

An analysis of the Colombian Civil Conflict: Synthetic Control Approach

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Abstract: This paper assesses the impact of the Colombian conflict on the unemployment rate for the period 1995-2014. Using a difference-in-differences estimation, and a synthetic control method, we align with Calderon-Mejia and Ibañez (2016) assessing the impact of violent events on the unemployment rate. We find that after the increase in the intensity on the Colombian conflict, in 1995, the unemployment rate increased relative to a counterfactual formed by Latin American countries. We demonstrate the significance of our results using placebo tests. Overall, our results allow us to identify the incidence of the violent conflict on the total unemployment rate, and establish a reference for the implementation of similar assessments for other socio-economic outputs.

Keywords: Unemployment rate, synthetic control, high intensity conflict.

JEL Codes: ***

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Introduction

This paper assesses the economic impact of the “high intensity conflict” in Colombia for the period 1995-2014.

On one hand, the constant state of violence in Colombia represents a treatment for the political and economic institutions, affecting firm’s decisions to stay or to exit the market (Camacho and Rodriguez 2013), that added to the massive forced displacement of civil population toward big urban areas, impacted local investments and created obstacles for foreign investments. On the other hand, despite these adverse conditions, political and economic institutions did not suffer major transformations, and democracy remains as the form of government (Chacón, Robinson, and Torvik 2011); moreover, for some years within this period of violence, Colombia experienced positive income shocks and reduced poverty levels in urban areas according to official data (World Bank 2017). This context and the recent peace negotiations with two of the major illegal armed groups, allow us to inquire about the economic impacts of the armed conflict in Colombia. In particular: did the conflict affect the unemployment rate in Colombia?

Several studies assess the socio-economic impact of conflict in Colombia. Some of them show the incidence of violent actors on the decision process in policy making (Acemoglu, Robinson, and Santos 2013; Chacón, Robinson, and Torvik 2011), studying the impact of conflict on political elections, and democratic processes. In particular, Acemoglu et al.(2013) using electoral data by region and legislative data, find a strong relation between right wing illegal armed groups, and electoral outcomes in determined regions in Colombia. Other empirical studies, examine this issue assessing its impact on health outcomes (Camacho 2008), its consequences on vulnerability of forcibly displaced households (Ibáñez and Vélez 2008; Ibáñez and Moya 2010;

Ibáñez and Vélez 2008; Ibanez 2009); or its incidence on firms' exit decisions (Camacho and Rodriguez 2013; Rozo 2016). These studies contribute to determine the welfare losses due to the forced displacement phenomena, provide evidence regarding policy instruments for preventing displacement, and determine the impact of conflict on firm's exits from the market.

Similarly, the unemployment in Colombia is an issue analyzed under several approaches in Colombia. Some authors estimate the effect of non-salary cost on the unemployment rate (Sánchez, Duque, and Ruíz 2009; Bernal and Cardenas 2004), the impact of the economic cycle (Nuñez and Bernal 1997), and the gap between the supply and demand of high quality workers (Nuñez and Sanchez 1999; Cárdenas and Bernal 1999). Even though most of these studies relate the increase on the unemployment rate strictly to macroeconomic conditions, we encounter a correlation between the intensification of the Colombian conflict in the 1990s decade, and this raise in the unemployment rate for the same period (figure 3).

Some other works examine the relationship between the labor market and forced displacement in Colombia (Ibáñez and Moya 2010; Ibáñez and Vélez 2008; Ibanez 2009; Calderón-Mejía and Ibáñez 2016); however, only one of them, specifically, estimates the impact of forced displacement on the labor market in Colombia (Calderón-Mejía and Ibáñez 2016). Using instrumental variables to assess the effect of these migrations on the urban labor market, the authors find that this phenomenon reduces wages for urban unskilled workers who compete for jobs with the arriving population. Our study aligns with the examination of Calderon-Mejia and Ibanez (2016), and contributes to the literature implementing a methodology that allows estimating this effect using a consistent counterfactual, following Abadie and Gardeazabal (2003).

To estimate the effect of the “high intensity conflict” on the unemployment rate, we approach the problem from two similar methods. First, we estimate a difference-in-differences model to establish the average treatment effect of the “high intensity conflict” in Colombia relative to similar countries within the region; and second, we construct a “synthetic Colombia” to estimate the effect of this treatment on the unemployment rate. A main problem is the definition of a treated and untreated region within Colombia, due the geographic uniformity of the violent events and multiplicity of illegal armed groups (Figure 1). As a result of this, we choose eight countries in South and Central America, with a relatively low or inexistent conflict during the period of analysis, as control groups (donor countries).

The untreated countries we choose for the period of study are Argentina, Chile, Ecuador, Uruguay, Paraguay (South America), Costa Rica, Panama, and Honduras (Central America). Although all Latin American nations had guerrilla movements after 1960, few of them have a history of conflict with the length or intensity of the Colombian conflict. Other countries such as Mexico and Brazil share institutional characteristics with Colombia, in particular Mexico; but they are not comparable given their economic size relative to the Colombian economy.

Using the World Development Indicators data base available at the World Bank, we got information on economic variables (GDP per capita, investments, unemployment by sector, population, enrollment, population, and labor force among others) for all the potential control units and Colombia, between 1977-2014. We also consult public available data from the Center for Social Studies at Universidad de los Andes - CEDE and the Conflict Analysis Resource Center - CERAC to explore measures on conflict and violence.

Using 1995 as a break point for the treatment period we estimate our difference-in-differences (DID), and our synthetic control estimated effect. For the DID, we find an average treatment

effect of 3.7 points in our preferred estimation relative to the control group. Meanwhile, our synthetic control shows an average estimated effect of 4.9 relative to the synthetic Colombia. Both estimations represent at least one third of the average unemployment rate for the treatment period (1995-2014); however, the synthetic control suggest an effect larger than the first average effect estimated by DID. We test our DID results through three different standard test, and for the synthetic control method we follow Abadie et al.(2010) implementing a placebo test to validate our results.

The rest of the paper is organized as follows. Section 1 presents a detailed literature review describing studies examining economic impacts of conflict worldwide and in Colombia; section 2 offers a brief context on the Colombian conflict pointing out key elements for the period selection; sections 3 and 4 are devoted to present the empirical strategy for our analysis and the results obtained; and the last section contains some conclusions and comments.

1. The Colombian Conflict and Economic Outcomes

For the past fifty years Colombia has faced a constant threat to its institutional stability, as well as a situation of violence originated from different armed groups representing multiple ideologies, motivations, and tactics. From the mid-sixties communist guerrillas were formed with the remains of former bipartisan self-defense armies (Comisión Nacional de Reparación y Reconciliación (Colombia) 2013; Palacios 2006; Dube and Vargas 2013), and later on the seventies and eighties, paramilitary groups and drug cartels arise, both motivated by the control and protection private property of agricultural land, as well as the returns of the drug dealing (GMH 2013). Even though there was a constant state of violence, the political and economic institutions did not suffer major transformation within the country, and democracy has remained as the formed of government.

During the past twenty years the Colombian economy experienced a recovery boosted by high prices in commodities such as oil, coal and gold, as well as a persistent reduction in poverty levels in urban areas according to official data (WB 2017). Similarly, the state has negotiated peace agreements with two of the major illegal armed groups during the past fifteen years. Given this context, it is valid to question what was the impact of the armed conflict in Colombia on economic outputs; in particular, how the labor market was affected by the persistence of violent events that derived in forced displacement toward main urban areas, and obstacles to local and foreign investments.

Several studies have considered the impact of conflict on economic outcomes using different approaches. Most of them examine the impact of political conflict using cross-country level data (Alesina et al. 1996; Alesina and Perotti 1996; Barro 1991; Mauro 1995; Venieris and Gupta 1986); finding a negative effect of conflict on investments, savings, and economic growth.

Abadie and Gardeazabal (2003); Grier and Maynard (2016); and Horiuchi and Mayerson (2015) use a synthetic control to estimate the impact of political instability and conflict on economic outcomes. These works conclude that political instability has a negative impact on the economic performance of regions or firms. Abadie and Gardeazabal (2003) assess the economic impact of conflict, using the terrorist conflict in the Basque Country as a case study. They find that, after the outbreak of terrorism, per capita GDP in the Basque Country decreased around 10 percentage points compared with the synthetic control region. Grier and Maynard (2016) find that political instability affected negatively economic growth while other indicators such as poverty, health and inequality improved, and Bove, Elia, and Smith (2016) find a negative but not significant effect of conflict on economic growth. To do so, this study compares its results with the results of a sample of “cases of studies” using synthetic controls to demonstrate the heterogeneous effects of conflict on economic performance.

