Forced Migration and Violent Crime: Evidence from the Venezuelan exodus to Brazil

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June 21, 2024

Abstract

Does increased exposure to forced migration affect violent crime rates in developing host countries? To answer this question we exploit the unprecedented inflow of Venezuelans to Brazil. Contrary to fears propagated by the anti-immigration rhetoric, our two-stage least squares estimates reveal that the sudden influx of refugees did not affect violent crime in which natives were victimized. In fact, our results suggest that forced migration only increased violent crime involving Venezuelan victims. Victimization of migrants seems to have increased at a slower pace than their presence in the host country. Yet, it was concentrated among young males between the ages of 15 and 39 living in the border region of Brazil with Venezuela. Evaluating the causal impacts of forced migration in a developing context is crucial to providing governments and international agencies with rigorous evidence to support policy decisions. In absence of the latter, public perception can play a key role as host populations may pressure authorities for anti-immigration policies based solely on perceptions. Moreover, violence hinders migration's documented long-term benefits by imposing high economic and social costs.

Keywords: Forced Migration, Violent Crime, Brazil, Venezuelan Crisis

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1 Introduction

Forced migration is not a new topic neither in the economic literature nor in the political agenda. By the end of 2020, 82.4 million forcibly displaced people had fled their homes and were seeking a safer place to live (UNHCR, 2021). Conflicts and insecurity have contributed to the increasing influx of refugees and asylum seekers worldwide. Until recently, the humanitarian crises in Syria and Venezuela represented the two largest population exodus in the last decade. However, as of February 2022, the Russian invasion of Ukraine debunked prior conflicts and is now responsible for the largest forcibly displacement population in recent history. As highlighted by Filippo Grandi, the United Nations High Commissioner for Refugees, "we are witnessing a changed reality in that forced displacement nowadays is not only vastly more widespread but is simply no longer a short-term and temporary phenomenon" (UNHCR, 2020).

These large inflows of forced migrants raise concerns about the economic, social, and political impacts on receiving countries. In particular, the increase in crime is one of the most common related concerns reported by native populations (Bianchi et al., 2012). According to the 2020 Latinobarometer[1], an annual survey held in 18 Latin American countries, 56% of the respondents strongly agree that migration increases crime. Substantive literature has already explored the relationship between immigration and labor market outcomes. However, less is known regarding other aspects of socioeconomic conditions, particularly in developing countries with historically high homicide rates, such as Brazil. According to the United Nations Office on Drugs and Crime, Brazil ranks among the top twenty countries with the highest intentional homicide rate.

Under these circumstances, this paper aims to explore the impact of forced migration on violent crime in a hosting developing country. Recent findings suggest that there is an increasing share of refugees who seek protection further away in higher-income destinations, however, more than 80% of the displaced population is still hosted by neighboring countries of those in conflict (Devictor et al., 2021). This emphasizes the importance of understanding the consequences of forced displacement on hosting communities that tend to share similar characteristics with those in crisis. Socioeconomic incentives for violent crime, such as the presence of organized crime, weak labor market conditions, and lower

[1] https://publications.iadb.org/es/la-opinion-publica-respecto-de-la-migracion-en-america-latina-y-el-caribe

levels of educational attainment may be stronger drivers in these settings.

Furthermore, we argue that evaluating these impacts is crucial to providing governments and international agencies with rigorous evidence to support policy decisions. In absence of the latter, public perception can play a key role as host populations may pressure authorities for anti-immigration policies based solely on perceptions (see Hangartner et al., 2019). According to the 2017-2020 World Values Survey[2], approximately 45% of the population in Latin American countries are uncertain or do not believe that refugees should be granted asylum. Developing countries already face challenges of their own, such as persistent economic and social inequalities, and have increasingly been given the humanitarian task of protecting and integrating vulnerable migrant populations.

The context of our study is the unprecedented influx of Venezuelans to Brazil, following the escalation of the humanitarian crisis caused by the authoritarian regimes of Hugo Cháves and his successor, Nicolás Maduro. According to data reported by the Regional Inter-Agency Coordination Platform (R4V), by January 2023 Brazil already hosted approximately 400,000 Venezuelans. The migration flow which started in 2015 has increased the Venezuelan population in Brazil by more than one hundred and eighty times compared to the 2010 population census, the last run by the Brazilian Institute of Geography and Statistics (IBGE). In that year, the 2,165 Venezuelans living in Brazil represented only 0,5% of total foreign-borns.

Our initial approach to assessing the impact of the Venezuelan exodus on violent crime is to estimate a two-way fixed effects model that exploits variation in exposure to forced migration across Brazilian municipalities between 2010 and 2019. Yet, relying solely on our OLS estimate to establish a causal effect requires caution. In light of such concern, we employ the distance-based instrument proposed by Del Carpio & Wagner (2015) to overcome the omitted-variable bias imposed by the intrinsic endogeneity of migration decisions. The use of travel distance as an instrument has been one of the most frequently used empirical approaches in the forced displacement literature (see Verme & Schuettler, 2021). In our context, the main motivation for using distance as an instrument is the unprecedented nature of the Venezuelan crisis, which imposed on the population an urge of fleeing the country to neighboring regions. The northern region of Brazil, particularly the bordering states with Venezuela, Roraima, and Amazonas, were disproportionately

[2] https://laboratoriomigracion.iadb.org/#/en/encuestas

exposed to the influx of forced migrants.

At first, we find null effects of increased exposure to forced migration on the overall violent crime rate in Brazil. However, by disentangling violent crime rates by nationality, age, and sex of the victims we find that the sudden influx of refugees increased violent crime involving Venezuelan victims. There is no evidence of a corresponding increase in violent crime in which natives were victimized. We evaluate the robustness of our findings by assessing the plausibility of the main assumption for the validity of our instrument.

We find that the violent crimes in which Venezuelans were victimized increased at a slower pace than their presence in the host country. This suggests that they were not disproportionately affected when compared to natives. We interpreted this finding with caution and emphasize that it does not diminish the importance of providing support to vulnerable migrant populations. Forced migrants flee their homes seeking host countries for protection. Nonetheless, our findings seem to be driven by a surge in violent crime against male migrants between the ages of 15 and 39 living in the border region of Brazil with Venezuela. Based on the economics of crime literature and descriptive evidence, we identify two candidates for mechanisms driving the positive relationship between forced migration and crime in our setting: anti-immigration-driven hate crimes and the presence of criminal organizations.

Our paper makes several contributions to migration economics literature. First, it adds to the scarce literature that solely investigates the relationship between immigration and crime by providing novel evidence of a positive association in a distinct context than the majority of other papers. On one hand, Bianchi et al. (2012), Bell et al. (2013), and Ajzenman et al. (2020) find negligible or null effects of immigration on crime in Italy, the United Kingdom, and Chile, respectively. On the other, in the context only of forced migration, results are mixed. While Knight & Tribin (2023) also find that the large inflow of Venezuelans to Colombia increased migrant homicide rates. Kırdar et al. (2022) and Kayaoglu (2022) find either null or negative effects of the Syrian refugee crisis on crime rates in Turkey. Nevertheless, Akbulut-Yuksel et al. (2022) find a positive relationship in the same context, as does Dehos (2021) in Germany.

Second, it contributes to a broader rising literature on the impacts of forced migration in developing host countries by providing a novel approach to estimating the distribution of refugees when recent data is not available and showcasing the sensitivity of the

distance-based instrument to different ways of calculating travel distances (see Altındağ & Kaushal, 2021; Bahar et al., 2021; Caruso et al., 2019; Ceritoglu et al., 2017; Fallah et al., 2019; Ibáñez et al., 2021; Rozo & Vargas, 2021; Tumen, 2016 for examples of this literature). Verme & Schuettler (2021) document that although there already was a consolidated field focused on studying the impacts of migration in general, the question of whether forced displacement has been harmful or beneficial to host communities gained increasing attention from researchers only after the beginning of the conflict in Syria in 2011.[3] Until then, studies mostly evaluated the impact of voluntary migration on labor market outcomes in developed countries (see Card (1990); Borjas (1994); Dustmann et al. (2005) for seminal examples). Today's research span political, fiscal, criminal, health, and educational outcomes.

To the best of our knowledge, this paper is the first on the impacts of the Venezuelan forced migration on crime in Brazil. Therefore, it also contributes to the incipient group of studies that investigate the causal effects of this unprecedented refugee crisis. Shamsuddin et al. (2021) find that the large influx of forcibly displaced Venezuelans had no short-term effect on fiscal variables. They also document an increase in unemployment among women and a decrease in employment among low-skilled workers. Ryu & Paudel (2021) present similar results and show that the crisis lowered employment and labor force participation, but find no impact on wages.

The remainder of the paper is structured as follows. Section 2 presents the theoretical framework guiding our analysis. Section 3 brings background information on the Venezuelan crisis. Section 4 reveals the data used to build our panel. Section 5 presents our empirical strategy, which is followed by the results in Section 6, a discussion in Section 7 and a robustness test in Section 8. Finally, we share our sensitivity analysis of the distance-based instrument in Section 9 and conclude our paper in Section 10.

[3]We emphasize the importance of distinguishing the different types of migration movements because they imply different legal statuses of migrants in host communities. This plays a key role in incentives, access to the labor market, freedom of movement within hosting communities, and the guarantee of the *non-refoulment*. Ruiz & Vargas-Silva (2013) show that economic (voluntary) and forced migration (involuntary) are two different phenomena with distinct natures and motivations. Addressing them in empirical research requires different methodological approaches.

2 Theoretical Framework

Seminal work on the economics of crime by Becker (1968) and Ehrlich (1973) suggests that an individual's decision on involvement in criminal activity is based on the conscious or subconscious comparison between the expected costs and benefits associated with his action. The expected returns of crime are calculated based on potential personal and social earnings, while costs are primarily derived by the probability of punishment compared to potential legal labor market earnings. Thus, in line with the theory of rational choice under uncertainty, individuals decide to engage in criminal activity if the expected benefits exceed the expected costs.

