Guns N' Roses:

The Impact of Stable and Secure Employment Opportunities on Violence in Colombia

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Abstract

This paper investigates the impact of the dramatic growth of the fresh-cut flower sector in Colombia, on different forms of violence, measured at the municipality level. Our empirical strategy exploits municipal variation in the geoclimatic suitability for floriculture, together with time variation from the sector's growth. We show that the expansion of the sector was associated with a reduction in unorganized violent crime (in particular the homicide rate) in the suitable municipalities, but not in any changes in participation in guerrilla warfare. In contrast, increases in the coffee price are associated with a decrease in guerrilla warfare (as in Dube and Vargas, 2013) but, as we show in this paper, an increase in homicide. We propose a household model where households both participate in and indirectly consume criminal activities (organized and unorganized) and women have different preferences than men, which can explain these asymmetric results.

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1 Introduction

"To save Colombia from cocaine, buy its roses"[1]–Former President of Colombia César Gaviria (1990)

"Better roses than cocaine, no?"[2]–Nicholas Kristof, New York Times Op-Ed (2008)

In the beginning of the 1990s decade Colombia was landswept with unregulated agitation and control over drug production was considered to be a major contributor to the disintegration of public order. Almost twenty years later, the popular sentiment that encouraging legal commerce, and strengthening international trade ties could set the path for a peaceful and steady process of socio-economic development still lingered. In fact, the fear that "blocking [Colombia's] attempts to expand legal [coffee and flower] exports may be forcing Colombians to choose between drugs and poverty"[3] (Passell, 1989) was a central concern. A question that naturally arises in this setting is: does the provision of the, mainly female, jobs in the flower industry indeed lead to decreased violence, and does it do so differentially relative to other source of legal employment?

The employment opportunities that we consider can be embedded within a greater global phenomenon: the increased feminization of the labor force (Mammen and Paxson, 2000). This process has been facilitated by the proliferation of low-skill manufacturing employment opportunities in an environment of increased trade liberalization. Remarkably, in many of these settings where the incorporation of females has been more pronounced, female earnings in the paid labor force (outside the household) were once not considered the norm (ibid). The emergence of the maquiladoras in the Latin American continent and the garment and textile industries in South East Asia are two of the most prominent examples of such factory-style employment. This type of employment entails very specific characteristics: it has disproportionately targeted females, providing them with arguably a more permanent and stable source of income, and, depending

[1] César Gaviria (1990). "The Americas: To Save Colombia From Cocaine, Buy Its Roses". The Wall Street Journal, op-ed, November 2, 1990. Accessed March 17, 2013. Retrieved from Factiva, Inc. http://new.dowjones.com/products/factiva/

[2] Nicholas Kristoff (2008). "Better Roses Than Cocaine". New York Times, April 24, 2008. Accessed October 12, 2013. http://www.nytimes.com/2008/04/24/opinion/24kristof.htm

[3] Peter Passell. "Economic Scene: Fighting Cocaine, Coffee, Flowers". New York Times, September 20, 1989. Accessed March 17, 2013. http://www.nytimes.com/1989/09/20/business/economic-scene-fighting-cocaine-coffee- flowers.html

on the industry, it has required them to attain a varying degree of educational skills (from the agricultural work, to the more skilled tasks performed in the business, process and outsourcing centers).

This paper employs micro-level data to estimate the impact of this agro-processing sector, the fresh-cut flower industry, on various forms of violence in Colombia. We specifically look at the relationship between the flower growth and the homicide rate at the municipal level from 1990 to 2012. Our source of identifying variation comes from the interaction between changes in the national value of flower production and the cross-sectional distribution of flower farms in Colombian municipalities. The novelty of our study arises from its focus on an economic sector that is believed to be female-friendly, thus offering a secure income opportunity that disproportionately targets women. As such, women constitute over 60 percent of the floricultural production workforce (Census, 2005). The flower sector is giving them access to a permanent source of employment with a steady income. Furthermore, the work schedule on the flower farms is compatible with the managing of the household chores for many female household heads (Friedemann-Sánchez, 2006), making it a covetable employment sector.

Primarily, we concentrate on violent forms of crime, where we chose the homicide rate as our main outcome of interest,[4] since this "form of violent crime has a broad impact on security and the perception of security" within any society (UNODC, 2013). To shed some light on the magnitude of the numbers, over our sample period (1990 – 2013) there were approximately 500,000 homicides recorded in Colombia. That figure nearly matches the average number of homicides that happened worldwide for the most recent year (UNODC, 2013). We want to emphasize that the general violent crime happened within the broader context of an ongoing civilian conflict.

Secondarily, we extend the study of the flower shocks into the realm of illegal armed activity, thereby building on the Dube and Vargas (2013) study on commodity price shocks. This allows us to introduce not only a gender comparison, where we contrast commodity price shocks that differ in their employment gender-intensity, but also to look at their differential impact on

[4]We look at other forms of crime, including different types of theft (personal theft, burglary, commercial theft, and vehicle theft) and kidnappings.

various forms of violence (unorganized violent crime vs. armed conflictual violence).

We recognize that violence might certainly affect the location decision of any economic activity, including that of floriculture entrepreneurs. To deal with this potential source of endogeneity, we proceed with an instrumental variable strategy that exploits the fact that flowers require very particular climatic conditions to bloom. This presents us with a series of geo-climatic instruments to evaluate the suitability of a municipality to become a flower-producing center. We additionally address concerns about the growth in the (dollar) value of the sector, by concentrating on the exports to the US—a market that is dominated by Colombian flowers, and the interplay between Colombian producers and other competitors within the US. Our regressions control for municipality characteristics measured at the beginning of the sample period and we allow them to have a time-varying impact—including, among others, the presence of coffee, petrol reserves, altitude, and to the capital and historical experiences of violence, as well as regional, linear time trends.

We show that the expansion of the flower sector led to a reduction in the homicide rate in the flower suitable municipalities. In summary, we find that a one percent increase in the national level of flower production differentially decreased the rate of homicides in flower-suitable municipalities, by –0.08 homicides per hectare of flower being cultivated. In contrast, increases in coffee price led to a decrease in guerrilla warfare (as shown in Dube and Vargas, 2013) but, as we show in this paper, an increase in homicide. We propose a household model where households both participate in and indirectly consume criminal activities (organized armed conflict and unorganized violence) and women have different preferences from men, which can help to rationalize these asymmetric results. We posit that the gendered nature of this modern, agro-industrial flower employment might have had a "pacifying process" on the flower communities, via income shocks that were channeled through the females of the flower households.

The remainder of the paper has the following organization: in Section 2, we provide a conceptual framework with which to think about the relationship between female employment and violence, as well as a compact introduction to the Colombian institutional context, and a description of the rapid expansion experienced by the agro-industrial sector. Building on these, Section 3 illustrates our empirical strategy; Section 4 describes the data for this study; Section 5 discusses the estimation results. Finally, Section 6 concludes.

2 Institutional Context and Background

This section will discuss a brief introduction into the Colombian history, a conceptual framework and the development of the flower sector.

2.1 A Brief History of Conflictual Violence in Colombia

Colombia is an Andean republic whose political stability in the twentieth century was undermined by internal dissent, creating a societal schism that endures to this day. Its modern history has been marked by political strife, arising from a three-way conflict between: the two leftist guerrilla groups, the Fuerzas Revolucionarias de Colombia (FARC, in its Spanish acronym) and Ejército de Liberación Nacional (ELN); the military, representing the government; and paramilitary groups historically funded by wealthy landowners. The long-lasting legacy of the conflict is very much felt still: as the 2014 presidential elections unfold, the conflict, and in particular the post-conflict management and peace negotiations, continue to be a major element of the political agenda, alienating to the extreme the two major contending parties in the runoff.

The emergence of the conflict is believed to have its roots in the extremely unequal distribution of land (Sánchez-Friedemann, 2006). In particular, peasant struggles in the 1920s and 1930s over labor conditions on large coffee-producing estates, property rights, and broader political concerns lead to organized peasant movements, which would later set the foundations of the leftist revolutionists (Vargas, 1998). In 1948 violence spilled over to the two main political parties. This episode, called La Violencia, generated a rupture between Liberals and Conservatives, claiming more than 200,000 lives over the course of a decade. To repress the upheavals, repeated government attacks were launched on peasant self-defense organizations. This tactic, together with the resulting forced displacement of peasants, is believed to have further triggered the emergence and establishment of the leftist guerrillas (Encyclopedia Britannica, 2013).[5] We will later incorporate this incident into our analysis to account for historical levels of violence, with an indicator variable that captures if the municipality actively participated in the violent confrontations during *La Violencia*.

Our work will look at the Colombian state of affairs from 1990 to 2013, analyzing both the evolution of unorganized measures of violence and conflictual violence.

2.2 Literature Review: Unorganized Violence and Conflictual Violence

There is a growing literature on the impact of shocks to household welfare on violence and conflict. The studies have often looked at local commodity shocks and exploited one dimension of violence (either unorganized violent crime or conflictual violence). They have also varied widely in terms of the characteristics of the commodities considered: their illegal nature (coca shocks), their labor intensity (coffee shocks), or capital intensity (mining and oil shocks). Non-commodity shocks (such as military aid) have also been analyzed.

Among the most notable recent studies, Dube and Vargas (2013) studied the incentives of civilians to actively participate on conflict in Colombia. Their paper discloses how, in a Beckerian sphere, participation in conflictual revolts might subside in response to positive income shocks in labor-intensive employment sectors—through an opportunity cost mechanism. The authors find that positive shocks to the price of coffee significantly altered the course of the conflict by raising the opportunity cost of partaking in the illegal armed struggle. The authors, however, did not extend their study to levels of unorganized crime, which is the task that we take up in this study.

Furthermore, evidence on the impact of natural resource shocks on Colombian conflictual violence also comes from Dube and Vargas (2013). In the presence of value shocks, appropriation becomes more salient, and distinctly so in sectors that are capital-intensive (such as oil

[5] Encyclopedia Britannica Online. Colombia. Retrieved 25 November, 2013, http://www.britannica.com/EBchecked/topic/126016/Colombia

and mining). This incited a rapacity effect in a contest over the control of resources, which significantly generated more conflictual violence.

In Colombia, trafficking and the "war on drugs" have been shown to be major destabilizers of the public order (Mejía and Restrepo (2014), and Angrist and Kruger (2008)). Both through the competition for the control of profits in the illicit market, but also, as remarked by Cubides, Olaya and Ortiz (1998), through the cultivation of a machismo and honor culture, where the extensive use of violence became "a banal resource". Mejía and Restrepo (2014) focus on shocks to the value of coca cultivation to unravel the causal impact of illicit drug markets on systemic violence. The authors use exogenous external demand shocks to Colombian coca and find that increases in the value of coca cultivation differentially raise violence in coca-suitable municipalities. Angrist and Kruger (2008) first studied the impact of demand shocks for the illicit coca market on rural economic conditions and civil conflict, and find that rent-seeking behavior by combatants translates into more violence.

Dube and Naidu (2014) examine how US Military Aid affects political conflict, also in Colombia. The authors find that US military assistance lead to differential increases in paramilitary attacks and homicides in military-base municipalities. They conclude that, for Colombia, foreign military assistance helped to sustain conflict by strengthening the armed, non-state actors. The authors address the endogeneity of the aid component, not the locale of the military bases; by contrast, our analysis endogenizes the location of the flower municipalities, as well as the temporal variation in the value of the sector.

Last, Ksoll, Macchiavello and Morjaria (2014) study the reserve relationship: how ethnic violence affects firms in an export-oriented industry. They use firm-level data from the Kenyan flower sector to analyse how the 2008 episodes of post-electoral violence impacted firms' operations. The authors show how the episodic violence impact on trade can be mediated by different institutional arrangements within firms.

The present analysis elaborates on the aforementioned studies by looking at the expansion of secure employment opportunities in a non-traditional agricultural sector that represented a more fundamental shock to the economic environment of women. We proceed to compare the impact of flower shocks on various forms of violence (unorganized crime vs. conflictual violence) and contrast it to other less female-oriented shocks, such as coffee. We conjecture that the employment features of stability and permanency, as well as the gender component within the sector, might be an important determinant behind the results.

2.3 Conceptual Framework

The traditional paradigm for the study of crime started with Becker (1968), who introduced an economic approach to understanding the intricacies between incentives and deterrence mechanisms to commit crime. He succinctly stated that the "types of legal jobs as well as law, order, and punishment are an integral part of the economic approach to crime" (Becker, 1993). Building on those premises, other models of violence reviewed by Blattman and Miguel (2010) consider poverty and lack of opportunities as fundamentally lowering individual incentives for maintaining law and order. Taking these two statements into our flower setting, we can see how the fresh-cut flower industry, a legal sector with its salient features of stability and permanence in employment, would offer a unique standpoint from which to examine the relationship between violence and female employment.