Regarding to the effect of conflict within specific countries on microeconomic level Shemyakina (2011), Chamarbagwala and Morán (2011), and Eccleston (2011), consider the impacts of conflict or exposure to terrorism on education outcomes (human capital accumulation).. Eccleston (2011) finds that psychological stress due to exposure to terrorist events has negative impacts on early educational attainment and cognitive ability. Similarly, Chamarbagwala and Morán (2011), and Shemyakina (2011) find a strong negative impact of conflict over educational attainment and schooling, especially among vulnerable populations

located on regions with high conflict intensity (Chamarbagwala and Morán 2011; Shemyakina 2011).

Specifically for Colombia and Bosnia Herzegovina, some scholarly works, assess the impact of forced displacement on labor participation and welfare (Ibáñez and Moya 2010; Ibáñez and Vélez 2008; Kondylis 2010; Calderón-Mejía and Ibáñez 2016) . Kondylis 2010 finds that displaced people in Bosnia are less likely to be working compared with those who stayed at the same place; her results reveal a differential effect on men whom experience high unemployment rates, while displaced women are more likely to drop out the labor force). Similarly, Ibáñez and Moya 2010 examine the effect of forced displacement (caused by conflict) on households' welfare after displacement; and Ibáñez and Vélez 2008 estimate the welfare losses due to forced displacement compared to a situation of traditional (unforced or voluntary) migration.

Lastly, we want to reference studies that analyze the impact of the conflict on politics, labor, and human capital specifically for Colombia. Acemoglu et al., (2013), consider the influence of irregular armies on policy decisions, in particular vote shares, finding a strong relation between paramilitaries and electoral outcomes in determined regions of Colombia. Ibáñez and Moya (2010), contribute to the literature of the conflict in Colombia assessing the vulnerability of households through information collected from a representative sample of forcibly displaced households in Colombia. These authors find that victims of forced displacement face difficulties in generate income and significant drops in consumption, revealing the limitation on the effectiveness on the public interventions. Similarly, Ibáñez and Vélez (2008) examine the causes of the forced displacement in Colombia, estimate the welfare losses and provide some evidence regarding policy instruments for preventing displacement.

These previous studies open the opportunity to ask: Did the extended violence in Colombia have an impact on the labor market? Although our analysis is strongly based on the methodology used by Abadie and Gardeazabal (2003), our study focused on the impacts on unemployment in Colombia, using as a control group a set of Latin American countries which constitutes a regional analysis rather than an analysis focused within Colombia.

2. Context: The Colombian Conflict

This document investigates on the impact of the armed conflict on the Colombian economy during the period 1977-2014¹. Even though there was a constant state of violence in Colombia, the political and economic institutions did not suffer major transformation within the country, and democracy has remained as the form of government (Chacón, Robinson, and Torvik 2011). Moreover, for some year within this period, Colombian economy experienced income shocks by the high prices in commodities such as oil and coal, as well as it experienced a reduction in poverty levels in urban areas according to official data (WB 2017). This context makes the Colombian conflict interesting from an economic perspective.

Colombian armed conflict has lasted for more than a half of a century. It has had a multiplicity of internal actors (Colombian Government, Paramilitaries, Guerrilla, and Drug Cartels) which appeared in different moments, and played different roles in the conflict. Former bipartisan self-defense groups remains derived in the formation of communist guerrilla groups after 1964 claiming lack of political representation (Palacios 2006; GMH 2013). As a response to these communist groups, the national government did incentive the formation of self-defense

¹ According to the General Report of the Historical Memory Group (GMH) (2013), the civil conflict in Colombia can be divided into four periods. Our analysis includes the second (1982-1996) and third period (1996-2005).

(paramilitary) groups as a counter-insurgency strategy². And finally, during the decade of 1980, the boom in the drug trafficking activity became a part of the paramilitary activity and, therefore fueled the rise of violence in the country during the decade of 1990.

Table 1 Victims of violence in Colombia 1980-2014

Years	Selective Deaths	Forced Displacement	kidnapping	Victims of Massacres	Victims of Landmines
1980	NA	NA	279	10	0
1981	98	NA	92	62	0
1982	178	NA	114	106	1
1983	138	NA	124	193	0
1984	190	60.039	150	138	1
1985	180	13.835	346	229	0
1986	280	15.459	154	125	0
1987	60	19.099	132	125	0
1988	444	33.371	335	526	0
1989	390	29.735	280	290	0
1990	393	37.671	1122	328	22
1991	421	33.233	766	418	69
1992	461	43.935	912	419	151
1993	389	49.579	354	271	84
1994	491	54.066	691	187	85
1995	614	105.466	509	275	130
1996	565	137.364	1269	463	120
1997	811	246.95	2100	662	96
1998	439	239.354	3278	684	58
1999	682	272.792	3354	1134	54
2000	1291	598.026	3547	1441	137
2001	761	653.228	3545	1370	299
2002	1067	753.678	3306	815	634
2003	1495	453.126	2303	427	756
2004	1071	414.909	1773	303	890
2005	702	473.898	1283	160	1182
2006	399	454.267	1350	105	1235

² The lack of confidence of the elites in how the government was handling the conflict with the Guerrillas, and the decision of the Guerrilla to reach more rural zones, contributed to the emergence and expansion of paramilitary groups to protect the interests of the elites. The Colombian government passed the Law 48 of 1968 to legitimize the creation of these groups². In this sense, the paramilitaries were born as legal groups with the mission to help the Colombian army to fight Guerrillas. These were declared illegal by the Ordinance 813/1989, but they continued operating until peace agreements in 2005.

2007	486	476.171	1384	89	978
2008	427	424.856	1455	78	857
2009	518	247.75	1252	106	747
2010	361	191.803	1252	87	552
2011	353	230.316	NA	80	549
2012	183	231.683	NA	45	502

Authors' elaboration

Sources: Group of Historic Memory – Colombia³; Victims Unit – President Office Colombia⁴; Center for Conflict Studies – CERAC.

Table 1, presents data collected by the Group of Historical Memory, the Center for Conflict studies – CERAC, and the Victims Unit in Colombia. The violent activity, in terms of victims, was relatively low during the decade of 1980; the number of victims of landmines or unexploded ordinance was very low during this decade, and its use increased after 1990 and it reached the peak in 2006. Other indicators of violence such as the number of kidnappings or the number of victims of massacres jumped up after 1988, right after the government declared as illegal any paramilitary activity within the country. Finally, although the communist guerrillas did not expand or confronted aggressively before the 1980s, they did occupy more territory, and structured themselves in a more sophisticated way.

The peak of the conflict in terms of magnitude of terrorist attacks occurred in the period 1996-2005. According to the GMH (2013) this period was marked by the simultaneous expansion of the guerrillas and the paramilitaries⁵, the war against the drug trafficking, and the change in the organization of the drug cartels. The magnitude of violent events such as kidnappings, massacres, deaths, and landmine victims reached the highest point between years 1995-2002; and the forced displacement worsened between 2000 and 2008.

³ <http://www.centrodememoriahistorica.gov.co/micrositios/informeGeneral/basesDatos.html>

⁴ <https://cifras.unidadvictimas.gov.co/Home/Desplazamiento>

⁵ Also during this period, through the decree 356 of 1994, the Colombian government allowed the emergence of new armed groups named “Convivir” (Private Surveillance Companies). These groups defined themselves as anti-subversive Political-Military groups, so they controlled of strategic locations (municipalities) of the country and influenced politicians both at local and national level (Acemoglu, Robinson, and Santos 2013; Gutiérrez 2010; Garay Salamanca and Salcedo-Albarán 2010).

Although the territorial control was still one of the main objectives among the different armed actors, the reasons why they fought changed (Salazar and Castillo 2001). Popular perception of the leftist guerrillas as defenders of social demands transformed into an image of vandalism and common delinquency; in this sense, all illegal armed groups used intimidation, killed, and forced displacement of population as instruments to instill the fear among the civil population. Thus, the violent groups dominated the population through fear.

The level of the conflict in this period reached such a big magnitude that according to the GMH (2013), Colombia was ranked second to Sudan in terms of forced displaced people. The massive displacement of the population from different regions in Colombia, especially toward the main populated cities affected the labor market and the welfare of this part of the population. The Colombian labor market suffered negative impacts on wages and employment opportunities (Ibanez 2009), and the victims of forced displacement faced difficulties to generate income, significant drops in consumption, and significant losses in welfare (Ibáñez and Moya 2010; Ibáñez and Vélez 2008; Ibanez 2009). It took time for displaced people to adjust to a new environment.

