Guns N' Roses:

The Impact of Female Employment Opportunities on Violence in Colombia

Sara Hernández*

August 15, 2015

Abstract

This paper investigates the impact of the dramatic growth of the fresh-cut flower industry in Colombia on different forms of violence. My empirical strategy exploits variation in the geo-climatic suitability for flowers to understand how export shocks affect violence at the municipality level. I show that flower shocks lead to a differential reduction in unorganized violent crime (homicide rates) in the suitable municipalities, but not to any changes in participation in guerrilla warfare. In contrast, increases in the coffee price are associated with a decrease in civil conflict (as in Dube and Vargas, 2013) but, as I find in this paper, an increase in homicide. I 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.

Keywords: Flower Exports, Colombia, Violence, Civilian Conflict

*I am extremely grateful to Esther Duflo and Dave Donaldson for their feedback and guidance. I would also like to thank Abhijit Banerjee, Suresh Naidu, Juan Fernando Vargas and all the participants in the MIT Development Lunch and Applied Micro Lunch. I am grateful to Juan Fernando Vargas and Oeindrila Dube for making their conflict data available. I am much obliged to Pascual Restrepo for all his constructive comments and suggestions, and to Sebastian Akle, David Colino, Reshma Hussam, Patricia Gómez, David Jiménez, Srishti Nayak, Giovanni Reggiani and Julian Urrutia for their invaluable encouragement. Ana Bermúdez and Jorge Bermúdez provided expert insights into the Colombian flower industry. All errors are my own. PhD Candidate. Massachusetts Institute of Technology, Department of Economics. Email: sara_hdz@mit.edu

1 Introduction

"To save Colombia from cocaine, buy its roses"[1] – Former President of Colombia, César Gaviria, Wall Street Journal Op-Ed (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 violence. Submerged in an ongoing civil conflict, control over drug production soon became a catalyst for 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 an integral concern of the conversations in the policy circles. A question that naturally arises in this setting is: can the provision of jobs in the flower industry, predominantly female, indeed lead to decreased violence? And does it do so differentially relative to other sources of legal employment?

The employment opportunities I consider are embedded within a greater global phenomenon: the increased feminization of the labor force (Mammen and Paxson, 2000). This incorporation of females into the labor market has often relied on the expansion of the manufacturing and agro-processing industries. Leading examples of this experience are found in the textile and garment industries of Bangladesh, the *maquilas* of México and the *dagongmei* in China.

Spurred by international trade dictums, this new export-oriented jobs entail very specific characteristics: they have disproportionately targeted females, requiring them to attain a varying degree of educational skills. Remarkably, in many of these settings, female earnings in the paid labor force were once not considered the norm *(ibid)*.

Employing micro-level data, my goal is to estimate the impact of these local, agro-industrial shocks on various forms of violence in Colombia, always measured at the municipality level. The labor shocks are associated with the Colombian fresh-cut flower industry, which emerged in the year 1965. The arrival of the flower jobs soon transformed the landscape of formal employment opportunities, particularly for women, offering them 'wages, security, and [a] sense of community' (Friedeman-Sánchez, 2006). Noteworthy, throughout this period, Colombia experienced a secular increase in the female labor force participation rate, going from 47 percent in the 1980s to 65 percent by 2006 (Amador et al, 2012).

[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 Kristof (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

I contrast commodity price shocks across industries and sectors that differ in their employment gender-intensity on an array of violence outcomes. I establish two categories: unorganized violent crime vs. armed conflictual violence. My 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. The novelty of my study arises from its focus on an industry that is believed to be substantially female friendly: women constitute over 60 percent of the floricultural production workforce (Census, 2005).

Primarily, I concentrate on violent forms of crime. I chose the homicide rate as my main outcome of interest,[4] since this "form of [violence] 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, it is worth noting that, over the course of twenty-three years (1990–2013), there were approximately 500,000 homicides recorded in Colombia. That figure closely matches the world total number of homicides for the year 2013 (UNODC, 2013). I should emphasize that this form of general violent crime (homicides) happened within the broader context of an ongoing civilian conflict, to which I turn next.