To frame the empirical question on how the arrival of employment opportunities for females can affect various forms of violence, we have adapted a household model from Bardhan and Udry (1998) and Browning, Chiappori and Weiss (2014). This household is made of a male (M) and a female (F), each with private consumption. Males derive utility from the consumption of regular goods (c_M), leisure (l_M), and vice (v_M), which includes alcohol, and illicit drugs among others. The utility of females also incorporates the consumption of regular goods (c_F) and the enjoyment of leisure (l_F), but they do not participate in vice. Both males and females have egoistic preferences.

In this economy, the males can choose between three types of occupations: work in coffee cultivation (legal sector), commit crime (unorganized violent crime), or join the illegal armed struggle (participate in conflictual violence). The wages that males obtain from each of these sectors are described in the following set: $W_M = \{w_{coffee}, w_{crime}, w_{conflict}\}$. It should be noted that joining the illegal armed struggle often means abandoning civilian life, as combatants live on camps, where daily activities, and training are strictly scheduled (Human Rights Watch, 2003). By contrast, a person who choses to commit crimes as an occupation (criminal activities such as robbery, burglary, and kidnapping can be thought as means to extract resources) doesn't necessarily have to leave the community where he normally resides.

Females can only work in the flower sector and earn a wage of w_{flower}. Moreover, we are going to assume that females do not participate in conflictual violence (though their presence has been acknowledge for some of the warring factions, particularly the guerrillas).

Having said that, and before we proceed to lay out the program that the household solves, it is important to account for the consumption of *vice* as a risk-factor for inter-personal violence, since strong links have been established between drinking patterns and rates of inter-personal violence (WHO, 2006). We posit that the consumption of *vice* can affect the level of crime (unorganized violent crime). Examples of procyclical mortality has been acknowledged in the literature: for instance Neumayer (2005) posits that economic upturns can affect health via increased consumption of health-damaging consumption goods (alcohol, tobacco). In addition, the same less moderate consumption of harmful goods might further incite violent behavior. Thus, what we may call *drunken* crime is an increasing function of the consumption of vice,[6] $druken\ crime = \rho(v_M)$.

In our setting, the total level of violent unorganized crime that we observe in a community consists of the sum of two categories: that attributed to criminals who commit crime as a means to earn an income, and drunken crime ($\rho(v_M)$).

The problem of the household then becomes to maximize the collective household utility function

$$u^{household}(c_M, c_F, l_M, l_F, v_M, \alpha) = \max\ \alpha U_M(c_M, l_M, v_M) + (1-\alpha)U_F(c_F, l_F)$$

where α captures the bargaining weights of each spouse and is a function of distribution factors, and prices (we abstract from non-labor income). The agents will choose their preferred

[6] Here, we are also assuming that no extra time involvement is required for drunken crime, since it is often a wrong by-product of leisure joint with psychoactive substances.

consumption bundle given any particular distribution of total income. As stated in Browning, Chiappori and Weiss (2014), this corresponds to a two-phase decision process: agents first determine the sharing rule, and then proceed to the consumption phase (where all commodities hereby considered are privately consumed).

$$\max \alpha U_M(c_M, l_M, v_M) + (1-\alpha)U_F(c_F, l_F) \tag{1}$$

$$\begin{gathered} p(c_M + v_M + c_F) \leq \\ w_{flower}h_F + w_{coffee}h_{coffee,M} + w_{crime}h_{crime,M} + w_{conflict}h_{conflict,M} \end{gathered} \tag{2a}$$

$$l_M + h_{coffee,M} + h_{crime,M} + h_{conflict,M} = \bar{L}_M \tag{2b}$$

$$l_F + h_F = \bar{L}_F \tag{2c}$$

Again, Equation (1) is the household utility function in which the utility for males and females has a corresponding bargaining weight (which is dependent on the wage received by each partner). As it can be seen, the utility of males depends on the consumption of regular goods, leisure and vice; the utility of females depends on the consumption of regular goods and leisure. The maximization will be done with respect to the consumption of regular goods, vice, leisure and labor to flower farms (females), and labor devoted to coffee cultivation, crime and illegal armed struggle (males).

Equation (2a) is the standard budget constraint, where the actual cash expenditures on regular goods and vice cannot exceed the labor income generated through the various economic activities. Equations (2b) - (2c) define the resource constraints: labor allocation by the male across leisure and the various occupations should equal his labor endowment; the time use for females is distributed across leisure and labor in flower farms.

Upon closer inspection of the full-income constraint for males

$$w_{coffee} * h_{coffee,M} + w_{crime} * h_{crime,M} + w_{conflict} * h_{conflict,M}$$

it is important to notice that males will choose the occupation with the higher wage, and they will devote whatever many hours they choose to work (h_M) to that one particular occupation solely. This means that we can rewrite the maximization problem and budget constraint as

$$\max \alpha U_M(c_M, l_M, v_M) + (1-\alpha) U_F(c_F, l_F)$$

$$s.t.\ p(c_M + v_M + c_F) \leq w_{flower} * h_F + \max\{w_{coffee},\ w_{crime},\ w_{conflict}\} * h_M$$

In order to understand the implications of this model, we begin studying the implications of positive shocks to flower prices. First, they will relax the budget constraint of the household through female labor income. For this to happen, the female labor supply needs to respond positively to flower price shocks ($\frac{dl_F}{dw_F} \leq 0,\ \frac{dh_F}{dw_F} \geq 0$). We need to remember that the flower shocks happened in a setting where females "would have otherwise been restricted to the informal sector, or proscribed by peasant culture from becoming factory-workers" (Friedemann-Sánchez, 2006), and thus we could expect a dominance of the substitution effect over the income effect (particularly if women were not part of the paid labor force prior to this).

As a result of this shock, we expect the consumption of legal goods but also of vice to increase; second, we would also expect male labor supply to go down (since they might consume slightly more leisure now that the household is richer). This means that males will spend less working hours in whatever occupation they were involved in. Second, through the female bargaining power channel, the consumption bundle is likely to tilt towards relatively more legal consumption.

We can therefore analyze the impact of the positive flower shock on the measures of unorganized violent crime and conflictual violence at the community level as

$$\frac{d(violent\ crime)}{dw_F} = \frac{dl_M}{dw_F} + \frac{ddruken\ crime(v_M)}{dv_M} * \frac{dv_M}{dw_F} = -\frac{dh_{crime,M}}{dw_F} + \frac{d\rho(v_M)}{dv_M} * \frac{dv_M}{dw_F} \leq 0$$

$$\frac{d(conflictual\ violence)}{dw_F} = \frac{dl_{,M}}{dw_F} = -\frac{dh_{conflict,M}}{dw_F} \sim 0$$

On the one hand, the impact on violent unorganized crime will be affected by three forces: the reduction in working hours devoted to crime (via a higher consumption of leisure by males), the increase in the consumption of vice goods (via the relaxation of the household budget constraint), and the increase in the relative consumption of legal goods (via the female bargaining power).

On the other hand, the impact on conflictual violence will only arise from the reduction in working hours devoted to illegal armed struggle (via higher consumption of leisure by males). Thus, to first order: we could posit that violent unorganized crime will go down, and conflict would remain unaffected.[7]

By contrast, positive shocks to coffee prices alter the household and community dynamics in the following way: first, they relax the budget constraint of the household through male labor income. Again, this will make both the consumption of legal goods and vice to go up. Second, the increased returns to working in the legal sector (cultivation of coffee), have been shown to raise the opportunity cost of participating in conflict (Dube and Vargas, 2013). In our model, they also raise the opportunity cost of committing unorganized violent crimes in the community. Last, through increased male bargaining power, the consumption bundle is likely to tilt relatively more towards vice (relative to before), thereby potentially raising drunken crime.

$$\frac{d(violent\ crime)}{dw_{coffee}} = \frac{dh_{crime,M}}{dw_{coffee}} + \frac{ddruken\ crime(v_M)}{dv_M} * \frac{dv_M}{dw_{coffee}} = \frac{dh_{crime,M}}{dw_{coffee}} + \frac{d\rho(v_M)}{dv_{coffee}} * \frac{dv_M}{dw_{coffee}} \lesseqgtr 0$$

$$\frac{d(conflictual\ violence)}{dw_{coffee}} = \frac{dh_{conflict,M}}{dw_{coffee}} \leq 0$$

To first order: we would expect conflictual violence to decrease in the presence of coffee shocks (as tested in Dube and Vargas, 2013) and we are ambiguous about the sign of the impact on unorganized crime.

In summary, positive flower shocks will lead to a reduction in unorganized violent crime, and have no effect on conflictual violence. At the same time, positive coffee shocks lead to a reduction in conflictual violence, but have an ambiguous impact on unorganized violent crime. We will be testing the impact on unorganized violent crime and conflictual violence coming out of the flower and coffee shocks in our empirical analysis.

[7] To the extent that combatants participating in the conflict live in camps, we could set aside the impact of vice consumption on conflictual violence; nevertheless, it could certainly affect violence within the camps.

2.4 The Flower Sector

In spite of the geography of terror, successive government administrations directed their efforts to promote economic growth as a means of achieving a more peaceful society. Since the 1960s attention was concentrated on diversifying Colombian exports, which were highly dominated by coffee. These initiatives were concomitant with the "Alliance for Progress" program for Latin America, initiated by the Kennedy administration in 1961, with the intention of maintaining stability in the broader Andean region.

In the year 1964, the publication of a graduate thesis study at Colorado State University identified Colombian farmland as highly substitutable with American farmland (Colombian Ministry of Agriculture and Rural Development, 2008). The country had favorable climatic conditions, soil quality, and labor availability, as well as lower production costs. Given its proximity to the US market (through the Miami port of entry), Colombia constituted an attractive investment destination for flower entrepreneurs, who were quick to take advantage of the opportunity to relocate. By the early 1980s, fifteen years after the first flower farms were established, Colombia had already become the second largest world exporter of cut flowers (Méndez, 1991), and the industry was a major employer of low-skill female labor from the low-income areas in the regions surrounding the Sabana de Bogotá and Antioquia. The World Bank reported that the industry was "a textbook story of how a market economy works" (ibid).

The major sources of production costs for the sector were and remain non-skilled labor, the availability of specialized transportation, and cold storage technologies. Urrutia (1985) calculated that the low daily wage for production workers in 1966 and the less capital-intensive production process gave Colombia cost advantages that were instrumental for the establishment and successful development of the sector.[8]

The tasks at the flower farms vary from unskilled to skilled. The process is highly labor-intensive, requiring labor at every stage of the cut flower production and leaving "little room for mechanization" (Friedemann-Sánchez, 2006). Each woman is responsible for caring for ap-

[8] In Colombia, greenhouses can be constructed with relatively cheaper materials like wood and plastic. In many instances, no heating or cooling mechanisms are needed given the natural growing conditions, thereby reducing production costs and increasing the profitability margin.

proximately 12,000 plants, and there are close to 28 tasks that need to be performed on each plant (ibid). The entry-level workers, *operarias*, get permanent contracts, earn the government-specified minimum salary, and enjoy other legally mandated employment benefits, including contributions to the Social Security pension funds and to the National Health Insurance Plans. Two other types of workers can be found at the farms: monitors of plant diseases and supervisors. Both of them are paid above the minimum salary in compensation for the higher required skills and derived responsibilities.

It is critical to acknowledge the stability of the employment, for "jobs in the industry are so stable that working in the fresh cut-flower industry is becoming a métier" (ibid). The alternatives for females outside the flower farms are scarce and of the informal type, which often entail lower wages and lack the added legal and social security benefits.

In terms of the gender component, anthropologists have accentuated the fragility and perishability of flower production as a rationale behind the industry being female oriented. Fine motor skills and meticulousness become an essential requirement for the sector, attributes that have traditionally been associated with females. Friedemann-Sánchez (2006) notes that this is grounded on the assumptions that "equate production imperatives of quality, consistency, and speed with ostensibly feminine traits of dexterity, conscientiousness, and aversion to unrest" and that women are believed to be more skilled at intricate tasks such as "pruning, harvesting, sorting, selecting, and packaging". Women tend to remain employed within a given flower farm for an average of 5 years and an average of 15 years within the sector–rotation of workers among flower farms being a common phenomenon.[9]

2.5 Flower Production

Flowers require very particular climatic requirements to bloom. Within Colombia, certain regions benefit from natural year-round conditions to grow flowers, due to their geographical location, topography and climate. This need for very special climatic conditions presents us

[9]Based on information gathered by the Colombian Association of Flower Producers (Asocolflores) from its members. Private correspondence with Asocolflores.

with a series of instruments reflecting the suitability of a particular municipality to become a flower-producing center.

In particular, the optimal range of temperatures for which a given flower can grow ranges from 13 to 24 Celsius centigrade. Temperatures above this upper limit impede the metabolic process of the flower plants; very low temperatures severely affect the shrub or vine, causing permanent damage to its structure.[10] Although flower farms are equipped to deal with sudden changes in temperatures for short periods of time,[11] given the rudimentary greenhouse structure of flower farms, reliance on natural conditions becomes an important determinant of suitability. We will use this temperature criterion to construct a suitability index measured at the municipality level.

