombia and Venezuela. Second, our research goes beyond estimates in terms of inequality and provides empirical evidence on the underlying mechanisms. Third, unlike most migration episodes, we discuss a case in which the

potential inequality effects of migration can be mitigated relatively fast: the Venezuelan exodus was a massive migratory flow individuals with the same level of qualification than the native workers who could participate in the labor market of high and middle-income native workers if they were regularized upon arrival in Colombia. Therefore, if some inequality effects arise given the massive influx of immigrants and the increased pressure on the low-income labor market due to downgrading, an immigrant regularization and integration program could help ameliorate these possible negative effects on income distribution. Finally, this paper is the first one to evaluate the inequality effects of a massive regularization program of forced migrants carried out by the government of the receiving country.

The rest of the paper is organized as follows: Section 2 shows information on the Venezuelan social and economic crisis and the subsequent migratory exodus; Section 3 presents the data source used in the paper and some descriptive statistics; Section 4 introduces the empirical strategy; Section 5 shows the main results on income distribution, inequality and poverty; Section 6 presents the main mechanisms of the results found; Section 7 describes the regularization program implemented by the Colombian government and its consequences in terms of inequality and labor integration of immigrant workers. Section 8 discusses the internal validity of the instrumental variable. Finally, section 9 concludes.

2 Context

2.1 The Venezuelan exodus

The Chavismo, headed by its natural leader Hugo Chávez, took office in Venezuela in 1999 and has governed since then. During Chavez's government, which ended in 2013 with his death, populist economic policy measures were implemented with high public spending that increased domestic consumption. These policies were based on resources coming from the high prices of commodities, mainly oil on which most of the country's fiscal and external revenues relied.[1] However, since 2013, when Nicolás Maduro assumed the presidency of Venezuela as Chávez's successor, the international reference price of oil fell from close to USD 120 per barrel in early 2012 to a minimum of close to USD 25 in early 2016 (Castillo Crasto and Reguant Álvarez, 2017; Rozo and Vargas, 2021; CEPAL, 2019; Monaldi, 2015).

This reduction in government revenues along with unsustainable levels of public debt and macroeconomic imbalances have led to an unprecedented economic crisis that generated, according to estimates by CEPAL (2019), a 62.2% drop in GDP in the 2013-2019 period (Bahar et al., 2021; Monaldi, 2015). This economic crisis, combined with food shortages, insecurity and multiple human rights violations by the government have resulted in an environment where chaos, uncertainty and social crisis have reigned (UN Human Rights, 2019). This situation triggered a massive exodus of Venezuelans (approximately 4 million Venezuelans) who have had to leave their country to seek a new future in other countries, mainly in Latin America. Given the

[1] In the early 2010s oil represented more than 90% of Venezuelan exports and the public fiscal deficit represented more than 17% of the domestic GDP.

natural proximity, Colombia has been the main destination of Venezuelan migrants: more than 1.8 million immigrants have arrived in the last five years (Castillo Crasto and Reguant Álvarez, 2017; UN Human Rights, 2019).

The reopening of the borders between Colombia and Venezuela in August 2016, after nearly a year of being closed due to political tensions between the governments of both countries, boosted the massive exodus (Peñaloza-Pacheco, 2019). Panel (a) of Figure 1, shows the monthly stock of Venezuelan immigrants living in Colombia over the 2013-2019 period. As can be seen, after the re-opening of the borders between both countries (vertical dashed line) the number of Venezuelans settled in Colombia increased significantly reaching its maximum in 2019.

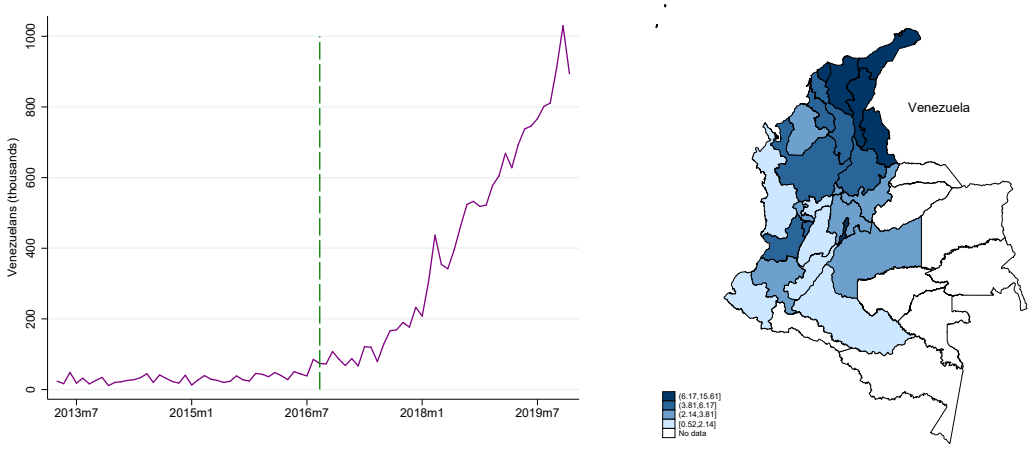
Furthermore, in panel (b) of Figure 1 we show the share of Venezuelans relative to the local population for each department of Colombia in 2019. The share ranges between 0.5% in some departments in the south and west of the country to more than 15% in those departments located close to the border with Venezuela such as La Guajira and Norte de Santander; this pattern according to which the closer the department is located to the Colombian-Venezuelan border the higher the share of Venezuelan immigrants is explained by the intrinsic nature of the Venezuelan exodus (an episode of forced migration) and is crucial for our identification strategy (see Section 4).

Also, due to this forced nature of the migration, Venezuelan immigrants initially faced several constraints to regularize their migratory situation in Colombia and to legally integrate to the society. These constraints led to an absence of access to public services like health and education for Venezuelan immigrants settled in Colombia. These barriers also prevented immigrants to participate actively in the formal labor markets and to be able to validate their educational credentials attained in their country of origin (Bahar et al., 2021). To solve this, the Colombian government has taken several policy measures to formalize and regularize Venezuelan immigrants in Colombia (See Section 7 for more details). Yet, according to official statistics from the Migration Unit in Colombia, more than half of the Venezuelans in Colombia in an irregular situation by the end of 2019.

Figure 1: Venezuelan exodus in Colombia

(a) Number of Venezuelans over time

(b) Share of Venezuelans by department (2019)



Notes. Dashed vertical line in panel (a) indicates the moment in which the borders between Colombia and Venezuela were re-opened. Departments with no data in panel (b) are mainly departments in the Amazon region 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 represents less than 3% of the total population in Colombia.
Source. Own elaboration based on data from DANE.

3 Data and Descriptive Statistics

3.1 Data

To conduct our analysis we use the Gran Encuesta Integrada de Hogares (GEIH, by its acronym in Spanish) of the Departamento Administrativo Nacional de Estadística (DANE), a nationally representative household survey carried out on a monthly basis in urban and rural areas of Colombia. The GEIH is a repeated cross-sectional survey that includes sociodemographic and economic information on employed, unemployed and inactive individuals. Since April 2013, the GEIH also includes detailed information on respondents' place of birth and area of residence for the previous 5 years and 12 months. Therefore, we consider the period 2013-2019 and restrict the sample to native individuals (i.e., we exclude from our sample individuals who reported being born in another country). The working database is composed of 4,858,125 observations

from 24 departments of Colombia out of a total of 32.[2]

When analyzing downgrading in Section 6, we consider two dimensions: wages and routinization. To analyze the routine component of each worker in our sample, in this paper we rely on Gasparini et al. (2021) and work with their Routine Task Content (RTC) indices constructed from microdata from the Programme for the International Assessment of Adult Competencies (PIAAC) surveys conducted by the OECD.[3] The authors construct the routine index from the following four questions: (i) Do you manage or supervise other people?; (ii) Do you plan activities of other workers?; (iii) Are you confronted with problems?; and (iv) Do you write articles or reports? According to them, these four questions provide information about thinking, flexibility and problem-solving skills that are not threatened by the implementation of new technologies (i.e., they are less routine and less prone to being automated). The routine index we consider in our analysis is the RTC1-PIAAC index of Gasparini et al. (2021) which indicates the percentage of individuals for each occupational level (according to the ISCO 08 classification) who do not perform any of the non-routine tasks mentioned above. Therefore, the higher the RTC1-PIAAC index, the more routine that occupation is. Then, we match each routine index at the occupational level with the GEIH information in Colombia considering the ISCO 08 classification.[4] In other words, the RTC1 index indicates the average routine task content of each occupation.

Finally, when analyzing the effect of the regularization of Venezuelan immigrants on downgrading, poverty and inequality, we will use the data available in Bahar et al. (2021) on the number of Venezuelans who were regularized in each Colombian department through the implementation of the PEP-RAMV. The database of regularized immigrants is confidential, so we will rely on the descriptive statistics and the characterization of the data provided by the authors in their work.

3.2 Descriptive Statistics

3.2.1 Socio-demographic characteristics of Colombians and Venezuelans

Table A.1 of Appendix A presents several descriptive statistics for Colombians and Venezuelans in our sample. We show overall statistics for Venezuelans and Colombians in the first two columns. Then in the two last columns of the table we split Venezuelan immigrants between those who arrived to Colombia 5 years ago and 1 year ago in 2019, respectively. We group descriptive statistics in two: Panel A shows socio-economic characteristics (age, sex, living con-

[2] The departments for which data are not available are: Amazonas, Vaupés, Guainía, Guaviare, Vichada, Arauca, Casanare and San Andrés. In these departments the GEIH is not carried out with the same periodicity as in the rest of the country. For this reason, these departments will not be considered in the analysis. However, according to the latest Census in Colombia (2018), the population of these eight departments represents about 3% of the population in Colombia because they are mainly rural regions. Therefore, the results presented here should not be affected.

[3] They use data from the four Latin American countries included in the survey: Chile, Ecuador, Mexico and Peru.

[4] We do not use the Colombian occupational classification of SENA (Clasificador Nacional de Ocupaciones 1970), but the equivalences to ISCO-08 provided by the World Bank and CEDLAS.

ditions, etc.) for all individuals, and Panel B presents labor characteristics for those individuals who were working when surveyed.

Regardless of when Venezuelan immigrants arrived in Colombia, they are on average younger, have a lower socio-economic level and are more likely to live in urban areas. We also observe that they are more likely to participate in the labor force compared to natives but have a higher probability of being unemployed. All these characteristics are consistent with the expected self-selection of those forced migrants who left Venezuela in search of new opportunities in a different country and are also expected given the difficult conditions that forced migrants face in terms of labor opportunities when they arrive in a new country. In addition, the poverty and extreme poverty rates of Venezuelan immigrants are significantly higher (56.3% and 15.5%, respectively) than those of Colombian individuals (35.7% and 9.8%, respectively); when considering only Venezuelans who arrived 1 year ago, both rates are almost double (61.2% and 17%) compared to the local population.