Secondarily, I extend my analysis into the realm of the illegal armed activity, thereby building on the Dube and Vargas (2013) study. Bringing the civil conflict and coffee sector into the picture allows me to do two things simultaneously: introduce a gender comparison, and look at the differential impact on various forms of violence.

I recognize that violence might indisputably affect the location decision for any economic activity, including that of flower entrepreneurs. To deal with this potential source of endogeneity, I proceed with an instrumental variable strategy that relies on geo-climatic requirements. This allows me to determine the suitability of a municipality to become a flower-producing center. Further, to generate shocks to the flower value, I concentrate on the interplay between Colombian producers and other world exporters to the US market. My regressions will control for differential trends based on municipality characteristics—including, among others, the presence of coffee, petrol, altitude, and distance to the capital, as well as regional, linear time trends.

My estimates suggest that the expansion of the flower industry led to a significant reduction in the homicide rate in the flower suitable municipalities. In summary, I find that a 1 percent increase in the national value of flower production differentially decreased the rate of homicides by –0.08 fewer homicides per flower hectare. In contrast, increases in coffee price led to a decrease in guerrilla warfare (as in Dube and Vargas, 2013) but, as I show in this paper, an increase in homicide. To guide the interpretation of these asymmetric results, I propose a household model where households both participate in and indirectly

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

consume criminal activities (organized armed conflict and unorganized violence) and women have different preferences from men. I hypothesize that the gendered nature of this modern employment might have ignited a "pacifying process" in the flower communities, one that occurred via female income shocks.

The results from the rose jobs offer a more subtle picture into the impact that the expansion of low-skill, semi-industrial employment opportunities has had for living standards in the developing world. I present new evidence on how international trade can dictate the evolution of violence within a nation, a question that remains of prime importance for development economists, particularly in the context of global trade.

The remainder of the paper has the following organization: in Section II, I provide a conceptual framework, a compact introduction to the Colombian institutional context, and a description of the rapid expansion experienced by the flower industry. Section III illustrates my empirical strategy; Section IV describes the data; Section V discusses the estimation results. Finally, Section VI concludes.

2 Institutional Context and Background

This section will discuss an introduction into the Colombian history, a conceptual framework to guide my empirical strategy and a brief account on the development of the flower industry.

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 factional 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 unfolded, the post-conflict management and peace negotiations remain at the core of the political agenda.

The emergence of the conflict is believed to have its roots in the extremely unequal distribution of land (Sánchez-Friedemann, 2006). In the decades of the 1920s and 1930s, consternation over labor conditions on large coffee-producing estates, property rights, and broader political concerns led to the first peasant struggles and organized *campesino* movements (Vargas, 1998). In 1948, violence spilled over to the two main political parties, Liberals and Conservatives, tragically claiming more than 200,000 lives. To repress the upheavals, repeated government attacks were launched on the peasant self-defense organizations. This tactic, together with the resulting forced displacement of peasants, triggered the proper establishment of the leftist guerrillas (Encyclopedia Britannica, 2013).[5] To account for historical levels of violence, I will later incorporate this incident, *La Violencia,* into the analysis.

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

2.2 Literature Review: Unorganized Violence and Civil Conflict

A growing body of literature has analyzed the impact of local shocks to household welfare on violence and conflict. These studies have often exploited one dimension of violence, focusing either on unorganized violence or conflictual violence. Not only that, the shocks also vary widely in terms of their characteristics: illegal nature (coca shocks), labor intensity (coffee shocks), capital intensity (mining and oil shocks); and non-commodity shocks (military aid).