The optimal growth conditions have been identified with regions that feature mountain plateaus, low-lying plains, and valleys located at relatively high altitudes above sea level (Ministry of Agriculture and Rural Development, 2008). Historically, the first region to cultivate flowers was the southern section of the Sabana de Bogotá. The industry was able to expand in a seemingly rapid and sustained manner, partly due to the lack of barriers to entry. The first operative farms where established by the privileged class who possessed former haciendas and large estates that could be converted into flower farms (Friedemann-Sánchez, 2006). A graphical display of the distribution of flower farms is presented in Figure 1. This graph identifies the distribution across a total of 142 municipalities that were in operation as of the year 2007.[12]

As of 2007, there were 142 municipalities growing flowers (out of the 1119 that are found in Colombia), and 2113 flower-producing farms (*fincas*), cultivating a total of 7,849 hectares. The average number of hectares cultivated in the flower-municipalities was 65.7, with a standard deviation of 141.6.

Estimates from the 2005 Census and data on employment by Major Industry Sector report that each flower hectare generated employment for approximately 25 people. As such, the

[10] Optimal growing conditions for flowers as indicated by the agronomy experts of the flower exporting members of the Colombian Flower Growers Association (Asocolflores).

[11] As long as they are not very prolonged in time (from a few hours to at most 4 to 5 days).

[12] Data on the timeline of municipalities becoming flower-producing centers, and the evolution of hectares cultivated per municipality is unfortunately unavailable.

average flower-municipality in our sample would employ nearly 1,600 people. In contrast, other major export sectors like coffee generated employment for an average of 0.8 people per coffee hectare. Given that the average coffee municipality in our sample has 1,300 hectares, this figure would translate into employment for around 1,000 coffee farmers.

Coffee is also a much more widespread activity, and its total area occupied approximately 869,500 hectares (National Coffee Growers, 1997). The average coffee farm was close to 1.7 hectares in size, with 20 percent of the coffee farms (there are close to 530,000 coffee farms) being administered by females. Miller and Urdinola (2010) further discuss how labor on coffee farms falls into one of three categories: small farmers who supply their own labor, day laborers who live nearby and work-year round on the same farm, and finally seasonal migrant workers for harvest peak seasons–who tend to be exclusively young, unmarried men. To further explore the labor intensity of different agricultural commodities, appendix Table 11 shows the employment data on major agricultural activities for Colombia in 2005. As it can be seen, the flower sector, a non-traditional agricultural export, is highly labor intensive (with the highest figure of nearly 25 annual jobs per hectare).

3 Empirical Strategy

Our empirical strategy uses the growth in the national value of flower production and the geographical distribution of flower farms to proxy for the generation of agro-industrial employment over time. Using a difference-in-difference specification, we assess whether changes in the value growth of the flower sector affect violence outcomes differentially in the municipalities that meet suitability criteria for growing flowers.

We estimate the impact of the growing sector on a host of general violence outcomes from 1990 to 2013, including: the rate of homicides (homicides per 100,000 inhabitants), different types of theft (robbery, burglary, commercial property, and vehicle theft) and kidnappings. In terms of armed conflict, we analyze the impact on guerrilla attacks, paramilitary attacks, clashes, and casualties (thereby replicating all the outcomes that Dube and Vargas (2013) pursue in their study), for a restricted sample of years from 1988 to 2005.[13]

The employment shocks can be proxied with either the growth in national value (total dollar value of exports, adjusted by an export price index), volume of production (flower stems exported) or price of exports. The later is a measure we construct that takes the total national value of flower exports over the volume.[14] Given the high degree of exclusivity that Colombian farmers enjoy in the US market (proximity is crucial given the perishability of the good being traded), we choose to concentrate on the evolution of Colombian exports to the US.

We measure the change in exposure to the floriculture sector in each municipality using the growth rate in the national price of production. This interpretation is equivalent to assuming that the number of flower jobs in each flower municipality grew at the nationwide rate. Given that data is not available to measure the growth of hectares over time disaggregated at the municipality level, the proxy for the national expansion of the sector presents itself as a reasonable, if not sole, alternative.

In order to test the hypothesis that more stable and secure jobs in a community can impact its path for violence, we run the following regression

$$\begin{aligned} violence_{m,t} = \alpha + \beta flower_m \times log(Flower\ Price)_t \\ + \gamma_m + \gamma_t + \varphi_r \times t + [X_m^{'} d_t]\rho + \epsilon_{m,t} \end{aligned} \tag{3}$$

where $violence_{m,t}$ identifies the relevant violence outcome in municipality m, and year t; $flower_m$ refers to the number of flower hectares under cultivation in a municipality and is interacted with the (log) dollar price of Colombian flower exports to the US; γ_m and γ_t are municipality and year fixed effects; $\varphi_r \times t$ is a regional, linear time trend; finally, $X_m^{'} d_t$ is a vector of differential trends by baseline characteristics, explained below. The base specification always incorporates municipality and year fixed effects. In equation (3), the coefficient of interest is , which captures the differential effect of the shocks to flower prices in municipalities that cultivate flowers more intensively. Importantly, we will run regression (3) with a set of unorganized violent outcomes (including homicide rate, thefts, and kidnappings), and we will also extend the analysis into the

[13]These are the years covered in the Dube and Vargas (2013) paper, which we replicate here.

[14]The price measure captures the dollar value per 1000 flower stems exported.

realm of conflictual violence (guerrilla attacks, paramilitary attacks, clashes and casualties).[15]

In order to generate differential trends by baseline characteristics, we interact year categorical variables with a host of municipal-level covariates, $X_m^{'}$. The characteristics we consider vary depending on the specification, and they include: the distance to main market center, and distance to the capital of the department, which will be a measure for the remoteness of a municipality; the altitude, since altitude could favor conflictual insurgency; and the presence of other main export commodities, including coffee, petrol, coal and gold, since they have been shown to affect the path of conflictual violence in Dube and Vargas (2013). To control for the violence levels that were prevalent before the beginning of our sample (and account for the notion that "violence begets violence"), we use an indicator variable to denote whether a municipality participated in the aforementioned historical, internal war episode called *La Violencia* (1948 to 1964).

Because of the potential endogeneity of the location of flower farms, we exploit the differential suitability of flower cultivation at the municipality level using the aforementioned temperature requirement in an instrumental variables procedure that we now describe. The discontinuity that we consider is *coolness* (measured by temperatures that are in the range of 13 to 24 Celsius). This allows us to determine the likelihood that a municipality meets the optimal conditions to grow flowers (extensive margin), as well as the number of hectares that it would cultivate (intensive margin). Equation (4) captures this coolness regression—see below.

Next, in Equation (5) we proceed to incorporate the coolness criterion into the first-stage of our 2SLS strategy. To address concerns about the influence of certain flower-growing places over the total value of the flower sector in Colombia, we incorporate the volume exported by other flower countries from which the US gets its flower imports, such as other Latin American and Caribbean Basin producers as well as the Netherlands and Kenya, instead of the price of Colombian flowers, yielding an alternative first-stage specification in Equation (6).

$$flower_m = \gamma_o + \gamma_1 \times coolness_m + \epsilon_m \tag{4}$$

[15] For the conflictual violence outcomes which are given as a count, the (log) of the population is also included to account for population scale effects.

$$flower_m \times log(Flower\ Price)_t = \delta coolness_m \times log(Flower\ Price)_t + \psi_m + \psi_t + \theta_r \times t + [X_m^{'} d_t]\phi + \nu_{m,t} \quad (5)$$

$$flower_m \times log(Flower\ Price)_t = \delta coolness_m \times log(Top\ Q_{flower,US})_t + \psi_m + \psi_t + \theta_r \times t + [X_m^{'} d_t]\phi + \nu_{m,t} \quad (6)$$

In Equation (4) $flower_m$ represents the number of hectares that a municipality cultivates (intensive margin).[16] In Equations (5) and (6), we present two alternative specifications for the first-stage that differ in whether we use the (log) price of Colombian exports interacted with the coolness criterion, Equation (5), or the (log) export volume of the top competitors faced by Colombia in the US market, Equation (6).

Finally, from the Dube and Vargas (2013) paper, we know that coffee shocks affect conflictual violence. We thus replicate their instrumentation strategy using rainfall, temperature and interaction of the later two geo-climatic requirements with the volume of other world coffee producers. Equation (7) incorporates our violence regression and introduces flower and coffee shocks simultaneously, and Equation (8) shows the first-stage for coffee instrumentation as in Dube and Vargas (2013). The results of the agronomic suitability for coffee cultivation are presented in Appendix Table A.7. The distrubtion of coffee producing municipalities is shown in the map corresponding to Appendix Figure A.5.

$$violence_{m,t} = \alpha + \beta flower_m \times log(Flower\ Price)_t + \lambda coffee_m \times log(Coffee\ Price)_t + \gamma_m + \gamma_t + \varphi_r \times t + [X_m^{'} d_t]\rho + \epsilon_{m,t} \quad (7)$$

$$coffee_m \times log(Coffee\ Price)_t = [\delta_1 Rainfall_m + \delta_2 Temperature_m + \delta_3 Rain_m \times Temp_m] \times log(Top\ Q_{coffee,world})_t + \psi_m + \psi_t + \theta_r \times t + [X_m^{'} d_t]\phi + \nu_{m,t} \quad (8)$$

[16] An alternative specification we consider uses the categorical flower status of a municipality, thereby capturing the extensive margin of cultivation. Results are shown in the appendix tables.

4 Data

4.1 Data Sources

The data for violence outcomes and municipality covariates comes from a panel put together by the Center for the Study of Economic Development (CEDE). It incorporates all of the municipalities in Colombia (1120),[17] from 1990 to 2013. The panel contains data from both the Colombian Security Agency (DAS in its Spanish acronym) and the Office of the Vice-President with detailed information about municipality characteristics as well as violence measures.

Data to identify the geographic distribution of flower farms comes from a 2007 governmental registry list, publicly released by the Agriculture and Rural Development Ministry.[18] This is a cross-section snapshot from a year in the middle of the sample (2007) that allows us to identify the entire universe of flower producers. The public registry identifies the geographic location (municipality) of the farms as well as the size in hectares of the land cultivated. The size variable is further broken into hectares dedicated into flowers and foliage; for the purpose of the current analysis the total hectares will be used.

We categorize a municipality as having flower status if it has at least one flower farm, cultivating a positive number of hectares ($flower_m > 0$) as of the year 2007. Unfortunately, as mentioned earlier, we do not have access to a panel of data with the evolution of hectares over time across municipalities.

Data on the level and value of production comes from three sources. First, the UN ComTrade portal has data available for the aggregate volume and value of Colombian exports to the world. Secondly, the US Food and Agricultural Service (FAS),[19] also has detailed volume and value information for Colombian exports coming into the US market, expanding a few more years than its UN counterpart . In addition, there is the work put together by Marín and Rangel (2000), "International Commercialization of Flowers", which combines the yearly

[17] The political administration of Colombia consists of 32 distinct Departments. Each Department has several municipalities, totaling 1120 over the entire territory.

[18] Flower farms had to be registered for an agricultural program: *Incentivo sanitario a las flores y follaje (ISFF).*

[19] Retrieved from the Foreign Agriculture Service, through its Global Agricultural Trade System (GATS), code 0795AT – fresh cut flowers.

bulletins published by the Colombian Association of Flower Growers (Asocolflores) on several production aggregates. From all sources, we retrieve the level and value of production whenever available, always measured at the national level.

We prefer the data retrieved from the Food and Agricultural Service (FAS) administration. It allows us to have very detailed information on the entry of the number of flower stems and their value, both for Colombia and its main other competitors within the US market.[20]

4.2 Descriptive Statistics

Table (1) presents the summary statistics of cross-sectional differences between flower and non-flower municipalities. We have a final sample of 1046 municipalities for which there is complete information on all relevant measures to the analysis.

Panel A shows the unorganized violent crime outcomes across flower versus non-flower municipalities. In other words, this is the comparison of violence outcomes between the regions where the flowers are typically grown relative to those regions that have no flower cultivation. Noticeably, the average level of unorganized crime and violence is higher in flower municipalities. The average for the sample (1990 to 2013) is 71 homicides per 100,000 inhabitants in flower municipalities, whereas non-flowers stand at 50 homicides per 100,000. Flower municipalities also suffer from higher rates of personal theft, burglary, vehicle theft and commercial theft. Anecdotal evidence tells us that the floriculture industry took off in more peri-urban areas as opposed to rural regions (coincidentally more populated places). In that respect, this amorphous category of unorganized violent crime that we observe in Colombia seems to have had a higher toll in the more semi-urban regions, as opposed to the more rural areas, which bore a greater burden of the conflictual violence. To address this, a well as possible concerns about mean-reversion, we will introduce the initial level of violence (homicide rate in the year 1990) interacted with a full set of year dummies and we will also generate different samples based on population restrictions and a rurality index in a robustness exercise. In Appendix Figure (A.3) and Appendix Figure

[20]The UN ComTrade data doesn't have a complete volume for all years and main competitors, and the relevant competitors seem to be within the region, given the perishability and importance of geographical proximity for flower cultivation.