A very important feature of this episode of forced migration compared to those episodes usually studied in the economic literature refers to the educational composition of Venezuelan immigrants relative to that of natives. In the last rows of Panel A we show that Venezuelan immigrants have, on average, at least the same level of education as Colombians. When we divide the groups by educational level we can see that there is a significantly higher proportion of Venezuelan immigrants with completed secondary school (25.5%) compared to Colombians (20.5%) and that the secondary school dropout among immigrants appears to be significantly lower. Finally, the dropout rate from post-secondary education among Venezuelan immigrants (10.3%) is lower and the rate of individuals from Venezuela with some post-secondary education appears to be very similar compared to natives.[5]

In Panel B of Table A.1 we analyze the characteristics of the native and Venezuelan working population. First, Venezuelans earn an average hourly wage about 28% lower compared to Colombian workers; this difference seems to be close to 39% when we consider only Venezuelan immigrants with one year of residence in Colombia. This significant difference in terms of hourly earnings for Venezuelan immigrants may be part of the explanation for the higher poverty rates among immigrants compared to natives. In addition, we find that Venezuelans in the labor market work, on average, at least 4 to 5 hours per week more than Colombian workers and that they have jobs with more routine tasks compared to native workers. In general, although Venezuelan immigrants have a similar (or even better) level of education compared to Colombians, they experience much higher unemployment rates, have lower income levels and, consequently, live in much tougher conditions in terms of poverty.

In the last part of Panel B in Table A.1 we show the distribution of Colombian and Venezuelan workers by economic sector. We observe that Venezuelan immigrants are significantly more concentrated in commercial activities (46.2%), construction (11.7%), low-tech industries (7.4%) and domestic service (3.9%) compared to Colombian workers. Also, although the education lev-

[5] Since quality of secondary and post-secondary education is similar between Colombia and Venezuela, it is reasonable to consider that Venezuelan and Colombian skilled workers have similar abilities. See Lebow (2021) for further discussion and detailed analysis.

els of Venezuelans are similar to those of Colombians, they are less represented in high-skilled economic sectors such as high-tech industries (4%) and skilled services (4.7%). In turn, the participation of Venezuelan workers in the public administration is practically zero. This distribution of the Venezuelan labor force across economic sectors is consistent with the fact that immigrants are less likely to participate in economic sectors with higher rates of formality due to the barriers they face in terms of regularization. These legal constraints push them to economic sectors with more flexible admission and participation processes such as commerce and construction, where we expect to see a higher rate of informality.

In Section B of the Appendix, we provide a brief description of the income distribution in Colombia, its evolution over the last decade and analyze the heterogeneity of income inequality across departments.

4 Empirical Strategy

In order to estimate the effect of the Venezuelan exodus on several indicators of income inequality, poverty and also on average expected values of our dependent variables of interest, we implement RIF-regressions. This allows us to obtain a first-order approximation to a large variation in the distribution of X (our explanatory variables) in the statistic $\nu(F_Y)$ or can be used to estimate the effect of a "small change" in the distribution of X in $\nu(F_Y)$, given individuals' characteristics (Firpo et al., 2009). In this first part of the paper we study the effect of a marginal increase in migration (*ceteris paribus*), given the characteristics of individuals, on the unconditional (marginal) distribution of per capita income and labor income for the 2013-2019 period.

More formally, the average derivatives calculated using RIF regressions produce the partial effect of a small location shift in the cumulative distribution function of the covariates X on the distributional statistic of interest. Firpo et al. (2009) call this parameter "unconditional partial effect" (UPE)[6]:

$$\alpha(\nu) = \int \frac{dE[RIF(y,\nu)|X=x]}{dx} dF_X(x) \tag{1}$$

By approximating conditional expectations with linear functions, RIF-regression coefficients indicate the extent to which the functional (e.g., the quantile, Gini, Atkinson, mean, etc.) of the distribution of the marginal outcome variable is affected by an infinitesimal rightward location shift in the distribution of regressors. We approximate the effect on mean, quantiles and various inequality/poverty indicators of slightly disturbing the joint distribution of per capita and labor income and observable characteristics towards the distribution where migration is larger.

Intuitively, RIFs are constructed by adding the specific distributional statistic (ν) under consideration to the corresponding influence function (IF), which is to re-center the IF on the statistic ν. The IF is a statistical tool that measures the sensitivity of a certain distributional statistic of interest to outliers in the sample. For example, the IF of the mean is given by $Y - \mu$,

[6] Assuming also that the conditional distribution of Y given X remains constant.

as this function is not bounded, "contaminating" the sample with observations that are far from the mean $(Y - \mu)$ will have a greater influence on this statistic than observations closer to it (it is worth noting that there are a different IF for each statistic). Consequently, the RIF of the mean is given by Y, hence when we estimate the effect of an explanatory variable by considering the mean as our statistic (ν), we are basically estimating the effect of a marginal change in our independent variable on the mean value of Y. For the remaining distributional statistics, the interpretation is also how a marginal change in our explanatory variable (in our case migration) affects ν.

In order to perform our analysis, we estimate the following equation:

$$\mathsf{RIF}(y_{idt}, \nu_Y) = \beta M_{dt} + X_{idt}^{'}\delta + \omega_d + \pi_t + \mu_{idt} \tag{2}$$

Where:

$$\nu_Y : \{\text{Mean, UQPE, Gini Coefficient, Atkinson Index, Entropy Index, FGT}(\alpha)\}$$

From equation 2 we have that y_{idt} is the outcome variable of individual i living in Colombian department d in year-month t. Our variable of interest is M_{dt} which represents the share of Venezuelan immigrants relative to the local population in each department-year-month. We consider as Venezuelan immigrants those individuals in the GEIH who reported being born in Venezuela. X_{idt} is a vector of individual variables including age, sex, years of education, marital status and the relationship to the head of household of each individual i; ω_d and π_t are department and year-month fixed effects, respectively. Finally, μ_{idt} is the error term. We cluster standard errors at departmental level to account for potential serial correlation between individuals in the same department over time.

Our parameter of interest is β which captures the marginal average effect of an increase in the share of immigrants of 1 p.p. on ν considering the RIF equation 2. Given that the location of Venezuelan immigrants in each Colombian department is not random we address this endogeneity concern by implementing an instrumental variable approach. The instrument for M_{dt} 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 state from which the displaced is fleeing to each potential Colombian destination department is a key determinant of the refugee location decisions. Formally:

$$IV_{drt} = V_t \sum_s \frac{\alpha_s^{2011}}{K_{drs}} \tag{3}$$

where V_t is the stock of Venezuelan immigrants living in Colombia in year-month t and provides our IV time variation. This component is orthogonal to the differences in the share of Venezuelans across Colombian departments given that the discrete jump in the inflow of

Venezuelans between 2015 and 2018 was due to events occurring in Venezuela: the macroeconomic, social, and political crisis.

Furthermore, α_s^{1990} is the share of Venezuelans living in Venezuelan State s according to 2011 Venezuelan census (pre-crisis) and K_{drs} is the driving-distance in kilometers between Colombian department d in region r and Venezuelan State s.[7]

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. In Section 8 we will perform a robustness analysis in order to provide further evidence to ensure the validity of our empirical strategy.

5 Results

5.1 Immigration and the labor market

We first start by showing the effect of Venezuelan forced migration on the mean income of natives: labor income, family labor income per capita, and total income per capita. The sample for the former is composed of the native working population, while the sample for the latter two is total population.

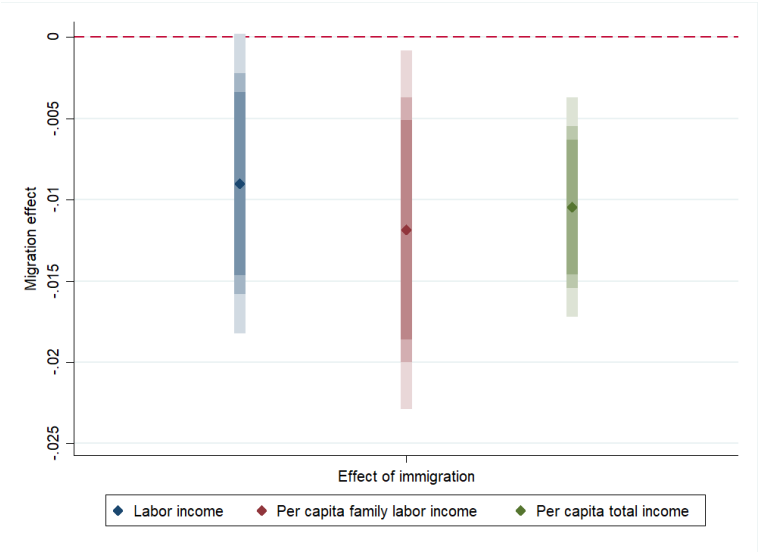
As can be seen in Figure 2 the average effect of immigration on total and labor income is negative and statistically significant. Our estimates indicate that a 1 percentage point (p.p.) increase in the share of immigrants relative to the departmental population reduces total and labor income per capita, on average, by 1%. The fact that the negative effect on labor income appears to be basically the same compared to total income might suggest that the entire negative effect on total income is due to a negative impact of immigration on the labor market for native workers.[8]

These estimates are consistent with previous findings in the economic literature on the average labor market effect of Venezuelan forced migration on wages. For example, Peñaloza-Pacheco (2019) and Caruso et al. (2019) through different empirical strategies find that Venezuelan immigration negatively affected native workers' wages, especially those of low-skilled and informal workers.

[7] Driving-distance is estimated by implementing Stata command *georoute* written by Weber and Péclat (2017).

[8] Furthermore, labor income represents approximately 80% of total individuals' income.

Figure 2: Effect of immigration on income



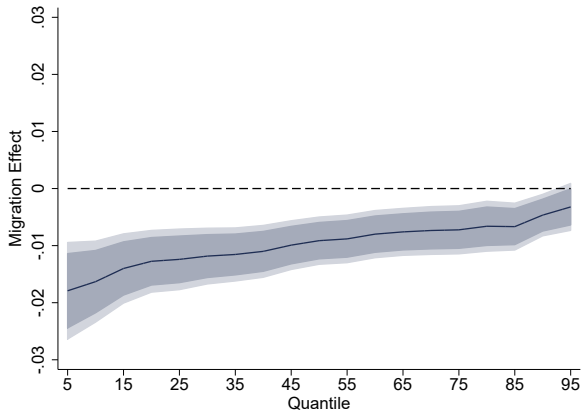
Notes. Each point shows the IV estimated effect of Venezuelan immigration on the logarithm of income for different types of sources for the period 2013-2019. The sample was restricted to individuals with positive income. The color bars represent the 90%, 95%, and 99% confidence intervals constructed using standard errors grouped at the department level. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

To analyze whether the effect shown above on per capita family income was heterogeneous across the income distribution and whether there was any distributional effect of immigration, we estimate the Unconditional Quantile Partial Effect (UQPE) for each ventile of the native income distribution. Our results are shown in Figure 3. As can be seen, the average negative effect of immigration shown in Figure 2 seems to be concentrated mainly in the left tail of the natives' per capita family income distribution. Our estimates indicate that, once we control for individual characteristics and the non-random pattern of location of Venezuelan immigrants through our IV strategy, the negative effect of those below the 25th percentile of the income distribution almost doubles that of those on the right tail.

We further analyze in Figure 4 which source of income is the most affected by immigration. We consider three types of income sources: labor income (panel a), transfer income (panel c), and capital income (panel d).[9] Finally, other income in panel (b) is the sum of transfer income and capital income.

[9] Transfer income includes revenues from assistance from other households and institutions (public and non-public); capital income consists of revenues from interest, dividends, and rental income.