Among the most notable recent works, Dube and Vargas (2013) study the incentives of civilians to actively participate in the Colombian conflict. Their paper reveals how, in a Beckerian sphere, participation in conflictual revolts subsides in response to positive income shocks in labor-intensive economic activities. They find that positive shocks to the price of coffee altered the course of the conflict by raising the opportunity cost of partaking in the illegal armed struggle. By contrast, value shocks to a capital intensive sector (such as oil and mining), foster conflict by making appropriation more salient—via a *rapacity* effect. The authors did not extend their study to unorganized violent crime, which is the task that I take up in this study.

In Colombia, still, trafficking and the impetuous "war on drugs" also brought about unprecedented levels of civil violence and crime. In this context, the extensive use of violence became "a banal resource", spurred by competition for the control of profits in the illicit drug markets, but also through the cultivation of a *machismo* honor culture (Cubides, Olaya and Ortiz (1998). Angrist and Kruger (2008) find that coca value shocks fostered the civilian conflict, via rent-seeking behavior, while economic gains remained meagre for rural producers. Mejía and Restrepo (2014) further unravel the causal impact of illicit drug markets on systemic violence.

Dube and Naidu (2014) examine how US military aid affected the Colombian civil conflict, and find that it led to a differential increase in paramilitary attacks and homicides in military-base municipalities. They conclude that foreign military assistance helped to sustain the Colombian 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, my analysis endogenizes the flower locations, as well as the temporal variation in the export value.

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

Last, Ksoll, Macchiavello and Morjaria (2014) study the reserve relationship: how ethnic violence affects firms in an export-oriented industry. Using firm-level data from the Kenyan flower industry, they analyze how the 2008 episodes of post-electoral violence impacted production and export operations. The authors show how different institutional arrangements within firms can help mitigate the impact of episodic violence on trade.

The present analysis elaborates on the aforementioned studies by looking at the expansion of secure employment opportunities in a non-traditional export-oriented industry, one which represented a more fundamental shock to the economic environment of women. I 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 the ones originating from coffee. I conjecture that the gender component, as well as the employment features of stability and permanency, might be an important determinant behind the results.

2.3 Conceptual Framework

The traditional paradigm for the study of crime started with Becker (1968). He introduced first an economic approach to understanding the intricacies between incentives and deterrence mechanisms to commit crime. As he succinctly stated: "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 together, the fresh-cut flower industry offers a unique standpoint from which to examine the relationship between violence and female employment shocks.

To frame my empirical question, I have adapted a household model from Bardhan and Udry (1998) and Browning, Chiappori and Weiss (2014). The household is made of a male (M) and a female (F), each with egoistic preferences and 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 incorporates the consumption of regular goods (c_F) and leisure (l_F), but they do not participate in vice.

In this economy, the males can choose between three types of occupations: work in coffee cultivation (legal sector), commit crime as a means of extracting resources (unorganized violent crime), or join the illegal armed struggle (participate in conflictual violence). The wages from each occupation 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 entails 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[6] doesn't necessarily have to leave the community where he normally resides. Coffee growers, except for the migrant harvest workers, work and live in their own community.

Females, on the other hand, can only work in the flower industry and earn a wage of w_{flower}. I am going to assume that they 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 I 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. I posit that the consumption of *vice* can affect the level of crime (unorganized violent crime). Strong links have been established between drinking patterns and high rates of inter-personal violence (WHO, 2006). Further examples of procyclical mortality include the work Neumayer (2005) who finds that economic upturns affect health via increased consumption of health-damaging consumer goods, like alcohol and tobacco. In my setting, I hypothesize that the less moderate consumption of harmful goods also incites violent behavior. I thus establish a new subcategory of violent crime, *drunken* crime, which is an increasing function of the consumption of vices, $druken\ crime = \rho(v_M)$[7].

Recapitulating, the total level of unorganized violent crime that I observe in a community will consist of the sum of two categories: (i) that attributed to criminals who commit crime as a means to earn an income, and (ii) drunken crime.

The problem of the household then becomes to maximize the collective utility function. As stated in Browning, Chiappori and Weiss (2014), the solution corresponds to a two-phase decision process: agents first determine the sharing rule, and then, given any distribution of total income, proceed to consume their preferred bundle.