(A.4), we have mapped the intensity of the homicides over the sample period into quartiles, as well as the standard deviation of the homicide rate, to measure the variability.

Panel B offers insights into the conflictual violence across flower and non-flower municipalities. The conflictual violence outcomes (including the number of guerrilla attacks, paramilitary attacks, clashes and casualties) are lower for the flower municipalities. Notice that the illegal armed struggles, as well as the bastions for recruitment, are thought to be found in more rural regions, where dispossessed peasants first started arising in the 1920s and 1930s against the harsh working conditions on large coffee-producing states (Vargas, 1998).

In Panel C we focus on the municipal level covariates, to gauge the heterogeneity between flower and non-flower municipalities, since later we will be controlling for these characteristics interacted with year fixed effects in our specifications (the differential trends by baseline characteristics). Both flower and non-flower municipalities cultivate coffee–which is a widespread agricultural activity across the nation, covering approximately 850,000 hectares, or nearly 100 times more hectares than flowers. Flower municipalities seem to be cultivating coffee more intensively.

It is also worth noting that flower-intensive locations do not overlap with the coca cultivating regions. This was already acknowledged back in 1989, when the Commerce Department accused Colombian growers of dumping practices and it was captured by a *New York Times* article: "Colombian farmers, driven from the legal markets for coffee and cut flowers, are not likely to turn to cultivating coca. Indeed, they could not: the soil and weather conditions in coffee and flower-growing regions are not right for coca" (Passell, 1989).[21] Appendix Table (A.8) uses the flower *coolness* requirement to evaluate the suitability of coca cultivation. The results suggest that meeting the temperature criterion for growing flowers negatively affects the likelihood of growing coca, as well as the number of coca hectares. Thus, it seems implausible that land where coca bushes were grown can be allocated to cultivating flowers. Appendix Figure (A.6) identifies the municipalities that grew coca (at any point in the time period from 2000 to 2009).

[21] Peter Passell. "Economic Scene: Fighting Cocaine, Coffee, Flowers". New York Times, September 20, 1989. Accessed March 17, 2013. http://www.nytimes.com/1989/09/20/business/economic-scene-fighting-cocaine-coffee- flowers.html

We further look into the historical experiences of violence, depicted by an indicator for *La Violencia* episode. It seems that flower municipalities were less likely to have been affected by the hostilities that erupted in this historical war in the 1950s.

Flower municipalities tend to be closer to the capital of the department, and to the main urban markets. This is aligned with flower production logistics: the perishability of the goods requires access to infrastructure, and proximity to the main ports and gates of exit becomes critical.

In terms of geo-climatic characteristics, flower municipalities are at a relatively higher altitude above sea level, receive medium levels of rainfall and have, on average, cooler temperatures, in line with temperate climates. As mentioned earlier, all these three geo-climatic attributes will be later used to assess the suitability for growing flowers.

To alleviate concerns about the comparability of flower vs. non-flower municipalities across the entire Colombian territory, we will later construct different samples of control municipalities. These will include: the sample of neighboring municipalities (non-flower municipalities that share a geographical border with flower ones); restricting the sample to control municipalities that lie within a flower Department (defined as a Department has hectares > 0); a control sample of matched municipalities that meet the common support (propensity score for non-flower municipalities is larger than the minimum propensity score for flower municipalities); and a sample of control municipalities matched using the 10-nearest neighbor matching method. The respective panels with descriptive statistics can be found in the Appendix Tables (A.1), (A.2) and (A.3).

Last, Panel D provides figures on the evolution of the volume and value of the flower sector. The value series are measured in dollars, deflated by a price index for exports. The volume figures can either be measured in tones of flowers exported, or in millions of stems.

5 Results

5.1 Suitability for Flowers

We begin our analysis with Table (2), which shows the regression estimates for Equation (4), on the *coolness* requirement, since it is needed to proceed to the instrumental variable regressions that I report next. This requirement is meant to show how the *coolness* temperature discontinuity affects the likelihood of flower cultivation as well as the number of flower hectares being cultivated. Columns (1) and (2) show the extensive margin of flower cultivation and Columns (3) and (4) looks at the intensive margin–number of hectares.

We can see that as expected the temperature requirement (coolness) does seem to positively affect the likelihood and production intensity for flowers. This suggests that meeting the criterion for the temperature is indeed an important contributor to the likelihood that a municipality will become a flower producing center as well as the number of hectares it will grow. The specification that uses the flower hectares as the dependent variable shows that our geoclimatic requirement is highly significant.

We consider alternative temperature requirements, which are not considered optimal for flower growth: hot (for temperatures above 24 Celsius) and cold (for temperatures that are below 13 Celsius). As we can see in Columns (2) and (4), these alternative characteristics negatively affect the likelihood of becoming a flower-producing municipality as well as the number of hectares under cultivation.

5.2 Flower-Sector Growth and Unorganized Violence in Flower Municipalities

Next, we turn to the core of our empirical strategy. We first proceed to run an OLS regression of the homicide rate on the interaction of a municipality's flower status and year categorical variables, while controlling for municipality and year fixed effects. Figure (2) plots the coefficients of these flower-year interactions. We also overlap the evolution of the price of flower exports to the USA (dollars, deflated by the pertinent price index). Figure (3) plots the coefficients from the flower-year interactions and overlaps the total value of Colombian exports (where the total value of exports could capture a scale effect, not adjusted by volume of production). From Figure (2) we can see that positive shocks to the price of flowers reduce the homicide rates differentially for flower municipalities. As it can be seen from the second figure, Figure (3), the growth in the flower sector value was also concomitant to a differential decline in the homicide rates in flower producing municipalities versus non-producing ones. From the beginning of the period, 1990 to 1995, the value of Colombian exports entering into the US market grew persistently and this is associated with the greatest reduction in the homicide rate observed.

We next proceed with an instrumentation strategy that incorporates the ability of a municipality to become a flower-producing center based on a temperature requirement (the cross-sectional pattern). In addition to that, we will also instrument the price of the flower exports (the time-series pattern) with the volume of Colombian competitors in the US market.[22] As mentioned earlier, given the high degree of exclusivity enjoyed by Colombian producers in the US market, and the perishability of the product being traded–which limits the destination options that Colombian producers can ship to-we chose to concentrate on the value of Colombian exports to the US. The evolution of volume and value is highly correlated, and the flower sector was vastly shaped by US market conditions–with the share of value of Colombian flowers from the US closely tied to the exchange rate dynamics.

5.3 Instrumental Variables

The non-random location of flower farms constitutes a major concern that could be biasing our OLS results. To deal with this potential source of endogeneity, we pursue an instrumental variable 2SLS strategy.

Table (3) Panel A reports the OLS and 2SLS estimates of Equation (3). The first column of Table (3), Column (1), shows the OLS result for comparison purposes. Column (2) reports the

[22] The volume of production can be measured as the tones of fresh-cut flowers exported to the United States, according to the Harmonized Tariff Schedule (H), code 0603; alternatively, the FAS Department also keeps through the GATS dataset, records of the number of stems (0795AT). Competitors can be categorized as regional (Latin-American and Caribbean Basin countries) and non-regional (rest of the world).

base specification for the instrumentation–where the base specification only includes controls for municipality and year fixed effects. The IV results are negative, and significant: a one percent increase in the national price of production leads to -0.0715 fewer deaths per hectare in the rate of homicides in flower-suitable municipalities relative to non-flower regions. The IV estimates are negative, significant and considerably larger in magnitude than the OLS. The OLS is likely to result in a biased picture if highly suitable municipalities did not become flower-producing centers because of violence concerns, or if badly suitable municipalities decided to start growing flowers because they were relatively peaceful. In particular, the OLS could be severely biased towards zero if only safe havens were turned into flower-producing municipalities–and thus, we should not expect any further reductions in violence, since they were nonviolent regions to begin with.

In columns (3) to (5) we address concerns about the characteristics that distinguish flower from non-flower municipalities. Column (3) controls for the distance to the closest market center, and the distance to Bogotá interacted with year fixed effects, and results remain highly significant. Column (4) controls for the presence of other export sectors (including coffee) interacted with year fixed effects–this is particularly important since coffee has been shown to affect the path of conflictual violence. Last, to alleviate concerns about the altitude of a municipality affecting its violence levels (as could be the case if higher locations become safe havens for illegal uprising), Column (5) interacts the altitude with a full set of year fixed effects, and results remain stable. Column (5) also explores the idea that historically violent municipalities might have been on a different trend, and we do so interacting the exposure to *La Violencia* episode with year fixed effects. It also incorporates all other export-oriented commodities interacted with year fixed effects and a regional linear time trend. Last Column (6) and Column (7) explore the impact of the flower shocks on the rate of homicide by gender (female victims vs. male victims). Results suggest that the flower shocks are significantly affecting the male homicide rate.[23]

[23] Appendix Tables A.4, A.5 and A.6 show the corresponding 2SLS when we consider the extensive margin of flower cultivation (flower status), and when we use the growth in the value of exports (scale effect) as opposed to prices.

Table (3) Panel B reports the corresponding first-stage estimates of Equation (6), in which the dependent variable is the flower hectares of a municipality interacted with the growth in the national price of flowers (as they enter the US). We use as an instrument the interaction of the temperature requirement with the (log) volume of Colombia's top competitors in the US market. From the first-stage results we can see that increases in the volume produced by other flower export competitors significantly affect the growth in the value of cultivation of flower suitable municipalities. It seems that the US was a buoyant market, and that conditions there affected the development and profitability of the flowers exported by Colombian growers and its other competitors.

Table (4) reports the estimates of Equation (7), which incorporates the coffee shocks to understand how growth in a less female-biased sector might affect the path of violence. For coffee, we use the instrumentation strategy described by Dube and Vargas (2013) and shown in Equation (8). As discussed previously, this involves incorporating the cross-sectional distribution of coffee presence and instrumenting the internal price for Colombian farmers with the volume of its main world competitors. Because coffee is a less female-intensive activity (and the resources generated from it might be channeled by the male of the household as opposed to being control by the females), we want to compare the impact of coffee shocks on general violence (i.e. homicides). Surprisingly, we find that the rate of homicides is positively affected by coffee shocks–in clear contrast to what was found for flower shocks. The result that emerges from this regression is interesting in so far as positive coffee shocks were shown to decrease other forms of conflictual violence through an opportunity cost mechanism (Dube and Vargas, 2013), and yet, when considering unorganized violent crime we find a positive impact.

Table (5) analyzes other crimes and proceeds to run Equation (3). These include: property theft, burglary (residential theft), vehicle theft, commercial theft and kidnappings. The IV results present some mixed evidence on the impact of flowers on these other crimes but none of them is statistically significant.

5.4 Conflictual Violence

This section studies the impact of the flower sector on measures of conflictual violence. From the Dube-Vargas results we know that conflictual violence was affected by coffee and oil shocks via an opportunity cost mechanism and rapacity effect, respectively. We are now interested in understanding the correspondence between the female-friendly arrival of employment opportunities and the level of armed conflict experienced in their communities.

As it has been said, females were not as likely as men to participate actively in the conflict, but their bringing an income home might have affected the need of the males in their communities to engage in armed conflict. Moreover, even though the flower municipalities were not considered traditional nuclei for guerrilla recruitment, we suspect that the booming flower municipalities might have become targets of illegal armed attacks in an attempt to spread terror among the population, and eventually force the military and government forces to concede and negotiate.

In Table (6) we apply our empirical strategy to the study of these conflictual outcomes. The table is divided into three panels: Panel A for the flower shocks, Panel B for coffee shocks, and Panel C for the instrumentation of flower and coffee shocks simultaneously. We show the IV results for each of the conflictual outcomes. These include the number of guerrilla attacks, paramilitary attacks, clashes, and casualties.

In Panel A we can see the flower shocks do not seem to have affected any of the conflictual outcomes.[24] The flower shocks, which happen in a female-friendly sector, are not affecting the opportunity cost for males to join the illegal armed struggle, and thus it is not surprising that we do not observe any occupational shift (combatants giving up on the armed struggle). If anything, we could have observed a second-order decrease in conflictual violence: coming from the fact that males in flower households could now enjoy slightly more leisure due to the positive flower shocks.

In Panel B we replicate the Dube and Vargas results: we can see that coffee shocks significantly altered the course of the conflict. Last, Panel C proceeds to instrument both shocks

[24]Notice further that the conflictual violence analysis can only be performed for a sample of municipalities that is considered to be non-urban (average population throughout the sample had to be less than 250,000 inhabitants) and for a limited number of years (1988-2005).

simultaneously.