The proposed theory is particularly relevant for property crime because benefits are arguably directly associated with the monetary value of illegally acquired goods. However, in our study, we focus only on violent crime resulting in death and thus the economic value involved seems less clear. Grogger (2005) states that violent crime plays a complementary role to other crimes, such as the illegal drug market, and thus we can extend the traditional economic model to these types of crime. That said, understanding the impact of forced migration on violent crime requires a comparison between what affects the incentives of engaging in criminal behavior both for natives and the forcibly displaced in the host community.

Incentives for asylum seekers and refugees to engage in violent criminal activity seem to be affected by several individual factors such as prospects for integration in the host community, duration of the asylum process, conditions of access to the labor market and social security services, the possibility of relocation, previous exposure to violence, traumas, and other intrinsic vulnerabilities associated with victims of forced displacement (Andersen et al., 2019; Arendt et al., 2020; Pinotti, 2017). These dictate the cost-benefits analysis and are in line with the framework proposed by Becker (1968) and Ehrlich (1973).

In contrast, incentives for natives to engage in criminal activity upon the arrival of migrants seem to be affected by compositional effects at the aggregate level which are driven by the demographic supply shock. These are more associated with the macrostructural theory (Messner & South, 1986) and include further tightening of labor market conditions and increased pressure on public services such as health and education, leading not only to an overall increase in criminal propensity but also to anti-immigration sentiments that nurture hate crimes. Lastly, native criminal organizations may seize the opportu-

nity to co-opt vulnerable migrants into criminal activity as they are more likely to live in disadvantaged areas (Martinez & Jr, 2014).

Building on the theoretical and empirical literature we hypothesize that in our setting the potential channels driving a positive effect of forced migration on violent crime in the host country could be: (i) a change in demographic composition leading to an increase in the population of young males that tend to be more involved in criminal activity (Freeman, 1999), (ii) a rise in urbanization and population density in a weakly institutionalized context favoring higher crime rates (Glaeser, 2014) (iii) low-income levels and an already weak formal labor market in the host community, before the arrival of refugees, suffering from increasing competition (Borjas et al., 2010; Britto et al., 2022; Dix-Carneiro et al., 2018), (iv) a low cost associated with committing a crime when taking into consideration the risk of deportation (Butcher & Piehl, 2006) and (iv) a pre-existing context of violence with the presence of illegal and organized crime leading to a favorable environment (Chimeli & Soares, 2017).

However, the theory and existing evidence may also support null or negative effects of forced migration on crime. If so, in our case the main channels driving a negative association could be: (i) increased presence of humanitarian actors and military forces in the region which most received Venezuelan migration flows, (ii) granted access to the formal labor market and freedom of movement within the host country (Mastrobuoni & Pinotti, 2015), (iii) facilitated access to aid and public social services (Lehman & Masterson, 2020), and (iv) lower cultural barriers than in other forced migration context (Böhmelt & Bove, 2020).

In essence, the theoretical framework and available empirical evidence lead to non-concluding results. Nevertheless, we argue that among the hypothesized channels, increased urban population density in a pre-existing context of economic deprivation and violence are potential candidates for the main channels driving the relationship between forced migration and crime in our setting. In addition, the geographical remoteness and weak institutional capacity of the regions most exposed to the Venezuelan exodus may put further pressure on these channels, as moving to other regions of Brazil involves high costs and long distances. Thus, we initially anticipate a positive effect. However, the ambiguity in our hypotheses reinforces the importance of further empirical investigation to understand the direction of this relationship.

3 Context

3.1 Venezuelan Crisis

By December 2022, 7.1 million Venezuelans had left their country in search of dignified and safer living conditions (R4V, 2022). Approximately 5.5 million of them migrated to countries in Latin America and the Caribbean. Colombia is currently host to the largest part of the displaced population, followed by Peru, Ecuador, Chile, and Brazil.

Once one of the richest countries in Latin America and with high prospects of economic growth due to extensive oil reserves, Venezuela's economic and social conditions have consistently deteriorated since 2013 (ECLAC, 2021). The election of Hugo Chávez in 1998 brought major changes to the political and economic dynamics of Venezuela (Vera, 2015). Although the country benefited from oil revenues during the first years of government, Chávez's regime continued to put forward its controversial and polarizing agenda. Following his death, Nicolás Maduro (former Vice President) assumed office in 2013 under charges of irregularities (Corrales, 2020). Since then, intensified by decreasing oil prices (2014-2020) and international sanctions, the country has been led to a state of humanitarian crisis.

Venezuela has been facing a systematic shortage of food across the country and the population has restricted access to basic healthcare necessities. Doocy et al. (2019) assess data from a variety of sources and suggest that food insecurity has nearly reached the entire population and acute malnutrition among children has become increasingly common. In addition, human rights violations and repression by the authoritarian regime have become a persistent threat to the oppositionists and the general population (Human Rights Watch, 2020).

3.2 Northern region: the gateway to Brazil

The city of Pacaraima, located in the northern state of Roraima, hosts the only official crossing by land between Brazil and Venezuela (see precise location in Figure 1). As the main gateway to Brazil, it received a rapid and unprecedented influx of forced migrants during the escalation of the crisis. Based on data from the International Traffic System (STI) collected by the Brazilian Federal Police, we estimate that almost 70% of all Venezuelans that have entered Brazil since 2015 came through the port of entry located

in Pacaraima. This disproportionately exposed the region, among the least populated in the country, to the influx of the forcibly displaced.

Figure 2 shows the yearly flow and accumulated stock of Venezuelans in Brazil between 2010 and 2019, while Figure A.1 in the appendix reveals the characteristics of this population. The inflow has mainly been composed of children and adults up to 40 years old, which at the beginning were predominantly male but later converged to a more balanced sex ratio. As a consequence of this migration flow, the population of Venezuelans in Brazil has increased by more than one hundred and eighty times compared to the 2010 population census. In that year, the 2,165 Venezuelans living in Brazil represented only 0,5% of total foreign-borns.

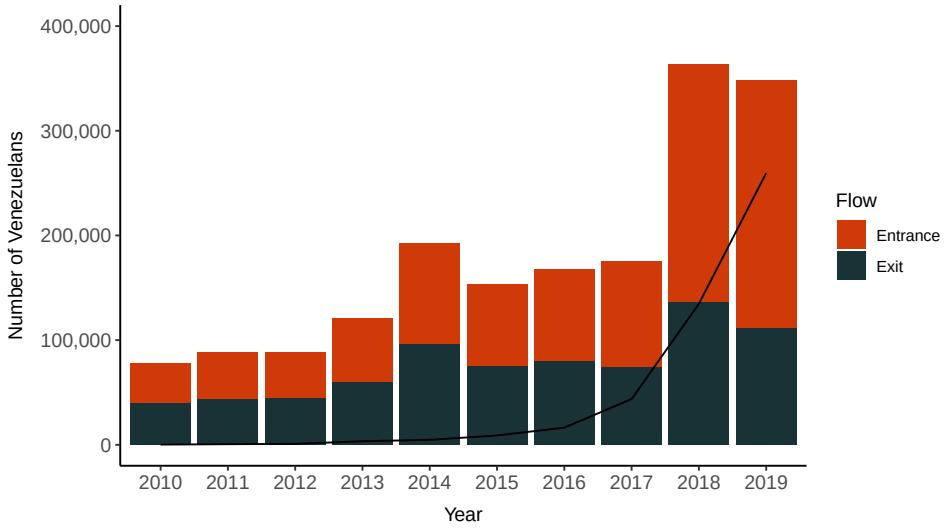
Figure 1: Map of Brazil and Venezuela

Notes: This figure presents a map of Brazil and Venezuela. The grey shaded area is the state of Roraima in the North Region of Brazil. The blue circle represents the port of entry located in the city of Pacaraima. *Source:* Author's creation using the Leaflet R package, © OpenStreetMap and © CARTO.

During the same period, the northern states witnessed a dramatic increase in violent crime rates (Cerqueira et al., 2021). In 2018, Roraima became the state with the highest homicide rate in Brazil. The time frame does coincide with the increase in the Venezuelan migration flow. However, other important factors played a key role in local criminal dynamics. A dispute between three of the major crime organizations in Brazil escalated substantially during this period and increased violent conflicts among local groups in

the region (Carvalho, 2019; Madeiro, 2019). The northern region of Brazil is a major drug route for cocaine produced in Colombia, Peru, and Ecuador. Moreover, and closely related, environmental crimes, such as illegal deforestation and lodging have also affected violence in the region (Chimeli & Soares, 2017; Marcelo Justus et al., 2016). Despite primarily involving the local population, these factors could still affect our findings. As we hypothesize in Section 7 they may be associated with our results.

Figure 2: Yearly Flow and Accumulated Stock of Venezuelan Forced Migrants in Brazil (2010-2021)



Notes: This plot illustrates the yearly flow and accumulated stock of Venezuelan migrants and refugees in Brazil. The black line represents the yearly accumulated stock since 2010. It is calculated using the yearly net inflow of Venezuelans. The sharp decrease in migration flows during 2020 and 2021 are attributed to the closing of borders during the COVID-19 pandemic. The data refers to all Brazilian ports of entry. *Source:* Author's calculation from the International Traffic System (STI) organized by Brazilian Federal Police. Data made publicly available by the Observatory of International Migration (OBMigra).

4 Data and Descriptive Statistics

The data used in our empirical strategy can be grouped into three categories: (i) violent crime, (ii) Venezuelan forced migration, and (iii) control variables. To build the panel we collected yearly data for all 5,570 municipalities between 2010-2019. In Brazil, municipalities are the federation unit with the smallest territorial coverage. Each of the three categories is described in the subsections below.