Figure 3: Unconditional Quantile Partial Effects of Immigration on Per Capita Family Income



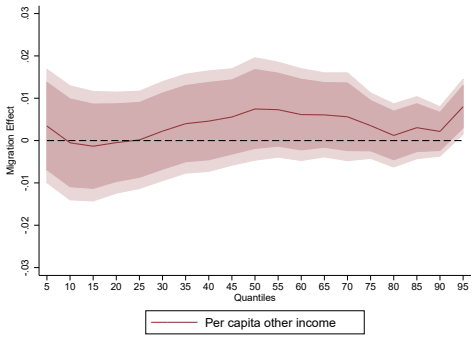
Notes. The line represents the estimated UQPE according to the equation 2 for each percentile of per capita family income. The dark blue and light blue areas are the 90% and 95% confidence intervals, respectively. Standard errors were clustered at the departmental level. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

Our coefficients show that the regressive effect of Venezuelan forced migration found above is entirely explained by the effect on labor income, while the UQPE for the other income sources shows no clear negative effect or regressive pattern. Figure 4 provides additional evidence suggesting that the negative distributional effect of Venezuelan migration only occurred in the labor market, which is consistent with the fact that Venezuelan immigrants may have put greater pressure on the wages of natives, affecting them negatively due to higher levels of competition between native and immigrant workers.

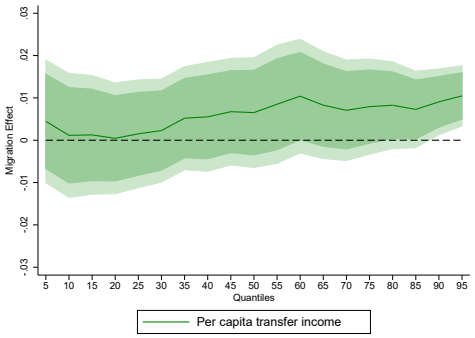
Figure 4: Effect of Immigration on Income by source

(a) Per capita labor income

(b) Per capita other income



(c) Per capita transfer income



(d) Per capita capital income

Notes. Each line represents the estimated UQPE according to the equation 2 for each percentile of the corresponding per capita income. The per capita other income is the sum of per capita transfer and capital income. The dark and light areas are the 90% and 95% confidence intervals, respectively. Standard errors were clustered at the departmental level. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

Once we determine that the negative distributional effect was concentrated in the labor market and, particularly, in the labor income, it is crucial to consider the two potential sources that might explain the negative effect on wages: hourly wages and hours worked. On the one hand, it could be possible that higher levels of competition in the labor market between natives and Venezuelan immigrants negatively affected hourly wages paid to native workers due to a greater competition in the labor market under which the increased labor supply forces them to be willing to work the same number of hours for a lower wage. On the other hand, this reduction in the labor income of natives, which implies an increase in the opportunity cost of working instead of consuming leisure or dedicating hours to other alternative activities, could

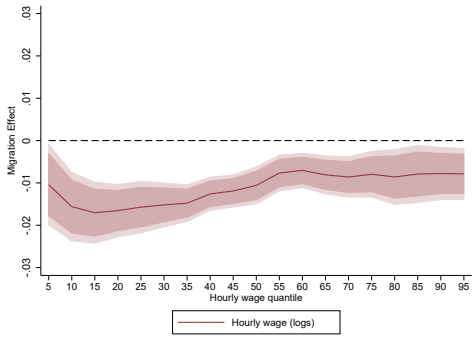
have affected the labor decisions of native workers by making them less willing to work the same number of hours they worked before the mass exodus and, therefore, their labor income would not only have been affected by the reduction in hourly wages, but also by the lower number of hours worked.

To disentangle these two possible explanations in Figure 5 we split our UQPE estimates into two variables: hourly wages and hours worked (both in logs). Our estimates indicate that the first explanation could be the one that plays an important role in the negative redistributive effects presented above; that is, increased competition in the labor market due to the incoming labor supply from Venezuelan immigrants affected the hourly wages of native workers, especially for those on the left side of the hourly wage distribution. Our estimates in panel (a) of Figure 5 show that the negative effect on hourly wages earned by those below the 50th percentile of the distribution was significantly larger (in absolute values) compared to the negative effects of those on the right tail of the hourly wage distribution. However, when considering the number of hours worked as our outcome variable of interest, it is not possible to identify any negative effect on the number of hours worked.[10]

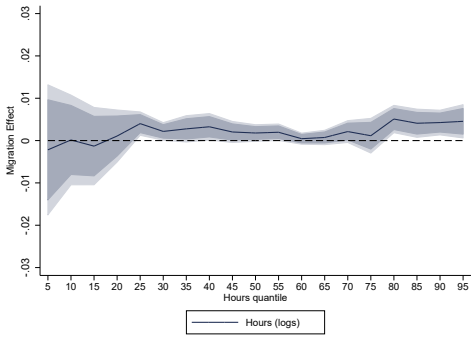
[10] The estimated effect on hours worked by native workers is different from that presented by Pedrazzi and Peñaloza-Pacheco (2020) and Caruso et al. (2019). On the one hand, Pedrazzi and Peñaloza-Pacheco (2020) analyze the effect on hours worked considering as zero those individuals who are not part of the employed population, so their effects also include the extensive margin effect of migration on employment, a variable on which Caruso et al. (2019) also finds a negative effect. On the other hand, Caruso et al. (2019) shows a positive effect on the average hours worked, however, they only analyze the 2013-2017 period, leaving out two important years in which the Venezuelan exodus intensified.

Figure 5: Effect of immigration on hourly wage and hours of work

(a) Hourly wage (logs)



(b) Hours (logs)



Notes. The sample corresponds to employed individuals with non-zero income. Each line represents the estimated UQPE according to the equation 2 for each percentile of the hourly wage (in logs) and the hours worked (in logs), respectively. The dark and light areas are the 90% and 95% confidence intervals, respectively. Standard errors were clustered at the departmental level. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

5.2 Immigration, poverty and income inequality

Based on the results presented so far, we know that Venezuelan immigration negatively affected the labor income of the lowest paid individuals (and in particular, those with the lowest hourly wages), who are expected to be the poorest in the income distribution. These effects could have affected the income distribution among native individuals by increasing inequality due to the relative worse situation of those with lower incomes compared to the native population on the right side of the income distribution. In order to test for these inequality regressive effects, Table 1 shows the RIF regressions estimates of equation (2) with inequality indicators such as the Gini Coefficient, Atkinson index and Entropy index as outcomes.

Several insights emerge from our results. First, the OLS estimates appear to be a lower bound of the actual effect of immigration on inequality. Once we control for the non-random pattern of allocation of Venezuelan immigrants in Colombian departments by implementing an IV strategy, our estimated coefficients almost double those of the OLS estimates. This result is expected given that it is reasonable that Venezuelan immigrants choose departments where the social situation of natives is better and, therefore, if we do not control for this negative correlation between the migratory pattern and inequality our estimates could be biased downward. Second, our estimates indicate that, regardless of which inequality indicator is considered, the Venezuelan exodus increased inequality: for instance, a 1 p.p. increase in the share of Venezuelan immigrants increased the Gini index by 0.002 points.

To put it in simple numbers, on average the proportion of Venezuelan immigrants for each of Colombia's departments increased by approximately 3 p.p., which translates into an average Gini coefficient rise of 0.006 points, which is the average annual reduction of the same coefficient at the national level during the 2013-2017 period according to Table A.1. This 0.002 point effect on the Gini coefficient is also close to a 0.4% increase relative to the national Gini coefficient in Colombia before the Venezuelan exodus (2013).

Table 1: Effect of immigration on inequality

	OLS				
	(1) Gini	(2) Atkinson (0.5)	(3) Atkinson (1)	(4) Entropy (0)	(5) Entropy (1)
Share of Immigrants	0.001*	0.001*	0.001**	0.002**	0.002*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
	IV				
Share of Immigrants	0.002***	0.002***	0.003***	0.004***	0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
F-statistic	115.08	115.08	115.08	115.08	115.08
Number of Departments	24	24	24	24	24
Observations	4,858,125	4,858,125	4,858,125	4,858,125	4,858,125
Department FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Economics controls	Yes	Yes	Yes	Yes	Yes

Notes. ***, **, and * denotes statistical significance at 1%, 5% and 10%, respectively. Clustered standard errors at department level in parenthesis. Each column represents the coefficient of a regression of inequality index and the share of Venezuelan immigrants relative to native population for the period 2013-2019 according to equation 2. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

The results presented above are also consistent with an increase of poverty (and extreme poverty) rate in Colombia due to the decrease in labor income of the lowest income earners explained by the Venezuelan exodus. According to Table 2 an increase in the share of Venezuelan immigrants of 1 p.p. also increased the poverty rate by 0.5 p.p. and the extreme poverty rate by 0.2 p.p. This increase in the poverty rate during the studied period corresponds to more than 200,000 and 90,000 new poor and extreme poor people in Colombia, respectively, given an average increase of 1 p.p. in the share of Venezuelan immigrants. This effect is also very close to the average annual reduction rate of poverty and extreme poverty during the 2013-2017 period

according to Table A.1.

Table 2: Effect of immigration on poverty

	OLS			
	(1) FGT(0)	(2) FGT(1)	(3) FGT(2)	(4) Extreme Pov.
Share of Immigrants	0.002*	0.001**	0.001***	0.001***
	(0.001)	(0.000)	(0.000)	(0.000)
	IV			
Share of Immigrants	0.005***	0.003***	0.002***	0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
F-statistic	115.08	115.08	115.08	115.08
Number of Departments	24	24	24	24
Observations	4,858,125	4,858,125	4,858,125	4,858,125
Department FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Economics controls	Yes	Yes	Yes	Yes

Notes. ***, **, and * denotes statistical significance at 1%, 5% and 10%, respectively. Clustered standard errors at department level in parenthesis. Each column represents the coefficient of a regression of the poverty index and the share of Venezuelan immigrants relative to native population for the period 2013-2019 according to equation 2. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

Our estimates suggest that the effect of forced Venezuelan migration in Colombia increased inequality and poverty among native individuals. These impacts were mainly driven by the fact that Venezuelan immigrants competed particularly with workers at the bottom of the labor income distribution, which are expected to be those employed in low-skilled and more routine jobs. These effects are puzzling considering that, as shown in Table A.1, Venezuelan immigrants have the same (or even higher) skill levels compared to Colombians, so if greater competition with native workers was expected, it should be primarily among the highly skilled.

In the following section we empirically show that Venezuelan immigrants, regardless of their skill level, have downgraded in the Colombian labor market due to legal barriers to integrate and regularize their migratory status. Thus, they were forced to compete for low-skilled, more routine and lower-paying jobs, affecting the wages of Colombia's poorest natives and increasing levels of inequality.

6 Downgrading of Venezuelan Immigrants

Downgrading of immigrants in the labor market, according to the economic literature, is the situation in which immigrant workers (in our case Venezuelan workers) are employed in jobs that are worse (in terms of wages, routine and skills) than the jobs of native individuals with the same observable characteristics such as education, experience and age (Dustmann et al., 2013, 2016).

Downgrading can be caused by several reasons. On the one hand, there are informal or non-legal reasons, such as the fact that some immigrants have a different mother tongue from that of the host country or region and therefore have to spend time at the beginning to learn the language of the natives in order to work in more skilled jobs. In this case, it is expected that, once immigrants succeed in acquiring these skills, they will be able to better integrate into the labor market and there will be a job upgrading. On the other hand, there are formal and legal reasons that prevent immigrants from effectively participating under the best conditions in the labor market due to barriers to formalization or restrictions that do not allow them to validate their educational credentials or to have a legal and defined migratory status. Finally, it is possible that situations may arise that combine the two reasons.

