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The Indirect Effect of Violence Via Unemployment on Destination Choice of Migrants: The Case of Poor People in Colombia

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Abstract
Areas with violence problems have traditionally been considered the origin of migration flows but not their destination. We propose that the effect of violence on the choice of a destination depends on economic incentives and pre-violence exposition. High levels of violence in a location lowers the utility of migrating to that location. This is the direct effect of violence. However, violence may also eject people, decreasing labour supply, making a municipality attractive to migrants. This is the indirect effect. To estimate both effects, we apply: "The restricted mediation model with instrumental variables". Violence is the "treatment", unemployment is the "mediator" and the number of migrants from an origin to each destination is the "final outcome". We estimate this model for 1091 sender municipalities. We find that municipal unemployment decreases as the homicide rate increases. For some municipalities, the indirect effect of violence via unemployment attenuates, cancels, or even exceeds its negative direct effect. We find migration flows toward municipalities with high levels of violence and unemployment. The municipalities where we observe this behaviour belong to manufacturing clusters or to regions dedicated to produce oil, coal, and coca, among others.

Keywords
violence, migration, destination choice, unemployment, economic incentives, emigration, direct and indirect effects

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1. Introduction

Areas with high levels of violence have traditionally been considered the origin of migration flows but not their destination. However, we find that the correlation between municipal immigration rates and homicide rate is positive, 0.34, and statistically significant. This suggests that the effectsof some pull factors (e.g., low migration costs, finding an income source, and infrastructure) that are considered when choosing a destination may be mitigated but not eliminated by violence. Besides, exposure to violence might change people's valuation of pull factors. It can be argued that being exposed to violence might make people less averse to staying in or migrating to violentmunicipalities.

Poor people in Colombia and most countries with violence problems, because of armed conflict and crime, often have to decide between violence and poverty. The decisions on leaving a place oforigin and choosing a destination are related to the push and pull factors of the places of origin anddestination, respectively. For instance, in the case of crime, Medellin and Cali historically have been the cities with the highest homicide rate; however, they are also two of the main destinations in Colombia. Concerning the armed conflict, violence acts as a push factor; however, some authors(Engel and Ibáñez 2007; Czaika and Kis-Katos 2009) find that its effect may depend on the economic circumstances of the origin, which can make high levels of violence tolerable. In the same way, we propose that other incentives, like finding a job, an income improvement and or benefit from better infrastructure, can compensate for the level of violence of a destination. Therefore, the effect of violence on the choice of a destination depends on other factors, such as economic incentives, especially among poor migrants.

In Section 2 we propose a theoretical model to explain the destination choice of poor people. We propose that the effect of violence on the choice of a destination depends on other factors, such asfinding a job or enjoying a better infrastructure. We suggest that high levels of violence in a location lowers the utility of migrating to that location. This is the direct effect of violence. However, violence also ejects people, decreasing labour supply, making a municipality attractiveto migrants that look for a source of income. This is the indirect effect. To estimate both, the direct

and indirect effects, we apply: “The restricted mediation model with instrumental variables” (Dippel et al. 2018). In this case, violence is the “treatment”, unemployment is the “mediator” and the number of migrants from an origin to each destination is the “final outcome”. A restricted mediation model is estimated as destination choice models by the sender municipality. In total 1091 models were estimated. The dependent variable for each sender municipality is the number of migrants who migrate to each destination. These models allow us to identify the features of the destinations chosen by poor migrants from municipalities with different characteristics, for instance, different levels of violence, unemployment, or displacement rate. Also, the models control by the population and rurality level at destinations.

In this research, we use three national records: Vital Records of Deaths, RUV (Unique Record of Victims), and Sisben (System of Identification of Potential Beneficiaries of Social Programs). The dependent variable is estimated with this last database. The analysis utilizes the 2006–2009 data from Sisben II. This Colombian database was updated every three months and allowed the tracking of migrants who belong to social programs, since beneficiaries of social programs must have registered in the residence municipality to receive government benefits. With this database, it is possible to identify yearly the poor population members who stay in a municipality and those who migrate to another. To detectmigrants, the database of each year from 2006 to 2008 was merged with the database of 2009, thuswe construct the Sisben panel database of migrants between 2006 and 2008.

Some conclusions of the study are the following: first, we prove that violence, measured by homicide rate, reduces the unemployment rate at the municipal level. Second, we find 195 sender municipalities, for which the direct effect of violence is negative; nevertheless, this effect is nulled and even reversed by the indirect effect through unemployment. Third, in most municipalities, 611, both the direct and indirect effects are not statistically different from zero; therefore, the destination choice of migration flows from these municipalities is not affected by the violence and the unemployment at the possible destinations. Finally, there are other factors beyond violence and unemployment that make people choose a destination; one of these factors could be regional activity specialization. We find migration flows toward municipalities with high levels of violence and unemployment. The municipalities where we observe this behaviour belong to manufacturing clusters or to regions dedicated to produce oil, coal, and coca, among others.

The remainder of the study is divided into six sections. The second section covers the background and the theoretical model. The third part shows how the Sisben data panel of poor migrants is constructed. Section 4 explains how the methodology proposed by Dippel, Gold, Heblich, and Pinto (2018), called "The restricted mediation model with instrumental variables", is used to estimate the indirect and direct effects of violence on destination choice. The fifth section presents the results, whilst the last part is dedicated to the conclusions.