4.1 Violent Crime

Yearly data on violent crime comes from the Mortality Information System (SIM) organized by the Brazilian Health Ministry and implemented with the support of Health Secretaries at the state and municipal level.[4] The main input for the SIM is the Death Statement (DO), a standardized document issued by a medical doctor that includes the cause of death based on the International Classification of Diseases and Related Health Problems (ICD-10). The DO also includes several information on the victim, such as the date of death, nationality, gender, marital status, municipality of death, and the municipality of residence. Following Cerqueira et al. (2021), we compute total violent crimes as a sum of these two major categories:

- **Homicides**: deaths resulting from aggression (ICD-10 codes: X85-Y09, Y35-Y36). Within this category, we can also identify homicides caused by firearms, legal intervention, and other forms of aggression.
- **Violent Deaths By Undetermined Cause**: deaths resulting from undetermined cause (ICD-10 codes: Y10-Y34).

The yearly crime rate ($ViolentCrimeRate_{m,t}$) is constructed by dividing the number of violent crimes ($ViolentCrime_{m,t}$) in a specific municipality by its annual population [5] ($Population_{m,t}$) and multiplying the result by 100,000.

[4] As has been mentioned, all our estimates use data on violent crime that resulted in death to overcome methodological issues with self-reporting (see Junger-Tas & Marshall, 1999). Nonetheless, access to and quality of police incident reports vary significantly between states in Brazil. This imposes serious limitations to study the effects of forced migration on other types of criminal activities.

[5] Annual population statistics are projected by the Brazilian Health Ministry in a joint project with the Brazilian Institute of Geography and Statistics (IBGE). These estimates includes the total population (natives and migrants).

$$ViolentCrimeRate_{m,t} = \frac{ViolentCrime_{m,t}}{Population_{m,t}} * 100,000 \quad (1)$$

Table 1 provides descriptive statistics for the violent crime rate in Brazil. The average yearly violent crime rate across all municipalities was 20.10 per 100,000 people before the beginning of the Venezuelan crisis (2010-2015) and 23.92 in the following years (2016-2019). High standard deviations in both periods suggest heterogeneity in violent crime rates across the country. Figure 3 reveals that between 2010 and 2019 trends in violent crime rates were on average similar across the five regions of Brazil. However, consistent with what we presented in Section 3, the Northern region alongside the Central-West and Northeast has had consistently higher crime rates than the South and Southeast.

Table 1: Descriptive Statistics

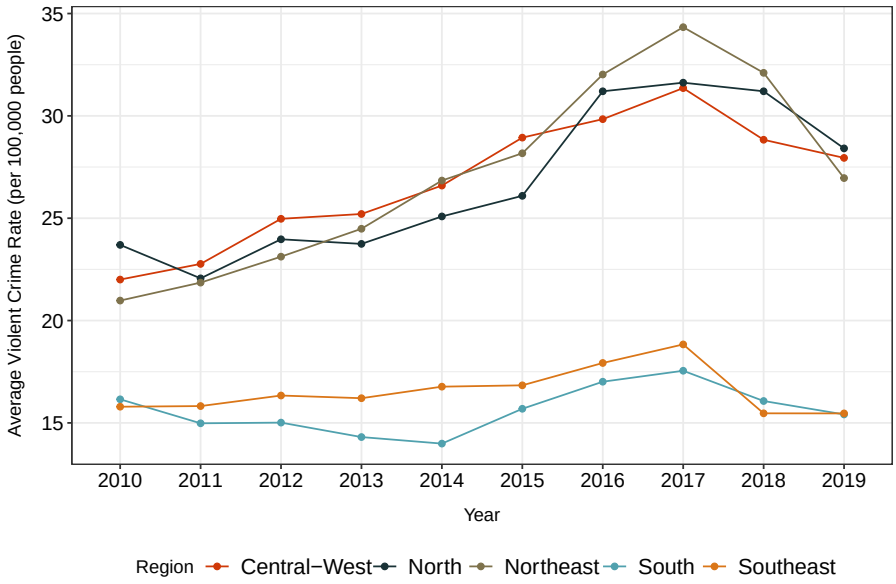
Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
			Pre migration crisis: 2010-2015				
Violent crime rate (per 100,000 people)	29495	20.103	20.92	0	2.738	29.18	205.835
Venezuelan share (%)	33405	0.001	0.044	0	0	0	4.17
GDP per capita (R$)	33404	9.403	0.723	5.724	8.82	9.894	13.619
Pop. density (pop./km2)	33420	113.353	597.551	0.086	11.761	53.937	13398.282
Young males between 15-39 (as % total pop.)	33420	20.357	2.063	11.188	19.294	21.389	71.907
Formal sector employment rate (%)	33390	15.265	11.695	0.081	7.255	19.768	220.989
School drop-out rate (%)	33405	2.044	2.329	0	0.562	2.736	32.683
Net inflow Venezuelans	33420	1410.667	1518.115	-224	313	2532	4163
			During migration crisis: 2016-2019				
Violent crime rate (per 100,000 people)	20072	23.922	25.14	0	5.449	34.634	357.143
Venezuelan share (%)	22280	0.007	0.228	0	0	0	26.06
GDP per capita (R$)	22280	9.772	0.684	8.105	9.191	10.241	13.275
Pop. Density (pop./km2)	22280	118.396	620.699	0.049	11.713	55.74	14207.573
Young males between 15-39 (as % total pop.)	22280	19.958	2.32	10.425	18.714	21.144	71.901
Formal sector employment rate (%)	22280	15.214	10.521	0.307	7.646	19.693	178.151
School drop-out rate (%)	22280	1.344	1.735	0	0.296	1.778	27.343
Net inflow Venezuelans	22280	62662.75	47331.94	7504	22342.75	99495.5	124796

Notes: This table reports the descriptive statistics for the outcome variable (*Violent crime rate*), the independent variable (*Venezuelan share*) and the set of control variables. We also report the descriptive statistics of the *Net inflow of Venezulans* used to construct the distance-based instrument.

4.2 Venezuelan Forced Migration

Since recent data on the number of refugees and migrants is not available at the municipal level, we propose a novel way to estimate the varying intensity of exposure to Venezuelan forced migration. Leveraging rich microdata from the Brazilian School Census, we are able to calculate the number of Venezuelan students in each municipality for every time

Figure 3: Average Yearly Violent Crime Rates in Brazil by Region (2010-2019)



Notes: This plot presents average yearly violent crime rates per 100,000 people across the five regions of Brazil. Each line represents the average yearly violent crime rate for each of the five regions of Brazil. *Source:* Author's calculation using the Brazilian Mortality Information System (SIM).

period of our analysis. This allows us to approximate the yearly ratio of Venezuelans to the total population. The Brazilian School Census is organized each year by the National Institute of Educational Studies and Research (INEP) and contains individual-level characteristics of all students enrolled in public and private schools across the country.

The underlying assumption of our proxy is that the ratio of Venezuelan students to the total student population should be similar to the share of the Venezuelan population in each municipality. We argue that this is highly plausible for two main reasons. First, primary and secondary education is compulsory and access to public schools is free in Brazil. In addition, the Brazilian Statute of Refugees (Law 9.474/1997) guarantees the right of asylum seekers and refugees to access education. Thus, we expect that the majority of children that migrated with their families were enrolled in school upon settlement in Brazil. Second, the inflow of Venezuelans during the crisis was largely composed of children up to the age of fifteen. Figure A.1 in the appendix illustrates in detail the age and sex distribution of the net inflow of Venezuelan forced migrants in Brazil during the period of our study.

It is important to mention that upon arrival in Brazil, Venezuelans initially chose be-

tween applying for asylum or a residence permit [6]. Both legal statuses entitled Venezuelans to a working permit, free movement within the country, and access to all public services (i.e. education, health, and social programs). In contrast to the available information on asylum seekers, data from the residence permits do allow us to identify the municipality of residence of each applicant. However, each migrant only appears in the dataset once, that is, in the year the request was filed. Using this data as a measure for forced migration exposure, as done by Shamsuddin et al. (2022), would imply a strong assumption of the absence of internal migration. Moreover, it could largely underestimate the size of the Venezuelan population in Brazil. Those with residence permits accounted for only half of the Venezuelans that were living in Brazil in 2019, the remainder had applied or already been granted asylum[7].

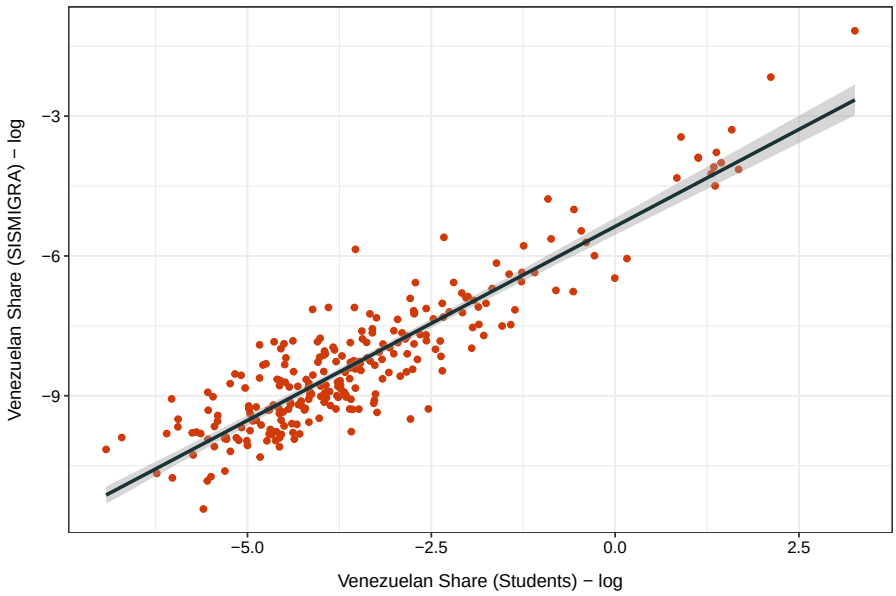
We test the validity of our proposed proxy by assessing the relationship between the share of Venezuelans that filed for residence permits in 2019 and the share of Venezuelan students in those municipalities for the same year. Figure 4 reveals a strong and significant correlation between both variables. Not only in terms of direction but also of magnitude. More importantly, by leveraging the Brazilian School Census data we were able to find Venezuelan students in 642 municipalities, while the National Migration Registration System (SISMIGRA) - the administrative record of residence permits - had only registered Venezuelans living in 281 municipalities in 2019. This not only supports the plausibility of the underlying assumptions of our proxy but also demonstrates its potential to identify more comprehensively where Venezuelans settled in Brazil regardless of their legal status. Figure 5 presents the share of Venezuelan students in different time periods of our analysis. The increase in the share of Venezuelan children enrolled in Brazilian schools coincides with the increase in the migratory flow presented in Figure 2.