The economic activity in general was affected as a result of these tactics of domination over the civil population. The extortion had an impact on firm's decision to stay or to exit the market (Camacho and Rodriguez 2013). Similarly, the level of regional influence and political control of some of these violent groups allowed them to take advantage of public resources, and not be prosecuted by the national authorities given the prominent mutualism among some illegal groups and politicians at the central level of government (Acemoglu, Robinson, and Santos 2013) . These conditions, plus the massive displacement of civil population toward big urban areas,

impacted local investments, and created obstacles for foreign investment, as well as generated pressure on the country’s production, and therefore on the rate of unemployment.

The violence in Colombia has evolved, and has taken multiple shapes. There are many factors that contributed to the continuation of the conflict. This factors included the limitation of the political participation of some armed groups like the guerrillas, the beginning of drug trafficking, and its propagation around the country. The poor performance of Colombian institutions, and paradoxically, the decentralization opened an opportunity for the illegal armed actors to get involved in the political and economic life of local and regional governments taking control over some regions and their resources (Acemoglu, Robinson, and Santos 2013; Gutiérrez 2010; Garay Salamanca and Salcedo-Albarán 2010). Although with different levels of impact, the armed conflict spread in one form of violence or another to the whole national territory, as it is shown in the figures from the Group of Historical Memory report (2013).

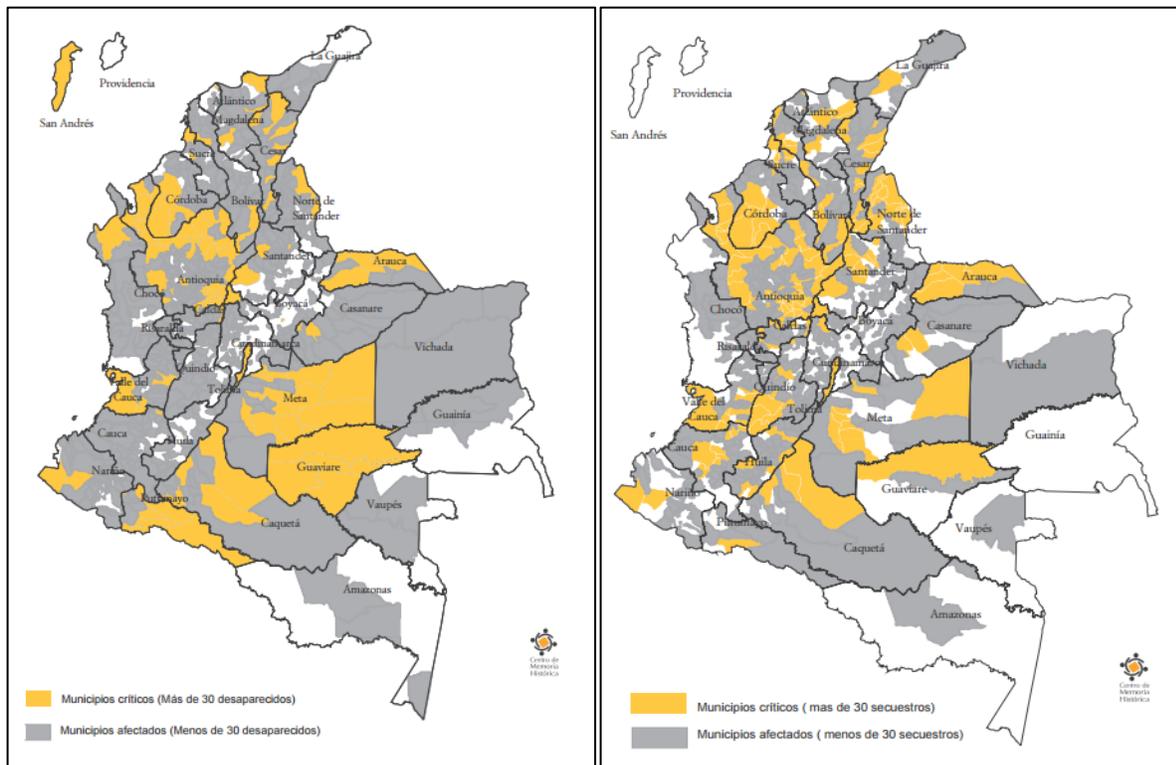


Figure 1
Source: Group of Historical Memory – Colombia. Report “Basta ya”

Left: Municipalities affected by forced disappearances
Right: Municipalities affected by kidnappings

3. Empirical Strategy

To study the impact of the conflict in the Colombian economy, we focus our analysis on the impact on the unemployment rate. For these we use two strategies. First, using countries in the Latin-American region, which have not been involved in a prolonged and intense armed conflict as Colombia, we construct a difference-in differences model; second, using the synthetic control methodology and the same set of countries we construct a control region that resembles relevant economic characteristics of Colombia before the high level of Colombian armed conflict starts. For both approaches we think about Colombian conflict as a natural experiment in which, according to the previous description of the armed conflict, Colombia as a whole is the treated unit.

a) Sample Selection and Data

We propose to estimate a difference-in-differences model, and to create the Synthetic control using a set of countries that are related to Colombia in terms of institutional framework, income and even geographically. Although we follow the study proposed by Abadie and Gardeazabal (2003) in which they explore regions within Spain, our analysis cannot rely on the exploration of the different regions in Colombia. The geographic uniformity of the violent events and the multiplicity of illegal armed actors in Colombia are restrictions for the definition of an untreated (unaffected) “region” within Colombia by the conflict (e.g., Figure 1). As a result of this, we choose eight countries in South and Central America as potential control units.

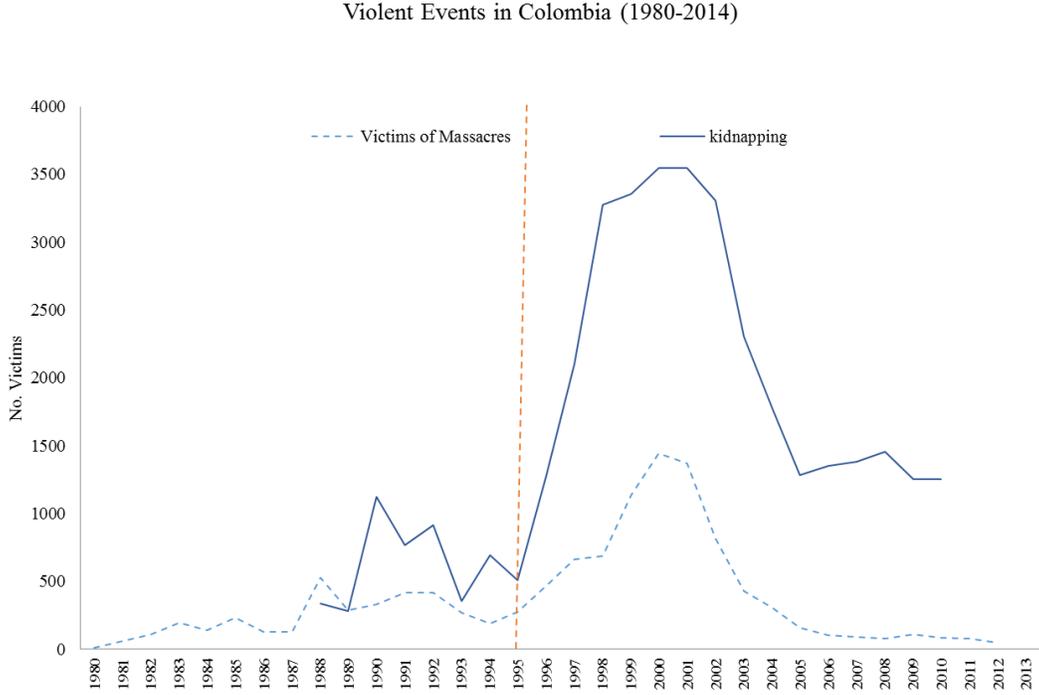
These countries are not treated with a “high intensity conflict” for the period of study. Considering this, we pick a pool of countries formed by Argentina, Chile, Ecuador, Uruguay, Paraguay (South America), Costa Rica, Panama, and Honduras (Central America). Although all Latin American nations had guerrilla movements after 1960, few of them have a history of conflict with the length or intensity of the Colombian conflict. Most of the countries selected do not have any armed conflict for the analyzed period. Other countries such as Mexico and Brazil share institutional characteristics with Colombia, in particular Mexico⁶; but they are not comparable with Colombia given their economic size relative to the Colombian economy. Including countries with predictor values far different from the treated unit may generate problems with the estimation of the synthetic control, and the resulting weights of those countries are not going to be of help to the implementation of the synthetic control. Other countries such as Nicaragua, El Salvador and Peru are excluded since they face high intense armed conflicts for the analysis period.