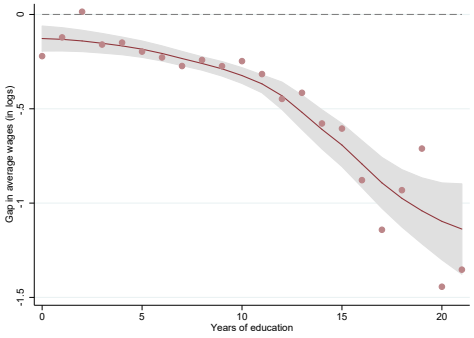
In the case of the Venezuelan exodus, immigrants are very similar to native workers (they speak the same language and have quite similar cultural backgrounds compared to Colombians), so they have no non-formal reasons to downgrade in the labor market. However, due to the forced nature of their migratory flow, they could not legally integrate into the Colombian economy and had to participate mainly in informal, low-skilled and routine jobs.

Unlike the situation in which downgrading is explained by non-legal factors, downgrading explained by legal and formal barriers can be mitigated by implementing public policies of regularization of immigrants to formalize their legal status in the host country. In this part of the paper we will empirically evaluate and show evidence suggesting that downgrading is the main driver of the inequality and poverty effect of the Venezuelan exodus in Colombia.

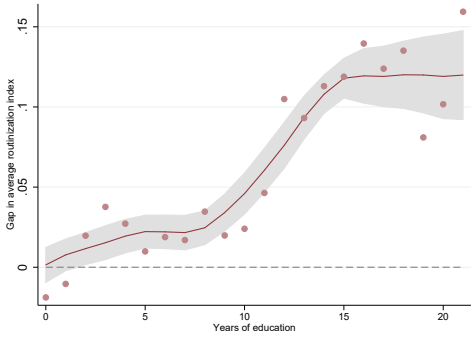
Figure 6 shows the unconditional gap in terms of wages and routinization between immigrants and Colombian workers for each year of education in 2019. Both figures mirror each other. In the case of wages in panel (a), we can observe that immigrant workers earn an hourly wage that is consistently lower compared to native workers with the same years of education. Moreover, the higher the number of years of education of immigrants and natives, the larger the wage gap between the two groups: while an immigrant worker with 5 years of education earns, on average, an hourly wage that is 18% lower compared to a Colombian worker with the same years of education, this difference approaches 58% for an immigrant worker with 16 years of education compared to a native worker with the same education. The pattern in panel (b) of Figure 6 for the routinization index is the same: Venezuelan workers are employed, on average, in more routine jobs compared to native workers with the same number of years of education. Consistent with panel (a), the higher the years of education of Venezuelan and Colombian workers, the greater the gap in the routinization index.

Figure 6: Gap in wages and routinization between immigrants and natives in Colombia by years of education, 2019

(a) Wages



(b) Routinization



Notes. Each point on the graph represents the difference in the average wage (in logs) and routinization index of immigrants and natives for each year of education. In the case of wages, a negative value means that the average wage (in logs) of immigrants is lower than that for natives for a given year of education. While, in the case of routinization a positive value means that the average routinization index of immigrants is higher than that for natives for a given year of education. The solid line was constructed from a smooth local polynomial. The gray area is the 95% confidence interval.
Source: Own elaboration based on data from DANE.

These first calculations in Figure 6 are suggestive of the presence of downgrading of Venezuelan immigrants vis-à-vis Colombian workers with the same skill level. That is, the fact that, given the years of education, Venezuelan immigrants have jobs with significantly lower wages and more routine tasks, and that this gap intensifies the more years of education they have, could indicate that they are downgrading in the labor market due to potential restrictions that make them work in the informal sector and, therefore, in less complex and worse paying jobs. In the following subsection we will analyze this issue in greater depth.

6.1 Downgrading measurement

In this subsection we estimate downgrading in terms of wages and routinization of Venezuelan immigrants by implementing a methodology used by Dustmann et al. (2013, 2016). First, we estimate the following equation for Colombian workers:

$$Y^c_{ijhk} = \alpha^c_j + \beta^c_j X^c_{ijhk} + \mu^c_{ijhk} \tag{4}$$

Where Y^c_{ijhk} is the wage or the routinization index of Colombian individual i of sex j, age category h and education category k; X is a vector of variables including dummies of age and

education categories (and their interactions) and department fixed effects.[11] We estimate each equation for both male and female workers separately. Then, from the estimated coefficients for Colombian workers we predict the wage/routinization index of Venezuelans from their characteristics with the following equation:

$$\hat{Y}^v_{ijhk} = \hat{\alpha}^c_j + \hat{\beta}^c_j X^v_{ijhk} + \hat{\epsilon}^v_{ijhk} \tag{5}$$

Where $\hat{\epsilon}^v_{ijhk}$ is constructed from a normal distribution of zero mean and variance equal to the residual variance of each sex-age-education category of the regressions for Colombian workers:

$$\hat{\epsilon}^v_{ijhk} \sim \mathcal{N}\left(0, \sqrt{\frac{\sum(\hat{\mu}^c_{ijhk})^2}{n_{jhk}}}\right) \tag{6}$$

Then, we compare the actual and predicted income or routinization index of Venezuelan immigrants. Thus, if Y^v_{ijhk} is lower (greater) than $\hat{Y}^v_{ijhk}$, this means that Venezuelans actually earn a lower wage (work in more routine jobs) than what they should do according to their characteristics under the native wage/routinization index distribution.

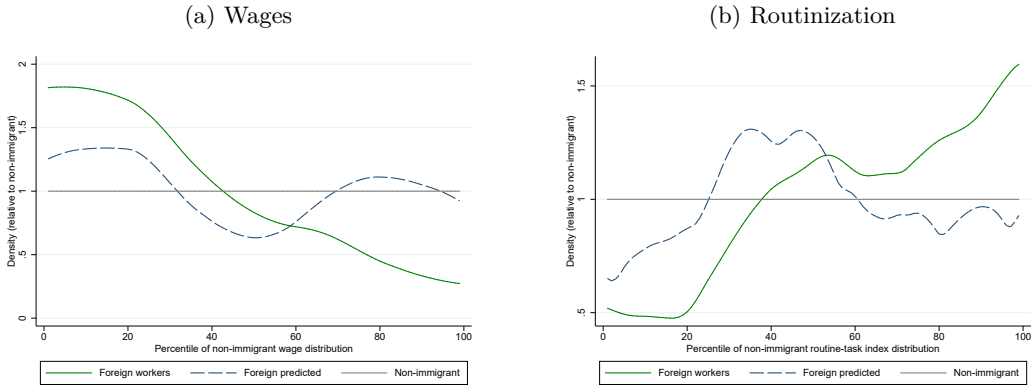
Panel a (panel b) of Figure 7 shows the distribution of the wage position (routinization index) of migrants relative to the wage distribution (routinization index distribution) of natives. Both panels show the distribution for the actual and predicted wage/routinization index of Venezuelan migrants and include the horizontal line of value equal to 1 that corresponds (by definition) to natives. For panel (a), the figure can be read as follows: a density value equal to 1.8 at the 10th percentile indicates that Venezuelans are 80% more likely to be in the 10th percentile of the native wage distribution compared to Colombians. Similarly, in panel (b) a density value close to 1.4 at the 90th percentile indicates that Venezuelan workers are 40 percent more likely to be in the 90th percentile of the native routinization distribution compared to Colombian workers, i.e., they are more likely to be in jobs with highly routine tasks.

Both panels are highly suggestive of downgrading among Venezuelan workers in Colombia. In both panels of Figure 7 we can observe that the actual wage and routinization index distributions of Venezuelan workers mirror each other: while our estimates suggest that Venezuelan workers are significantly concentrated in low-wage jobs, especially below the 40th percentile compared to natives and their predicted value given their observable characteristics, they are also heavily concentrated in jobs in the right tail of the routinization index distribution (i.e., approximately above the 60th percentile), compared to natives and their predicted value given their education, age and gender. Finally, it is worth noting that the predicted distributions in terms of wages and routinization for Venezuelan workers (dashed line in both panels) are more similar to the actual distributions of native workers (horizontal line of value equal to 1). However, immigrants are expected to be less concentrated than natives in jobs with very low

[11] Age categories are (18/25), (26/35), (36/45), (46/55) and (56/64). The education categories are incomplete secondary, complete secondary, incomplete post-secondary education and complete post-secondary education.

routinization given their observable characteristics and more concentrated between the 20th and 40th percentile.

Figure 7: Downgrading of immigrants in Colombia



Notes. Both panels show the density of immigrants located in each of the percentiles of the native wage and routinization index distribution, respectively. The green line corresponds to the actual density of immigrants at each percentile; the blue line is the predicted density according to equation 5. By definition the horizontal gray line represents native workers since they are equally distributed at each wage/routinization index percentile.
Source: Own elaboration based on data from DANE.

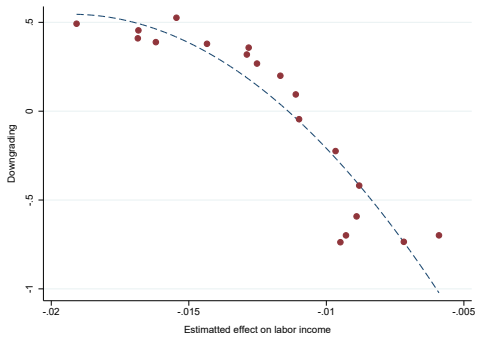
The fact that Venezuelan workers downgraded upon their arrival in Colombia and were placed in low-paying jobs due to formal barriers or restrictions in the labor market may explain the stronger negative effect on the left-hand side of the labor income distribution found above (Figures 4 and 5). In short, when Venezuelans arrived in Colombia they tried to find work and, due to their irregular migration status, the impossibility of working in formal (and therefore better paying) jobs and validating their educational credentials, they could only work in low paying jobs, with more routine tasks, putting additional pressure on the low-income segment of the labor market, increasing their relative labor supply, lowering wages in those jobs and having an aggregate unequalizing effect. Figure 8 shows evidence in that direction.

Each point in Figure 8 relates the UQPE for each ventile of the per capita labor income and hourly wage presented above in Figures 4 and 5, respectively, and the gap between the actual and predicted hourly wage of Venezuelan workers for each ventile of the native wage distribution according to panel (a) of Figure 7. As can be seen, there is a negative relationship between both variables: the larger the downgrading (gap between the actual and predicted density of immigrants along the native wage distribution in Figure 7) the larger (in absolute value) and more negative is the effect of the Venezuelan exodus on the per capita labor income and the hourly wage of native workers. These relationships suggest that the greater pressure of Venezuelan immigrants on low-paying jobs due to downgrading is the main driver of the

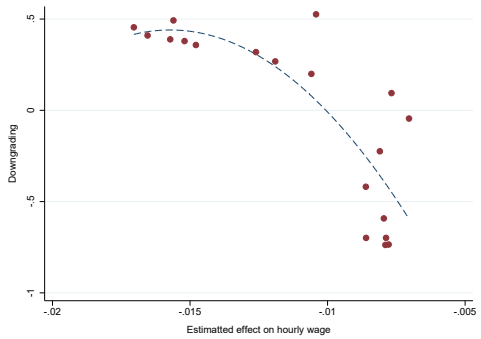
negative effect on the wages of low-income natives and, therefore, of the unequalizing effect of Venezuelan migration.