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

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

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

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

Equation (1) is the household utility function, where α captures the bargaining weight of each spouse and is a function of distribution factors and prices—I abstract from non-labor income. As it can be seen, the

[6] Criminal activities such as robbery, burglary, and kidnapping can be thought as a means to extract resources.
[7] Here, I assume that no extra time involvement is required for drunken crime, since it is often a wrong by-product of leisure joint with psychoactive substances.

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. Females will further choose how much leisure to enjoy and labor to devote to flower farms, whereas males decide over labor devoted to coffee cultivation, crime and illegal armed struggles. Equation (2a) is the standard household budget constraint, where the actual cash expenditures cannot exceed the labor income. Equations (2b) - (2c) define the resource constraints in terms of time endowments—leisure (l) and working hours (h).

Upon closer inspection of the full-income constraint for males, it is important to notice that, out of its linearity, males will choose the occupation with the higher wage. Once chosen, they will devote whatever many hours they decide to work (h_M) to that one particular occupation, solely. This allows me to rewrite the household maximization problem as:

$$\max\ \alpha U_M(c_M, l_M, v_M) + (1-\alpha)U_F(c_F, l_F)$$
$$s.t.\ p(c_M + v_M + c_F) \leq w_{flower} h_{flower,F} + max\{w_{coffee}, w_{crime}, w_{conflict}\} h_M$$

In order to understand the implications of this model, I begin studying positive shocks to flower prices. First, they 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 ($\frac{dh_F}{dw_F} \geq 0,\ \frac{dl_F}{dw_F} \leq 0$). At this point it is worth noting that the flower shocks happened in a setting where females "would have otherwise been restricted to the informal sector" (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 it. Second, I expect the consumption of legal goods, as well as vice, to increase. Third, I could observe a reduction in male labor supply if men decide to consume more leisure, if ever so slightly. In fact, this would translate into males spending less working hours in whatever occupation they were involved in. Last, through the female bargaining power channel, the consumption bundle is likely to tilt towards relatively more legal consumption, for which females have a stronger preference.

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

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

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 civilian conflict will only arise from the reduction in working hours devoted to the illegal armed struggle (via higher consumption of leisure by males). Thus, to first order, I posit that violent unorganized crime will go down, and conflict would remain unaffected.[8]

Next, I analyze how positive coffee shocks alter the household and community dynamics. First, they relax the budget constraint through male labor income. 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) raise the opportunity cost of participating in conflict (Dube and Vargas, 2013). In my model, they also raise the opportunity cost of committing unorganized violent crimes. Thus, we should observe occupational switches towards the legal coffee sector. Last, through increased male bargaining power, the consumption bundle is likely to tilt towards vice (relative to before), potentially raising drunken crime. To first order: I would expect conflictual violence to decrease in the presence of coffee shocks (as tested in Dube and Vargas, 2013) and I remain ambiguous about the sign of the impact on unorganized crime.

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

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

In summary, I expect positive flower shocks to lead to a reduction in unorganized violent crime, and have no effect on conflictual violence. At the same time, positive coffee shocks should lead to a reduction in conflictual violence, but have an ambiguous impact on unorganized violent crime. This remains an empirical question that I attempt to answer in this paper.

2.4 The Flower Sector

In spite of the conflict, 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 and dependent on coffee. These initiatives were concomitant with the "Alliance for Progress" for Latin America. This program was initiated by the Kennedy administration in 1961 with the intention of maintaining and reinforcing stability in the broader, if mercurial, Andean region.

In the year 1964, the publication of a graduate thesis at Colorado State University identified Colombian farmland as highly substitutable with American farmland (Ministry of Agriculture and Rural Development, 2008). The country presented favorable climatic and soil conditions, and labor was abundantly available. Given its proximity to the US (through the Miami port of entry) as well as lower production costs, Colombia

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

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 shipment was sent to the US, Colombia already ranked as the second largest world exporter of cut flowers (Méndez, 1991). The industry became a major employer of female labor from the low-income areas in the regions surrounding the Sabana de Bogotá and Antioquia. In the same study, the World Bank reported that the flower industry was "a textbook story of how a market economy works" *(ibid)*.