Similarly, we chose the pre-treatment and treatment based on two criteria. First, the availability of data for Colombia, and the control countries. Even though the Colombian conflict can be traced back from 1950, most of the information regarding the conflict in Colombia is available after 1980 (table 1); besides, the availability of data for Colombia, and many other Latin American countries is somehow complete or at least available after 1960. Second, the history of the Colombian armed conflict in the recent years that defines the peak of the conflict⁷

⁶ Mexico has been suffered from an internal conflict related to the drug cartels. This has triggered a big wave of criminal violence implying events such as massacres, assassination of politician leaders, and regular citizens. The occurrence of these violent events, which include disputes for the political and economic control of some parts of the Mexican territory, excludes this country from our potential control group.

⁷ The period between 1995 and 2005 is marked by an increase in violence with drug cartels, guerrillas and paramilitaries being part of it.

after 1995 (GHM 2013) as noticed also in figure 2 and figure 3. Therefore, the pre-treatment period is 1977-1994, and the treatment period is 1995-2014.



Source: Authors elaboration
Data: National Center of Historical Memory, Conflict Analysis Research on Center -CERAC

Figure 2. Violent Events in Colombia (1980-2014) Victims of Massacres and Kidnapping

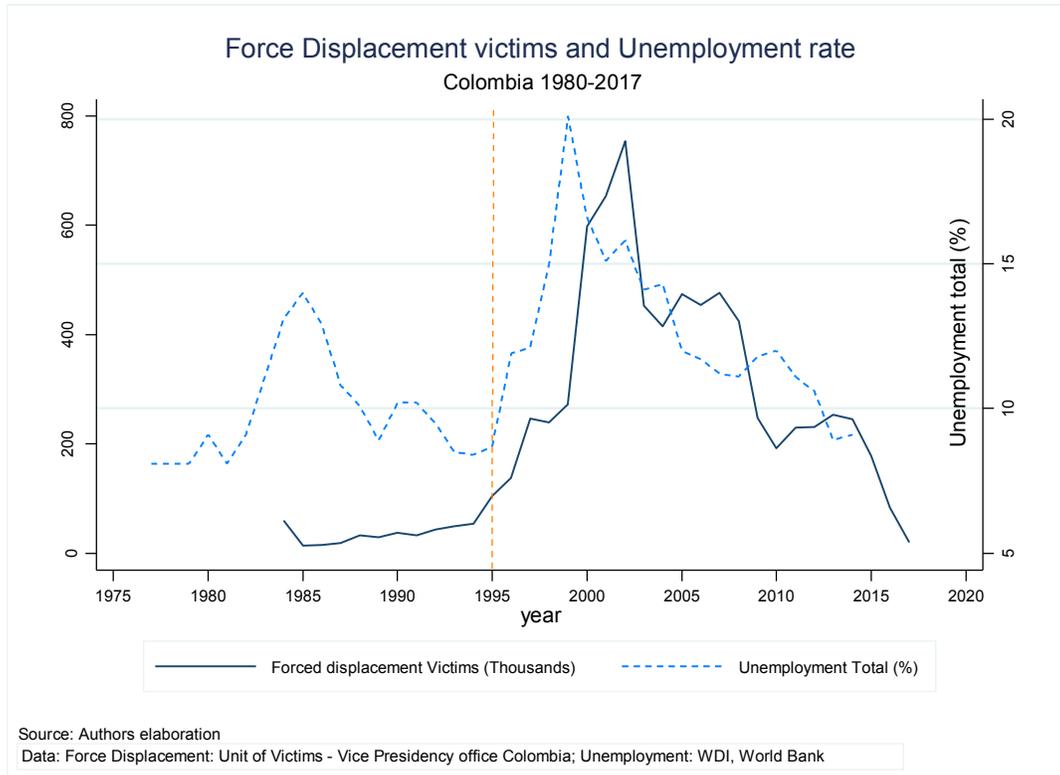


Figure 3 Forced Displacement victims (thousands) and Unemployment rate (1982-2017)

To implement our strategies, we collected data for these countries from two major sources. From the World Development Indicators – WDI platform established by the World Bank, we gather data for economic variables such as GDP, GDP per capita, unemployment rate, labor force, and Gross fixed formation of Capital; as well as other variables such as population, population density, and life expectancy at birth, land area, and gross enrollment for primary, secondary and tertiary education. From the International Labor Organization – ILO, we gathered data on total employment and employment by sectors (agricultural, industry and services). Finally, we also consulted data on conflict variables (i.e., violent events) from the Group of Historical Memory – GHM, the Conflict Analysis Research Center – CERAC, and the Unit of Victims from the Vice-Presidency office in Colombia.

b) Differences-in-Differences

In our first approach we estimate a difference-in-differences (DID) model with the armed conflict as our natural experiment; Colombia as the treated unit, and a set of countries within the region⁸ as the untreated or control units (these are countries in the region that have been not treated during the period under analysis). As it was mention before, our treatment period starts after 1995 and last until 2014. This period is characterized by the high levels of intensity of the conflict. Therefore, we have divided the whole period which goes from 1977 to 2014 into a pre-treatment period from 1977 to 1994 and a post-treatment period from 1995 to 2014.

In the case of the DID approach we have two groups indexed by treatment status $T = \{1, 0\}$. Where 0 indicates countries not receiving treatment, i.e. the control group, and 1 indicates the country receiving the treatment, i.e. the treatment group, which in our case is Colombia. Then, every country has two kinds of observations, one pre-treatment and one post-treatment.

The two outcomes our interest can be model through this equation:

$$Y_{it} = \alpha + \beta T_i + \gamma t_t + \delta(T_i \cdot t_i) + \theta X + \epsilon_i \quad (1)$$

Where $\alpha, \beta, \gamma, \delta, \theta$ are unknown parameters, and ϵ_i is a random, unobserved “error” term which contains all determinants of Y_{it} , which our model omits. It is important to notice that, β is the treatment group specific effect, γ is the time trend common to control and treatment effect, and δ is the true effect of treatment. Therefore, the purpose of our interest focused on the assessment of δ , for unemployment as outcome variable.

The matrix X includes covariates such as the GDP per capita in constant 2010 US dollars, the gross fixed capital formation as a proportion of the GDP as a measure of investments, and

⁸ Chile, Argentina, Ecuador, Uruguay, Paraguay, Costa Rica, Panamá, Dominican Republic, and Honduras.

general characteristics such as population density, life expectancy at birth, and gross enrollment in primary and secondary education.

c) Synthetic Control

The second strategy which uses a combination of countries to construct a synthetic region resembling Colombia during the pre-treatment period relies heavily on the Synthetic Control approach proposed by Abadie and Gardeazabal (2003). They find that it would be problematic to assess the impact of the conflict in the Basque Country simply by a comparison between the Basque country and the rest of Spain during terrorism year, since this may not show the true impact and also pre-terrorism differences between the Basque Country and the rest of Spain. Therefore, they approach this problem using a weighted combination of other Spanish regions with similar characteristics to the Basque Country before terrorism; they called this weighted average as a “Synthetic Basque Country” not affected by terrorism. In other words, this is an ideal counterfactual to examine the true impact of conflict.

In this way, the methodology considers the availability of J control “regions” different than the treated region, and W a $J \times 1$ vector of nonnegative weights summing to one. Each scalar in the W vector (i.e., w_j) represents the weight of region j in the synthetic control region. The main idea is to find a vector W in such a way that the synthetic control is the closest to the treated region before the beginning of terrorism. Then, given a vector X_1 ($K \times 1$) of pre-terrorism values of K economics variables for the treated region, a $K \times J$ matrix X_0 containing the values of the same variables for the J possible control regions, and a diagonal matrix V with nonnegative components reflecting the relative importance of the different economic variables, a vector W^* of weights is chosen to minimize $(X_1 - X_0W)V'(X_1 - X_0W)$ subject to $w_i \geq 0$ and $w_j + \dots +$

$w_j = 1$. The objective is to approximate the outcome variable in the treated region Y_1 to the path this would have in the absence of conflict, so this counterfactual outcome path is calculated as the outcome of the synthetic control region $Y_1^* = Y_0W^*$.