2. Background and Theoretical Model

This section introduces a theoretical model of migration that explains the decisions to leave an origin and choose a destination considering violence and employment. In general, the migration decision is the result of higher expected net benefits in the destination than in the origin (Sjaastadt 1962). Locations may vary in terms of wages (W), infrastructure (I), and the probability p of an individual with given characteristics obtaining a job. Wages are likely to vary within locations according to individual characteristics (b), and likewise, the probability of obtaining a job (p) will depend on these characteristics. In addition, both, this probability and wages, also depend on the labor conditions (L) in each location, such as unemployment. The indirect utility function for each individual *i* in location *k* is determined by the location-specific economic opportunities:

$U_{ik}=U_{ik}(I_k, p_{ik}W_{ik})$ where $p_{ik}W_{ik} = f(b_i, L_k)$.

Violence, because of armed conflict or crime, can be considered in the migration model in two ways. It can be an attribute of a location (V) that lowers the utility of that location in a similar way to a good infrastructure that increases it. This could be the case if violence is perceived as lowering the quality of life, including threats to the welfare and life of family members. We call this, the direct effect of violence. However, violence also modifies the labour conditions in a location, because it ejects people, decreasing the labour supply, making it attractive to migrants that look for a source of income. We can also argue the effects of violence on labour offer and demand depend on municipalities' economic circumstances; the better these circumstances, the most tolerable violence is. Hence, violence also has an indirect effect. Thus, the indirect utility function for each individual *i* in location *k* considering violence is determined by:

$U_{ik}=U_{ik}(I_k, V_k, f(b_i, L_k))$ where $L_k=g(V_k)$

Where the first V_k represents the direct effect of violence and the second, $L_k=g(V_k)$, the indirect. The indirect effect suggests that violence may affect positively the indirect utility of choosing a destination because of its effect on labour market, which decreases labour supply and unemployment, making a municipality attractive.

As in peaceful circumstances, an individual in a violent area considering migration will evaluate the value of the indirect utility in the origin *l* and the indirect utility in the destination *j* net of the migration costs (C). Migration occurs if the indirect utility differential is greater than zero. The index M* represents the differential in utility between location *j* and location *l*.

$M^*_i= U_{ij}(I_j, V_j, f(b_i, g(V_j))) - U_{il}(I_l, V_l, f(b_i, g(V_l))) – C_{lj}$; migration will occur ($M_i=1$) if and only if $M^*_i>0$.

According to this model, residents in areas with high levels of violence also consider employment opportunities, wage and infrastructure endowments, and migration costs in their migration decision. However, the migration choice will depend directly on the disutility associated with violence, and indirectly on the effect of violence on labour supply. In line with this, previous studies confirm that the economic incentives to stay in an origin are mitigated by the increase in violence levels, but they do not disappear completely (Czaika and Kis-Katos 2009). Engel and Ibáñez (2007) find that the degree of violence faced by a household moderates the effects of economic variables (e.g. land, public utilities, and services) on the displacement decision. In the same sense, Mesnard (2009) concludes that receiving welfare benefits discourages migration when the levels of violence are not extremely high, but, if the levels of violence are extremely high, receiving welfare benefits increases the likelihood of migrating. Lindley (2009) concludes that the forces behind migration very often have both an economic and a political dimension, and sometimes economic factors weigh more than political ones.

Deepening the circumstances faced by poor migrants regarding exposure to violence, they have two options: 1) migrate to a safe destination or 2) migrate to an area with high violence levels. In terms of the migration model, migration to safe destinations with a low probability of finding a job will occur if people perceive a large disutility from experiencing violence, outweighing the bad labour prospects in safe destinations and the migration costs.[1] Comparing two destinations, j and q, the first peaceful and the second violent, individual i will migrate to j instead of to q if:

$M^*_{iq}-M^*_{ij}= U_{iq}(I_q, V_q, f(b_{i,} g(V_q))) - U_{ij}(I_j, V_j, f(b_{i,} g(V_j))) - (C_{lq} - C_{lj})<0$, since $V_j<V_q$ although $f(b_{i,} g(V_q)) > f(b_{i,} g(V_j))$, $C_{lj}=C_{lq}$ and $I_q = I_j$,.

Regarding the second option, migrants who move to municipalities with high levels of violence are likely to be attracted by the opportunity of finding a source of income or by good living conditions. For instance, Medellin and Cali, two of the main cities of Colombia, have a long history of crime because they were the hometowns of the main drug cartels; but at the same time, they have been developmental focuses. In 2005, their homicide rates were 155 and 101 homicides per 100,000 persons, respectively (Vital Records from Death Certificates 2002 and DANE 2020); however, both municipalities contributed 10 percent of the GDP and (municipal panel of CEDE 2018). In the case of armed conflict, several authors (Romero 1993; Perez-Murcia 2001; Ibáñez 2008) indicate that guerrillas attack more frequently the municipalities from which they can benefit financially. Hence, these municipalities also attract migrants, despite their violence problems. Migrants may be attracted by the production of gold, silver, oil, coca, and so on (Romero 1993; Perez-Murcia 2001; Ibáñez 2008). In this case, the migration model indicates that migrants would prefer to migrate to a municipality with violence problems if they find better job opportunities and/or infrastructure (schools, hospitals, etc.):

$M^*_{iq}-M^*_{ij}= U_{iq}(I_q, V_q, f(b_{i,} g(V_q))) - U_{ij}(I_j, V_j, f(b_{i,} g(V_j))) - (C_{lq} - C_{lj})>0$,

because $f(b_{i,} g(V_q)) > f(b_{i,} g(V_j))$ and/or $I_q > I_j$, although $V_j<V_q$ and $C_{lj}=C_{lq}$

[1] For example, forced migrants are highly dependent on state aid, since displaced males do not usually find a suitable job to match their abilities, so unemployment tends to affect them severely (Goodhand 2001; Ramírez 2001).