Except for a decline starting in calendar year 1995, the rose exports grew continuously since the inception of the industry. Towards the end of 1994, the industry was negatively affected by an American anti-dumping ruling, vehemently fought by the Californian flower growers. This protectionist measure brought a lot of uncertainty to the Colombian growers; it also sent their exports into a sluggish period, which lasted for approximately a quinquennium. This episode was widely registered in the popular press: "companies that produce roses in Colombia could go out of business if the measure is upheld; that would put out of work thousands of poor women who make up 80% of the labor force in the industry" (Ambrus, 1994).[9]

The major sources of production costs 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 successful establishment of the industry.[10]

At the flower farms, the tasks vary from unskilled to skilled. The entire process is highly labor-intensive and resembles the modern assembly-line factories. Flowers require labor at every stage of the production and the delicacy of the product itself leaves very "little room for mechanization" (Friedemann-Sánchez, 2006). On a given farm, each woman is responsible for approximately 12,000 plants, spread across dozens of flower beds. There are close to 28 tasks that need to be performed on each plant *(ibid)*, making it a rather laborious activity.

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 on the farms: monitors of plant diseases and supervisors. Both of them are paid above the minimum salary, a compensation that is a direct reflection of the higher required skills and derived responsibilities involved.

[9] Steven Ambrus. "International Business : U.S. Ruling a Thorn in Colombian Rose Growers' Side : Trade: Commerce Department decision imposes punitive anti-dumping levies". Los Angeles Times, October 20, 1994. Accessed June 17, 2015. http://articles.latimes.com/1994-10-20/business/fi-52664_1_colombian-rose

[10] 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. This helps to reduce production costs and increase the profitability margin.

Meier (1999) notes that women have also found relatively skilled positions as "social workers, psychologists, doctors, personnel managers, biologists, secretaries, and receptionists" within the bigger flower farms. The seasonality of US demand also leads to foreseeable temporary labor contracts within a given year. In particular, in order to meet "the demand levels for Mother's Day and Valentine's Day" Colombian growers have to hire "additional seasonal employees" (Figueroa et al, 2013).

At this point, it is crucial to acknowledge the stability of employment, for "jobs in the industry are so stable that working in the fresh cut-flower industry is becoming a métier" (Friedemann-Sánchez, 2006) . The permanence trait of employment can be seen in the following figures: women remain employed within a given flower farm for an average of 5 years, and stay 15 years within the industry—rotation of workers among flower farms being a common phenomenon.[11] The alternatives for females outside the flower farms are scarce and lean towards informality. They often entail lower wages and lack the added legal and social security benefits.

In terms of gender, women constitute over 60 percent of the floriculture workforce (Census, 2005) and flower jobs represent 25 percent of rural employment for women (Ministry of Agriculture and Rural Development, 2008). Anthropologists have accentuated the fragility and perishability of flower production as a rationale behind the industry being female intensive. This argument falls within the *"nimble fingers"* discourse (Elson and Pearson, 1981):

> 'Women work in the Colombian flower industry according to a strict gendered division of labor. They attend to all activities required in cultivation, such as planting, fertilizing, cutting, classifying, and bunching flowers together, while men are hired to apply pesticides, maintain the greenhouses structures, and transport the flowers to Bogotá's international airport' (Talcott, 2004).

Friedemann-Sánchez (2006) notes that this division 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".

2.5 Flower Production

Flowers require very particular geo-climatic requirements to bloom. Due to their geographical location, topography and climate, certain regions within Colombia benefit from natural year-round conditions to grow them. This very specific need presents itself as an instrument for the empirical strategy, reflecting the suitability of a particular municipality to become a flower-producing center.