4. Results

a) Difference-in-Differences and Synthetic Control for Unemployment

i. Differences-in-Differences Analysis

Table 2 reflects the results for our DID estimation; presenting two sets of estimations. First we have the parsimonious model (columns 1-3); second, we include a set of covariates (columns 4-6). In each set, we show the unemployment rate aggregated (total), and disaggregated by gender. For both estimations, the parsimonious and including covariates, the DID coefficient reflects a positive estimated mean difference on the unemployment rate total, and the unemployment rates for females and males; interestingly, the inclusion of covariates reveals a positive expected mean change in the unemployment rate from before to after the onset of the “high intensity conflict” period among the control group, in other words, the more complete estimation shows a positive effect of time on the unemployment rate in the absence of treatment.

Table 2. Differences in Differences unemployment rate

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Unemployment Total	Unemployment Female	Unemployment Male	Unemployment Total	Unemployment Female	Unemployment Male
Diff-in-Diff	3.229*** (1.081)	3.844*** (1.272)	3.039*** (0.961)	3.711*** (0.899)	3.218*** (1.073)	3.695*** (0.822)
Controls				X	X	X
Observations	380	380	380	349	349	349
R-squared	0.024	0.025	0.042	0.427	0.397	0.405
Number of id	10	10	10	10	10	10

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In order to identify causal effects, the DID assumes that prior to the intervention, the unemployment rates have identical trends in treatment and control countries. Then, after the intensification of the conflict (treatment), the DID estimates how the unemployment rates change in the treatment (Colombia) compared to the control countries that did not suffer a “high intensity conflict”. To test the common trend assumption we apply two standard falsification tests. Following Talosaga and Vink (2014), we try to estimate directly any difference in trends using the following regression model for the pre-treatment (if year < 1995):

$$Y_{it} = \alpha + \beta_1 trend + \beta_2 (treatment \times trend) + \theta X + \epsilon_i \quad (2)$$

If the common trend assumption holds, the coefficient β_2 should not be statistically significant. The second test estimates the model using a “placebo” treatment. We re-estimate the DID for the pre-treatment period assuming that the treatment impacted at an earlier date. In this case the DID coefficient should be not significant and close to zero. The first test confirms the common trend assumption either for the parsimonious case, or including covariates (Table 5. Appendix). For the second test we estimate two placebos (Table 6 and 7 Appendix), one assuming that the treatment started in 1985 (ten years earlier), and second assuming the treatment started in 1990. For the first placebo we find a not statistically significant DID coefficient for the parsimonious model, but this becomes significant⁹ when including covariates. For the second placebo, neither the parsimonious nor the model with covariates reveals a significant DID coefficient.

Although we find an effect of the “high intensity conflict” on the unemployment rate in Colombia, as well as on the female and male unemployment rates; these mixed results for the falsification test, do not allow us to draw a conclusion. However, these results do signal the

⁹ It becomes significant at 10% significance level

existence of an impact in Colombia with respect to other countries within the region caused by the presence of a “high intensity conflict”; in order to establish a consistent conclusion, we rely on the synthetic control method proposed by Abadie and Gardeazabal (2003) applied for the Colombian case.

ii. Synthetic Control

The key question to evaluate the causal effect in which we are interested is how the unemployment has evolved in Colombia after 1994 in absence of the conflict. Certainly this question cannot be answered without the help of a counterfactual because we are not able to have both Colombia without and with conflict simultaneously. Therefore, we use the synthetic control method as a procedure to estimate that counterfactual.

Figure 1 above shows the trend of the unemployment in Colombia and the rest of countries in Latin-America¹⁰. As we can see the rest of Latin-America does not seem to be a suitable control group for our purposes. Although at the beginning of the pre-treatment period (1977-1994), the unemployment rate in Colombia was slightly similar than the average unemployment rate for the rest of countries in the region, this difference was greater by 1985 when the unemployment rate was about 5% greater in Colombia than the average for Latin America; and on average, the unemployment rate for Colombia during the pre-treatment period was 14%; meanwhile the average unemployment for Latin America was 9%. Figure 4 suggests that, even before the beginning of the “high intensity conflict” period in Colombia, there is a gap between the unemployment rate in Colombia and the unemployment rate in the rest of Latin-America. As suggested by Abadie et al.(2010) and Abadie and Gardeazabal (2003) the synthetic control

¹⁰ The countries included are: Argentina, Bolivia, Brazil, Chile, Costa Rica, Ecuador El Salvador, Honduras, Nicaragua Panama, Paraguay, Peru, Uruguay, Puerto Rico, and Venezuela RB.

method help us to estimate a counterfactual for Colombia from a pool of donor countries for the period 1977-1994

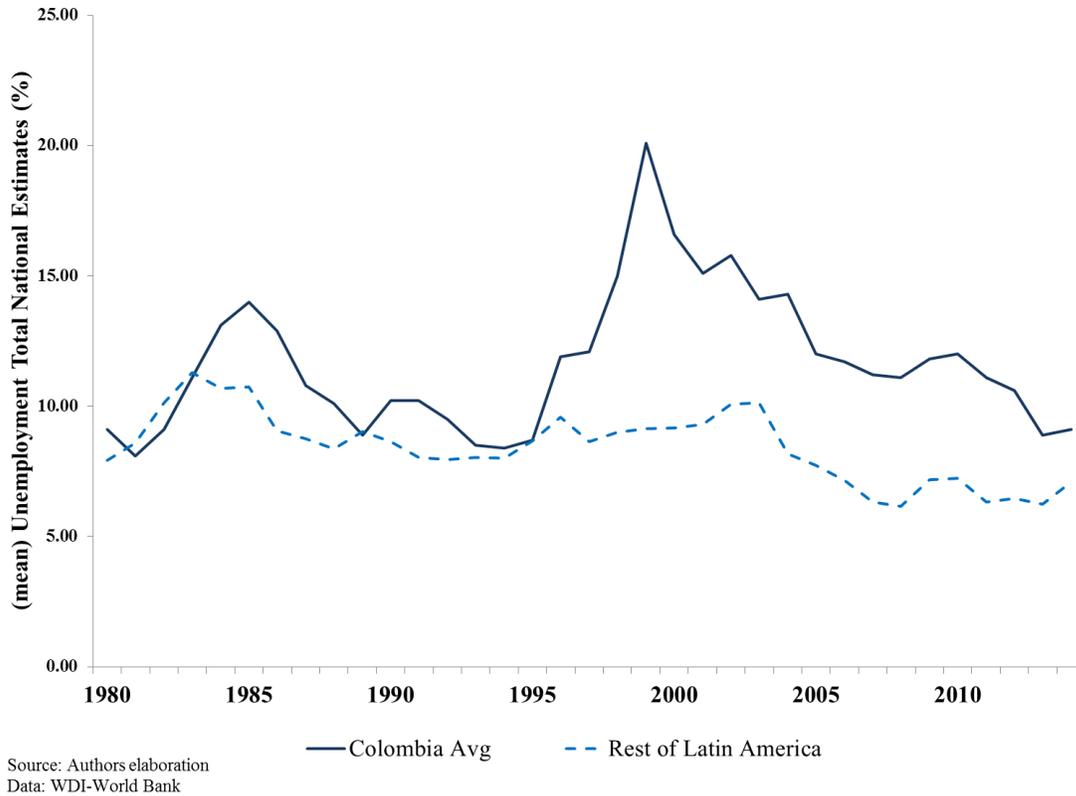


Figure 4 Trend in Unemployment rate: Colombia vs the rest of donor countries.

The table 3 displays the results of our synthetic control in terms of pre-treatment characteristics between Colombia and the pool of donor countries. These results compare the means of the predictors of unemployment among Colombia, the synthetic Colombia and the average of the 8 donor countries, excluding from our donor pool those countries which do not meet the characteristics to be part of this¹¹. We see that the average of countries that did not suffer a “high intensity conflict” after 1994 does not provide a good control group for Colombia. Economic predictors such as the GDP per capita or the investments (Gross fixed capital formation) adjust better for the Synthetic Colombia than the average of donor countries; a similar

¹¹ As we have explained in the empirical framework.

situation resembles with other predictors (i.e., life expectancy at birth, population density and gross enrollment in secondary education). Notice that it is important to have a donor pool of countries showing a high similarity with Colombia which is the country exposed to the treatment (high intensity conflict). In this sense, the synthetic Colombia accurately resembles the predictor values for the actual Colombia during the pre-treatment period. According to Abadie et al.(2010), this result assures that we have a counterfactual that falls within the convex hull of the data.

Table 3. Unemployment rate predictor means.