5.5 Robustness Checks

In this section, we proceed to construct different samples for the control municipalities (non-flower). Table (7) reports the estimates from this exercise. Column (1) maintains the entire sample (1046 municipalities for which we have complete data) to ease the comparisons. In Column (2) we limit the control sample to those municipalities that are found within a flower Department (where a flower Department is defined as a Department that has at least one flower municipality). This leaves us with a final sample of 615 municipalities. Although results are no longer significant, the magnitude of the IV estimates remains very close to the full-sample IV results of Column (1). In Column (3) the sample is restricted to control municipalities matched to flower municipalities using a 10-nearest neighbor match. In Column (4) the sample is restricted to control municipalities that meet the common support in the propensity score. Results with these different control samples remain consistent and quite robust. Finally, in Column (5) we keep as control municipalities those non-flower producing municipalities that share a geographical border with flower municipalities. Results remain significant. The descriptive statistics comparing the municipal-level covariates across these new control samples are provided in the appendix.[25] To visually capture the new sub-samples, Figure (A.1) in the Appendix shows the graphical distribution of the flower municipalities and the neighboring non-flower municipalities. Figure (A.2), also in the Appendix, shows the graphical distribution of flower and non-flower municipalities in flower departments.

Next, Table (8) further explores additional characteristics that could have affected the violence outcomes. First, in Column (1), we include department dummies interacted with year fixed effects. This serves to account for differential trends at the departmental level. In Column (2) we include the initial level of violence (year 1990) and an index for rurality (also measured in the year 1990) interacted with a full set of year dummies. Controlling for the initial level of

[25] Appendix Tables A.1, A.2 and A.3 show the comparison of municipal-level characteristics across flower and non-flower municipalities for the new restricted samples.

violence allows us to address the mean-reversion concerns, while the measure of rurality serves to eliminate differential trends in violence across the rural distinction. Last, Columns (3)-(5) impose different restrictions based on population. For that we compute the mean population for each municipality throughout the sample and we proceed to generate samples that include municipalities whose population was sufficiently urban (thereby leaving out of the control sample municipalities that were too rural, small, or isolated). Our estimates remain unchanged and significant. In Column (6) we leave out of the sample those municipalities that had an average population of more than 250,000 people throughout the sample—again, excluding the big urban center of Colombia does not affect our estimates.

Next, Table (9) presents a falsification exercise. We analyze the impact of flower shocks on two outcome variables from the Vital Statistics of Colombia that in principle should not have been affected by the arrival of flower jobs: the traffic death rate and the poison death rate. Both causes of death are identified according to the International Classification of Diseases and Related Health Problem (ICD), and we compute the corresponding rate (adjusted per 100,000 inhabitants). Results show that flower shocks did not significantly affect either outcome.

Finally, we introduce shocks to other agricultural commodities. As seen in Table 11. The agricultural goods we consider include: cocoa, sugar cane, palm oil and bananas. We use the evolution of the international price for each of these commodities, obtained from the Monetary International Fund. We also proceed with an instrumentation strategy that takes into account the agronomic requirements for the production of each of these crops. In Table 12, Column (1), we show the OLS coefficient estimates from the pooled regression. In Column (2) - (7), we instrument for the presence of the corresponding agricultural commodity using geo-climatic variables. We can see the impact of shocks to other sectors is positive, but only significant for the cocoa and palm oil sectors.

5.6 Elasticity of Violence to Local Shocks

As stated earlier, there is a growing literature on the impact of local shocks to household welfare on violence and conflict. The findings have also made use of shocks to commodities with very different characteristics: their illegal nature (coca shocks), their labor intensity (coffee shocks), capital intensity (mining and oil shocks), and other non-commodity shocks (military aid). Table (10) is an attempt to compute the elasticity of various forms of violence to these local shocks. From the table we can see that a 1 percent increase in the price of flowers leads to a -10.76 percent differential decrease in the homicide rate in the average flower municipality. By contrast, a 1 percent increase in the coffee prices is associated with almost a 10 percent increase in the homicide rate; the same applies to shocks to coca value (reported by Mejía and Restrepo, 2014), where a 10 percent increase to the coca revenue is associated with almost a 5 percent increase in the homicide rate.

When considering conflictual violence, it is interesting to note the difference between the impact of labor-intensive shocks (as the coffee results reported by Dube and Vargas, 2013), and the impact of oil or military aid shocks (which lead to differential increases in conflictual violence).

6 Conclusions

In this paper we use a unique dataset on violent crime and civil conflict in Colombia to understand the distinct role that local shocks to gender-related commodities can play on different forms of violence. Our main main result is an asymmetric finding where shocks to female-intensive sectors serve as a catalyst to curb unorganized violence, whereas shocks to more male-oriented and still labor-intensive sectors increase unorganized violence but reduce conflictual violence (as shown in Dube and Vargas, 2013).

The results presented here suggest that the growth in the national level of flower production led to a differential decrease in the rate of homicides of -0.08 fewer homicides per hectare per one percentage point growth in the price of flowers, in municipalities more suitable for flower cultivation. At the same time, the flower sector did not affect the course of the civilian conflict. While the findings of Dube and Vargas (2013) shed light into how shocks to coffee prices affected the participation in civilian conflict (via an opportunity cost mechanism), the impact on unorganized violence had been left unexplored. Our results for coffee on unorganized crime leave us to be less sanguine about the virtues of positive income shocks when these are channeled through the males of the household.

Even though the flower shocks do not directly affect the opportunity cost for the traditional perpetrator to commit crime, they alleviate the budgetary constraints of households and strengthen the bargaining power of females, thereby reinforcing her preferences within the household. This later argument is aligned with evidence that "societies in which women get a better deal tend to be societies that have less organized violence"(Pinker, 2011). The transformational role of women and their improved bargaining position are believed to have transformed other contexts historically: as Pinker (2011) mentions, the arrival of females to cities in the American West led to the "creation of an environment better suited to their interests" (ibid).[26]

These results have a bearing on the debate over trade reforms. They show that fostering trade agreements, which result in increased employment opportunities for females, can become a deterrent for unorganized violence. Anecdotal evidence encountered in the media argued in favor of trade as a means to "provide jobs for some of those now recruited into the kind of paramilitary organizations suspected in many of the labor murders".[27] What we have seen in this study, is that export-oriented jobs directed to females of a community may not have prevented the males from joining the illegal armed conflict, but did contribute to decreasing unorganized violent crime. It seems that one way to reduce violence at the community level might rely on advancing female-friendly employment opportunities.

[26]This included men 'abandoning their brawling and boozing' (page 105).

[27]Editorial. "Getting to a Colombia Trade Deal". New York Times, May 29, 2007. Accessed January 17, 2014. http://www.nytimes.com/2007/05/29/opinion/29tue2.html

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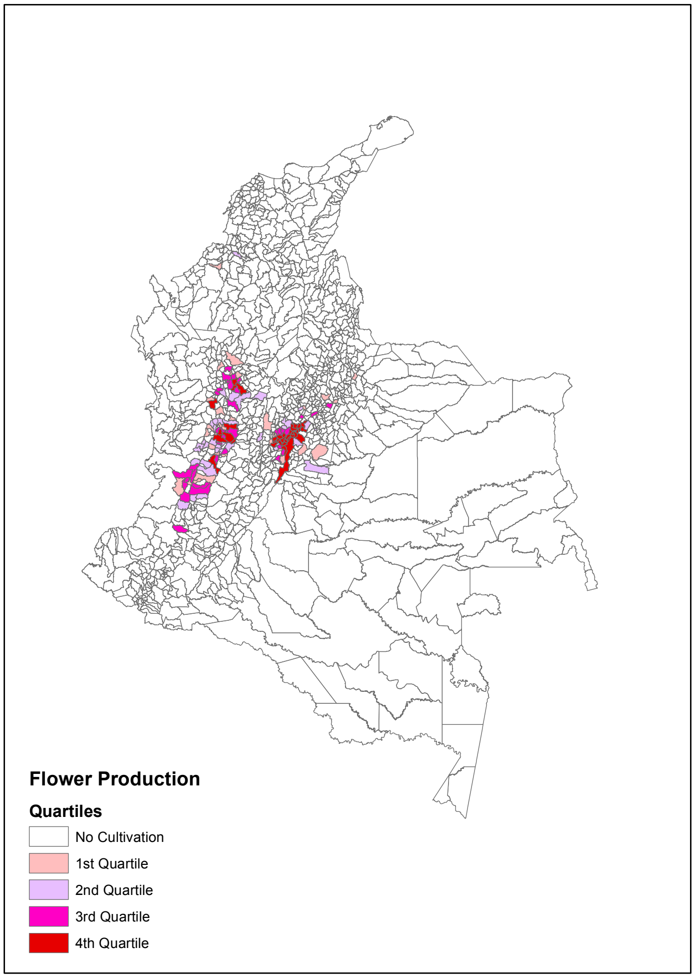
Figure 1: Distribution of flower hectares



This figure shows the intensity of flower cultivation at the municipality level across the Colombian territory for the year 2007. Flower municipalities are identified as those municipalities that have at least one flower farm (cultivating a number of flower hectares > 0). Sources: Shape-file from DANE; flower hectare distribution from the Ministry of Agriculture and Rural Development.

Figure 2: Price of Colombian Flowers and Differential Homicide Rates in Flower Municipalities

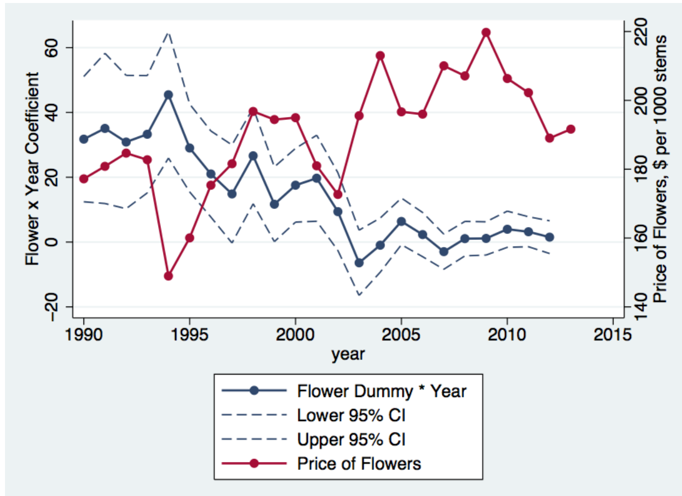


Figure shows the coefficient estimates of regressing the homicide rate on the interaction of the flower status of a municipality with a full set of year dummies, controlling for municipality and year fixed effects. We overlap the evolution of the Colombian flower prices (US dollars per 1000 stems exported), shown on the secondary axis.

Figure 3: Value of Colombian Flower Exports and Differential Homicide Rates in Flower Municipalities

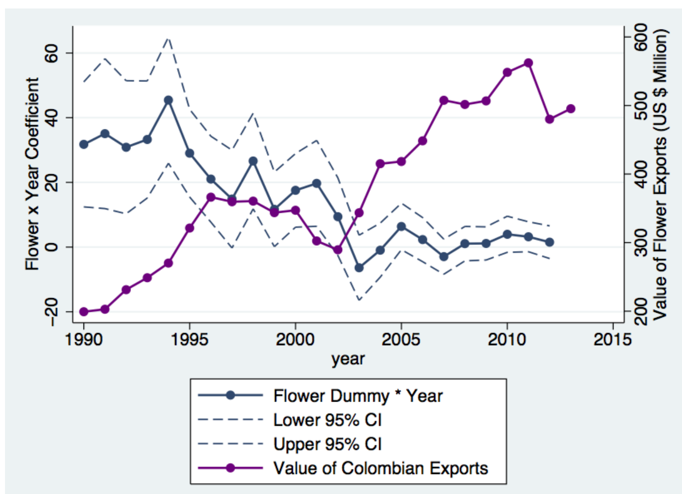


Figure shows the coefficient estimates of regressing the homicide rate on the interaction of the flower status of a municipality with a full set of year dummies, controlling for municipality and year fixed effects. We overlap the evolution of the value of Colombian flower exports (US million dollars), shown on the secondary axis.