Figure 8: Relationship between downgrading and the estimated effect of migration on per capita labor income and hourly wage

(a) Per capita labor income



(b) Hourly wage



Notes.The figures relate the difference between the actual and predicted density of immigrants along the native wage distribution (the difference of the green and blue lines in Panel (a) of Figure 7) and the estimated UQPE of Venezuelan migration for each percentile of two labor income distributions. Panel A considers labor income per capita and Panel B the hourly wage.
Source: Own elaboration based on data from DANE.

Considering the information presented above, the downgrading of immigrants seems to be the driver and necessary condition for the negative effect of the Venezuelan exodus on the wages of low-wage workers and, therefore, on the strong effects on inequality and poverty. If this is the case, it might be expected that a regularization program implemented by the Colombian government according to which Venezuelan immigrants could formalize their migratory status in Colombia and thus access better jobs, could alleviate the pressure on the informal and low paid segment of the labor market, mitigating the negative wage effects on those jobs and the effect on inequality and poverty estimated above. In the following section we will present evidence in this direction that will reinforce the mechanism proposed in this paper.

7 Regularization of Venezuelan Immigrants

7.1 The PEP-RAMV program

Considering the growing influx of Venezuelans in Colombia and their irregular situation, the Colombian government took several measures in order to integrate them and legalize their migratory situation in the country. Although Venezuelan immigrants are allowed to enter Colombia, they are only authorized to remain in the country as tourists for 180 days, period in which

the tourist visa they receive upon arrival in Colombia expires; once this period is over if they remain in Colombia they are in an irregular situation.

To regularize the situation of those Venezuelans whose tourist visa had expired, the Colombian government created a migratory status that functions as a temporary residence permit that allows them to work in the formal labor market and to access public services such as health and education. This new migratory status known as *Permiso Especial de Permanencia (PEP)* was first implemented in January 2017 and February 2018 in which the government was able to regularize only 182,000 immigrants whose tourist visa had expired. Given the limited scope of these two waves of regularization we will not focus on them.

Between April and June 2018, the Colombian government implemented a massive and voluntary census of Venezuelan irregular immigrants known as the *Registro Administrativo de Migrantes Venezolanos (RAMV)* to measure the magnitude of the Venezuelan exodus in Colombia. This census was carried out in 441 Colombian municipalities out of a total of 1,122, particularly those municipalities with a large presence of Venezuelan immigrants, those located close to the border with Venezuela and also those that requested the implementation of the RAMV; the census was carried out in 1,109 different points spread throughout the country.

The government explicitly stated that the registration in the RAMV was not going to have any legal consequence for those Venezuelan immigrants with an irregular status in Colombia nor any benefit such as the issuance of a residence permit like the PEP. The RAMV was able to register 442,462 Venezuelan immigrants, less than the total estimated by the national government were living in Colombia by that time. According to Bahar et al. (2021), 49.7% of the Venezuelans registered in the RAMV were women, the average age of those registered was close to 26 years, 34.7% were married or cohabiting and 52.4% were head of household. Also, on average, the registered Venezuelans had 10.5 years of education, however the educational degree of about 89% of the surveyed Venezuelans was not officially recognized by the Colombian government. 62.6% were in the labor force, 32% were informal workers, 24.4% were unemployed and only 1.1% had access to the health system. Regarding their family in Colombia and Venezuela, 44% reported to have family in Colombia, 66% had family in Venezuela, 20% were parents and the average number of children of each individual was about 0.6.

Later, before the end of the term of Juan Manuel Santos, president of Colombia during the 2010-2018 period, he unexpectedly decided to regularize through the issuance of PEPs to those Venezuelan immigrants who registered in the RAMV. In order to be regularized, Venezuelans had to apply for the PEP and the only requisites were that they had to be registered in the RAMV, they had to be in Colombia in the moment in which the announce was made and could not have any criminal record or deportation order. The process was voluntary and only 63.8% of Venezuelans received a PEP out of the 441,237 registered in the RAMV (Bahar et al., 2021).

Considering this, we will use the share of Venezuelans that received a PEP relative to the departmental population as our measure of the PEP-RAMV implementation and will evaluate how this policy affected our variables of interest, namely, downgrading, inequality, poverty, family income and labor income.

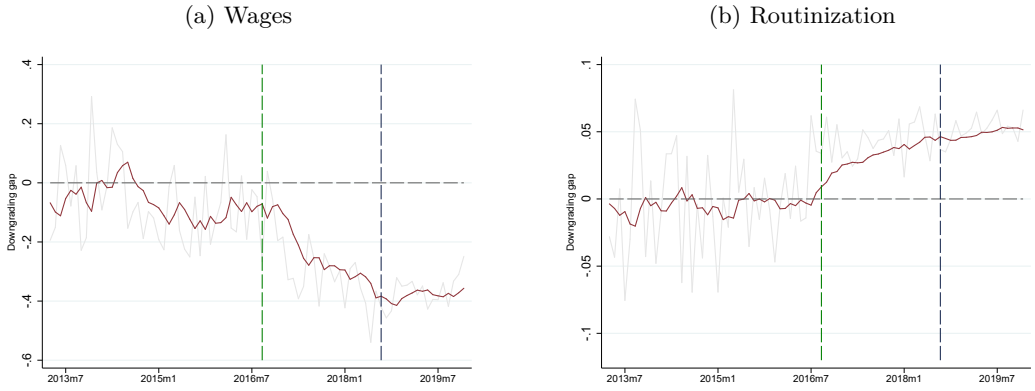
7.2 Regularization, downgrading, poverty and inequality

As a first approximation to the analysis of the effect of the regularization of Venezuelan immigrants on downgrading, inequality and poverty, we estimate the evolution of downgrading in terms of hourly wages and routinization of Venezuelan workers over time during the 2013-2019 period. These estimates are presented in Figure 9.

Two specific moments can be highlighted in panels (a) and (b) of Figure 9: first, August 2016 (green dashed vertical line), when the borders between Colombia and Venezuela were reopened after a year of being closed due to a political crisis between the two countries; this reopening of the borders triggered the influx of Venezuelans to Colombia pushed by the Venezuelan economic and social crisis. Second, August 2018 (blue dashed vertical line) when the PEP-RAMV program was implemented.

As can be seen, the downgrading of immigrants (both in wages and routinization) was around zero before the onset of the Venezuelan exodus; subsequently, between the beginning of the exodus (August 2016) and the implementation of the PEP-RAMV (August 2018) the downgrading of Venezuelan workers increased significantly along with the entry of Venezuelans into Colombia. Finally, after the implementation of the PEP-RAMV we can identify a stagnation in the evolution of downgrading in terms of wages and routinization since the moment the Venezuelan immigrants regularization program took place. This evidence suggests that, immigrants' downgrading intensified over time and, more importantly, slowed down and stabilized when a large number of Venezuelans were regularized, which could suggest that regularization helped them to work in jobs with wages and tasks more similar to those of native workers with similar observable characteristics, such as education, gender and age. We will formalize the estimation of this potential effect in the following subsection.

Figure 9: Gap in wages and routinization due to downgrading in Colombia, 2013-2019



Notes. The gray line in panel a (panel b) of the figure shows the average gap between the actual wage (routinization index) of Venezuelan immigrants and the predicted wage (routinization index) based on their characteristics according to equation 5 for each year-month in the period 2013-2019; the red line shows the trend component of an exponential smoothing to eliminate the cyclical factor of the series. The vertical dashed green line indicates the time at which the re-opening of borders between Colombia and Venezuela took place; the dashed blue line shows the moment at which the PEP-RAMV was implemented.
Source: Own elaboration based on data from DANE.

7.2.1 Empirical strategy

To estimate the joint effect of Venezuelan immigration and the implementation of the PEP-RAMV regularization program on downgrading, inequality and poverty, we estimate a regression similar to the equation (2) but in which we also include a variable that captures the effect of PEP-RAMV according to the following specification:

$$\mathsf{RIF}(y_{idt}, \nu_Y) = \beta M_{dt} + \phi PEP_{dt} + X_{idt}^{'}\delta + \omega_d + \pi_t + \mu_{idt} \tag{7}$$

Where:

$$\nu_Y : \{\text{Mean, UQPE, Gini Coefficient, Atkinson Index, Entropy Index}\}$$

Our outcome variables of interest are: (i) the gap between the predicted wage of immigrants as if their characteristics were rewarded like those of natives and their actual wage; (ii) the gap between the predicted routinization index of Venezuelan workers as if they were occupationally employed according to their characteristics and the actual routinization index of their occupations; (iii) the RIF variables to estimate the UQPE on per capita family income and hourly wages; (iv) the RIF variables of our inequality indicators (Gini, Atkinson and Entropy); finally, (v) the RIF variables of our poverty indicators.

The variables in the right-side of the equation (7) are the same as those included in the

equation (2) except that now the variable PEP_{dt} is also included. This variable captures the effect of regularization on the variable of interest. The variable PEP_{dt} is the same as the one used by Bahar et al. (2021) and is equal to the interaction between a dummy variable that takes value equal to 1 for each observation corresponding to a period from August 2018 or later (period in which the PEP-RAMV was implemented) inclusive (0 otherwise) and the percentage of PEP holders relative to the local population for each department at the end of the program implementation. Therefore, the coefficient ϕ indicates the estimated effect on the variable of interest of a 1 p.p. increase in the share of PEP holders relative to the population of the department. Then, M_{dt} and PEP_{dt} are our main variables of interest. We instrument M_{dt} with the same instrument presented above in equation (3).

In order to interpret causally the estimated effect of the PEP variable, our identification strategy is based on the fact that the issuance of the PEP-RAMV for those Venezuelans registered in the RAMV was unexpected. Therefore, although on average our outcome variables of interest might differ across departments depending on whether they have a large share of regularized immigrants or not, our identification strategy relies on the assumption that there is no systematic difference in the trends of our outcome variables before the implementation of the PEP-RAMV explained by the share of regularized immigrants.

7.2.2 Main results

First, we show the estimation of the effect of the regularization program in the downgrading of Venezuelan immigrants in terms of wages and routinization for the whole sample (first and third columns). Next, we include the interactions of the PEP variable and education level dummies to estimate whether there was any differential effect of the regularization program between individuals with different levels of qualification.

Specifically, we include incomplete post-secondary and complete university dummies. The incomplete post-secondary dummy takes value equal to 1 if the Venezuelan worker has attained a post-secondary non-university degree, such as a technician or technologist, or if she has attended some post-secondary level without attaining a degree. Finally, the complete university dummy takes value equal to 1 if the individual has a university or postgraduate degree. Therefore, when the interactions of the PEP variable and the education level dummies are included, the PEP variable is the base category indicating the effect of the PEP-RAMV regularization program on the downgrading of Venezuelan workers with secondary education or less.

According to Table 3, the PEP-RAMV program had a mitigating effect on downgrading, especially for Venezuelan workers with higher levels of education; these results are consistent with Figure 9. Moreover, the finding that the effect is stronger and statistically significant especially for the most educated Venezuelan workers is in line with the fact that these workers are those whose relative gain from regularization is stronger, considering that they are the workers who face the strongest downgrading in terms of wages and routinization, given their observable characteristics.