	Colombia		Average of control countries
	Treated	Synthetic	
GDP Per capita (constant 2010 US \$)	3969.80	3948.49	4599.337
Gross Enrollment Primary (female and male)	108.07	104.27	107.4469
Gross Enrollment Secondary (female and male)	47.28	52.40	54.34334
Life expectancy at birth (age)	67.12	68.65	69.56216
Population Density (ages 15-64 pop per km sq.)	16.40	16.67	14.94567
Gross fixed capital formation (% of GDP)	17.14	17.49	18.88967

Note: All variables are averaged for 1977-1994 period

The weights of each control country in the synthetic Colombia are reported in Table 4. The unemployment rate in Colombia before the “high intensity conflict” period is best resembled by a combination of Panama, Uruguay and Honduras, which are the only countries within our donor pool with positive weights. All other countries within the donor pool have a weight of zero for the synthetic Colombia.

Table 4. Country weights in the Synthetic Colombia

Country	Weight
Chile	0
Costa Rica	0
Ecuador	0
Panamá	0.379
Paraguay	0

Uruguay	0.25
Argentina	0
Honduras	0.371

Figure 5 shows the trend of the unemployment rate of Colombia and the synthetic Colombia for the period 1977-2014. We see that the synthetic Colombia presents a similar trajectory during the pre-treatment period. Altogether, this similarity and the similarity among the unemployment rate predictors reveal that the synthetic Colombia approximates the unemployment rate that would have occurred in Colombia in the absence of a “high intensity conflict” after 1994.

During the treatment period (1995-2014), there is a gap between the unemployment rate for Colombia and the unemployment rate for the synthetic Colombia. This divergence in figure 5 suggests a positive effect of the “high intensity conflict” on the unemployment rate in Colombia. The estimated effect of this treatment on the unemployment rate is given by the difference between Colombia and the synthetic Colombia. On average, the “high intensity conflict” contributed with 4.9% of the unemployment rate for the treatment period; in other words, relative to the 12.8% average unemployment rate in Colombia for the period 1995-2014 our results suggest that the “high intensity conflict” explains more than one third of the unemployment rate.

i. Robustness of these results

Even though the figures and the computations based on the divergence suggest that the conflict in Colombia has an effect on the variable of our interest we test whether our estimates have real significance or they are obtained by chance following Abadie et al.(2010) and Abadie and Gardeazabal (2003). In this sense, the questions we must respond is what would it happen with our results if we choose a random country besides Colombia? Using the non-treated

countries within our donor pool, we apply the synthetic control during the sample period of our study. For each iteration, we reassign the “high intensity conflict” treatment to one of our 8 countries, and include Colombia within the set of donor countries. According to Abadie et al.(2010) the idea behind this placebo is that if the placebo creates gaps of similar magnitude to the gap estimated in our main synthetic, then we can affirm that our results do not provide significant evidence of a positive effect of the treatment on the unemployment rate in Colombia. On the opposite case, if the gap for Colombia is relatively larger than the ones estimated for the non-treated countries, we can say that our results provide significant evidence of a positive effect of the “high intensity conflict” on the unemployment rates.

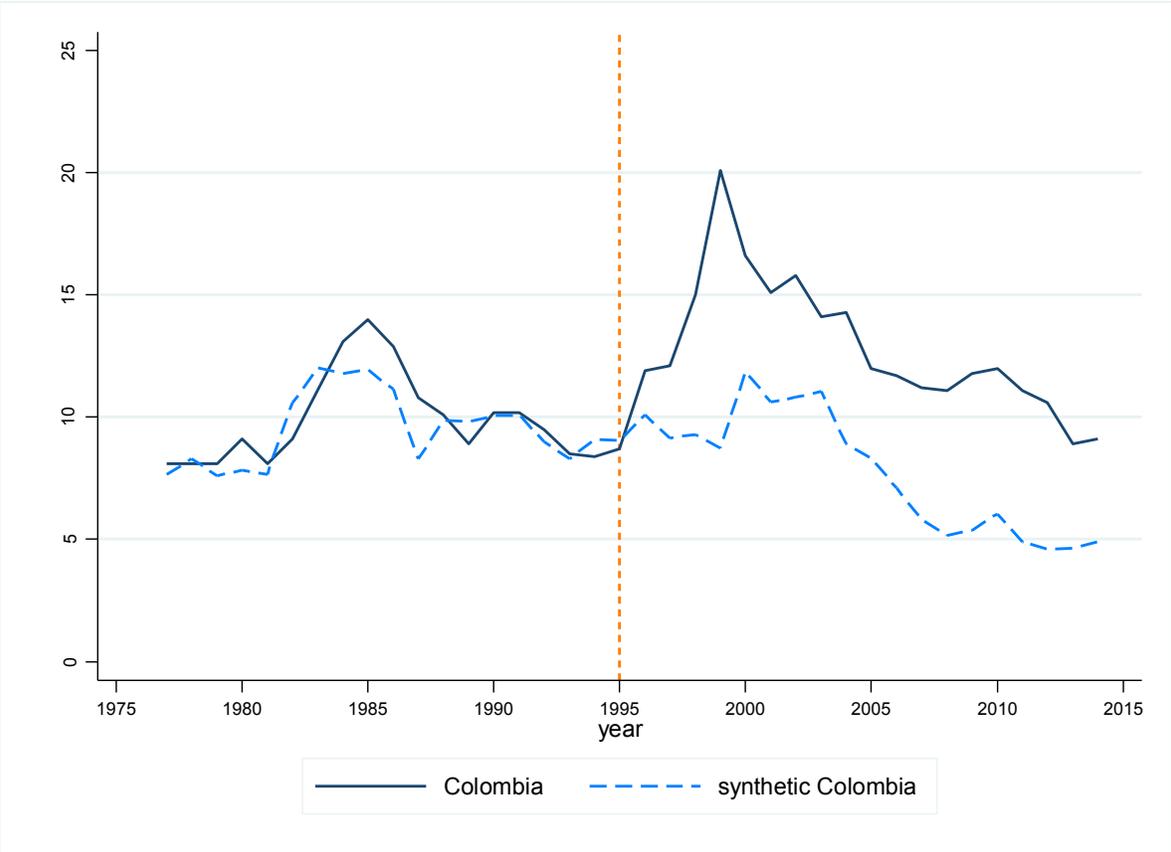


Figure 5. Trends in Unemployment rate: Colombia vs. Synthetic Colombia

We do this for each one of the other eight countries, and then we compute the estimated effect associated with each of the placebo run, as well as the distribution of these effects. Thus, we can see where Colombia as the treated unit lies in the distribution; and based on a standard level of rejection we can conclude whether the effect is significant or not. Figure 6 shows the gap in the unemployment rate for the eight placebos, and Colombia. This figure also reveals that Argentina could have fit problems in the pretreatment period; however its mean squared prediction error (MSPE) is 12.1. Removing Argentina, we can see that the effect of the conflict on the unemployment rate in Colombia is the highest (figure 7).

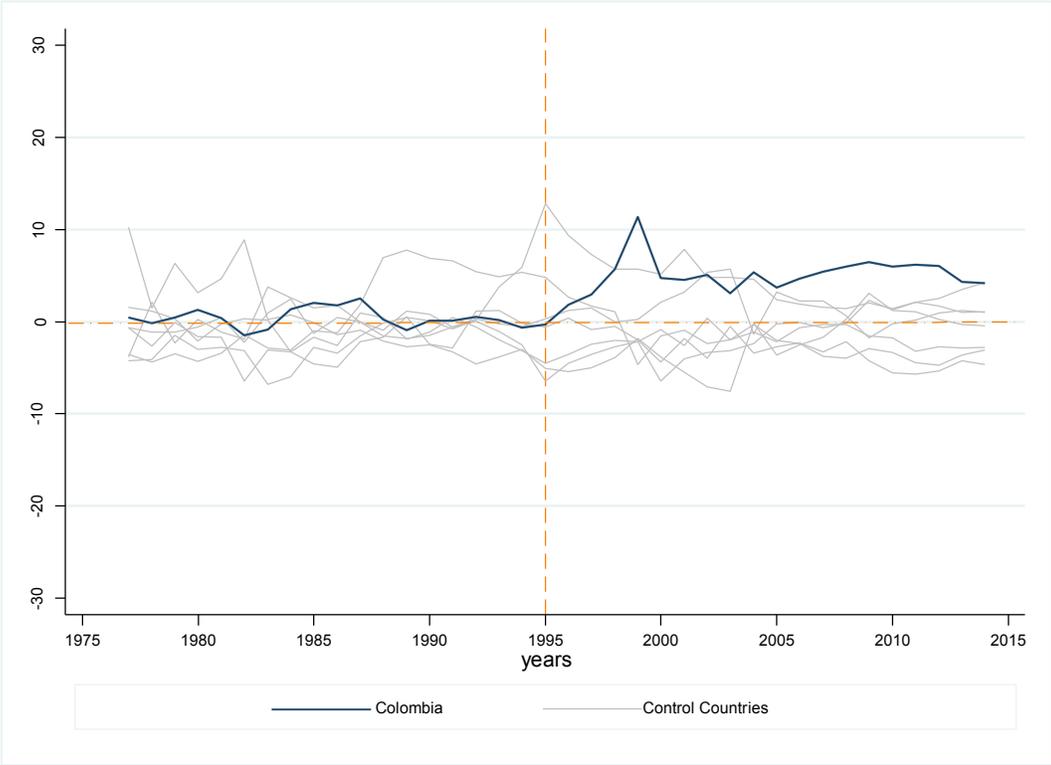


Figure 6. Unemployment rate gaps in Colombia and placebo gaps in all 8 control countries