Table 1: Summary of Descriptive Statistics

	Non-Flower			Flower		
	Mean	SD	Count	Mean	SD	Count
Panel A: Violence Variables						
Homicides						
Homicide Rate	49.25	71.28	21744	70.80	80.40	3360
Homicide Rate - Males	45.22	65.30	17195	62.16	54.64	2660
Homicide Rate - Females	4.38	10.09	17195	4.96	6.74	2660
Number of Homicides	12.59	35.52	21744	75.67	338.10	3360
Homicides - Male Victim	12.12	35.97	19910	78.12	373.63	3080
Homicides - Female Victim	1.08	3.11	19910	6.27	29.68	3080
Other Violent Crimes						
Robbery Rate	33.98	65.50	9060	75.17	94.37	1400
Burglary Rate	18.10	36.32	9060	35.62	49.76	1400
Auto/Vehicle Theft Rate	3.92	9.75	9060	10.31	16.40	1400
Commercial Theft Rate	11.73	22.13	9060	23.18	27.10	1400
Kidnap Rate	2.53	9.78	9060	1.82	6.17	1400
Panel B: Conflictual Violence						
Guerrilla Attacks	0.53	1.59	15462	0.21	0.68	2358
Paramilitary Attacks	0.08	0.41	15462	0.06	0.32	2358
Clashes	0.51	1.41	15462	0.23	0.75	2358
Casualties	2.00	7.18	15462	0.99	3.57	2358
Panel C: Municipal-Level Characteristics						
Hectares (2007)	0	0	906	62.41	133.85	140
Number of Flower Firms in Municipality	0	0	906	14.76	34.76	140
Hectares of Coffee	610.55	1277.30	906	1467.77	2003.79	140
Altitude (1000s of meters)	1.10	0.91	906	1.72	0.65	140
Temperature	21.90	4.98	906	18.69	3.89	140
Rainfall (1000s cm3)	1.95	1.11	906	1.62	0.77	140
Distance to market centre (km)	135.08	105.53	906	52.96	39.92	140
Distance to Department capital (km)	331.48	187.45	906	166.93	94.56	140
Oil Presence	0.08	0.27	906	0.01	0.12	140
Gold Presence	0.14	0.35	906	0.16	0.37	140
Emerald Presence	0.02	0.14	906	0.00	0.00	140
Coal Presence	0.10	0.30	906	0.11	0.31	140
Hectares of Coca (1999)	158.09	1019.61	906	0.05	0.61	131
Historical Land Conflicts (exposure)	0.05	0.22	906	0.06	0.25	140
La Violencia episode (exposure)	0.15	0.35	906	0.08	0.27	140
Panel D: Annual-Level Characteristics	Mean	SD	Years			
Flower Price (US $ per 1000 stems)	178	29	24			
Value Flower Exports from Colombia to US (Million US $)	378	110	24			
Value of Total Flower Imports by US (Million US $)	608	165	24			
Flower Stems exported by Colombia (Millions)	2090	351	24			
Flower Stems imported by US (Millions)	2600	485	24			
Internal Price of Colombian Coffee (Colombian Pesos)	1345	820	24			
Coffee Volume exported by Colombia (Bags of 60kgs (1000s))	11498	2272	24			

Notes: The homicides sample data covers the period 1990 - 2013. The other violent crimes cover 2003 - 2013. Conflictual violence outcomes in Panel B cover the period 1988 - 2005.

Table 2: Temperature Requirements for Flower Growth

	(1) Flower Status	(2) Flower Status	(3) Flower Hectares	(4) Flower Hectares
Cool (13 < T < 24)	0.194***		13.66***	
	(0.019)		(2.955)	
Hot (T > 24)		-0.195***		-12.97***
		(0.017)		(2.627)
Cold (T < 13)		-0.144***		-6.818
		(0.038)		(5.834)
Constant	0.0259***	0.206***	0.750	13.04***
	(0.007)	(0.016)	(0.547)	(2.626)
Observations	1046	1046	1046	1046
R-Squared	0.0802	0.0736	0.0163	0.0130
F-statistic	107.7	66.66	21.39	12.89

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: robust standard errors reported in parentheses. OLS results to evaluate the suitability of a municipality for flower cultivation. The outcome variables reflect both the extensive margin, flower status, as well as the intensive margin of cultivation, flower hectares. The flower status and flower hectares are measured at the municipality level. The flower status identifies whether a municipality is a flower-producing center or not. Hectares corresponds to the number of hectares under flower cultivation. Our suitability requirement exploits a discontinuity in temperature: *coolness*. It captures whether the average annual temperature lies between 13-24 degree Celsius (55-75 F), deemed to be optimal for flower growth. We add a dummy *Hot* for temperatures that exceed 24 Celsius and a dummy *Cold* for temperatures that are below 13 Celsius as alternative requirements potentially affecting flower production.

Table 3: IV Results for Flower Shocks on Homicides

	(OLS)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
Panel A: OLS and Second-Stage Results							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
						Males	Females
	Homicide Rate						
Flower Hectares	-0.108**	-7.115***	-8.613*	-2.593*	-8.249*	-7.298*	-0.421
× (Log) Flower Price	(0.049)	(2.485)	(5.046)	(1.566)	(4.692)	(3.756)	(0.383)
Panel B: First-Stage Results							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Flower Hectares × (Log) Flower Price						
Coolness		-2.253***	-1.102***	-3.506***	-1.558***	-2.237***	-2.237***
× (Log) Export Volume Competitors		(0.487)	(0.331)	(0.856)	(0.526)	(2.477)	(0.753)
Observations		25104	25104	25104	25104	19855	19855
Municipalities		1046	1046	1046	1046	1045	1045
	Differential Trends						
Distance × FE			Yes		Yes	Yes	Yes
Other Exports × FE				Yes	Yes	Yes	Yes
Altitude × FE					Yes	Yes	Yes
La Violencia × FE					Yes	Yes	Yes
Regional * t					Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. The outcome of interest is the homicide rate, defined as the number of homicides per 100,000 inhabitants for the sample period 1990 to 2013. Our regressor consists of the interaction between the number of flower hectares and the (log) price of Colombian flower exports. Our instrument is made of the interaction of the volume (tones) of flower exports of other competitors faced by Colombia in the US market, and the coolness requirement for flower suitability (temperature criterion 13-24 Celsius). All monetary value time series are deflated by the relevant price index. In Column (1) we report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the IV results for the base specification. We build upon this base specification by including differential trends based on municipality characteristics. Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre interacted with a full set of year fixed effects. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal) interacted with year fixed effects. Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence (the war episode of *La Violencia*) and altitude, all interacted with year FE. It also adds to it a regional linear time trend. Column (6) and Column (7) disaggregate the homicide rate by gender of the victim. Panel B reports the corresponding first-stage results.

Table 4: IV Estimates for Flower and Coffee Shocks on Homicides

	(1)	(2)	(3)
	Homicide Rate		
Flower Hectares	-8.249*		-7.177
× (Log) Price Flowers	(4.692)		(5.509)
Coffee Hectares		0.362***	0.611**
× (Log) Internal Coffee Price		(0.122)	(0.284)
Observations	25104	24058	24058
Municipalities	1046	1046	1046

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors clustered at the municipality level are shown in parentheses. Our two regressors of interest are the (log) price of flowers interacted with flower intensity and the (log) internal price of coffee interacted with coffee intensity. The number of flower and coffee hectares is measured at the municipality level. Our sample period covers the years 1990 - 2013. All specifications include year and municipality fixed effects (FE). In Column (1) we report our IV estimates where we instrument the flower intensity and (log) flower prices with a coolness requirement and the export volume of other main competitors that Colombia faces in the US market. In Column (2) we proceed to instrument the coffee regressor as in Dube and Vargas (2013), and we use temperature and rainfall requirements for coffee and the volume produced by main worldwide coffee competitors. Column (3) reports the results of instrumenting both regressors simultaneously. We also incorporate differential trends for the remoteness of a municipality, altitude, presence of other main export commodities, historical experiences of violence and a regional linear time trend. All monetary value time series are deflated by the relevant price index.

Table 5: IV Estimates for Flower Shocks on Other Types of Violent Crimes

	(1)	(2)	(3)	(4)	(5)
	Rate of Other Types of Violent Crimes				
	Robbery (Personal)	Burglary (Residential)	Vehicle Theft	Commercial Theft	Kidnap
Flower Hectares x (Log) Price Colombian Flowers	-3.798	9.062	0.801	8.992	-2.783
	(13.913)	(10.542)	(1.943)	(7.052)	(1.784)
Observations	10460	10460	10460	10460	10460
Municipalities	1046	1046	1046	1046	1046

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. Due to data availability the time horizon spans from 2003 to 2012. The other types of violent outcomes that we consider include: the rate of personal theft (robberies committed and denounced to the relevant police authority per 100,000 inhabitants); the rate of residential theft (burglaries); the rate of auto vehicles; the rate of commercial theft (illegal entry into a commercial building with intent to commit a crime); and last, the rate of kidnapping (number of reported kidnaps). Our regressor of interest consists of the interaction between the number of flower hectares and the (log) price of Colombian flower exports. All monetary time series are deflated. Our instrument is made of the interaction of the volume (tones) of flower exports of other main competitors faced by Colombia in the US market, and the coolness requirement for flower suitability (temperature criterion 13-24 Celsius).

Table 6: IV Flower Shocks on Conflictual Violence

	Panel A: Flower Instrumentation			
	(1) Guerrilla Attacks	(2) Paramilitary Attacks	(3) Clashes	(4) Casualties
Flower Hectares × (Log) Flower Price	-0.00615	0.0182	0.0837	0.0776
	(0.067)	(0.018)	(0.068)	(0.321)

	Panel B: Coffee Instrumentation			
	(1) Guerrilla Attacks	(2) Paramilitary Attacks	(3) Clashes	(4) Casualties
Coffee Hectares × (Log) Internal Coffee Price	-0.785***	-0.201***	-0.891***	-2.474***
	(0.136)	(0.038)	(0.179)	(0.814)

	Panel C: Simultaneous Instrumentation			
	(1) Guerrilla Attacks	(2) Paramilitary Attacks	(3) Clashes	(4) Casualties
Flower Hectares × (Log) Flower Price	-0.007	-0.008	0.003	0.029
	(0.029)	(0.006)	(0.028)	(0.117)
Coffee Hectares × (Log) Internal Coffee Price	-0.270	-0.176***	-0.546**	-2.202**
	(0.201)	(0.052)	(0.232)	(1.062)
Observations	17348	17348	17348	17348
Municipalities	964	964	964	964

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Standard errors clustered at the municipality level are shown in parentheses. We replicate the conflictual violence outcomes analyzed by Dube and Vargas (2013). They include: number of guerrilla attacks, number of paramilitary attacks, clashes and casualties. The sample spans the years 1988 to 2005, and it contains municipalities whose average population does not exceed 250,000 inhabitants during the period. In Panel A we provide the 2SLS estimates the interaction of flower prices and flower intensity; in Panel B we do so for the interaction of coffee hectares (in 1000s) and the (log) internal price of Colombian coffee. The interaction of flower price with flower intensity is instrumented with a coolness requirement and the export volume of other main competitors that Colombia faces in the US market. We replicate Dube-Vargas instrumentation strategy for coffee using temperature and rainfall and interacting the geoclimatic variables with the volume produced by main worldwide competitors. In Panel (C) we proceed to instrument both endogenous regressors simultaneously. We always include municipality and year fixed effects, as well as the level of oil production at the municipality level interacted with the (log) of oil price, linear trends by region and municipalities cultivating coca in 1994, and the log of the population.

Table 7: IV Results for Different Control Municipalities

	(1)	(2)	(3)	(4)	(5)
	Rate of Homicides				
Flower Hectares x (Log) Price Flowers	-8.249*	-5.512	-7.116**	-8.092***	-4.511*
	(4.692)	(3.850)	(2.812)	(2.516)	(2.414)
Observations	25104	14760	9072	14904	8376
Municipalities	1046	615	378	621	349
	Control Municipalities				
All Departments	Yes				
Department Hectares > 0		Yes			
10-Nearest Neighbor			Yes		
Common Support				Yes	
Geographical Border Neighbor					Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors clustered at the municipality level are shown in parentheses. In Column (1) we report the IV results for all the municipalities of Colombia. In Column (2) we restrict the sample to those municipalities (flower or non-flower) that lie in flower Departments, defined as those departments where the total departmental number of hectares is greater than 0. In Column (3) the sample is restricted to control municipalities matched to flower municipalities using a 10-nearest neighbor match. In Column (4) the matching is done by imposing the common support in the propensity score. In Column (5) we keep as control municipalities those non-flower producing municipalities that share a geographical boundary with the flower ones. All specifications include year and municipality fixed effects. We construct differential time trends for the remoteness of a municipality, altitude, presence of other main export commodities, historical experiences of violence. We also incorporate a regional linear time trend.

Table 8: IV Results for Flower Shocks, additional controls

	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)
	Homicide Rate					
Flower Hectares	-6.705***	-3.036**	-6.740***	-5.931***	-3.312**	-6.982***
x (Log) Price Colombian Flowers	(2.434)	(1.449)	(2.213)	(1.982)	(1.640)	(2.491)
Observations	20920	20920	21288	15648	6408	24576
Municipalities	1046	1046	887	652	267	1024
	Differential Trends and Samples					
Department $\times$ FE	Yes					
Initial level of violence (year 1990) $\times$ FE		Yes				
Municipalities with population $>$ 5,000 $\times$ FE			Yes			
Municipalities with population $>$ 10,000 $\times$ FE				Yes		
Municipalities with population $>$ 25,000 $\times$ FE					Yes	
Municipalities with population $<$ 250,000 $\times$ FE						Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. In Column (1) we include Department interacted with a full set of year fixed effects. In Column (2) we use the initial level of violence in the sample (year 1990) and an index of rurality interacted with year fixed effects. In Columns (3) - (6) we impose different restrictions on population thresholds.