3. Data

The analysis utilizes the 2006–2009 data from Sisben (System of Identification of Potential Beneficiaries of Social Programs). This Colombian database is updated every three months and allows the tracking of migrants who belong to social programs. With this database, it is possible to identify yearly the poor population members who stay in areas with armed conflict and those who migrate inside or outside of them. The Sisben survey is conducted at the household level and includes questions on education, housing, social security, and demographic conditions to assess well-being through the Sisben Index.[2] This index orders the members of the population according to their living conditions, and higher scores imply better conditions. According to their scores, the population is divided into six levels. People classified in levels 1 and 2, who live in extremely poor and poor conditions respectively, are the potential beneficiaries of social programs (Flórez et al. 2008). Hence, our study population is poor migrants who belong to social programs.[3]

The Sisben database does not have a unique identification number for every person, because its aim is to list people. To detect migrants, the database of each year from 2006 to 2008 was merged with the database of 2009, because this year had the highest number of observations. The merging criteria are itemized in Table 1. This table also shows the percentage of people who were merged using each criterion. The number of observations in 2009 in the Sisben data is 37,168,483, and about 41 percent of them could not be merged for 2006 and 2007 and 32 percent for 2008. The

[2] The variables included in the Sisben Index II are socioeconomic stratum, type of floor, wall materials, location of water supply, type of toilet, waste management, number of toilets, location of the toilet, shower, telephone – landline, cooking fuel, number of goods (refrigerator, washing machine, color TV, heater, oven, air conditioning, cable), years of education of the head of the household, years of education of his/her partner, schooling gap for persons aged between 6 and 25, the proportion of persons with private health care, the proportion of workers in the household, and overcrowding (Florez et al. 2008).

[3] The estimation of the number of poor migrants who have arrived in a municipality using the Sisben database depends on their willingness to register with the Sisben database in the destination. The baseline of the Sisben data includes all the poor population in Colombia, because the database was performed like a census in socioeconomic strata 1, 2, and 3. Hence, for the first observation, the sample is not biased. Nevertheless, the sample of poor migrants might be biased, since only those who are interested in being beneficiaries of a social program update their information after migration. Nonetheless, around 87 percent of the people in the Sisben data must update their information after migration, since they are beneficiaries of the *Subsidized Health Regime* (Living Conditions Survey LCS – 2008). Furthermore, 22 social programs utilize Sisben data as a requirement for giving benefits in 2007 (Florez et al. 2008). Therefore, the sample selection bias is reduced by the incentive of getting state aid.

reasons for non-merging are spelling mistakes in people's names or changes of identification number.[4]

To determine whether the merging success was random or not, a logit model is estimated for each consecutive period. The dependent variable is 0 if a person is not found in each year and 2009, and 1 if he/she is found. The independent variables are taken from the first year of the period; for example, for 2006–2009 the independent variables are taken from 2006. The results show that the merging success depends on most independent variables. Therefore, the weight for each person who is merged is calculated using the inverse of the predicted probability of the logit models. These weights are used to estimate the number of migrants by destination for each sender municipality, which is our dependent variable.

Table 1 Percentage of merging according to criterion by year

Merging criterion	2006–2009	2007–2009	2008–2009
Non-merged	41.27	41.05	32.13
First name, middle name, both surnames, citizen identification number, and date of birth	45.91	51.78	62.16
First name, middle name, both surnames, and citizen identification Number	1.03	0.58	0.41
First name, middle name, both surnames, and date of birth	10.09	4.93	3.44
First name, both surnames, citizen identification number, and date of birth	1.56	1.6	1.82
First name, both surnames, and citizen identification number	0.13	0.06	0.04
Total	100%	100%	100%
Number of observations non-merged	15,340,443	15,256,251	11,940,976
Number of observations merged	21,828,040	21,912,232	25,227,507
Total number of people in 2009	37,168,483	37,168,483	37,168,483

Notes: (1) Source: Sisben data 2006–2009.

[4] People's names and surnames are often spelled differently in the surveys pre- and post-migration, sometimes because the interviewers did not know how to spell the names. In addition, before 2000 people had to change their identification number twice, at ages 7 and 18, which created confusion in identifying them in the data. However, in 2000 the law changed, assigning to newborns a unique lifetime personal identification number.

4. Method

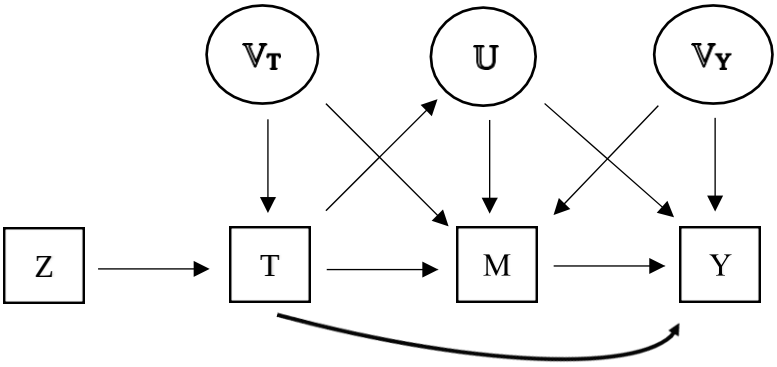
We are interested in knowing the extent to which violence makes people migrate to violent areas due to its effect on the labour market, specifically on unemployment, in potential destinations. To identify this causal mechanism, we apply the methodology proposed by Dippel, Gold, Heblich, and Pinto (2018). In this case, the violence level is the "treatment" (T), unemployment is the "mediator" (M) and destination choice or number of migrants from an origin to each destination is the "final outcome" (Y). According to Dippel et al. (2018), the model is straightforwardly estimated using three separate Two-Stage-Least-Square (2SLS) estimations of T on M, T on Y, and M on Y. They called this model "The restricted mediation model with instrumental variables". As every mediation model the total effect of T on Y could be expressed as the sum of an indirect effect that considers the chain T → M → Y, or mediated effect of M, and a direct effect between T and Y, that is not mediated by M:

$$\underbrace{\frac{dE(Y(t))}{dt}}_{\text{Total Effect}} = \underbrace{\frac{\partial E(Y(t,m))}{\partial t}}_{\text{Direct Effect}} + \underbrace{\frac{\partial E(Y(t,m))}{\partial m}\frac{\partial E(M(t))}{dt}}_{\text{Indirect Effect}} \quad (2)$$