Finally, as a first approach to evaluating the relationship between forced migration and crime, in Figure A.2 in the appendix we compare the share of Venezuelans living in each municipality with violent crime rates during the years of the crisis. A pooled linear analysis between both variables point towards a negative relationship in the Northern, Northeastern, and Southeastern municipalities. While an absence of correlation seems to

[6] Until 2019, those who applied for residence permits had legal support from a normative resolution that grants temporary residence to migrants of neighboring countries.

[7] According to the National Migration Registration System (SISMIGRA) and the International Traffic System - Alerts and Restrictions Module (STI-MAR), by the end of 2019 138,580 applications for residence permits had been filed, while 137,974 applications for asylum had been requested.

Figure 4: Relationship between the share of Venezuelans with residence permits (SISMIGRA) and the share of Venezuelan students by municipality in 2019



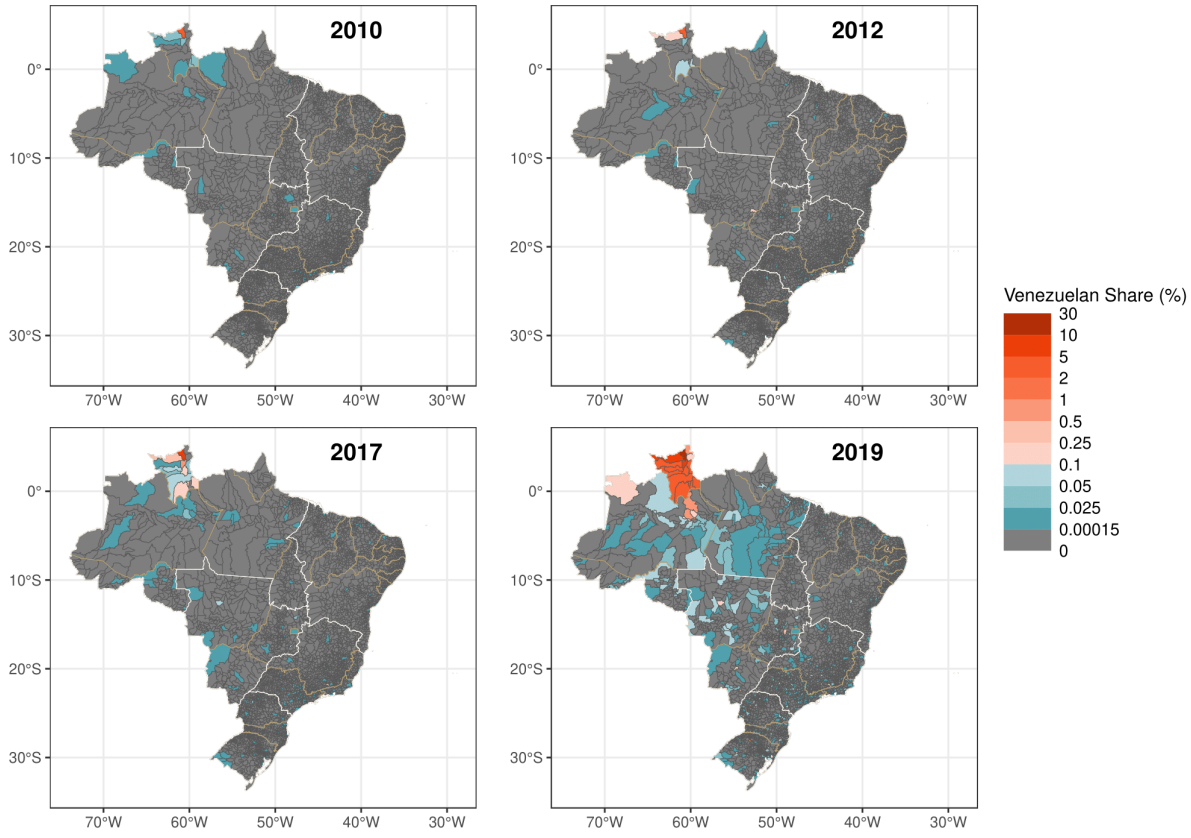
Notes: This figure illustrates the relationship between the ratio of Venezuelans that filed for residence permits to the total municipal population and the ratio of Venezuelan students to total student population in that same municipality. Each point represents the log transformation of these shares in 2019. Municipalities with either or both shares equal to zero were dropped. *Source:* Author's calculation using the National Migration Registration System (SISMIGRA) and the Brazilian School Census.

prevail in the Central-West and South regions.

4.3 Control Variables

Our time-varying control variables at the municipal level come from three different sources. GDP per capita, population density in km^2, and formal sector employment rate come from the Brazilian Institute of Geography and Statistics (IBGE). The population of young men between ages 15-39 (as % of the total population) comes from estimates provided by Brazil's Unified Health System (SUS). While primary education drop-out rates come from the Brazilian School Census.

Figure 5: Share of Venezuelans by municipality



Notes: The figure illustrates the share of Venezuelans in each municipality for 2010, 2012, 2017, and 2019. The share is approximated by leveraging the ratio of Venezuelan students to total student population. White lines represent the divison of Brazil into its five regions. Yellow lines and grey lines are state and muncipality lines, respectively. *Source:* Author's calculation using the Brazilian School Census.

5 Empirical strategy

Our empirical strategy exploits the variation in exposure to forced migration across Brazilian municipalities over time. Thus, our initial approach to assesss the impact of the Venezuelan exodus on violent crime rates is to estimate the following two-way fixed effects (TWFE) model:

$$y_{m,t} = \beta VenezuelanShare_{m,t} + \alpha_t + \alpha_m + \gamma t_m + X_{m,t} + \epsilon_{m,t} \tag{2}$$

where $y_{m,t}$ is the violent crime rate per 100,000 people of municipality m in year t; $VenezuelanShare_{m,t}$ is defined in Section 4 and is our proxy for the percentage of Venezuelan migrants and refugees in the total population of municipality m in year t; α_m are municipality fixed effects to control for time-invariant characteristics at the municipal level; α_t are year fixed effects to control for variables and shocks that are constant across municipalities but vary over time; t_m are twenty-seven state-specific linear time trends; and $X_{m,t}$ is a vector of time-varying municipal characteristics which might influence criminal behavior. $X_{m,t}$ includes GDP per capita, formal sector employment rate, school drop-out rates (Becker, 1968; Bianchi et al., 2012; Ehrlich, 1973), population density (L. Glaeser & Sacerdote, 1999) and the share of young men between ages 15-39 (D. Levitt, 1998; Freeman, 1999; Grogger, 2005). The error term is represented by $\epsilon_{m,t}$, and standard errors are clustered at the municipality level.

The inclusion of state-specific time trends (t_m) is particularly important in our context because public security is essentially a responsibility of each of the twenty-six states and the federal district in Brazil (Cano, 2006). As a consequence, each state could choose to implement a different response to the inflow of forced migrants to their municipalities. As has been shown in Section 3 the Brazilian federal did adopt a centralized response to the Venezuelan exodus. However, it was only concentrated in the state of Roraima and began in 2018, two years after the sudden increase in migration flows. Additionally, the inclusion of state-year interactions also allows us to control for possible differences in pre-existing trends across states and eventual internal migration effects.

The parameter of interest, β, can be interpreted as the change in the violent crime rate per 100,000 people when the share of Venezuelans increases by one percentage point.

Yet, relying solely on our OLS estimate to establish a causal effect requires caution for two main reasons. First, migration settlement patterns could correlate with violent crime rates across municipalities and, thus, the $VenezuelanShare_{m,t}$ would not be exogenous imposing an omitted-variable bias. Even if it were the case that criminal activity was not a factor influencing the decision to settle, other deciding factors are likely to be correlated with unobservable municipal characteristics that may affect violent crime. Second, a growing literature within the econometric theory has shown that empirical designs such as ours, with varying treatment periods, tend to be biased in the presence of heterogeneous effects (see a synthesis of these findings in Chaisemartin & D'Haultfœuille, 2022).

In light of these concerns, we employ the distance-based instrument proposed by Del Carpio & Wagner (2015) which should account for both sources of bias. The use of different distances as instruments has been the most frequently used empirical approach in the context of forced displacement (see Verme & Schuettler, 2021). A limited number of migrants living in neighboring regions before humanitarian crises generally hinder the use of the traditional shift-share type instrument that relies on the previous share of migrants as a pull factor through pre-existing networks. Nonetheless, push factors tend to play a bigger role than pull factors in these settings.

5.1 Distance-based instrument

The distance-based instrument distributes the yearly number of Venezuelan migrants and refugees in Brazil according to the shortest traveling distance between each of the 24 states in Venezuela and the 5570 municipalities in Brazil, yielding 133,680 possible routes. The identifying assumption is that travel distance between Venezuelan and Brazilian municipalities affects violent crime rates only through the increasing share of Venezuelan refugees. The instrument is constructed as follows:

$$IV_{m,t} = \sum_{e=1}^{24} pop_e * \frac{1}{dist_{e,m}} * NetInflow_t \tag{3}$$

where $IV_{m,t}$ is the expected number of Venezuelans in municipality m and year t; pop_e is the fraction of the Venezuelan pre-crisis population in each state e, that comes from the 2011 census; $dist_{e,m}$ is the shortest traveling distance in kilometers from the capital

city of state e in Venezuela to municipality m in Brazil calculated by the GraphHopper Matrix API[8]; and $NetInflow_t$ is the yearly net inflow of Venezuelans to Brazil that comes from the International Traffic System (STI) organized by the Brazilian Federal Police[9]. As hypothesized by the gravity models of migration and considering the absence of this specific data, we follow Akbulut-Yuksel et al. (2022) and include the ratio of Venezuelans living each in state because it is plausible to assume that a higher share of forced migrants originates from the more populated regions of the country.