Table 9: IV Estimates for Poison Deaths and Drownings

	(1) Traffic Death Rate	(2) Poison Death Rate
Hectares × (Log) Price Flowers	0.454	0.193
	(0.936)	(0.247)
Observations	19855	19855
Municipalities	1045	1045

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard Errors clustered at the municipality level are shown in parentheses. Outcome variables include the traffic accidents death rate and the deaths due to poisoning (rate). International Classification of Diseases and Related Health Problems (ICD).

Table 10: Elasticities for Different Types of Local Shocks

Computed Elasticity of Local Shock on Violence	Coefficient	Percentage Response in Violence	Paper Source
Price of Flowers on Homicide Rate	-8.249*	-10.76	
Value of Flowers on Homicide Rate	-3.87*	-5.04	
Price of Coffee on Homicide Rate	0.365***	9.62	
Coca Revenue on Homicide Rate	0.423***	0.423	Restrepo and Mejía (2014)
Price of Coffee on Guerrilla Attacks	-0.611**	-1.9	Dube and Vargas (2013)
Price of Coffee on Paramilitary Attacks	-0.160***	-3.20	Dube and Vargas (2013)
Price of Coffee on Clashes	-0.712***	-2.29	Dube and Vargas (2013)
Price of Coffee on Casualties	-1.8282*	-1.47	Dube and Vargas (2013)
Oil Shocks on Guerrilla Attacks	0.7	0.12	Dube and Vargas (2013)
Oil Shocks on Paramilitary Attacks	0.726***	0.79	Dube and Vargas (2013)
Oil Shocks on Clashes	0.304	0.05	Dube and Vargas (2013)
Oil Shocks on Casualties	1.526	0.06	Dube and Vargas (2013)
US Military Aid on Guerrilla Attacks	-0.266	-0.45	Dube and Naidu (2014)
US Military Aid on Paramilitary Attacks	0.305**	2.97	Dube and Naidu (2014)
US Military Aid on Government Attacks	0.301***	2.61	Dube and Naidu (2014)

Note: Elasticities of various forms of violence to local economic shocks. The elasticity is computed for a 1 percent increase in the value of the local commodity/aid considered. The computations adjust for the average number of hectares under cultivation in the municipality when relevant (flower hectares and coffee hectares); otherwise the coefficient just captures the extensive margin of cultivation. The overall impact ($\beta_{violence} * log(Value) * hectares = \beta_{violence} * 0.01 * hectares$) is then divided by the mean violence observed throughout the sample, so as to get an elasticity. When the extensive margin is used (presence of military bases, presence of coca), the impact of a 1 percent shock is computed as follows: $\beta_{violence} * log(Value) = \beta_{violence} * 0.01$. For oil, the number of hundred-thousand barrels per day extracted is used as a measure of the intensity of production for the average oil municipality. The local shocks considered here cover a female labor-intensive sector (flowers), a male labor-intensive legal sector (coffee), a non-labor intensive sector (oil), an illegal sector (coca shocks), and military aid shocks. The elasticities are also computed for two forms of violence: unorganized crime and conflictual violence. The estimates reported come from the papers by Dube and Vargas (2013) on coffee and oil shocks, Mejía and Restrepo (2014) on coca shocks, and Dube and Naidu (2014) on military aid shocks.

Table 11: Major Agricultural Sectors for Colombia (2005)

	(1) Hectares (Thousands)	(2) Work-days per hectare	(3) Work-Days (Thousands)	(4) Jobs (Thousands)	(5) Jobs per hectare
Cocoa	108	88	9484	55	0.51
Plantain	368	108	39,771	230	0.63
Coffee (Traditional)	150	150	22,476	130	0.87
Coffee (Tech Aged)	253	80	20,227	117	0.46
Coffee (Tech)	481	150	72,098	417	0.87
Coffee Total	884		114,801	664	0.75
Banana	67	144	9,641	56	0.84
Flowers	7	4230	30,037	174	24.86
Sugar Cane	176	39	6,878	40	0.23
Palm	166	108	17,927	104	0.63
Tobacco	8	160	1,229	7	0.875

Note: This table shows the agricultural employment for the year 2005 and several agricultural commodities. Column (1) identifies the total number of hectares under cultivation. Column (2) depicts the number of work-days (*jornales*) needed per hectare. Column (3) computes the total work-days required given the total number of hectares. In column (4) this figure is then translated into the number of jobs (where an annual job in the agricultural sector is equivalent to 173 working-days). Finally, Column (5) measures the jobs (annual full agricultural employment) per hectare. Sources include: Evaluaciones Agropecuarias Municipales. Ministerio de Agricultural y Desarrollo Rural - Secretarías de Agricultural Departamentales; DANE, Encuesta Continua de Hogares 2005; DANE, Dirección de Síntesis y Cuentas Nacionales.

Table 12: IV Results with Other Agricultural Shocks

	(OLS) (1)	(IV) (2)	(IV) (3)	(IV) (4)	(IV) (5)	(IV) (6)	(IV) (7)
	Homicide Rate						
Flower Hectares X Log(Price)	-0.079	-6.754***					
	(0.054)	(2.301)					
Coffee Hectares X Log(Price)	-0.002*		0.442***				
	(0.001)		(0.107)				
Cocoa Hectares X Log(Price)	0.009***			0.046**			
	(0.003)			(0.022)			
Sugar Cane Hectares X Log(Price)	-0.002				0.004		
	(0.002)				(0.018)		
Palm Oil Hectares X Log(Price)	-0.001					0.009*	
	(0.001)					(0.005)	
Banana Hectares X Log(Price)	0.022						0.013
	(0.016)						(0.217)
Observations	26064	26064	24978	26064	26064	26064	26064
Municipalities	1086	1086	1086	1086	1086	1086	1086

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. The outcome of interest is the homicide rate, defined as the number of homicides per 100,000 inhabitants for the sample period 1990 to 2013. We incorporate flower, coffee, cocoa, sugar, palm and banana shocks. We use agronomic variables to instrument for the presence of cocoa, sugar, palm oil and banana plantations. For these later variables, we use the growth in their international prices, published by the International Monetary Fund.

Appendix

Table A.1: Descriptive Statistics for Sample of Municipalities in Flower Departments

	Non-Flower			Flower		
	Mean	SD	Count	Mean	SD	Count
Flower Departments						
Hectares (2007)	0.00	0	475	62.41	133.85	140
Number of Flower Firms in Municipality	0.00	0	475	14.76	34.76	140
Rainfall (1000s cm3)	1.90	0.93	475	1.62	0.77	140
Distance to market centre (km)	109.32	59.29	475	52.96	39.92	140
Distance to Bogotá (km)	231.99	141.65	475	166.93	94.56	140
Oil Presence	0.05	0.23	475	0.01	0.12	140
Gold Presence	0.18	0.39	475	0.16	0.37	140
Emerald Presence	0.04	0.20	475	0.00	0.00	140
Coal Presence	0.12	0.32	475	0.11	0.31	140
Hectares of Coca (1999)	41.68	282.79	475	0.05	0.61	131
Historical Land Conflicts (exposure)	0.04	0.21	475	0.06	0.25	140
La Violencia episode (exposure)	0.17	0.38	475	0.08	0.27	140
Violence in 1990	77.01	95.21	475	98.27	112.00	140
Mean Population	21226.52	40867.98	475	122409.20	603248.40	140
Rurality Index	0.67	0.21	475	0.50	0.25	140

Notes: Municipal characteristics for flower municipalities relative to non-flower municipalities for the restricted sample of municipalities that lie within a flower Department (defined as a department for which the total departmental number of hectares > 0).

Table A.2: Descriptive Statistics for Sample of Control Municipalities matched with 10-nearest neighbor

	Non-Flower			Flower		
	Mean	SD	Count	Mean	SD	Count
10-Nearest Neighbor Controls						
Hectares (2007)	0	0	238	62.41	133.85	140
Number of Flower Firms in Municipality	0	0	238	14.76	34.76	140
Hectares of Coffee	1001.92	1621.30	238	1467.77	2003.79	140
Altitude (1000s of meters)	1.59	0.76	238	1.72	0.65	140
Temperature	19.43	4.48	238	18.69	3.89	140
Rainfall (1000s cm3)	1.71	0.83	238	1.62	0.77	140
Distance to market centre (km)	86.78	62.43	238	52.96	39.92	140
Distance to Bogotá (km)	206.32	117.60	238	166.93	94.56	140
Oil Presence	0.05	0.21	238	0.01	0.12	140
Gold Presence	0.13	0.34	238	0.16	0.37	140
Emerald Presence	0.00	0.00	238	0.00	0.00	140
Coal Presence	0.12	0.32	238	0.11	0.31	140
Hectares of Coca (1999)	3.86	47.59	238	0.05	0.61	131
Historical Land Conflicts (exposure)	0.04	0.19	238	0.06	0.25	140
La Violencia episode (exposure)	0.11	0.31	238	0.08	0.27	140
Violence in 1990	74.39	107.10	238	98.27	112.00	140
Mean Population	28063.94	66309.15	238	122409.20	603248.40	140
Rurality Index	0.64	0.21	238	0.50	0.25	140

Notes:Municipal characteristics for flower municipalities relative to non-flower municipalities. The sample of non-flower producing municipalities was obtained using a 10-nearest neighbor match.

Table A.3: Descriptive Statistics for Sample of Control Municipalities that share a geographical border

	Non-Flower			Flower		
	Mean	SD	Count	Mean	SD	Count
Border-Neighbors						
Hectares (2007)	0.00	0	209	62.41	133.85	140
Number of Flower Firms in Municipality	0.00	0	209	14.76	34.76	140
Hectares of Coffee	905.73	1511.77	209	1467.77	2003.79	140
Altitude (1000s of meters)	1.56	0.78	209	1.72	0.65	140
Temperature	19.65	4.66	209	18.69	3.89	140
Rainfall (1000s cm3)	1.96	1.23	209	1.62	0.77	140
Distance to market centre (km)	81.46	49.22	209	52.96	39.92	140
Distance to Bogotá (km)	187.21	108.88	209	166.93	94.56	140
Oil Presence	0.04	0.19	209	0.01	0.12	140
Gold Presence	0.18	0.38	209	0.16	0.37	140
Emerald Presence	0.03	0.17	209	0.00	0.00	140
Coal Presence	0.16	0.37	209	0.11	0.31	140
Hectares of Coca (1999)	6.34	82.29	209	0.05	0.61	131
Historical Land Conflicts (exposure)	0.05	0.21	209	0.06	0.25	140
La Violencia episode (exposure)	0.16	0.37	209	0.08	0.27	140
Violence in 1990	86.24	110.44	209	98.27	112.00	140
Mean Population	26041.74	57410.56	209	122409.20	603248.40	140
Rurality Index	0.65	0.22	209	0.50	0.25	140

Notes:Municipal characteristics for flower municipalities relative to non-flower municipalities. The sample of non-flower municipalities is restricted to those municipalities that share a geographic border with flower producing centers.

Table A.4: IV Results for Extensive Margin: Flower Status and (Log) Flower Price

	(OLS)	(IV)	(IV)	(IV)	(IV)
	(1)	(2)	(3)	(4)	(5)
	Homicide Rate				
Flower Status	-123.062***	-500.965***	-488.243*	-266.731*	-581.218**
× (Log) Price Colombian Flowers	(28.390)	(139.904)	(250.260)	(148.621)	(275.007)
Observations	25104	25104	25104	25104	25104
Municipalities	1046	1046	1046	1046	1046
	Differential Trends				
Distance FE			Yes		Yes
Other Exports FE				Yes	Yes
Altitude FE					Yes
La Violencia					Yes
Regional * t					Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. The outcome of interest is the homicide rate, defined as the number of homicides per 100,000 inhabitants for the sample period 1990 to 2013. Our regressor of interest consists of the interaction between the flower status of a municipaliy (extensive margin) and the dollar (log) price of Colombian flower exports. All monetary time series are deflated. Our instrument is made of the interaction of the volume of flower exports of other main competitors faced by Colombia in the US market, and the coolness requirement for flower suitability (temperature criterion 13-24 Celsius). In Column (1) we report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the IV base specification. We build upon this base specification by including differential time trends based on municipal characteristics. Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre interacted with year fixed effects. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal) interacted with a full set of year dummies. Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence and altitude. It also adds to it a regional linear time trend.

Table A.5: IV Results for Flower Hectares and (Log) Flower Value

	(OLS)	(IV)	(IV)	(IV)	(IV)
	(1)	(2)	(3)	(4)	(5)
			Homicide Rate		
Flower Hectares	-0.049*	-3.874***	-4.690*	-1.412*	-3.870*
× (Log) Colombian Export Value	(0.027)	(1.353)	(2.748)	(0.853)	(2.138)
Observations	25104	25104	25104	25104	25104
Municipalities	1046	1046	1046	1046	1046
			Differential Trends		
Distance FE			Yes		Yes
Other Exports FE				Yes	Yes
Altitude FE					Yes
La Violencia					Yes
Regional * t					Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. The outcome of interest is the homicide rate, defined as the number of homicides per 100,000 inhabitants for the sample period 1990 to 2013. Our regressor of interest consists of the interaction between the number of flower hectares and the dollar (log) value of Colombian flower exports to the US. The (log) value of exports captures a scale effect. All monetary time series are deflated. Our instrument is made of the interaction of the volume of flower exports of other main competitors faced by Colombia in the US market, and the coolness requirement for flower suitability (temperature criterion 13-24 Celsius). In Column (1) we report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the IV base specification. We build upon this base specification by including differential time trends based on municipal characteristics. Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre interacted with year fixed effects. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal) interacted with a full set of year dummies. Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence and altitude. It also adds to it a regional linear time trend.