If downgrading was indeed the main driver of the effect of the Venezuelan exodus on in-

equality and poverty, a mitigation of downgrading is expected to alleviate the pressure on the labor market of low-income workers. Given this, it is likely that the PEP-RAMV program has positively affected the hourly wages of those workers on the left side of the labor income distribution and, therefore, has improved inequality and poverty levels in those departments where the PEP-RAMV had a greater impact.

Table 3: Effect of regularization on downgrading

	Wages		Routinization	
	All	Educational attainment	All	Educational attainment
Share of Immigrants	0.001	0.002	0.005	0.004
	(0.027)	(0.026)	(0.003)	(0.003)
[a] PEP	0.007	-0.006	-0.001	0.003
	(0.038)	(0.037)	(0.006)	(0.006)
[b] PEP× Incomplete Post-Secondary		0.013		-0.013***
		(0.010)		(0.002)
[c] PEP× Complete University		0.132***		-0.014**
		(0.045)		(0.006)
Linear combination: [a]+[b]		0.007		-0.010*
		(0.043)		(0.005)
Linear combination: [a]+[c]		0.127**		-0.012
		(0.053)		(0.007)
F-statistic	112.51	110.77	112.40	110.69
Number of Departments	24	24	24	24
Observations	22,788	22,788	22,727	22,727
Department FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Economics controls	Yes	Yes	Yes	Yes

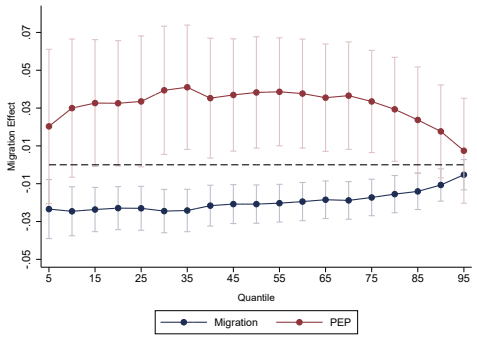
Notes. ***, **, and * denotes statistical significance at 1%, 5% and 10%, respectively. Clustered standard errors at department level in parenthesis. Each column represents the coefficient of a regression of inequality index and the share of Venezuelan immigrants relative to native population for the period 2013-2019. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

In Figure 10 we show the estimates of the UQPE of the share of Venezuelan immigrants and the PEP-RAMV variable jointly across different ventiles of per capita family income and hourly wage. We can see that, on the one hand, the estimated UQPEs of the Venezuelan exodus for each ventile remain negative, statistically significant and are stronger for those individuals located to the left of the corresponding income distribution. On the other hand, we also observe that the PEP-RAMV seems to have a positive effect especially for those low-income individuals in both panels of Figure 10. Although we cannot distinguish any differential effect between the quantiles of per capita family income and hourly wages, we can observe that the positive effect

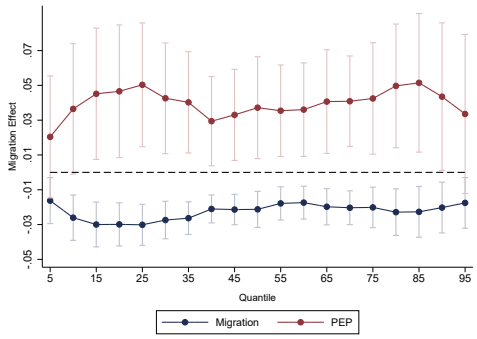
for each quantile would seem to mitigate the negative effect of Venezuelan migration.

Figure 10: UQPE of immigration and regularization on income

(a) Per capita family income



(b) Hourly wage



Notes. Each red and blue dot represents the coefficient of the share of Venezuelan migrants variable (M_{dt}) and the PEP implementation variable, respectively, from a regression according to the equation 7. Confidence intervals at 90% are included. Standard errors are clustered at the departmental level. The controls included in the regressions are: age (and its square), years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

This mitigating effect of the PEP-RAMV also seems to translate into an equalizing effect on the distribution of per capita family income of native individuals. To estimate this effect we consider as outcome variables the same inequality and poverty indicators included above in Tables 1 and 2. The results of the joint effect of immigration and the PEP-RAMV program on inequality and poverty are shown in Tables 4 and 5, respectively.

Three important things emerge from the results of Table 4: first, the effect of Venezuelan immigration on inequality remains robust to the inclusion of the PEP-RAMV variable; second, we estimate a negative effect of the PEP-RAMV program on inequality, regardless of the inequality indicator used as the dependent variable in our RIF regressions. For example, our estimates indicate that an increase in 1 p.p. of the share of regularized Venezuelans relative to the local population of the department reduces the Gini coefficient, on average, by 0.007 points. To measure the effect of the PEP-RAMV program, we calculate that, on average, the percentage of regularized Venezuelans in relation to the local departmental population was close to 0.73%, so that the average reduction in inequality measured by the Gini coefficient considering the actual number of regularized Venezuelans is close to 0.005 for an average department.

Finally, we can see that the inclusion of the PEP-RAMV variable generates that the estimated coefficient of the effect of the share of Venezuelan immigrants on inequality indicators is higher compared to our estimates when we do not include the PEP-RAMV variable (Table 1). This result suggests that the omission of the PEP-RAMV variable would have generated

a bias in the estimated impact of the share of immigrants in our estimates when it was not included in the regression. This is consistent with the fact that those departments where the share of immigrants is higher are expected to have a larger share of Venezuelans regularized through the PEP-RAMV program and, therefore, the omission of the latter variable could bias the coefficient of the share of immigrants towards zero.

Table 4: Effect of immigration and regularization on inequality

	IV				
	(1) Gini	(2) Atkinson (0.5)	(3) Atkinson (1)	(4) Entropy (0)	(5) Entropy (1)
Share of Immigrants	0.004***	0.003***	0.005***	0.007***	0.010***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
PEP	-0.007**	-0.006**	-0.007*	-0.010*	-0.019**
	(0.003)	(0.002)	(0.003)	(0.005)	(0.008)
F-statistic	51.30	51.30	51.30	51.30	51.30
Number of Departments	24	24	24	24	24
Observations	4,858,125	4,858,125	4,858,125	4,858,125	4,858,125
Department FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Economics controls	Yes	Yes	Yes	Yes	Yes

Notes. ***, **, and * denotes statistical significance at 1%, 5% and 10%, respectively. Clustered standard errors at department level in parenthesis. Each column represents the coefficient of a regression of an inequality index on the share of Venezuelan immigrants relative to native population for the period 2013-2019 and the PEP implementation variable according to equation 7. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

Finally, when we consider poverty indicators as our outcome variables, we find that our estimates go in the same direction as those for inequality. As shown in Table 5, the effects on poverty indicators explained by the share of Venezuelan immigrants remain positive and statistically significant when the PEP-RAMV variable is included in our estimates. In addition, we can see that there is also a statistically significant and negative effect of the PEP-RAMV program on the moderate poverty rate; however, for the case of the other more stringent poverty indicators the effects, although negative, are not statistically significant. This last result could be explained by the fact that these poverty indicators are more conservative and, therefore, it is less likely that the PEP-RAMV program could affect them to a large extent.

Table 5: Effect of immigration and regularization on poverty

	IV			
	(1) FGT(0)	(2) FGT(1)	(3) FGT(2)	(4) Extreme Pov.
Share of Immigrants	0.011***	0.004***	0.002**	0.003**
	(0.004)	(0.001)	(0.001)	(0.001)
PEP	-0.019*	-0.006	-0.002	-0.003
	(0.010)	(0.004)	(0.002)	(0.003)
F-statistic	51.30	51.30	51.30	51.30
Number of Departments	24	24	24	24
Observations	4,858,125	4,858,125	4,858,125	4,858,125
Department FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Economics controls	Yes	Yes	Yes	Yes

Notes. ***, **, and * denotes statistical significance at 1%, 5% and 10%, respectively. Clustered standard errors at department level in parenthesis. Each column represents the coefficient of a regression of an inequality index on the share of Venezuelan immigrants relative to native population for the period 2013-2019 and the PEP implementation variable according to equation 7. The controls included in the regressions are: age, age^2, years of education, marital status, relationship to the head of household, year-month and department dummies.
Source: Own elaboration based on data from DANE.

8 Internal validity of the identification strategy and robustness checks

8.1 Parallel-trends test for IV internal validity

Goldsmith-Pinkham et al. (2020) decompose the Bartik-type 2SLS estimator into its "shift" part and its "share" part: the estimator can be broken down into a weighted sum of just-identified separate instruments represented by each local share. Thus, while the shares can be understood as instruments, the common national shock functions as a weight matrix that shifts the share effects. Therefore, in settings such as ours where the strategy is based on differential exposure to a common shock, identification relies on the exogeneity of the shares.[12] More precisely, in cases such as the one we study in this paper, where there is a pre-shock period, the empirical strategy is equivalent to a difference-in-differences setting. Thus, testing whether the shares of

[12] In addition, according to Goldsmith-Pinkham et al. (2020) the consistency of the estimator also depends on the shares, although Borusyak et al. (2018) emphasize that under some assumptions the consistency of the estimator might also come from the shocks.

differential exposure to the common shock also lead to differences in our outcomes is vital to build credibility in our strategy.

Our weighted distance to Venezuela is a shift-share instrument. The "share part" is built from the product between (i) the inverse of each pairwise distance between Colombian departments and Venezuelan states, and (ii) the population density in each Venezuelan state according to the 2011 Census. These distance-density shares of 2011 (pre-shock) measure the differential exposure to the post-2015 common national Venezuelan exodus. Still, the effects we found due to the massive forced immigration of Venezuelans could be partly driven by changes that occurred at the departmental level prior to the arrival of the displaced. Then, we have to check for endogenous pre-exodus mechanisms that are correlated with both distances and our outcomes (inequality, downgrading or any other result of our research) in order to provide evidence that differential exposure to national arrival of displaced persons has identifying power. To this end, following Goldsmith-Pinkham et al. (2020) suggestion, we test for parallel-trends to alleviate the concern that our results are driven by pre-existing differential trends in our outcomes in departments with different distances to Venezuela's most populous states (and, hence, different exposure to the arrival of displaced citizens from that country).

Then, to test for parallel trends, we plot the reduced-form coefficients of the average distance-density shares on our outcomes of interest for the months of the two years prior to the opening of the Colombia-Venezuela border.[13] Accordingly, we regress our outcomes of interest for each year-month against the average of the distance-density shares (i.e., $\sum_s \frac{\alpha_s^{2011}}{K_{drs}}$) interacted with year-month fixed effects. In these regressions, we control for department fixed effects, month fixed effects, and for a vector of individuals' variables including age, sex, years of education, marital status and their relationship to the head of household. Figures A.1, A.2, and A.3 show the results.

We do not find significantly relevant systematic effects of parallel-trends prior to the opening of borders between Colombia and Venezuela. Distance shares to the most populous Venezuelan states do not statistically predict higher inequality or downgrading in the months prior to the exodus. This evidence holds for the effects on the quantiles of per capita household income, per capita labor income and hourly wage. This supports our identification assumption that the pre-exodus shares do not predict outcomes through mechanisms other than the post-2015 immigration shock.