The main motivation for using distance as an instrument is the unprecedented nature of the Venezuelan crisis, which imposed on the population an urge of fleeing the country to neighboring regions. Figure 5 highlights the importance of distance as a factor in the settling decision in our context. The first-stage of our two-stage least squares (2SLS) estimates and the F-statistics confirm the instrument's relevance. We find a positive and significant relationship between the share of migrants and the instrument, with the F-statistic exceeding the standard value of 10 across all specifications (see Table 2). Moreover, in Figure 6 we provide a visual assessment of this relationship in the years after the onset of the migratory exodus.

Indeed, the northern region of Brazil, particularly the bordering states with Venezuela, Roraima and Manaus, were disproportionately exposed to the influx of forced migrants. Several reasons may account for this trend. First, the city of Pacaraima located in Roraima hosts the only official crossing by land between Brazil and Venezuela (see precise location in Figure 1). Second, the region is characterized by extremely long distances and precarious routes to the major economic centers of Brazil[10]. Third, there might have been the belief that the displacement would be temporary and that the migrants would be able to return to Venezuela in the short term. Fourth, the state of Roraima was where humanitarian agencies and the Brazilian Federal government first established camps.

The main assumption for the validity of our instrument is that conditional on municipality fixed effects, year fixed effects, state-specific linear trends, and a set of controls,

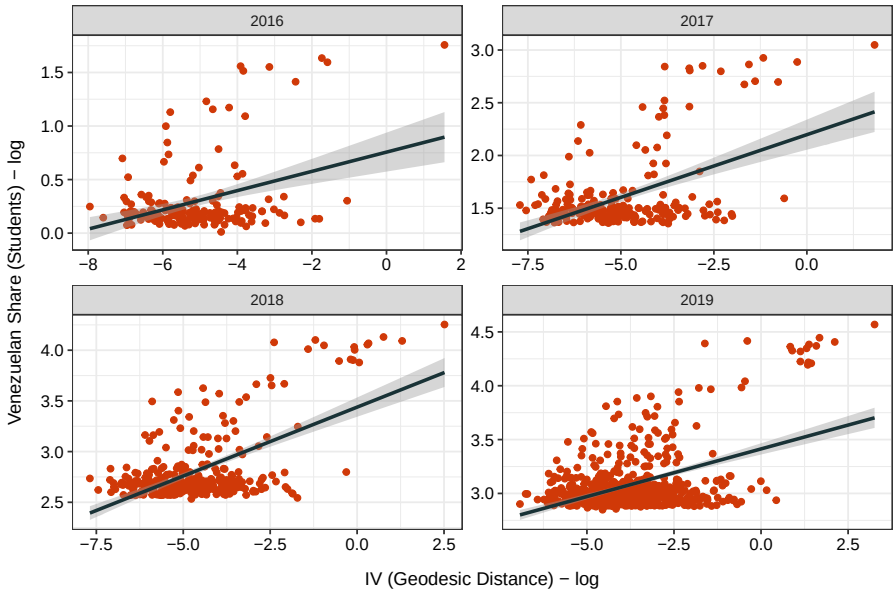
[8] In Section 8 we thoroughly discuss the reason why we chose this routing service and the implications of using different measures of distance, such as the simple Geodesic distance, in the construction of this instrument.

[9] The data is organized and made publicly available by the Observatory of International Migration (OBMigra)

[10] On one hand, access to the state of Roraima from other regions of Brazil is limited to a 748km road that connects Boa Vista (the capital city of Roraima) to Manaus (the capital city of Amazonas) or a small airport with flights to six destinations in Brazil. On the other, access to Roraima from Venezuela itself also requires a long journey.

trends in violent crime rates in the absence of the Venezuelan crisis would have been the same in municipalities less and more exposed to migration. That is, we assume that our distance-based instrument is not correlated with unobserved factors that could affect criminal behavior. In Section 8 we assess the plausibility of the exogeneity assumption by conducting a placebo test.

Figure 6: Instrument's relevance: Relationship between the Venezuelan Share and the Instrumental Variable (IV)



Notes: The figure illustrates the relationship between the ratio of Venezuelan students to total student population and the instrumental variable. The plot is faceted by year. Each point represents the log transformation of the shares and predicted migration flow (i.e., the instrument) in 2016, 2017, 2018, and 2019. Municipalities with either or both values equal to zero were dropped. *Source:* Author's calculation using data from the the Brazilian School Census. The instrument was constructed using data from the International Traffic System (STI) and GraphHopper API distance matrix.

Finally, we believe that the 2SLS estimates mitigate our concerns regarding the potential bias which could be imposed by varying treatment periods in the presence of heterogeneous effects. The predetermined distribution of Venezuelans in Brazil yielded by the instrument replaces the staggered inflow of migrants across municipalities and time present in our TWFE estimates.

6 Results

6.1 Effects on overall violent crime rates

Table 2 presents the results of the OLS and 2SLS estimations of Equation 2. Panel A (columns 1, 2, 3) contains all municipalities in Brazil, while Panel B (columns 4, 5, 6) contains only the municipalities located in the Northern region. We chose to estimate our specifications separately for Panel B to account for potential heterogeneous effects due to its disproportionate exposure to the Venezuelan exodus. For each panel, we report three different specifications. Columns 1 and 4 include only municipality and year fixed effects. While columns 2, 3, 5, and 6 gradually include control variables and state linear trends.

All the coefficients in Table 2 suggest a positive relationship between the share of Venezuelan refugees and violent crime. However, in our preferred OLS specifications (3 and 6), and in all of our 2SLS estimates these coefficients are not statistically significant at the standard levels. Thus, we find suggestive evidence that variation in the share of Venezuelans did not affect the overall violent crime rates across Brazilian municipalities. We also highlight that our OLS coefficients have significantly lower magnitudes when compared to the 2SLS estimates. This could partially be explained by Venezuelan's self-selection to settle in municipalities with lower crime rates which could downward bias the OLS estimates.

Initially and contrary to what we hypothesized these results suggest that a population shock in our context of forced migration did not increase overall violent crime rates. This is particularly interesting because of several characteristics of our setting that would lead us to expect otherwise. The increased urban population density in a pre-existing context of economic deprivation and violence was expected to be the driver of a positive relationship. Thus, to further evaluate our results we leverage our rich dataset to estimate the effects of forced migration on violent crime rates according to the victims' demographic characteristics. This allows us to distinguish between the nationality, age, and sex of the victims.

Table 2: Impacts of Venezuelan Forced Migration on Violent Crime in Brazil

Dependent Variable:	Violent Crime Rate per 100,000 people					
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: All municipalities			Panel B: Northern municipalities		
OLS Results						
Venezuelan Share (%)	1.412***	0.9987**	0.0497	1.164***	0.8586*	0.1236
	(0.3455)	(0.4283)	(1.044)	(0.3831)	(0.4857)	(1.009)
Observations	49,567	49,552	49,552	4,163	4,163	4,163
R^2	0.52485	0.52638	0.53804	0.52580	0.53003	0.53796
2SLS Results						
Venezuelan Share (%)	2.842	1.024	0.5164	1.612	0.3540	1.112
	(2.163)	(2.144)	(2.229)	(1.967)	(2.125)	(1.844)
Observations	49,235	49,220	49,220	3,895	3,895	3,895
R^2	0.5251	0.5267	0.5384	0.5229	0.5271	0.5348
First-stage	0.0346**	0.0344**	0.0394**	0.0579**	0.0576**	0.0660**
	(0.0122)	(0.0122)	(0.0149)	(0.0193)	(0.0197)	(0.0243)
F-statistic	693.86	463.77	221.30	67.93	45.47	38.36
Mean	21.65	21.65	21.65	26.76	26.76	26.76
Controls						
Municipality	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
State Linear Trend	No	No	Yes	No	No	Yes

Notes: Results from OLS and 2SLS models regressing violent crime rate per 100,000 on the share of Venezuelans. Panel A (columns 1, 2, 3) contains all municipalities in Brazil, while Panel B (columns 4, 5, 6) contains only the municipalities located in the Northern region. Columns 1 and 4 include only municipality and year fixed effects. While columns 2, 3, 5, and 6 gradually include control variables and state linear trends. Heteroskedasticity-robust standard errors in parentheses. They are clustered at the municipality level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

6.2 Effects on violent crime rates by victims' characteristics

In Table 3 we present the results of the impact of forced migration on violent crime rate by nationality of the victim for all municipalities in Brazil (Panel A). As in Equation 1 the denominator of the nationality-specific violent crime rates remains the total municipal population. Both our OLS and 2SLS estimates indicate that an increased share of Venezuelans only has a positive and statistically significant effect on the violent crime rates among migrants themselves. No effect is found for native victims or for other

nationalities.