Table A.6: IV Results with Flower Status and (Log) Flower Value

	(OLS)	(IV)	(IV)	(IV)	(IV)
	(1)	(2)	(3)	(4)	(5)
	Homicide Rate				
Flower Status	-48.974***	-272.776***	-265.849*	-145.235*	-296.961**
× (Log) Colombian Export Value	(13.847)	(76.178)	(136.267)	(80.924)	(140.446)
Observations	25104	25104	25104	25104	25104
Municipalities	1046	1046	1046	1046	1046
	Differential Trends				
Distance FE			Yes		Yes
Other Exports FE				Yes	Yes
Altitude FE					Yes
La Violencia					Yes
Regional * t					Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard errors clustered at the municipality level are shown in parentheses. All specifications include municipality and year fixed effects. The outcome of interest is the homicide rate, defined as the number of homicides per 100,000 inhabitants for the sample period 1990 to 2013. Our regressor of interest consists of the interaction between the binary flower status of a municipality (extensive margin) and the dollar (log) value of Colombian flower exports to the US. All monetary time series are deflated. Our instrument is made of the interaction of the volume of flower exports of other main competitors faced by Colombia in the US market, and the coolness requirement for flower suitability (temperature criterion 13-24 Celsius). In Column (1) we report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the IV base specification. We build upon this base specification by including differential time trends based on municipal characteristics. Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre interacted with year fixed effects. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal) interacted with a full set of year dummies. Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence and altitude. It also adds to it a regional linear time trend.

Table A.7: Geo-glimatic Requirements for Coffee

	(1) Coffee Status	(2) Coffee Hectares
Rainfall	1.349***	2240.3***
	(0.072)	(246.944)
Temperature	0.0690***	121.6***
	(0.005)	(12.426)
Rain × Temperature	-0.0538***	-90.74***
	(0.003)	(9.486)
Constant	-1.235***	-2322.2***
	(0.109)	(291.243)
Observations	1046	1046
R-Squared	0.240	0.080
F-statistic	120.42	34.96

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: robust standard errors in parentheses. OLS results to evaluate the suitability of a municipality for coffee cultivation. The outcome variable reflects the extensive margin, coffee status, as well as the intensive margin, coffee hectares. Coffee status and coffee hectares are measured at the municipality level. The climatic requirements chosen are as in Dube and Vargas (2013), and follow De Graaf (1986), including: *Temperature* (measured in Celsius), *Rainfall* (measured in cubic centimeters), and an interaction of the later two *Rain × Temperature*.

Table A.8: Assessment of the Flower Temperature Requirement on Coca

	(1) Coca Status	(2) Coca Hectares
Coolness	-0.100***	-424.0***
	(0.027)	(77.400)
Constant	0.308***	450.1***
	(0.021)	(77.256)
Observations	1046	1046
R-Squared	0.013	0.035
F-statistic	13.52	30.02

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: robust standard errors in parentheses. OLS results to evaluate if the flower temperature requirement ($13 < \mathrm{T} < 24$) affects coca cultivation. The outcome variables reflect the extensive margin, coca status of a municipality, as well as the intensive margin of cultivation, hectares of coca cultivation. The coca status assess whether a municipality cultivated any coca bushes at some point between 2000 and 2009. The coca hectares refers to the coca hectares under cultivation. The temperature requirement is the flower discountinuity we earlier used for flower cultivation, *coolness*. This captures whether the average annual temperature lies between 13-24 degree Celsius (55-75 F), deemed to be optimal for flower growth, but not for coca cultivation. We present this regression as a robustness check to assess whether flower cultivation could be displacing coca cultivation.

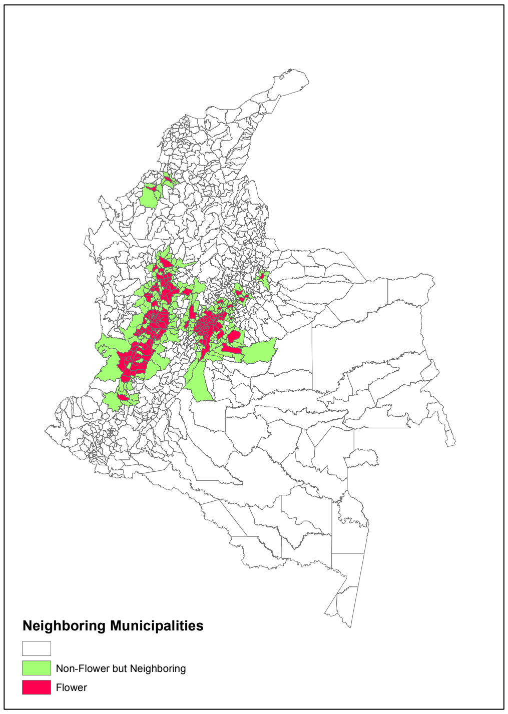


Figure A.1: Flower Status for Neighbor Municipalities

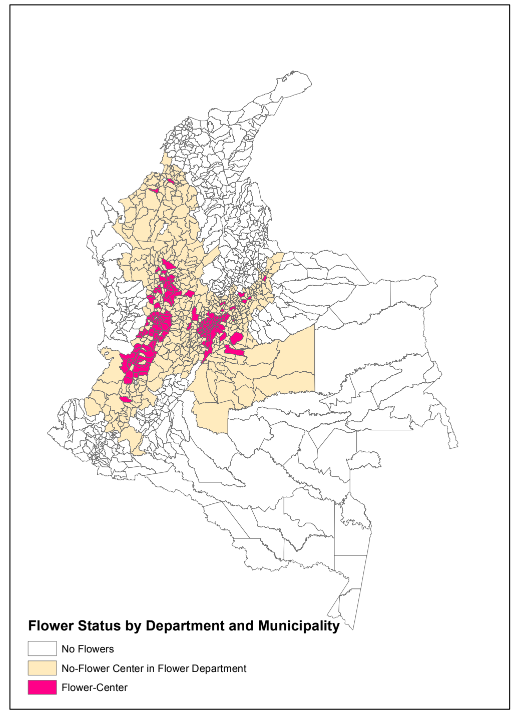


Figure A.2: Flower Status for Flower Department

The left figure shows the distribution of flower farms at the municipality level for the sample of control municipalities that share a geographical border with flower municipalities. This figure on the right shows the distribution of flower farms at the municipality level for the sample of Departments that have flower presence. Flower municipalities are identified as those municipalities that have at least one flower farm. At the Department level, we consider that a Department has flower presence if at least one municipality within the Department that is a flower-producing centre. Shape-file from DANE; flower hectares distribution from the Ministry of Agriculture and Rural Development.

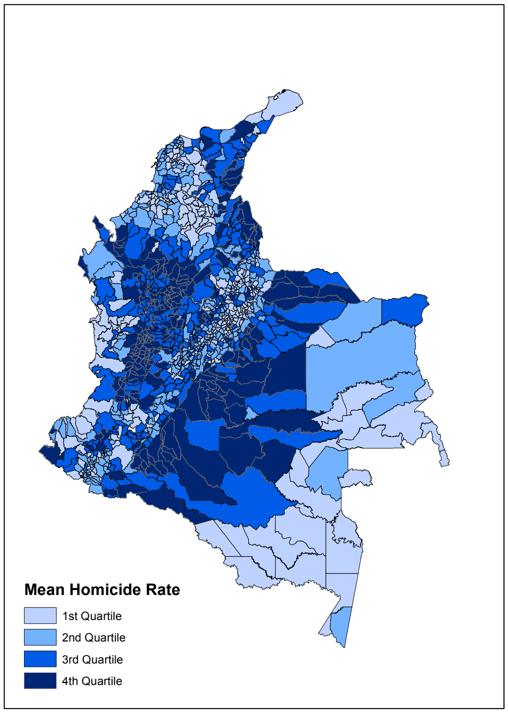


Figure A.3: Mean Homicide Rate

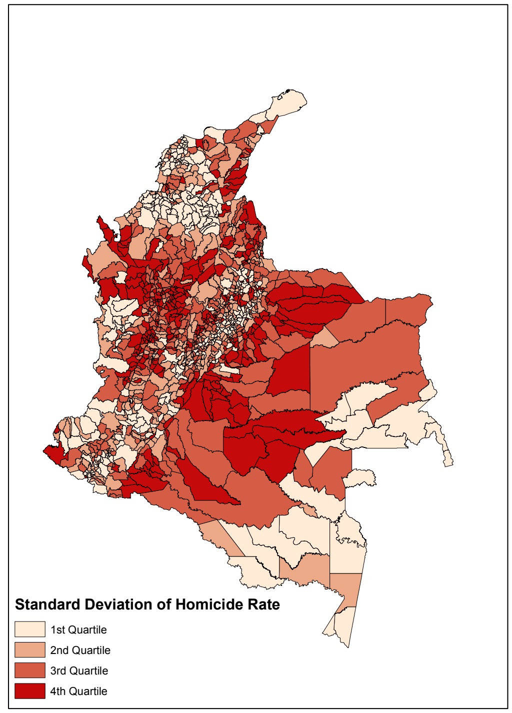


Figure A.4: Standard Deviation of Homicide Rate

These figures shows the mean homicide rate and standard deviation of the homicide rate for the sample years 1990 - 2013. The left panel computes the quartiles of the mean homicide rate; the right panel computes the standard deviation of the homicide rate for a given municipality throughout the sample period. These two figures allow us to identify the municipalities more affected by homicides as well as the variability. Sources: Shape-file from DANE; violence outcomes from CEDE.

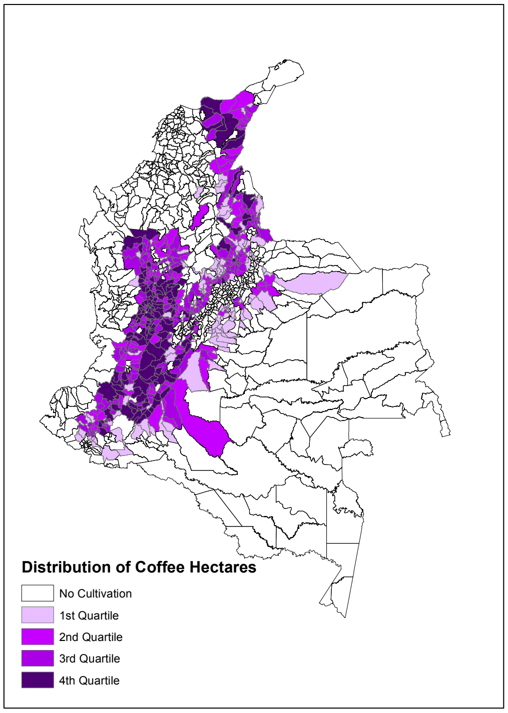


Figure A.5: Coffee Municipalities

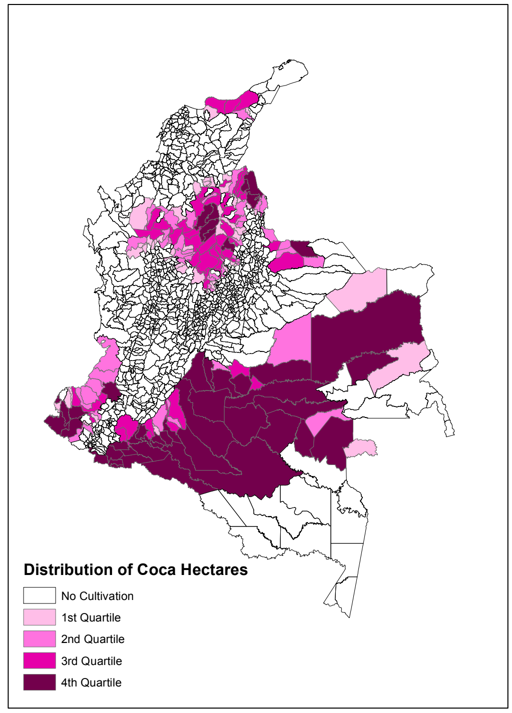


Figure A.6: Coca Municipalities

These figures show the distribution of coffee municipalities (left panel) and coca municipalities (right-panel). For coffee: there are 584 municipalities that cultivate coffee, with an average of approximately 1300 hectares. In terms of coca, there are 188 municipalities that cultivate coca, and the mean of hectares under coca cultivation is nearly 800. Sources: Shape-file from DANE and IFPRI; data on coffee and coca cultivation IFPRI and CEDE.