Finally, it is relevant to make a brief comment on the exogeneity of the shock common to all our treated units (the departments), V_t in equation 3, the stock of Venezuelan immigrants living in Colombia in year t. 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

[13] Specifically, since Goldsmith-Pinkham et al. (2020) deduces that the Bartik-type instruments are a sum of shares weighted by Rotemberg weights, these authors recommend first calculating these weights to determine which Venezuelan-state-specific exposure design gets a larger weight in the overall Bartik-2SLS estimate, and thus which state-share effects are worth testing. In our design, these weights are made explicit through the product with the population density of each Venezuelan state, so when calculating the average of what we call distance-density shares, we are already considering the most and least relevant distances.

and 2018 (Figure 1) was due to events occurring in Venezuela: the macroeconomic, social, and political crisis. In short, the Venezuelan exodus and its evolution over time is mainly explained by push factors rather than pull factors of the Colombian economy that could have affected the migration preferences of Venezuelans and attracted them to settle in that country. Given this, it is plausible to assume that the time-varying component of our instrumental variable (and of our shock) is not related over time to our outcome variables.

9 Concluding Remarks

In this paper we estimate the distributional impact of the recent massive migration of Venezuelan into Colombia, one of the main forced migration episodes in the world. By taking advantage of the geographical heterogeneity in the intensity of migration across regions, we study the impact of migration on the Colombian wage and income distributions, and explore the mechanisms behind these effects. In particular, to explore the heterogeneity of the impact along the income distribution we use RIF regressions combined with an instrumental variables approach that accounts for the non-random pattern of location of immigrants.

Despite the fact that Venezuelan immigrants are on average more skilled than native Colombian workers, we find that the exodus had a larger negative effect on the lower tail of the wage distribution, and hence an unequalizing effect on the wage and income distributions. These results seem to be driven by a large downgrading of Venezuelan recent migrants, who tend to earn lower wages than natives with similar characteristics. Finally, we take advantage of a recent large regularization program of immigrants in Colombia and find that it helped reducing the degree of downgrading, and then contributed to a mitigation of the unequalizing impact of the exodus. These results can shed light on the potential role for public policies to ameliorate the short-run negative impact of massive migrations flows on the labor market and the income distribution of the receiving country.

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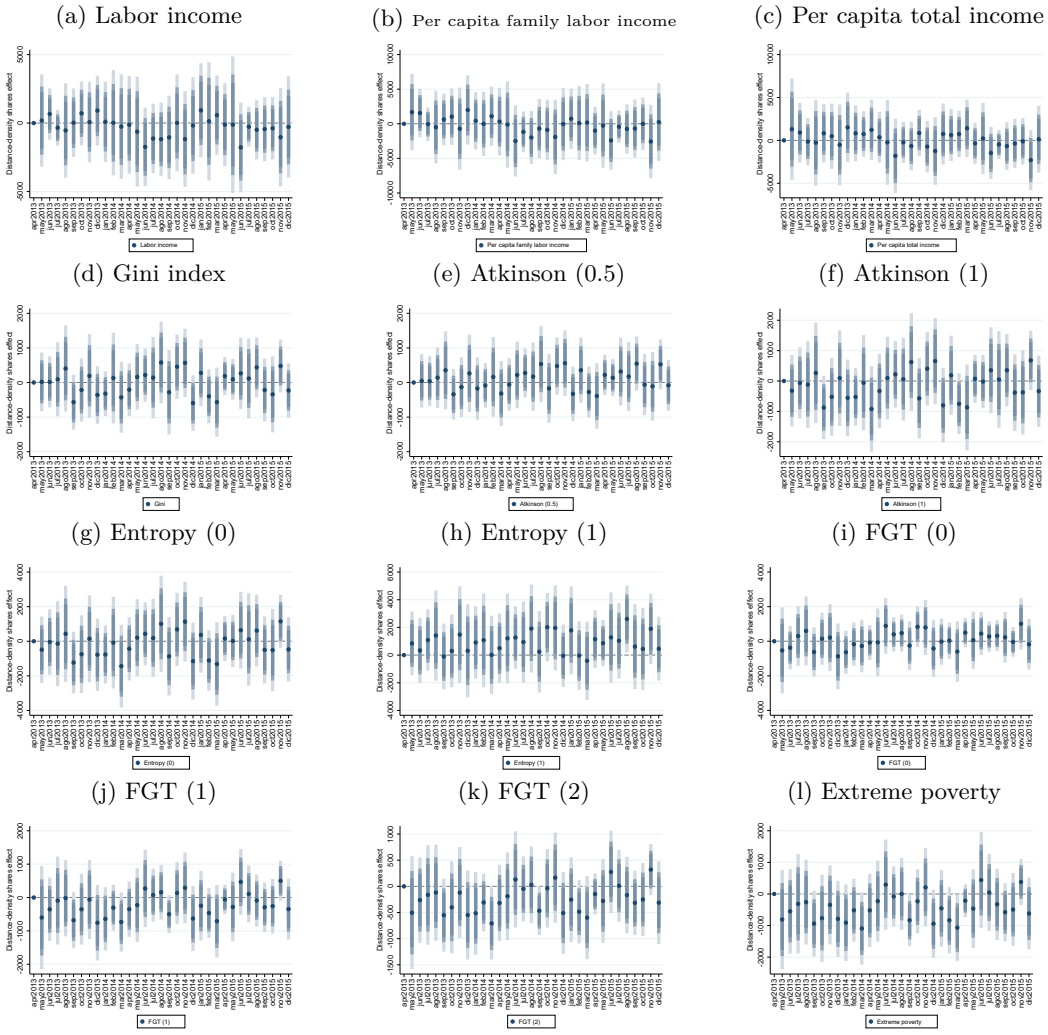
A Appendix Tables and Figures

Table A.1: Descriptive statistics - Colombians and Venezuelans, 2019

	Colombians	Venezuelans	Venezuelans 5 years	Venezuelans 1 year
Panel A: Socioeconomic characteristics				
Age (in years)	34.07	23.62	24.97	23.86
Sex (Man = 1)	0.492	0.499	0.496	0.483
Head of household	0.323	0.218	0.232	0.174
Socioeconomic level	2.031	1.940	1.943	1.961
In a relationship	0.414	0.434	0.465	0.401
Living in an urban area	0.773	0.878	0.886	0.906
Poverty rate	0.357	0.563	0.557	0.612
Extreme poverty rate	0.098	0.155	0.151	0.170
Working age population	0.848	0.759	0.812	0.769
Employment rate	0.565	0.631	0.632	0.578
Inactivity rate	1.000	1.000	1.000	1.000
Unemployment rate	0.102	0.145	0.148	0.202
Educational level				
Years of education	7.714	7.774	8.316	7.738
Incomplete secondary	0.596	0.566	0.534	0.574
Complete secondary	0.205	0.255	0.277	0.260
Incomplete Post-secondary	0.123	0.103	0.110	0.101
Complete Post-secondary	0.076	0.076	0.079	0.065
Panel B: Working population				
Hourly wage (in logs)	8.119	7.788	7.770	7.633
Routinization index	0.49	0.54	0.55	0.56
Hours of work per week	44.072	49.644	49.760	48.585
Economic sector				
Primary activities	0.173	0.062	0.059	0.057
Industry (low tech)	0.068	0.074	0.075	0.066
Industry (high tech)	0.050	0.040	0.040	0.037
Construction	0.066	0.117	0.119	0.113
Commerce	0.264	0.462	0.469	0.514
Utilities and transportation	0.086	0.053	0.051	0.046
Skilled services	0.091	0.047	0.045	0.039
Public administration	0.032	0.001	0.001	0.000
Education and health	0.139	0.104	0.102	0.086
Domestic servants	0.031	0.039	0.040	0.041

Source: Own elaboration based on data from GEIH-DANE.

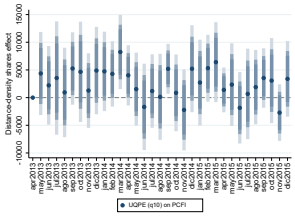
Figure A.1: IV internal validity test (pre-trends): inequality outcomes



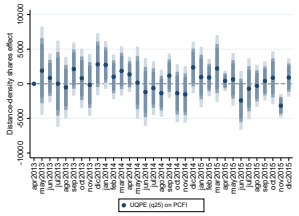
Notes. The titles above each graph show the outcome of each regression. Each dot represents the coefficient of the interaction between the average distance-density shares (i.e., $\sum_s \frac{\alpha_s^{2011}}{K_{drs}}$) in each month and monthly fixed effects. Regressions control for department fixed effects, month fixed effects, and for a vector of individuals' variables including age, sex, years of education, marital status and their relationship to the head of household. Standard errors were clustered at the departmental level.
Source. Own elaboration based on data from DANE.