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

In particular, the optimal range of temperatures for which a given flower can grow ranges from 13 to 24 centigrades.[12] Temperatures above this upper limit impede the metabolic process of the flower plants; very low temperatures can severely affect the shrub or vine, causing permanent damage to its structure.[13] Although flower farms are equipped to deal with sudden changes in temperatures for short periods of time,[14] given the rudimentary structure of greenhouses, reliance on natural conditions becomes a deciding determinant of suitability. I will thus use this temperature criterion to construct a suitability index, measured at the municipality level.

Historically, the first region to cultivate flowers was the southern section of the Sabana de Bogotá (Ministry of Agriculture and Rural Development, 2008). The industry was able to expand in a seemingly rapid and sustained manner, mostly 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 were converted into flower farms (Friedemann-Sánchez, 2006).

As of 2007, there were 142 municipalities growing flowers (out of 1,120). Across these municipalities, there were 2,113 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. A graphical display of the distribution of flower farms is presented in Figure 1.[15]

Estimates from the 2005 Census and data on employment by Major Industry Sector report that each flower hectare generated employment for approximately 25 people. The average flower-municipality in the sample would thus employ nearly 1,600 workers, or close to 1,000 females. 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 my sample has 1,300 hectares, this translates into employment for around 1,000 coffee farmers. Moreover, women administer one fifth of the coffee farms (Encuesta Nacional Cafetera, 2012). To further explore the labor intensity of different agricultural commodities, Table 10 shows the employment data on the major agricultural activities for Colombia in 2005. As it can be seen, the flower industry, a non-traditional agricultural export, has the highest labor intensity.

Last, it should be mentioned that, despite its lower labor intensity, coffee is a much more widespread activity: its total area occupied approximately 869,500 hectares (National Coffee Growers, 1997). The distribution of coffee producing municipalities is shown in Appendix Figure A.2. Miller and Urdinola (2010) discuss how coffee labor falls into three categories: small farmers who supply their own labor, day laborers

[12] In the range of 55 to 75 Fahrenheit degrees.

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

[14] Flower farms are equipped to countervail normal, if sudden, temporal changes that are not very prolonged in time, ranging from a few hours to at most 4 to 5 days.

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

who live nearby and work-year round on the large estates, and seasonal migrant workers for harvest and peak seasons—young, unmarried men who trot across the country.

3 Empirical Strategy

My 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 employment opportunities at the local level. Using a difference-in-difference specification, I assess whether changes in the value of flower exports affect violence outcomes differentially in the municipalities that meet the suitability criterion for flower cultivation.

First, I estimate the flower impact 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. Second, I study the armed conflict: guerrilla attacks, paramilitary attacks, clashes, and casualties—thereby replicating the Dube and Vargas (2013) outcomes. The analysis on conflict is conducted for a restricted subsample of years, from 1988 to 2005.[16]

The employment shocks can be proxied with either the national value of flower exports (total dollar value, adjusted by an export price index), the volume of production (flower stems) or the price of exports. The later is a measure I construct that takes the total national value of flower exports over the volume.[17] I chose to concentrate on the bilateral trade relationships between Colombia and the US for several reasons. First, Colombian growers enjoy a high degree of exclusivity in the US market. This is partly because of the proximity between the two countries and partly due to the perishability of the good being traded. Second, more distant destinations are logistically less feasible, as well as less profitable due to the higher transportation costs and the rapid decay in the product quality[18]. Third, Colombian domestic consumption of flowers is, at best, residual when compared to the volume exported abroad.

I proceed to estimate how municipality violence varies with: (i) shocks to the export price of flowers, and (ii) the presence of flower farms. For notation purposes, the flower impact is constructed a the level of the municipality m, the year t:

$$Flower_m \times ln(Flower\ Export\ Price_t)$$

where $Flower_m$ refers to the number of hectares that municipality m cultivates. I interact it with the (log) flower price on the calendar year t. In order to test the hypothesis that more stable and secure jobs for

[16]These are the years available in the Dube and Vargas (2013) study.