Where M(t), Y(t) and Y(t, m) are the potential outcomes of M and Y when T is fixed at value t and M at value m. The restricted mediation model allows three sources of endogenous effects: two unobserved confounders V_T that causes T and M and V_Y that causes Y, and M, and an unobserved mediator U that is caused by T and causes M and Y. The graphical representation of the Restricted Mediation Model with IV is shown in the following diagram:

Restricted Mediation Model with IV

DAG representation



Model Equations

Treatment: $T = f_T(Z, V_T, \varepsilon_T)$,
Unobserved Mediator: $U = f_U(T, \varepsilon_U)$
Observed Mediator: $M = f_M(T, U, V_T, V_Y, \varepsilon_M)$
Outcome: $Y=fY(T, M, U, V_Y, \varepsilon_Y)$
Independence: $V_T, V_Y, \varepsilon_T, \varepsilon_U, \varepsilon_M, \varepsilon_Y$ are statistically independent

Source: Dippel et al. (2018)

The restricted mediation model generates exclusion restrictions described in the following theorem:

	Targeted causal relatio	IV rel vance				Exclu ion restriction		
Property 1	for $T \rightarrow Y$	Z	$\not\perp$	T	And	Z	$\perp$	Y(t)
Property 2	for $T \rightarrow M$	Z	$\not\perp$	T	And	Z	$\perp$	M(t)
Property 3	for $M \rightarrow Y$	Z	$\not\perp$	M/T	And	Z	$\perp$	Y(m)/T

Source: Dippel et al. (2018). Notes: $\perp$ means statistical independency and $\not\perp$ the contrary

Properties 1 and 2 arise from the standard IV model, but Property 3 not. This property implies that Z can be used as a valid instrument for M conditional on T, even though Z directly causes T instead of M.

In the case of our study, we estimate a model for each sender municipality; in total 1088 models (Colombia has 1202 municipalities). In these models T, Z, M, and Y are:

T: Violence measured with the municipal homicide rate in potential destination j. This variable is calculated using 2002 Vital Records and the 2002 population at a municipal level (DANE 2020).

Z: The closest distance to the demilitarized zone of Caguán from the potential destination.[5] During the peace process in the Caguán, January 1999 - February 2002, FARC took full control of this area and its people, imposing their own laws, and the Colombian government lost any sovereignty over this area. The closer a municipality to the Caguan area, the higher the probability of armed conflict. The closest distance to this area is the Euclidian distance between the centroid of a sender municipality and the closest point on the border of the demilitarized zone.

M: Municipal unemployment rate in potential destination j in 2005, estimated with the 2005 Census.

Y: Number of migrants from municipality i to each destination j adjusted by the effect of distance between i and j. Since this distance cannot be included in the estimation of $\frac{\partial E(M(t))}{dt}$, its effect is controlled before calculating $\frac{\partial E(Y(t,m))}{\partial t}$ and $\frac{\partial E(Y(t,m))}{\partial m}$. Hence, $Y=Yo-a*d_{ij}$, where *Yo* is the number of migrants from municipality i to each destination *j* and *a* is the coefficient of dij in the regression $Yo= b_1+a*d_{ij}+\ldots+e$.

[5] *The demilitarized zone of Caguan* was an area granted by the government of President Andres Pastrana by Resolution 85 of October 14, 1998, to advance a peace process with the FARC and end the armed conflict in Colombia. It was established in November 1998 and came into effect in January 1999. This area covered 42,000 square kilometers and was comprised of the municipalities of La Uribe, Mesetas, La Macarena, and Vista Hermosa in the department of Meta, and San Vicente del Caguán in the department of Caquetá. The demilitarized zone was abolished by President Pastrana on February 21, 2002, who also ordered the Army to retake the demilitarized zone.

5. Results

5.1 **The effect of violence on municipal unemployment rate**

The term $\frac{\partial E(M(t))}{dt}$ represents the effect of violence measured by municipal homicide rate on unemployment. The instrumental variable for violence is the closest distance to the demilitarized zone of Caguán. The first stage shows that 1 km further of this zone decreases the homicide rate (homicides per 100.000 people) by 0.097. In the second stage, a one-unit-increase in homicide rate in municipality j decreases its unemployment rate by 0.068 percent; in other words, one-hundred-unit-increase in the homicide rate decreases the unemployment rate by 6.8 percent, as expected; since when people leave a municipality, because of violence or another reason, also leave their jobs, reducing unemployment.

Table 2. T on M: municipal homicide rate in 2002 on municipal unemployment rate in 2005

First stage				
Homicide rate in potential destinations				
Variables	Coef.	Std. Err.	t	P>t
Closest distance to the demilitarized zone	-0.097	0.011	-8.440	0.000
Second Stage				
Unemployment rate				
Homicide rate in potential destinations 2002	-0.068	0.010	-6.800	0.000
Number of observations			1091	
Weak identification test				
Ho: equation is weakly identified				
Cragg-Donald Wald F statistic			71.21	

Source: unemployment is estimated with the 2005 Census, population in 2005 is taken from DANE (2020), homicides rate is estimated with Vital Records from Death Certificates 2002. Notes: as control variables the estimations include the population in 2005 and the percentage of the rural population.