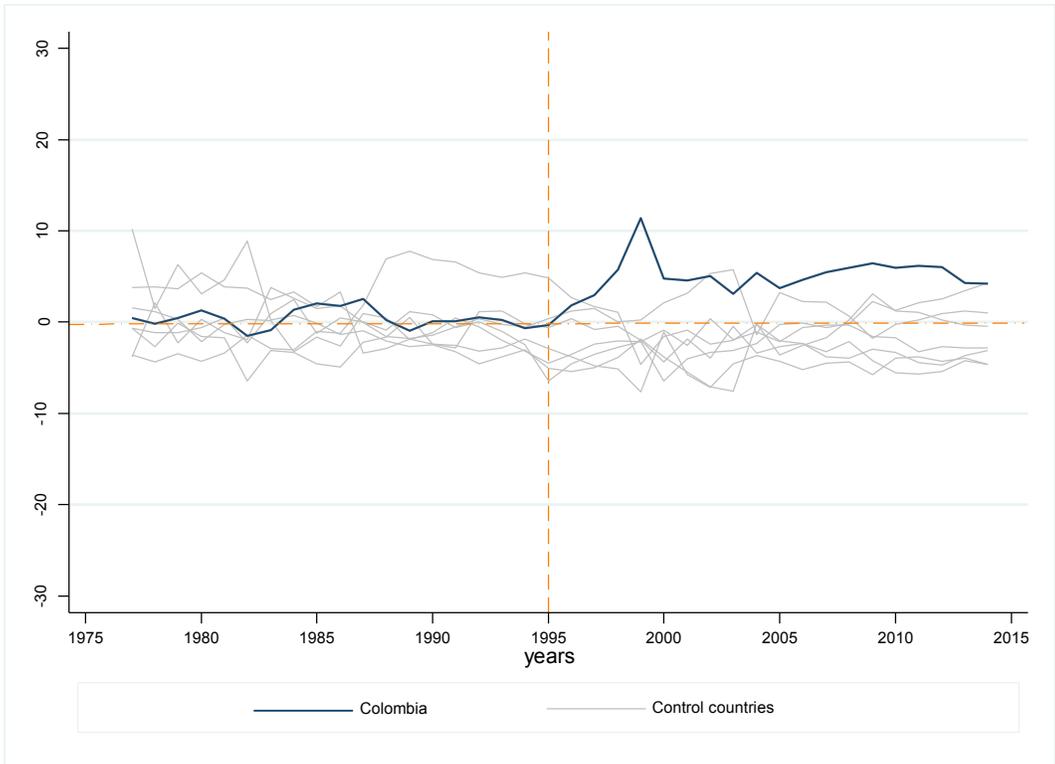


Figure 7. Unemployment rate gaps in Colombia and placebo gaps without Argentina

Even though these graphs give us an idea about how severe is the effect of the conflict comparatively with the placebos run, a more accurate way to evaluate the Colombian gap relative to the gaps obtained for the placebos is to analyze the distribution of the effects obtained after running iteratively a synthetic for every country. The idea is to calculate a post/pre-“high intensity conflict” MSPE ratio and constructs its distribution; based on that we assess the probability of having a value of the post/pre-“high intensity conflict” MSPE ratio as large as it is for Colombia. As it can be seen in the figure 8 the distributions of the post/pre conflict MSPE shows that the value of Colombia falls far from the values of the rest of the countries, meaning that our results are significant. The probability of observing a behavior similar to Colombia is one in nine.

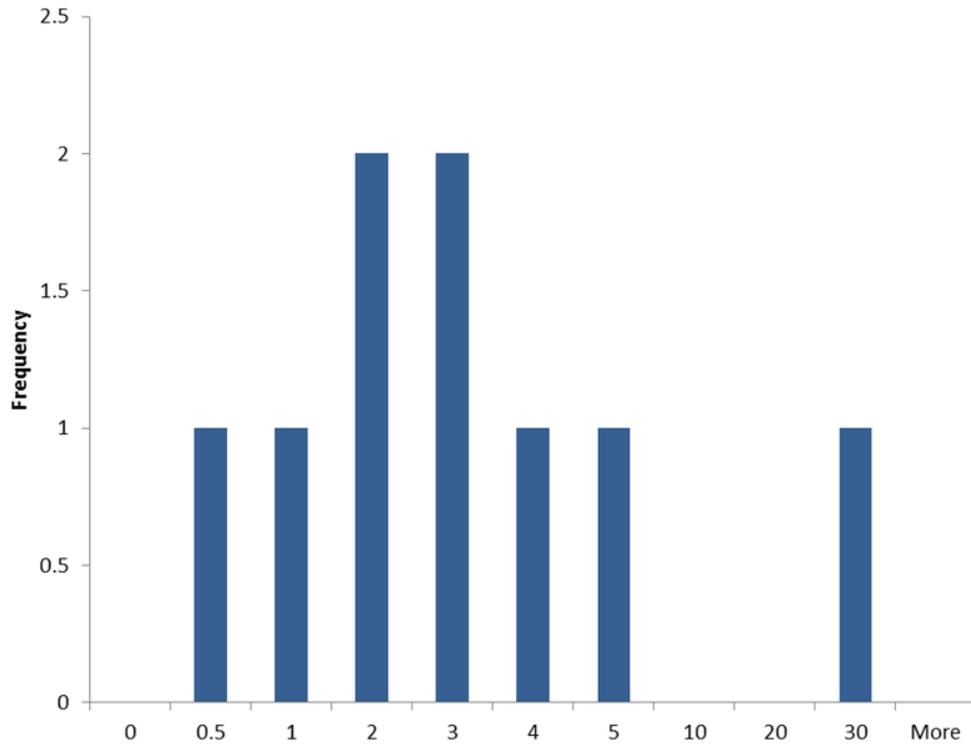


Figure 8 post/pre-“high intensity conflict” mean square prediction error

Similar results are achieved when disaggregating the unemployment rate by gender. However, the effect on the female unemployment rate seems to be higher than the effect on the male unemployment. These results are consistent with other studies on the Colombian labor market that find a greater affectation for unemployment within the female population (Nuñez and Bernal 1997; Sánchez, Duque, and Ruíz 2009); however, these studies do not include the “high intensity conflict” within their analyses (see appendix figures 9 and 10).

5. Conclusions

Analyzing the effects of the conflict in Colombia requires the consideration of multiple particularities including its duration, the multiplicity of armed actors involved, and the objectives of such armed actors. Using a set of Latin American countries as a control group we overcome the issue of finding a counterfactual within a region in Colombia; and estimated through two

methodologies the effect of the “high intensity conflict” in Colombia over the unemployment rate.

Our first approach using a difference-in-differences revealed an effect on the unemployment rate. For the period 1995-2014, the DID estimated effect was about 3.7% with respect the control countries in our preferred specification (table 2, columns 4-6); and this magnitude replicated for the unemployment rate for females and males. However, these results only signaled the impact of the conflict; in order to estimate the true impact of the conflict we construct a synthetic Colombia as a counterfactual.

Also, we found an estimated effect after running the synthetic for the period 1977-2014, and we gathered few interesting conclusions, First, from our pool of donor countries only three countries obtained a positive weight: Panama, Uruguay and Honduras with weights of 0.379, 0.25 and 0.371 respectively; second, the computation of the synthetic control allowed us to have an estimated impact of the conflict on the unemployment rate of 4.9% above the “Synthetic Colombia”, which represents more than one third of the average unemployment rate for the “high intensity conflict” period (1995-2014) in Colombia. It is important to notice that there was a differentiated impact for females and males; consistent with other studies on the Colombian labor market (Nuñez and Bernal 1997; Sánchez, Duque, and Ruíz 2009), we found a greater affectation among the female population for the “high intensity conflict” period than the male counterpart. Both, the DID estimated effect and the synthetic control estimate, represent at least roughly one third of the average unemployment rate for the post-treatment period. However, the synthetic control suggests an effect larger than our DID estimate.