Figure A.2: IV internal validity test (pre-trends): UQPEs

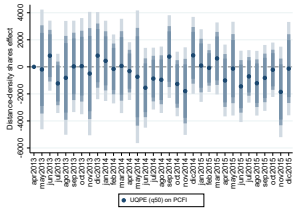
(a) UQPE (q=10) on PCFI



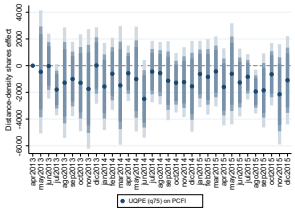
(b) UQPE (q=25) on PCFI



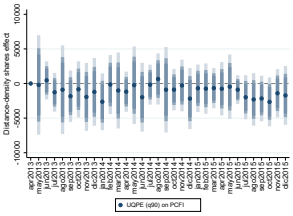
(c) UQPE (q=50) on PCFI



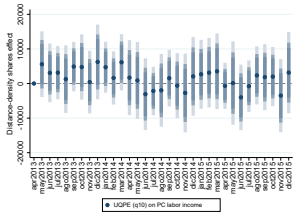
(d) UQPE (q=75) on PCFI



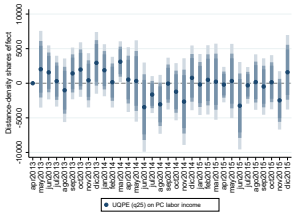
(e) UQPE (q=90) on PCFI



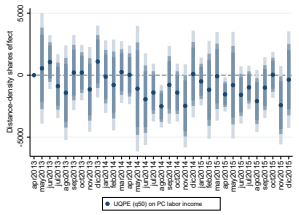
(f) UQPE (q=10) on PCLI



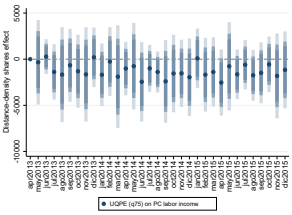
(g) UQPE (q=25) on PCLI



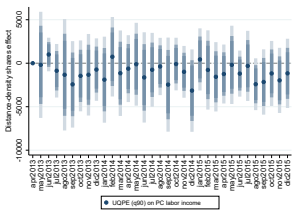
(h) UQPE (q=50) on PCLI



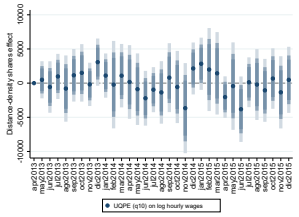
(i) UQPE (q=75) on PCLI



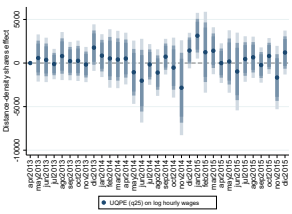
(j) UQPE (q=90) on PCLI



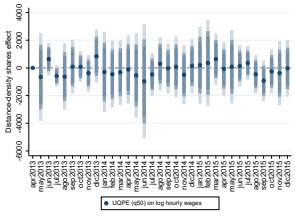
(k) UQPE (q=10) on HW



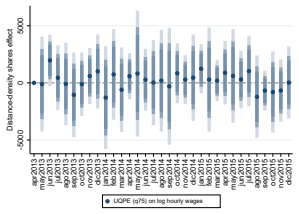
(l) UQPE (q=25) on HW



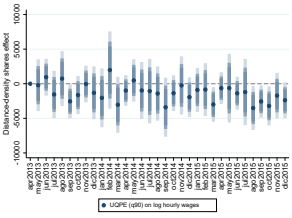
(m) UQPE (q=50) on HW



(n) UQPE (q=75) on HW

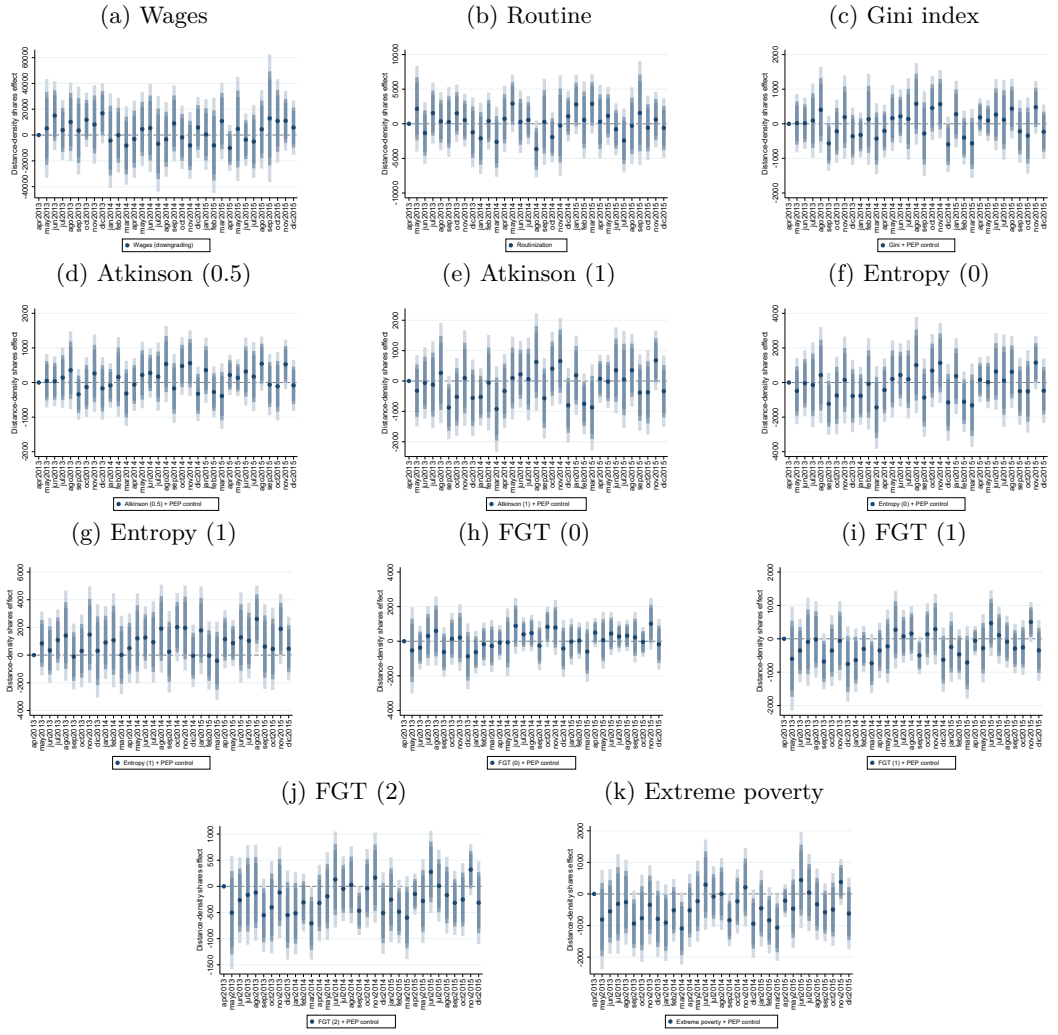


(o) UQPE (q=90) on HW



Notes. The titles above each graph show the outcome of each regression. PCFI stands for per capita family income, PCLI for per capita labor income, and HW for log hourly wages. Each dot represents the coefficient of the interaction between the average distance-density shares (i.e., $\sum_s \frac{\alpha_s^{2011}}{K_{drs}}$) in each month and monthly fixed effects. Regressions control for department fixed effects, month fixed effects, and for a vector of individuals' variables including age, sex, years of education, marital status and their relationship to the head of household. Standard errors were clustered at the departmental level.
Source. Own elaboration based on data from DANE.

Figure A.3: IV internal validity test (pre-trends): Downgrading outcomes



Notes. The titles above each graph show the outcome of each regression. Each dot represents the coefficient of the interaction between the average distance-density shares (i.e., $\sum_s \frac{\alpha_s^{2011}}{K_{drs}}$) in each month and monthly fixed effects. Regressions control for department fixed effects, month fixed effects, and for a vector of individuals' variables including age, sex, years of education, marital status and their relationship to the head of household. Standard errors were clustered at the departmental level.
Source. Own elaboration based on data from DANE.

B Income Distribution in Colombia

Colombia is one of the most unequal countries in Latin America (Tornarolli et al., 2018). According to data from SEDLAC (CEDLAS and World Bank), the Gini coefficient in Colombia has been reduced in the last decade. However, it is still above the average value for the region.

In Table A.1, we show several inequality and poverty indicators calculated based on GEIH data in Colombia. Our estimates indicate that income inequality seems to have an overall decreasing behavior during the 2013-2019 period regardless of the indicator considered, with a particular break point in 2018: there was a significant drop in income inequality during 2013-2017; however, from 2018 onwards there seems to be an increase in inequality in the country that did not reverse the reduction of previous years. In terms of poverty, the trend is similar: in 2013, 38.7% of Colombians were below the poverty line and this proportion reached its minimum in 2018 when the poverty rate decreased by 2.4 percentage points. Yet, in the last year of our sample we observe an increase in all poverty indicators considered in our estimates.

This significant change in the trends in terms of inequality and poverty during the 2018-2019 period coincides with the period in which the Venezuelan exodus took place and intensified. Although with this preliminary information we cannot argue that the deterioration of these social indicators is explained by the Venezuelan immigration, it is initial evidence suggestive of the potential regressive effects of this episode of forced migration.

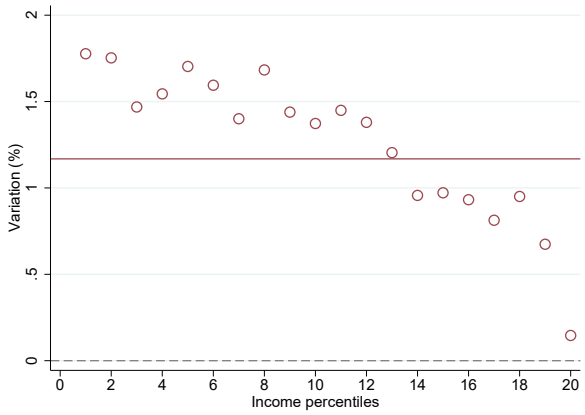
Table A.1: Income inequality and poverty indicators - Nationwide by year

	Gini	p90p10	p90p50	p50p10	A(0.5)	A(1)
2013	0.534	11.75	3.481	3.376	0.238	0.409
2014	0.533	11.61	3.439	3.375	0.236	0.406
2015	0.517	10.62	3.283	3.236	0.222	0.386
2016	0.511	10.19	3.174	3.209	0.218	0.379
2017	0.504	9.686	3.165	3.060	0.211	0.368
2018	0.512	10.15	3.225	3.148	0.219	0.379
2019	0.521	11.13	3.298	3.376	0.226	0.391
	GE(0)	GE(1)	FGT(0)	FGT(1)	FGT(2)	Extreme Pov.
2013	0.526	0.570	0.387	0.159	0.088	0.104
2014	0.521	0.566	0.376	0.154	0.085	0.103
2015	0.488	0.528	0.374	0.150	0.082	0.100
2016	0.476	0.519	0.377	0.149	0.081	0.106
2017	0.458	0.498	0.364	0.140	0.075	0.090
2018	0.477	0.521	0.358	0.139	0.075	0.086
2019	0.496	0.535	0.363	0.146	0.080	0.101

Notes. Each indicator was constructed using nominal per capita income for each year. For the calculation of the FGT(.) and Extreme Poverty indicators, the national poverty line calculated by DANE for each year was considered. Sampling weights were used to calculate the indicators.
Source: Own elaboration based on data from DANE.

The overall reduction in income inequality and poverty during the 2013-2019 period can be seen in more detail in Figure A.1. We show the average annual percentage change in per capita income per ventile during the period 2013-2019. Our calculations indicate that, during this period, average per capita income in Colombia increased by slightly more than 1% per year; however, this increase was heterogeneous across the income distribution: it was higher than 1.5% for the bottom half of the income distribution and significantly lower for the upper half.

Figure A.1: Average variation in per capita family income by ventile, 2013-2019

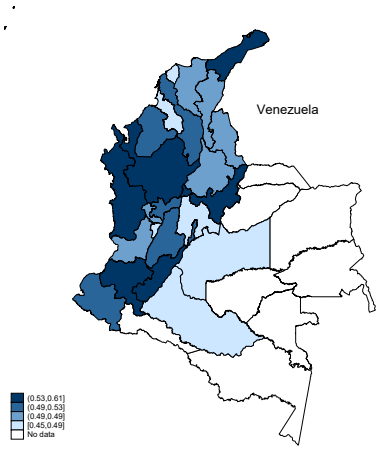


Notes. Each dot represents the average percentage change in per capita family income between 2013 and 2019 for each income ventile. The solid line represents the total average percentage change in per capita family income.
Source: Own elaboration based on data from DANE.

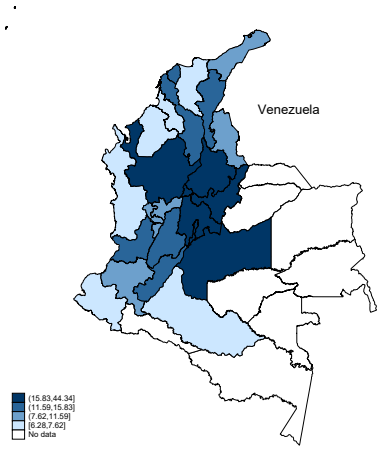
Figure A.2 shows the heterogeneity of income inequality and income level across departments in Colombia before the beginning of the Venezuelan migratory exodus (2013). There seems to be significant variability in both variables across departments: there are departments where inequality is significantly below the national average such as Sucre, Caquetá and Atlántico; on the other hand, departments such as Chocó, La Guajira and Cauca have the highest income inequality. It is also worth mentioning that income inequality appears to be significantly high regardless of the level of per capita income: for example, Antioquia and Chocó are among the departments with the highest income inequality; however, they are also departments with the highest and lowest income levels, respectively.

Figure A.2: Inequality and GDP, 2013

(a) Gini coefficient



(b) Per capita GDP (millions COP)



Notes. Departments with no data in the figure are mainly departments in the Amazon region 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 represents less than 3% of the total population in Colombia. We use survey weights to calculate the Gini coefficient.
Source. Own elaboration based on data from DANE.