5.2 Total, direct and indirect effects

Table 3 shows the classification of the municipalities according to the direct effect of violence and the effect of unemployment. The first line of each section indicates the case; for instance, case 6 corresponds to those municipalities where the direct effect is statistically higher than zero and the effect of unemployment is not statistically different from zero. Table 4 shows the means of all the effects for each case of Table 3. In the following analysis, to have a clear magnitude dimension of the emigration at the municipal level: the average number of emigrants from one municipality to another is 0.51 (this is because of the considerable number of zeros), the municipal average of the percentile 99 is 11 emigrants and of the maximum value is 94 emigrants. Additionally, to make the analysis simpler, we estimate logistic models to find out the features of the municipalities that belong to each case concerning three aspects: displacement, violence, and unemployment.

Table 3 shows that the direct effect of violence is generally positive, $\frac{\partial E(Y(t,m))}{\partial t} > 0$, for municipalities with high levels of violence. According to this table, the mean and the median of the homicide rates for cases 6 and, 9 are 147.6, 119.3 and, 145.4, 121, respectively. In contrast, these values are 54.7, 39.2 and 49.8, 36.2 for cases 1 and 4. This suggests that migration flows from peaceful municipalities go usually toward peaceful ones; likewise, migration flows from violent municipalities go usually toward violent ones. It is possible that residents in a violent context may get used to living in this environment, so they do not hesitate to move to a municipality with high homicide rates.

Table 3. Classification of the municipalities by the direct effect of violence and by the effect of unemployment on destination choice

$\frac{\partial E(Y(t,m))}{\partial m}$		$\frac{\partial E(Y(t,m))}{\partial t}$			
		<0	≡0	>0	Total
<0	**Case**	**1**	**2**	**3**	
	Number	41.00	6.00		47
	mean (Emigrant)	0.20	0.56		
	mean (Unemployment rate)	3.74	4.08		
	mean (% rural population)	27.77	50.02		
	mean (displacement rate)	2.69	5.72		
	mean (Homicide rate)	54.68	70.16		
	p25(Homicide rate)	26.72	31.94		
	p50(Homicide rate)	39.20	49.85		
	p75(Homicide rate)	66.33	129.60		
≡0	**Case**	**4**	**5**	**6**	
	Number	154.00	611.00	55.00	820
	mean (Emigrant)	0.54	0.44	0.57	
	mean (Unemployment rate)	4.22	4.81	3.08	
	mean (% rural population)	36.25	41.72	44.02	
	mean (displacement rate)	3.48	14.88	29.81	
	mean (Homicide rate)	49.80	70.93	147.63	
	p25(Homicide rate)	22.56	23.69	88.25	
	p50(Homicide rate)	36.23	49.19	119.83	
	p75(Homicide rate)	64.23	95.50	184.81	
>0	**Case**	**7**	**8**	**9**	
	Number		135.00	89.00	224
	mean (Emigrant)		0.34	0.59	
	mean (Unemployment rate)		7.09	6.18	
	mean (% rural population)		45.59	51.00	
	mean (displacement rate)		11.96	28.12	
	mean (Homicide rate)		57.66	145.40	
	p25(Homicide rate)		17.60	76.36	
	p50(Homicide rate)		36.77	121.03	
	p75(Homicide rate)		78.60	184.27	
Total		195	752	144	1091

Notes: <0: statistically lower than zero, ≡ 0: statistically non-significant at 90 percent. >0: statistically higher than zero.

Table 4. **Average total, direct and indirect effects for each case of Table 3**

Case	Total effect	Number	$\frac{dE(Y(t))}{dt}$ mean (total effect)	$\frac{\partial E(Y(t,m))}{\partial t}$ mean (direct effect)	$\frac{\partial E(Y(t,m))}{\partial m}$ mean (unemployment effect)	$\frac{\partial E(M(t))}{dt}$ Effect of violence on unemployment	Mean (indirect effect)
1	≡0	22	0.004	-0.002	-0.092	-0.068	0.006
	>0	19	0.006	-0.002	-0.116	-0.068	0.008
2	≡0	5	0.009	-0.002	-0.167	-0.068	0.011
	>0	1	0.007	-0.002	-0.119	-0.068	0.008
4	≡0	154	0.002	-0.004	-0.076	-0.068	0.005
5	<0	24	-0.007	0.000	0.105	-0.068	-0.007
	≡0	587	-0.002	0.000	0.034	-0.068	-0.002
6	≡0	55	-0.004	0.006	0.139	-0.068	-0.009
8	<0	126	-0.010	0.001	0.154	-0.068	-0.011
	≡0	9	-0.008	0.002	0.157	-0.068	-0.011
9	<0	58	-0.013	0.004	0.259	-0.068	-0.018
	≡0	31	-0.012	0.009	0.304	-0.068	-0.021

Notes: <0: statistically lower than zero, ≡ 0: statistically non-significant at 90 percent. >0: statistically higher than zero.