Table 3: Impacts of Venezuelan Forced Migration on Violent Crime by Nationality of the Victim

Dependent Variable:	Violent Crime Rate per 100,000 people				
	(1)	(2)	(3)	(4)	(5)
Nationality:	(Brazil)	(Venezuela)	(Other)	(Venezuela)	(Venezuela)
		Panel A: All municipalities		Panel B: Northern municipalities	Panel C: Northern excl. Roraima
OLS Results					
Venezuelan Share (%)	-0.6578	0.2640***	-0.0858	0.2678***	-0.0420
	(1.006)	(0.0400)	(0.0595)	(0.0410)	(0.4165)
Observations	49,552	49,552	49,552	4,163	4,018
R^2	0.53049	0.18860	0.18312	0.22497	0.19713
2SLS Results					
Venezuelan Share (%)	0.5268	0.2851***	-0.0444	0.2929***	0.1145
	(1.999)	(0.0679)	(0.1469)	(0.0656)	(0.0784)
Observations	49,220	49,220	49,220	3,895	3,750
R^2	0.53112	0.44398	0.18310	0.45182	0.10495
First-stage	0.0394**	0.0394**	0.0394**	0.0660**	0.0030**
	(0.0149)	(0.0149)	(0.0149)	(0.0243)	(0.0002)
Mean	15.13	0.002	0.05	0.018	0.010
Controls					
Municipality	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
State Linear Trend	Yes	Yes	Yes	Yes	Yes

Notes: Results from OLS and 2SLS models regressing violent crime rate per 100,000 by nationality of the victim on the share of Venezuelans. Panel A (columns 1, 2, 3) contains all municipalities in Brazil, while Panel B (columns 4, 5) contains only the municipalities located in the Northern region and Panel C contains municipalities located in the North excluding those in the state of Roraima. All columns include municipality fixed effects, year fixed effects, control variables and state linear trends. Heteroskedasticity-robust standard errors in parentheses. They are clustered at the municipality level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

To understand what may be driving this positive association we run the specification of column 2 only for the Northern municipalities (Panel B) and for the Northern municipalities excluding those in the state of Roraima (Panel C). Our results reveal that the increase in Venezuelan victimization seems to be driven by increased violence in the region most exposed to the population shock, particularly, in municipalities close to the

official border crossing located in the state of Roraima. Precisely, we estimate an increase of 115,27% in the violent crime rate involving Venezuelan victims relative to the average rate in Roraima (between 2010 and 2019), given a 1 percentage point increase in the share of forced migrants. These are very significant effects and in Section 7 we assess if they are disproportionate or not to the increase in the migrant population.

Table 4 presents evidence that the positive association found in Table 3 is probably explained by an increase in violent crime against Venezuelans between the ages of 15 and 39. In line with Freeman (1999) and the literature on the economics of crime, these results suggest that the increase in violence is probably related to criminal activity in the region. The statistical insignificance and small magnitude of the coefficients in column 3 of Table 4 hinder our concerns that the effects are being driven, for instance, by gender-related or domestic violence.

These results are similar to the positive impact of the Venezuelan exodus on homicide rates of these migrants in Colombia found by Knight & Tribin (2023). We complement their findings with novel evidence from Brazil and by disentangling the age and sex of victims. This allows us to dig deeper into what may be driving the relationship between forced migration and crime in the context of the Venezuelan exodus to Latin American countries.

Table 4: Impacts of Venezuelan Forced Migration on Violent Crime by Sex, Age and Nationality of the Victim

Dependent Variable:	Violent Crime Rate per 100,000 people				
	(1)	(2)	(3)	(4)	(5)
Nationality:	(Venezuela)	(Venezuela)	(Venezuela)	(Venezuela)	(Venezuela)
Sex:	(Male)	(Male)	(Female)	(Male)	(Male)
Age:	(All)	(Age: 15-39)	(All)	(All)	(Age: 15-39)
		Panel A: Northern municipalities		Panel B: Northern municipalities excl. Roraima	
OLS Results					
Venezuelan Share (%)	0.2628***	0.2665***	0.0050	-0.0420	-0.0376
	(0.0400)	(0.0361)	(0.0061)	(0.4165)	(0.4177)
Observations	4,163	4,163	4,163	4,018	4,018
R^2	0.22386	0.22572	0.17337	0.19713	0.19714
2SLS Results					
Venezuelan Share (%)	0.2869***	0.2643***	0.0060	0.1145	0.1222
	(0.0640)	(0.0675)	(0.0060)	(0.0784)	(0.0816)
Observations	3,895	3,895	3,895	3,750	3,750
R^2	0.44736	0.54148	0.17164	0.10495	0.10461
First-stage	0.0660**	0.0660**	0.0660**	0.0030**	0.0030**
	(0.0243)	(0.0243)	(0.0243)	(0.0011)	(0.0011)
Mean	0.018	0.016	0.0001	0.010	0.010
Controls					
Municipality	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
State Linear Trend	Yes	Yes	Yes	Yes	Yes

Notes: Results from OLS and 2SLS models regressing violent crime rate per 100,000 by nationality, age and sex of the victim on the share of Venezuelans. Panel A (columns 1, 2, 3) contains all municipalities in the Northern region Brazil, while Panel B (columns 4, 5, 6) contains the municipalities located in the Northern region exluding those in the state of Roraima. All columns include municipality fixed effects, year fixed effects, control variables and state linear trends. Heteroskedasticity-robust standard errors in parentheses. They are clustered at the municipality level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

7 Discussion

Access to and quality of police incident reports vary significantly between states in Brazil. This imposes serious limitations on linking the information we have on violent crime victims with arrest or incident data. Nonetheless, in this section, we assess to what extent the increase in Venezuelan victimization may be the direct consequence of the increased presence of migrants in Brazil and discuss why hate crimes and the presence of criminal organizations may be the mechanisms driving our findings.

Following Knight & Tribin (2023)'s risk analysis, our documented increase in violent crime with Venezuelan victims in the northern region of Brazil could be the consequence of two distinct scenarios: (i) the Venezuelan population in this area increased, consequently, their exposure to risk also increased and our findings are driven by that fact that migrants are victimized at the same rate as natives, or (ii) Venezuelans could be more exposed to risk and the increase in violence reflects disproportionate victimization when compared to the native population.

Table 5 reveals a third and distinct scenario. By regressing the Venezuelan share of violent crime victims on the share of the Venezuelan population we find that the violent crimes in which they were victims increased at a slower pace than their presence in the host country. More specifically, in Northern municipalities, a 10 percentage point increase in the share of Venezuelans leads only to a 6.74 percentage point increase in the Venezuelan share of violent crime victims. We acknowledge that this finding should be interpreted with caution and it does not diminish the importance of providing support to vulnerable migrant populations. Forced migrants flee their homes seeking host countries for protection.

Furthermore, our findings do suggest that the surge in violence victimized a specific demographic group: young male migrants. One could initially argue that the effects were concentrated among males between the ages of 15 and 39 merely because they represented the largest share of Venezuelan forced migrants. This would be highly plausible in other contexts of forced migration. But Figure A.1 in the appendix reveals a well-balanced distribution of migrants across age and sex in our setting. Unfortunately, we lack data to support a causal analysis of what channels may have driven this result. Nonetheless, as we mentioned in Section 6, increased violence among males between the ages of 15 and 39 is highly suggestive of criminal activity in the region (Freeman, 1999).

Table 5: Impacts of the Venezuelan Forced Migration on the Venezuelan share of victims

Dependent Variable:	Venezuelan share of violent crime victims	
	(1)	(2)
	Panel A: All municipalities	Panel B: Northern municipalities
2SLS Results		
Venezuelan Share (%)	0.645***	0.6739***
	(0.1954)	(0.1938)
Observations	37,588	3,323
R^2	0.57608	0.59196
Controls		
Municipality	Yes	Yes
Year	Yes	Yes
Controls	Yes	Yes
State Linear Trend	Yes	Yes

Notes: Results from 2SLS models regressing the Venezuelan share of violent crime victims on the share of Venezuelan population. Panel A contains all municipalities in Brazil, while Panel B contains only the municipalities located in the Northern region. Both columns include municipality fixed effects, year fixed effects, control variables, and state linear trends. Heteroskedasticity-robust standard errors in parentheses. They are clustered at the municipality level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

On one hand, the massive population shock to a weakly institutionalized, economically deprived, and low-populated region increased tensions between the host population and the forcibly displaced. Major newspapers reported several anti-immigration protests and roadblocks in which the local population claimed that upon the arrival of Venezuelans, the region suffered from increased violence and a deterioration of public services [11] [12] [13]. According to the articles, the population demanded more security and a solution from the government. As anecdotally documented by Ramalho (2019), this could have led to a surge of hate crimes against Venezuelans that would be consistent with our findings. We also believe that the negative impacts on employment documented by Shamsuddin et al. (2021) and Ryu & Paudel (2021) could also have been a trigger to anti-immigration

[11] https://g1.globo.com/jornal-nacional/noticia/2020/02/10/pacaraima-rr-tem-protestos-contra-a-entrada-de-venezuelanos.ghtml

[12] https://www1.folha.uol.com.br/mundo/2019/08/um-ano-apos-confronto-com-venezuelanos-moradores-brasileiros-protestam.shtml

[13] https://brasil.elpais.com/brasil/2018/08/17/politica/1534459908_846691.html

sentiments.

On the other hand, the state of Roraima has been a major stage of dispute among national criminal organizations. The region is known to be a major drug and illicit firearm route. Newspapers have documented two concomitant events that may have led to an increase violence and in Venezuelan victimization. First, it has been reported that Brazilian criminal organizations have taken advantage of vulnerable young male migrants who are arrested for petty theft and co-opted into illegal activity during their period in prison [14]. Second, according to the Federal Police, the major Venezuelan criminal organization has also reached the state of Roraima on the back of the migratory flow [15].

Finally, we do not rule out the possibility of conflict among Venezuelan refugees, however, we lack descriptive or even anecdotal evidence to support this as a potential mechanism.

[14] https://www.estadao.com.br/brasil/em-nova-ofensiva-pcc-recruta-venezuelanos-em-prisao-de-roraima/

[15] https://noticias.uol.com.br/cotidiano/ultimas-noticias/2019/09/10/pranato-faccao-venezuela-pacaraima-roraima-fronteira-brasil.htm

8 Robustness: Placebo test

The main assumption for the validity of our instrument is that in the absence of the migratory flows, violent crime rates would have been similar in municipalities closer and further to the border with Venezuela, conditional on municipality fixed effects, year fixed effects, state-specific linear trends, and the set of controls. That is, the instrument's exogeneity relies on the fact that our distance-based instrument is not correlated with unobserved factors that could affect criminal behavior.