The analysis conducted in this paper gives an idea of how the conflict is affecting one labor variable as it is the unemployment, the next step could be to explore differentiated effects by

schooling level and the economy by sectors to identify which segments of the population and which part of the economy was more affected by the conflict. Similarly, this study opens two questions: first, a question regarding the mechanisms through which this “high intensity conflict” treatment has affected the unemployment rate; one hypothesis may reside in the pressure imposed on the labor market in urban areas due the forced displacement phenomena; however we do not test such hypothesis in this document. Second, it is valid to ask if there was any effect on the GDP in Colombia given the impact on the unemployment rate; our first approaches to the last question do not reveals conclusive results (Appendix).

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Appendix

Table 5 Test for common trend assumption: test in pre-treatment period

VARIABLES	(1) Test Unemployment	(2) Test-controls Unemployment
Trend	-0.074 (0.078)	-0.009 (0.089)
Test1 (<i>Treatment</i> × <i>Trend</i>)	0.119 (0.135)	0.035 (0.073)
Covariates		X
Year Dummies	X	X
Constant	9.659*** (1.709)	54.587*** (8.341)

Observations	180	168
Number of id	10	10

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Test for common trend assumption: Placebo treatment ($t < 1985$)

VARIABLES	(3) Placebo Unemployment	(4) Placebo-controls Unemployment
Time-treat ($t < 1985$)	9.645*** (1.749)	53.668*** (8.338)
treatment	1.415 (4.784)	0.985 (1.050)
DID	-1.887 (1.459)	-2.796* (1.567)
Covariates		X
Dummy year	X	X
Observations	180	168
Number of id	10	10

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 Test for common trend assumption: Placebo treatment ($t < 1990$)

VARIABLES	(5) Placebo 2 Unemployment	(6) Placebo 2-controls Unemployment
timetreat3($t < 1990$)	1.091 (1.322)	56.056*** (8.348)
treatment	0.731 (4.884)	0.052 (1.470)
DID	-0.215 (1.628)	-0.439 (1.706)
Covariates		X
Dummy years	X	X
Constant	8.455*** (1.753)	

Observations	180	168
Number of id	10	10

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

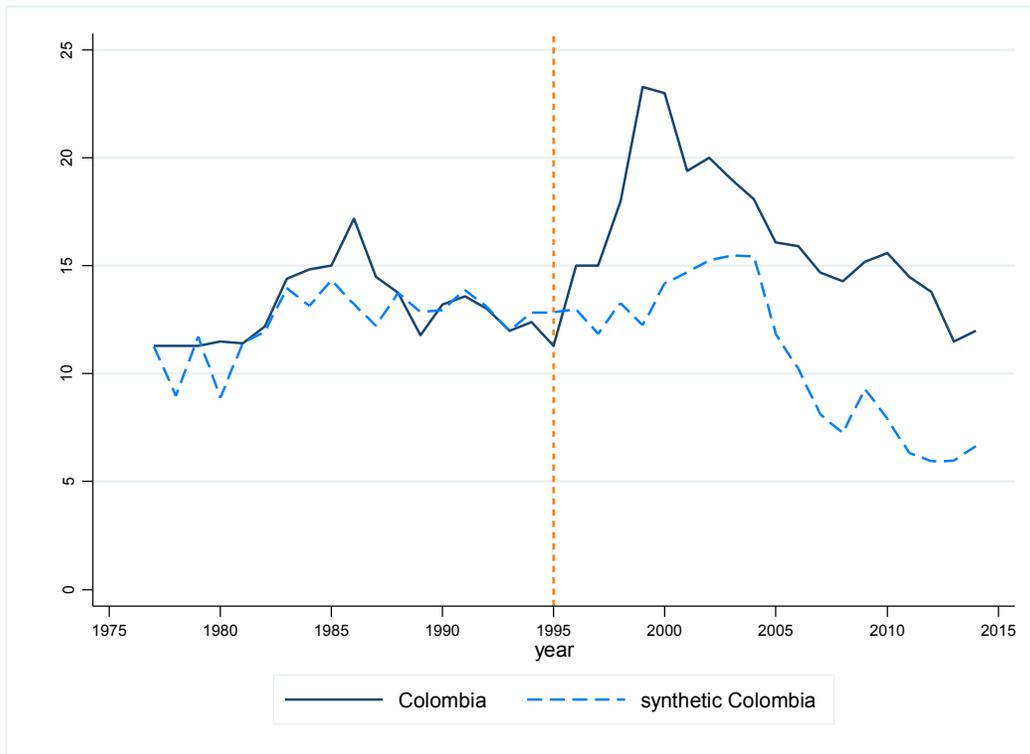


Figure 9 Trends in Unemployment rate Female: Colombia vs. Synthetic Colombia

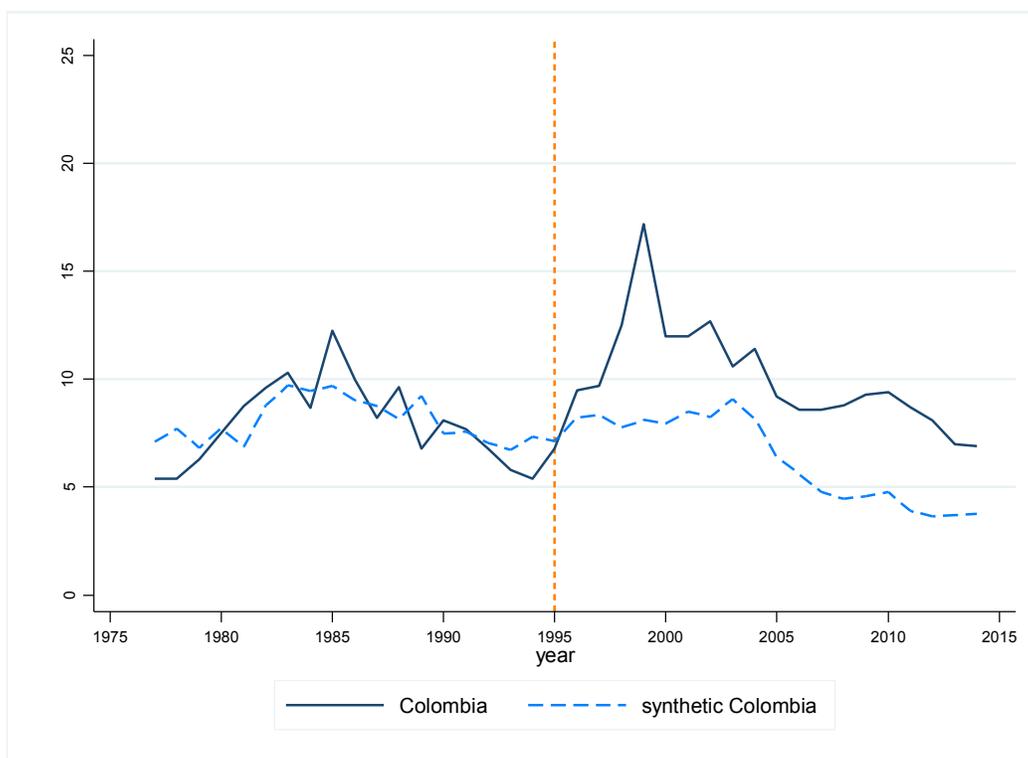


Figure 10 Trends in Unemployment rate Male: Colombia vs. Synthetic Colombia

Table 8 Differences in Differences GDP per capita (constant 2010 US\$)

VARIABLES	(1) GDP per capita Diff-in-Diff	(2) GDP per capita Diff-in-Diff - Controls
Time treatment (t<1995)	2,110.988*** (133.304)	674.737*** (204.147)
DID	-502.775 (421.544)	-495.879 (346.072)
Gross enrollment primary education		-56.447*** (10.344)
Gross enrollment secondary education		33.396*** (6.157)
Life expectancy at birth (ages)		177.666*** (33.917)
Population density (pop per kmsq)		-31.701*** (6.019)
Employment in Agriculture (% of labor force total)		-60.530***

		(8.695)
Employment in Services (% of labor force total)		28.287***
		(9.005)
Employment in Industry (% of labor force total)		4.734
		(17.173)
Gross fixed Capital formation (% GDP)		113.941***
		(12.842)
Constant	4,290.144***	-4,980.046*
	(91.746)	(2,607.693)
Observations	380	313
R-squared	0.420	0.721
Number of Countries (id)	10	10

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1