Case 1: $\frac{\partial E(Y(t,m))}{\partial t} < 0$ and $\frac{\partial E(Y(t,m))}{\partial m} < 0$

The first case corresponds to the municipalities in which both, the direct effect and the effect of the unemployment rate on the number of migrants by destination, are negative. On one hand, the negative sign of the direct effect, $\frac{\partial E(Y(t,m))}{\partial t}$, means that the number of migrants from these municipalities decreases as the level of violence in the destinations increases. This suggests that these migrants are reluctant to move to violent areas. On the other hand, the negative sign of the effect of unemployment on the number of migrants indicates that the number of migrants increases when the unemployment rate decreases. When this effect is multiplied by the effect of violence on unemployment, $\frac{\partial E(M(t))}{dt}$, the indirect effect of violence is positive. Therefore, although the number

of migrants from these 41 municipalities decreases when the violence at destination increases, this effect is attenuated by the indirect effect of violence through unemployment. This is shown in Table 4. For instance, when the total effect is statistically higher than zero, if destination q has a homicide rate one-hundred-units higher than that of j, the number of migrants to q is 0.2 persons less than those to j because of the direct effect of violence. However, the indirect effect of violence, through unemployment, is 0.8 migrants higher for q than that for j. Hence, the total effect of violence, in this case, is positive, 0.6 migrants (which is close to the municipal average number of emigrants from a municipality to another, 0.51).

The municipalities that exhibit this behaviour are not too violent, according to Table 3 the average homicide rate for them is 54.7 per 100,000 people, which is 16.3 percentage points lower than that of Case 5, where most municipalities are classified, 610. In fact, the average displacement rate is the lowest among the cases, 2.69 per 1000 people. In Table 4, we observe that the indirect effect of violence on the number of migrants to a destination through unemployment cancels and even reverses the negative direct effect of violence at destination. As result, this table shows that the total effect of violence is positive and statistically significant for 19 sender municipalities and non-significant for 22.

Table 5 shows the logistic models, where the dependent variable is 1 if a municipality belongs to Case 1 when the total effect is statistically non-significant (three first on the left) and when it is higher than zero (three first on the right). According to this table, the probability of belonging to Case 1 decreases with displacement rate, for both total effects $\frac{dE(Y(t))}{dt} \equiv 0$ and $\frac{dE(Y(t))}{dt} > 0$, so it is likely that the migration flows from these municipalities are mainly voluntary.

In short, the migration flows from municipalities where migration is mainly voluntary might go towards violent areas because of the indirect effect through unemployment. This effect can cancel and even exceed the negative effect of violence. This suggests that migrants in the Case 1 are averse to move to violent areas; however, finding a job may motivate them to migrate there.

Table 5**.** Characteristics of the municipalities where $\frac{\partial E(Y(t,m))}{\partial t}$<0 and $\frac{\partial E(Y(t,m))}{\partial m}$< 0

	Logit model where the dependent variable equals 1 if the municipality belongs to the case 1					
	$\frac{dE(Y(t))}{dt} \equiv 0$			$\frac{dE(Y(t))}{dt} > 0$		
Displacement rate	-287.2***			-95.54**		
	(96.99)			(47.91)		
Homicide rate		-0.00624			-0.00472	
		(0.00439)			(0.00433)	
Unemployment rate			-0.0655			-0.134
			(0.0659)			(0.0887)
Constant	-2.790***	-3.492***	-3.592***	-3.430***	-3.725***	-3.488***
	(0.28)	(0.318)	(0.341)	(0.294)	(0.338)	(0.384)
Observations	1,091	1,091	1,091	1,091	1,091	1,091

Source: unemployment rate is estimated with the 2005 Census, population in 2005 and 2002 is taken from DANE (2020), homicides rate is estimated with Vital Records from Death Certificates 2002 and displacement rate 2005 is estimated with the RUV (Registro Único de Víctimas).

Case 2: $\frac{\partial E(Y(t,m))}{\partial t} \equiv 0$ and $\frac{\partial E(Y(t,m))}{\partial m}$<0

Only six municipalities are classified in this case. As the first case, the number of migrants from one of these municipalities increases when the unemployment rate at destination decreases. Nevertheless, the direct effect of violence $\frac{\partial E(Y(t,m))}{\partial t}$ is statistically non-significant at 90 percent.

Table 4 shows that the indirect effect of violence, via the unemployment rate, makes the total effect positive and statistically significant at 90 percent for one municipality, and statistically non- significant for the others. In this case, as the previous one, finding a job might be the cause of migration flows go to violent municipalities.

Case 3: $\frac{\partial E(Y(t,m))}{\partial t} > 0$ and $\frac{\partial E(Y(t,m))}{\partial m}$<0

This case occurs when the effect of unemployment on destination choice is negative, while the direct

effect of violence is positive. Although this is one of the cases we wanted to prove, none of the municipalities are classified in this case.

Case 4: $\frac{\partial E(Y(t,m))}{\partial t} < 0$ and $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$

The municipalities that belong to the fourth case are also peaceful in general; their average homicide rate is 49.8 per 100,000 people and the average displacement rate is 3.48 persons per 1000 inhabitants, see Table 3. Considering exclusively the direct effect, the number of migrants decreases as the homicide rate increases at destination, $\frac{\partial E(Y(t,m))}{\partial t} < 0$. Unlike case 1, in this case, the effect of unemployment is statistically non-significant at 90 percent. Although the effect of unemployment is statistically non-significant, the indirect effect of violence cancels the negative direct effect, as results, the total effect is statistically non-significant at 90 percent for all 154 municipalities, see Table 4.

Table 6**.** Characteristics of the municipalities where $\frac{\partial E(Y(t,m))}{\partial t} < 0$ and $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$

	Logit model where the dependent variable equals 1 if the municipality belongs to the case 4 $\frac{dE(Y(t))}{dt} \equiv 0$			
Displacement rate	-121.6***			
	(19.72)			
Homicide rate		-0.00853***		
		(0.00189)		
Unemployment rate			-0.0518**	
			(0.0241)	
Constant	-1.047***	-1.277***	-1.566***	-1.519***
	(0.117)	(0.132)	(0.136)	(0.327)
Observations	1,091	1,091	1,091	1,090

Source: unemployment rate is estimated with the 2005 Census, population in 2005 and 2002 is taken from DANE (2020), homicides rate is estimated with Vital Records from Death Certificates 2002 and displacement rate 2005 is estimated with the RUV (Registro Único de Victimas)

Table 6 reports that the probability of being classified in Case 4 for a municipality decreases with

displacement, unemployment, and homicide rates. It seems, for these municipalities, that emigrants avoid migrating to violent areas, but the indirect effect through unemployment compensates the direct effect, making the total effect of violence at destination statistically non-significant.