To evaluate the plausibility of this assumption we follow Kırdar et al. (2022) and measure the impact of exposure to forced migration when absolutely no effect is expected. That is, we estimate specifications 3 and 6 of Table 2 and specifications 2 and 4 of Table 4 but restrict our sample to the period before the Venezuelan crisis (2010-2014) and assign the share of Venezuelans from 2015, 2016, 2017, 2018 and 2019 to the years 2010, 2011, 2012, 2013, and 2014, respectively. Table A.1 in the appendix presents the results of the placebo test and provides support for our identifying assumption. We find no evidence that our distance-based instrument correlates with violent crime rates before the Venezuelan crisis.

9 Distance-based instrument: sensitivity analysis

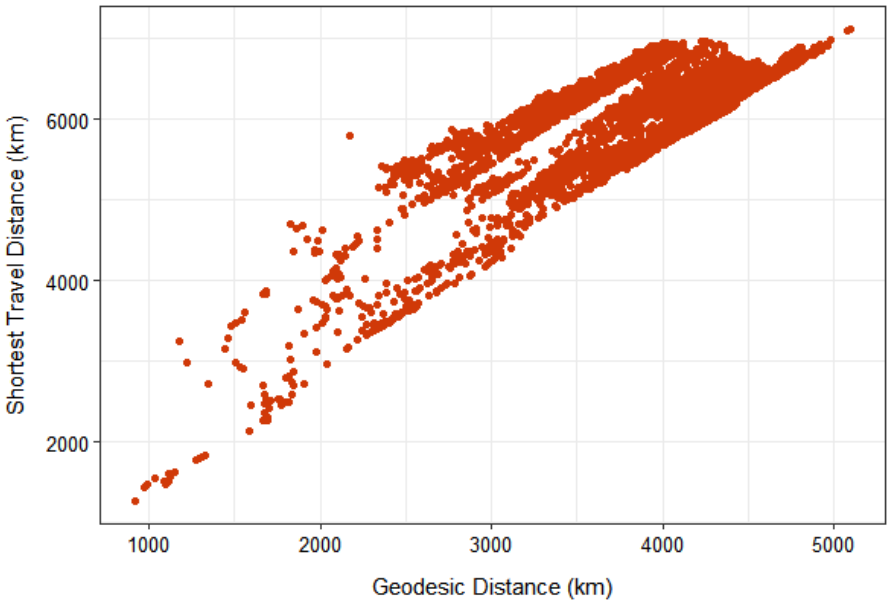
In this section, we discuss why we chose a particular routing service to estimate potential migration routes used in Equation 3 and present complementary findings regarding the sensitivity of the instrument used in our empirical strategy. We find that the distance-based instrument is extremely sensitive to the way that potential migration routes are estimated. By sharing our analysis we seek to emphasize the importance of taking into account the geographical and infrastructure particularities of each setting.

In Brazil, particularly in states of the northern region - where exposure to Venezuelan forced migration was disproportionate -, highway infrastructure is fairly limited. Navigable rivers are the main means of transportation between several municipalities in the states of Amazonas and Pará, for example. This hindered us from using a variety of routing services to calculate the travel distances between 24 Venezuelan states and 5,570 Brazilian municipalities necessary for Equation 3. Most of the available routing services, such as Google Maps API, were unable to estimate these distances. In several cases, the minimum distance included water transportation at some point. However, GraphHopper Directions API could estimate the minimum routes by including navigation on rivers when suitable. This was what allowed us to precisely estimate the potential routes necessary to build our instrument.

The particularity of our setting implies that predicting migration routes in regions with poor transportation infrastructure requires caution by researchers. Simply using latitude or longitude, as done by Shamsuddin et al. (2022), to approximate travel distance may yield biased estimates. Figure 7 shows the relationship between two different ways of calculating the potential routes between Caracas - the capital city of Venezuela - and all 5,570 municipalities in Brazil. The travel distances calculated by the GraphHopper Directions API are consistently larger than those estimated by a simple geodesic distance. Consequently, we expect that using two approaches to calculate the distance-based instrument yields different results.

To assess the magnitude of this difference we reestimate specifications 3 and 6 of Table 2 and specifications 2 and 4 of Table 4, but instead, in Equation 3 we use the simple geodesic distance to construct our instrument. Table A.2 in the appendix presents the second-stage results and reveals that our parameters not only change drastically in terms of magnitude and statistical significance but surprisingly present a negative coefficient in

Figure 7: Travel distances between Caracas (Venezuela) and 5,570 municipalities in Brazil



Notes: The figure illustrates the relationship between two alternative ways of calculating travel distance between Caracas, Venezuela, and all 5,570 municipalities in Brazil. *Source:* Author's creation using the shortest travel distance calculated by the GraphHopper API service. Geodesic distance was calculated using latitude and longitude.

column 1. Moreover, the first-stage results show that the instrument becomes consistently weaker (only significant at the 10% level) across all specifications. Overall, these results do not corroborate the findings presented throughout this paper and demonstrate the sensitivity of the distance-based instrument.

10 Concluding Remarks

This paper provides novel evidence on the impact of forced migration on violent crime in a developing country by exploiting the unprecedented inflow of Venezuelan forced migrants to Brazil. Using rich yearly data for 2010-2019 combined with complementary datasets, we leverage variation in exposure to forced migration across Brazilian municipalities over time and find suggestive evidence that the sudden influx of refugees increased violent crime involving Venezuelan victims. The effect is driven by crimes committed close to the land border between Brazil and Venezuela. There is no evidence of a effect on violent crime in which natives or other migrants were victimized.

Understanding the socioeconomic consequences of large population shocks on hosting communities has gained increased interest from scholars since the Syrian crisis that started in 2011. These findings have substantial policy implications, as public opinion may play a key role in shaping anti-immigration policies based solely on perceptions. Moreover, violence hinders migration's documented long-term benefits by imposing high economic and social costs on the receiving country.

Following Knight & Tribin (2023)'s findings on increased homicide rates against Venezuelan refugees in Colombia we seek to contribute to this debate by providing novel evidence of similar effects in a neighboring context. We substantially complement their findings by disentangling not only the nationality but the age and sex of the victims. This allows us to further understand the relationship between forced migration and crime in the context of the Venezuelan exodus to Latin American countries.

By regressing the Venezuelan share of violent crime victims on the share of the Venezuelan population we find that the violent crimes in which they were victims increased at a slower pace than their presence in the host country. Nonetheless, these violent crimes victimized a specific demographic group compose of young males between the ages of 15 and 39. We provide descriptive and anecdotal evidence that suggests two possible channels driving the positive relationship between forced migration and crime in our setting: anti-immigration-driven hate crimes and the presence of criminal organizations.

Unfortunately, the quality of police incident data varies significantly between states in Brazil. This imposes serious limitations on evaluating the impacts of an increased presence of refugees on other types of criminal activity. Thus, all our estimates rely on

health administrative data on deaths resulting from violent crime. On one hand, this helps overcome methodological issues with self-reporting. On the other, it does not enable us to understand if smaller types of crimes may have been affected by the population shock.

In the future, an important path of research is to investigate the integration policies that have been implemented by international agencies and the Brazilian Federal government since the arrival of Venezuelans. Little is known of how the *Estratégia de Interiorização* (Interiorization strategy), for example, has managed to integrate more than 80,000 refugees and migrants that have benefited from the program since 2018. Providing quick and efficient support to the vulnerable forcibly displaced is key for their short and long-term integration into the new country.

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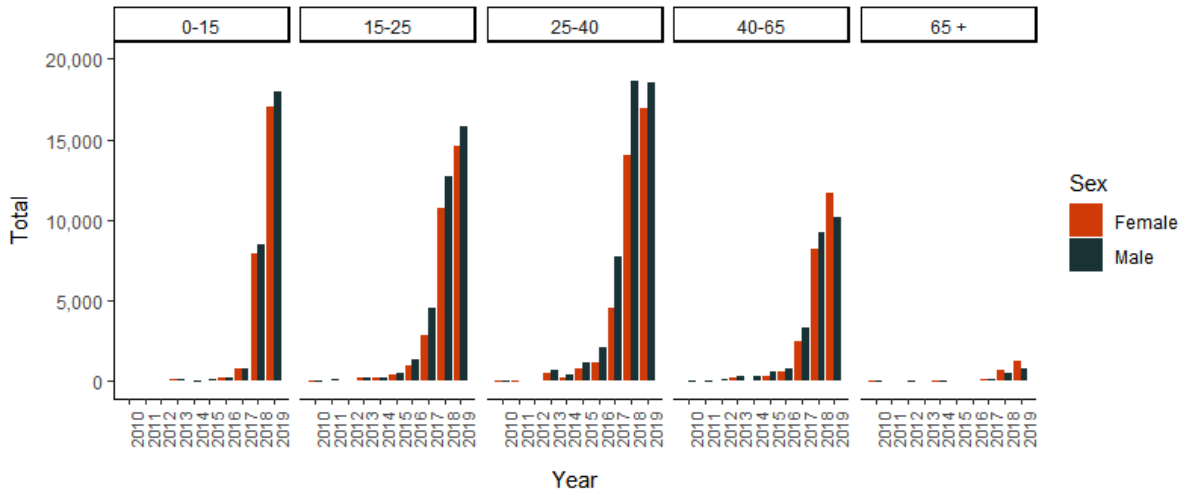
A Appendix