Case 5: $\frac{\partial E(Y(t,m))}{\partial t} \equiv 0$ and $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$

Most municipalities belong to this group, 611 out of 1,09. In this case both, the direct effect andthe effect of the unemployment rate on the number of migrants by destination, are statistically non-significant. Also, for 586 municipalities out of 611, the total effect is statistically non-significant.Only 24 municipalities have a negative total effect (Table 4).

Table 7**.** Characteristics of the municipalities where $\frac{\partial E(Y(t,m))}{\partial t} \equiv 0$ and $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$

	Logit model where the dependent variable equals 1 if the municipality belongs to the case 5					
		$\frac{dE(Y(t))}{dt}<0$			$\frac{dE(Y(t))}{dt} \equiv 0$	
Displacement rate	-9.581			2.408		
	(12.53)			(2.271)		
Homicide rate		-0.0135**			-0.00128	
		(0.00576)			(0.0008)	
Unemployment rate			0.0770***			-0.0333**
			(0.0227)			(0.0133)
Constant	-3.682***	-3.068***	-4.277***	0.119*	0.249***	0.318***
	(0.242)	(0.313)	(0.276)	(0.0685)	(0.0858)	(0.0898)
Observations	1,091	1,091	1,091	1,091	1,091	1,091

Source: unemployment rate is estimated with the 2005 Census, population in 2005 and 2002 is taken from DANE (2020), homicides rate is estimated with Vital Records from Death Certificates 2002 and displacement rate 2005 is estimated with the RUV (Registro Único de Víctimas)

The right side of Table 7 indicates that the probability of being in Case 5, when $\frac{dE(Y(t))}{dt} \equiv 0$, decreases with an increase in unemployment. This means that in these municipalities there is low unemployment, but the contrary occurs when $\frac{dE(Y(t))}{dt}<0$. Based on these results and Table 3, it seems that the municipalities in this group do not have a particular characteristic, the displacement and

homicide rates are the average of the other groups. As well, both the indirect and direct effects of violence do not have influence.

Case 6: $\frac{\partial E(Y(t,m))}{\partial t} > 0$ and $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$

According to the direct effect, the migration flows of the Case 6 are attracted by violent municipalities since $\frac{\partial E(Y(t,m))}{\partial t} > 0$. This occurs regardless of the level of unemployment at destination, $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$. The municipalities of Case 6 exhibit high violence levels; their homicide rate is 147.6 on average, see Table 3. This is confirmed by Table 8, the probability of belonging to this case increases with both, homicide rate and displacement rate. In addition, this probability is reduced by unemployment. So, these municipalities have violence problems, but also good job opportunities. Table 4 shows that the total effect is not statistically significant for all the municipalities of this group. Therefore, the positive direct effect of violence is not strengthened by unemployment.

One characteristic of these municipalities is the presence of oil. In fact, in this group, there are municipalities from Arauca, Casanare, and Meta. These departments exhibit the highest homicide rate because of armed conflict and crime in 2002, higher than 150 homicides per 100,000 people. The displacement rate of the municipalities that belong to these departments is 29.8 persons per 1000 inhabitants on average. Despite their violence problems, these departments attract migrants because they are among the biggest producers of oil. According to the National Hydrocarbon Agency, Arauca, Casanare and Meta produced 19.7, 28.5, and 21.1 percent of the oilnational production, respectively, in 2005.

In short, people from municipalities of Case 6 are used to live in violent contexts, so it is possiblethat moving to a municipality with a high homicide rate does not disturb them, regardless of the level of unemployment.

Table 8. Characteristics of the municipalities $\frac{\partial E(Y(t,m))}{\partial t} > 0$ and $\frac{\partial E(Y(t,m))}{\partial m} \equiv 0$

	Logit model where the dependent variable equals 1 if the municipality belongs to the case 6		
	$\frac{dE(Y(t))}{dt} \equiv 0$		
Displacement rate	10.29***		
	(2.831)		
Homicide rate		0.00736***	
		(0.00121)	
Unemployment rate			-0.202***
			(0.0617)
Constant	-3.133***	-3.676***	-2.160***
	(0.156)	(0.21)	(0.238)
Observations	1,091	1,091	1,091

Source: unemployment rate is estimated with the 2005 Census, population in 2005 and 2002 is taken from DANE (2020), homicides rate is estimated with Vital Records from Death Certificates 2002 and displacement rate 2005 is estimated with the RUV (Registro Único de Víctimas)

Case 7: $\frac{\partial E(Y(t,m))}{\partial t} < 0$ and $\frac{\partial E(Y(t,m))}{\partial m} > 0$

No municipality is found in this case.

Case 8: $\frac{\partial E(Y(t,m))}{\partial t} \equiv 0$ and $\frac{\partial E(Y(t,m))}{\partial m} > 0$

In these cases, the direct effect of violence is statistically non-significant, which suggests that people from these municipalities migrate to another without considering its level of violence. The sign of unemployment rate is positive, which is counterintuitive. This means that people from these municipalities tend to migrate to areas with high levels of unemployment. This behaviour makes the total effect negative; according to Table 4, for 126 out of 135 municipalities the total effect of violence is negative.

Analysing the features of these municipalities, on one hand, we observe in Table 9 that the probability of belonging to Case 8 decreases with an increase in homicide rate. So, it is likely that they are not too violent municipalities in general, their homicide rate is 57.7 per 100.000 persons

on average. On the other hand, the higher the unemployment rate, the higher the probability of belonging to this group (see Table 9). It is the case with the highest unemployment rate on average (Table 3).

A hypothesis regarding this result, it is that migrants go toward areas with high unemployment because there are other reasons for migrating there, for instance, the regional specialization. As in the previous case, where most municipalities belong to oil-producing departments, in this case, some municipalities belong to industrialized regions, such as Cali and Cartagena, and their sorrowing areas.

Table 9**.** Characteristics of the municipalities where $\frac{\partial E(Y(t,m))}{\partial t} \equiv 0$ and $\frac{\partial E(Y(t,m))}{\partial m} > 0$

	Logit model where the dependent variable equals 1 if the municipality belongs to case 8 $\frac{dE(Y(t))}{dt}<0$		
Displacement rate	-4.773		
	(4.471)		
Homicide rate		-0.00589***	
		(0.00183)	
Unemployment rate			0.0808***
			(0.0161)
Constant	-1.974***	-1.654***	-2.495***
	(0.109)	(0.14)	(0.139)
Observations	1,091	1,091	1,091

Source: unemployment rate estimated with the 2005 Census, population in 2005 and 2002 is taken from DANE (2020), homicide rate is estimated with Vital Records from Death Certificates 2002 and displacement rate 2005 is estimated with the RUV (Registro Único de Víctimas)

Case 9: $\frac{\partial E(Y(t,m))}{\partial t} > 0$ and $\frac{\partial E(Y(t,m))}{\partial m} > 0$

As the previous case, $\frac{\partial E(Y(t,m))}{\partial m} > 0$; however, $\frac{\partial E(Y(t,m))}{\partial t} > 0$. These municipalities are also characterized by a high homicide rate, 145.4 homicides per 100,000 persons (Table 3). Table 10 shows that the likelihood of being classified in this case increases with every rate: displacement, homicide, and unemployment. The total effect, see Table 4, is negative for 58 municipalities and statistically non-significant for 31. Analyzing the features of the municipalities that are classifiedin this group, we can identify several specialization clusters. Medellin and its metropolitan area, which is an industrialized cluster; municipalities in the south of La Guajira, which is a mining cluster and Caquetá, that is one of the principal coca-producing departments.[6]

Table 10**.** Characteristics of the municipalities where $\frac{\partial E(Y(t,m))}{\partial t} > 0$ and $\frac{\partial E(Y(t,m))}{\partial m} > 0$

	Logit model where the dependent variable equals 1 if the municipality belongs to the case 9					
	$\frac{dE(Y(t))}{dt} < 0$			$\frac{dE(Y(t))}{dt} \equiv 0$		
Displacement rate	8.266***			10.60***		
	(2.928)			(3.176)		
Homicide rate		0.00557***			0.00889***	
		(0.00121)			(0.00142)	
Unemployment rate			0.0583***			-0.0159
			-0.0189			-0.0429
Constant	-3.029***	-3.402***	-3.214***	-3.749***	-4.530***	-3.455***
	(0.151)	(0.194)	(0.184)	(0.205)	(0.29)	(0.271)
Observations	1,091	1,091	1,091	1,091	1,091	1,091

Source: unemployment rate is estimated with the 2005 Census, population in 2005 and 2002 is taken from DANE (2020), homicides rate is estimated with Vital Records from Death Certificates 2002 and displacement rate 2005 is estimated with the RUV (Registro Único de Víctimas)

[6] Coal production in La Guajira was 32.7 million tons in 2016, corresponding to 36.1 percent of domestic production. The department's sea salt production was 59,140 tons in 2016, corresponding to 14.17% of domestic production (Unidad de Planeación Minero Energética, 2017).

In 2005, Medellin contributes 7.2 percent of the industrial GDP.

In conclusion, the counterintuitive result of cases 8 and 9, which indicates that people tend to migrate to areas with high levels of unemployment, might be related to the economic specialization of the regions and the specialization of their human resources. This specialization may make people migrate to a destination that has similar economic activities to the ones of the municipality of origin, although the levels of unemployment and violence are high.

6. Conclusions

Using “The restricted mediation model with instrumental variables” we estimate the direct effect and the indirect effect of violence via unemployment on destination choice for 1091 municipalities. We find the following results:

First, we show that unemployment decreases at the municipal level as homicide rate increases. Violence probably acts as push factor that makes emigrants leave a municipality; as a result, they also abandon their jobs, which reduces unemployment.

Second, we identify 195 sender municipalities in which the direct effect of violence is negative. This suggests that migrants from these are reluctant to migrate to municipalities with high levels of violence. However, we found that the indirect effect of violence through unemployment can make the total effect positive or statistically non-significant. This means that migrants, who are averse to violence, are encouraged to move to a violent municipality if they can easily get a job there.

Third, we also find 611 municipalities where both the direct and indirect effects are not statistically different from zero. This implies that the destination choice of the migration flows from these municipalities are not affected by the violence and the unemployment at the possible destinations. Besides, there are 55 municipalities, whose direct effect is positive, but the indirect and the total effects are statistically non-significant. These municipalities are characterized by their high levels of violence. It seems that migrants are used to violent contexts, so high homicide rates at destination do not demotivated them, regardless of the level of unemployment.

Finally, we also observe that there is a group of municipalities, 224, where the indirect effect of violence via unemployment is negative. This negative indirect effect reverses or cancels the positive direct effect of violence. In consequence, the total effect is negative or statistically non-significant. This result demonstrates that there are other factors beyond violence and unemployment that make people choose a destination. In this study, we identify some specialization clusters that might influence migrant’s decisions about destination choice.

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