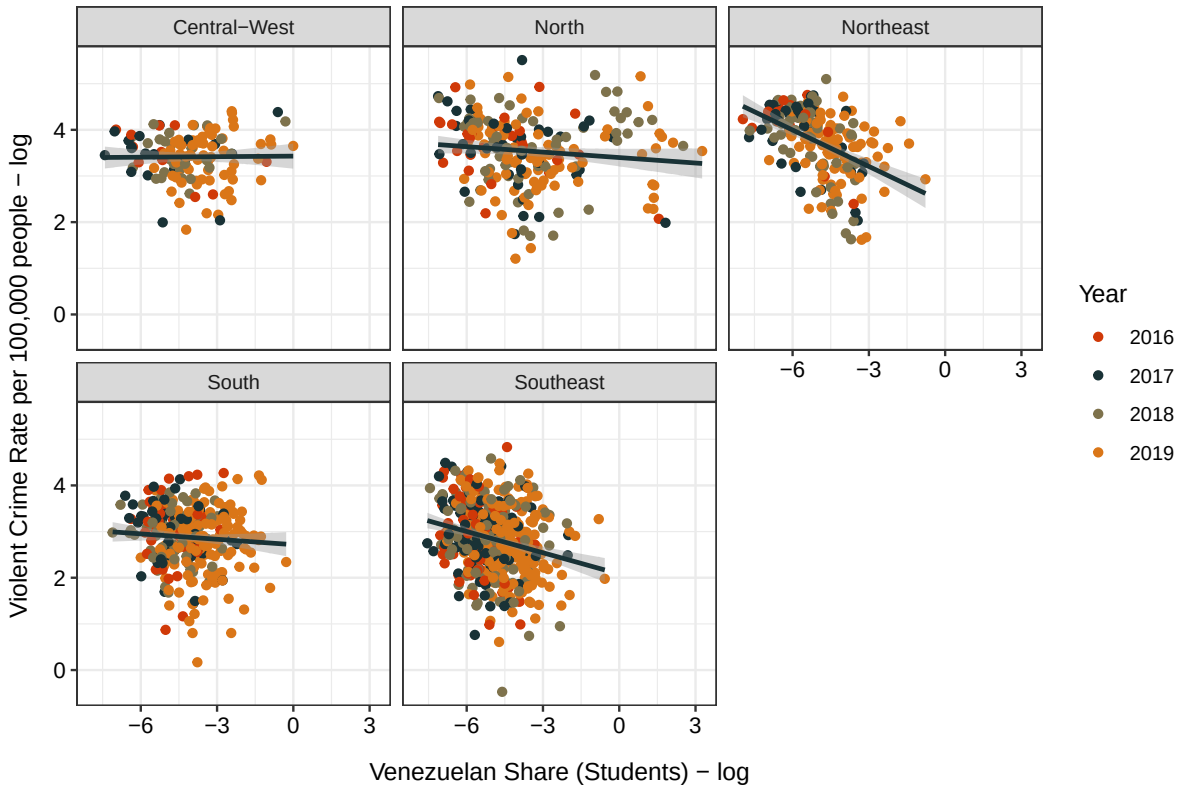
A.1 Figures

Figure A.1: Yearly Net Inflow of Venezuelan Forced Migrants in Brazil - By Sex and Age Group (2010-2021)



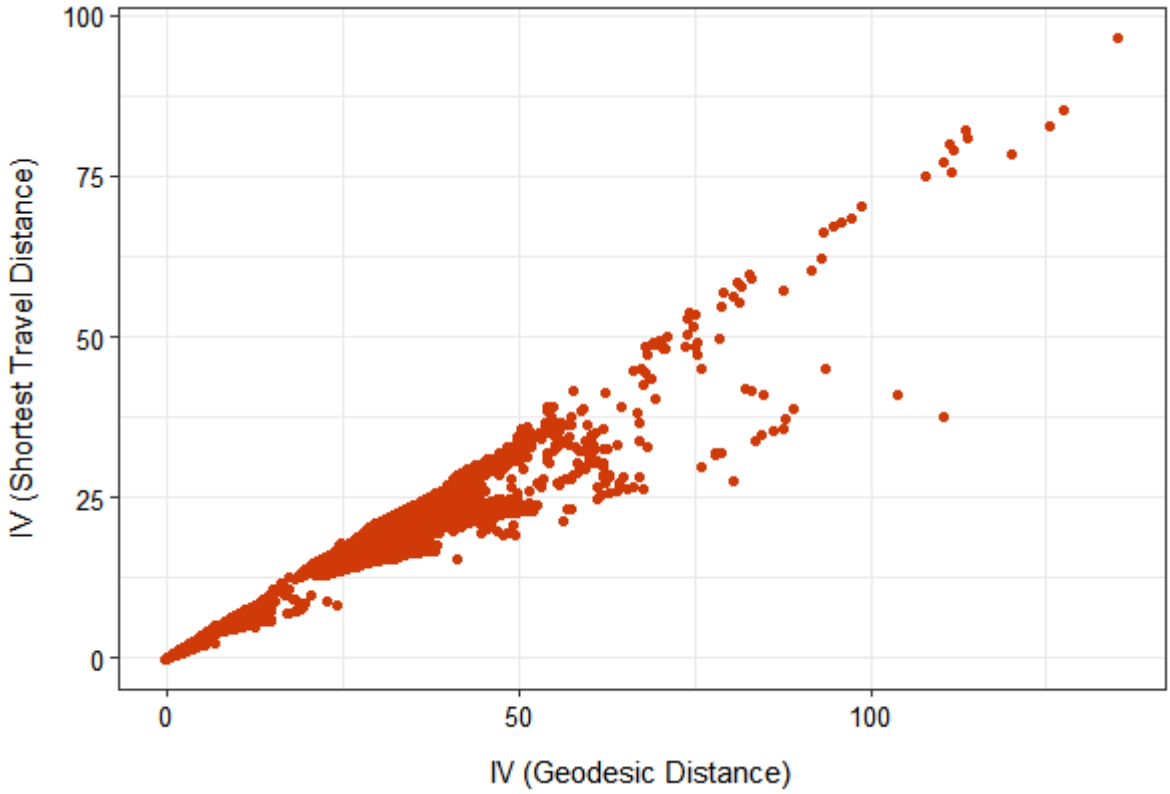
Source: Author's calculation from the International Traffic System (STI) organized by Brazilian Federal Police. Data made publicly available by the Observatory of International Migration (OBMigra).

Figure A.2: Relationship between the share of Venezuelans and violent crime rate per 100,000 people by region at the municipal level (2016-2019)



Notes: The figure illustrates the relationship between the ratio of Venezuelan students to total student population and violent crime rate per 100,000. The plot is faceted by region. Each point represents the log transformation of the shares and rates in 2016, 2017, 2018, and 2019. Municipalities with either or both values equal to zero were dropped. *Source:* Author's calculation using data from the Brazilian School Census and the Mortality Information System (SIM).

Figure A.3: Relationship between the IV calculated with the shortest travel distance x geodesic distance



Source: Author's creation using the shortest travel distance calculated by the GraphHopper API service. Geodesic distance was calculated using latitude and longitude. Population data from Venezuela comes from the 2011 National Census.

A.2 Tables

Table A.1: Impacts of Venezuelan Forced Migration on Violent Crime in Brazil - Placebo Test (2010-2014)

Dependent Variable:	Violent Crime Rate per 100,000 people			
	(1)	(2)	(3)	(4)
Nationality:	(All)	(Venezuelan)	(All)	(Venezuelan)
Sex:	(All)	(Male)	(All)	(Male)
Age:	(All)	(Age: 15-39)	(All)	(Age: 15-39)
	Panel A: All municipalities		Panel B: Northern municipalities	
OLS Results				
Venezuelan Share (%)	-0.9358	-0.00008	-0.7705	-0.00008
	(0.9837)	(0.0003)	(0.9932)	(0.0003)
Observations	24,515	24,515	2,060	2,060
R^2	0.62191	0.20729	0.63243	0.20935
2SLS Results				
Venezuelan Share (%)	2.803	-0.0283	-0.0028	-0.0315
	(10.93)	(0.0278)	(11.18)	(0.0784)
First-stage	-0.4818***	-0.4818***	-0.7374***	-0.7374***
	(0.1009)	(0.1009)	(0.1518)	(0.1518)
Observations	24,357	24,357	1,932	1,932
R^2	0.62128	-2.2866	0.62574	-2.7904
Controls				
Municipality	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State Linear Trend	Yes	Yes	Yes	Yes

Notes: Results from OLS and 2SLS models regressing violent crime rate per 100,000 by nationality, age and sex of the victim on the share of Venezuelans. Panel A (columns 1 and 2) contains all municipalities in the Northern region Brazil, while Panel B (columns 4 and 5) contains the municipalities located in the Northern region. The sample is restricted to the period before the Venezuelan crisis (2010-2014) and the share of Venezuelans from 2015, 2016, 2017, 2018 and 2019 is assigned to the years 2010, 2011, 2012, 2013, and 2014, respectively. All columns include municipality fixed effects, year fixed effects, control variables and state linear trends. Heteroskedasticity-robust standard errors in parentheses. They are clustered at the municipality level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table A.2: Impacts of Venezuelan Forced Migration on Violent Crime in Brazil - Sensitivity Analysis

Dependent Variable:	Violent Crime Rate per 100,000 people			
	(1)	(2)	(3)	(4)
Nationality:	(All)	(Venezuelan)	(All)	(Venezuelan)
Sex:	(All)	(Male)	(All)	(Male)
Age:	(All)	(Age: 15-39)	(All)	(Age: 15-39)
	Panel A: All municipalities		Panel B: Northern municipalities	
2SLS Results				
Venezuelan Share (%)	-1.634	0.5815*	3.915*	0.5677*
	(3.195)	(0.3428)	(2.3554)	(0.2965)
First-stage	0.0148*	0.0148*	0.0370*	0.0370*
	(0.0061)	(0.0061)	(0.0154)	(0.0154)
Observations	49,220	49,220	4,163	4,163
R^2	0.53798	0.14926	0.53502	0.19307
Mean	0.018	0.016	0.0001	0.010
Controls				
Municipality	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State Linear Trend	Yes	Yes	Yes	Yes

Notes: Results from 2SLS models regressing violent crime rate per 100,000 by nationality, age and sex of the victim on the share of Venezuelans. The IV was calculated using a simple geodesic distance instead of proper navigable routes. Panel A (columns 1 and 2) contains all municipalities in the Northern region Brazil, while Panel B (columns 4 and 5) contains the municipalities located in the Northern region. All columns include municipality fixed effects, year fixed effects, control variables and state linear trends. Heteroskedasticity-robust standard errors in parentheses. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1