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

[18]Once cut, flowers are highly perishable. Roses last 3 to 5 days, carnations 7 to 19 days. The perishability used to be the principal determinant of the location of cut flower production in the US prior to 1950. Development of reliable air transportation freed this constraint (Méndez, 1991).

the females of a community can impact its violence's path, I run the following regression:

$$violence_{m,t} = \alpha + \beta flower_m \times log(Flower\ Price_t) + \gamma_m + \gamma_t + \varphi_r \times t + \sum_{t=1991}^{2013} [\mathbf{X}_m d_t]\rho_{m,t} + \epsilon_{m,t} \quad (1)$$

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) price of Colombian flower exports to the US. The coefficients γ_m and γ_t represent municipality and year fixed effects; $\varphi_r \times t$ is a regional, linear time trend; finally, $\mathbf{X}_m d_t$ is a vector of differential trends by baseline characteristics, explained below.

In Equation (1), the coefficient of interest is β, which captures the differential effect of the flower shocks in municipalities that cultivate flowers more intensively. As explained, I will run this regression with a set of unorganized violent outcomes (including homicide rate, thefts, and kidnappings), and I will also extend the analysis into the realm of conflictual violence (guerrilla attacks, paramilitary attacks, clashes and casualties).[19]

Given that the flower price does not vary by region, the identification strategy relies on the interaction between the national performance of flower exports and the flower status of a municipality. Thus, the interpretation of the coefficients is equivalent to assuming that the number of flower jobs in each flower municipality grew at the annual nationwide export rate. Unfortunately, data is not available to measure the growth of hectares over time, making the proxy for the national expansion a reasonable, if not sole, alternative.

Further, I generate differential trends by baseline characteristics, measured at the beginning of the period. For that, I interact year dummy variables with a host of municipal-level covariates, $\mathbf{X}_m$. The municipality covariates I consider vary depending on the specification, and they include: the distance to main market center, and distance to the capital of the department, as a measure for the remoteness of a municipality; the altitude, since altitude could foster conflictual insurgency; and the presence of other export commodities, including coffee, petrol, coal and gold, which have been shown to affect the path of conflictual violence in Dube and Vargas (2013). Since "violence begets violence", I also generate differential trends that account for the initial level of violence (1990) and participation in historical war experiences, including *La Violencia* (1948 to 1964). This allows me to address concerns about mean reversion.

Because of the potential endogeneity of the location of flower farms, I proceed with an instrumental variables strategy that I now describe. First, I exploit the natural geo-climatic suitability for flower culti-

[19]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.

vation. The *coolness* criterion (measured by temperatures that are in the range of 13 to 24 Celsius) allows me 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 (2) captures this suitability regression, where $flower_m$ represents the number of hectares that a municipality cultivates (intensive margin):[20]

$$flower_m = \gamma_o + \gamma_1 \times coolness_m + \epsilon_m \tag{2}$$

Next, in Equation (3) I proceed to incorporate the *coolness* discontinuity into the first-stage of the 2SLS procedure, without instrumenting the temporal variation:

$$\begin{aligned} flower_m \times log(Flower\ Price)_t &= \delta coolness_m \times log(Flower\ Price_t) \\ &+\psi_m + \psi_t + \theta_r \times t + \sum_{t=1991}^{2013} [\mathbf{X}_m d_t]\phi_{m,t} + \nu_{m,t} \end{aligned} \tag{3}$$

To address concerns about the influence of certain flower-growing regions over the total value of the flower industry, I incorporate the volume exported by other country competitors that Colombians face in the US market. Top competitors include other Latin American and Caribbean-basin producers as well as the Netherlands and Kenya. This yields an alternative first-stage specification in Equation (4):

$$\begin{aligned} flower_m \times log(Flower\ Price_t) &= \delta coolness_m \times log(Top\, Q_{flower,US})_t \\ &+\psi_m + \psi_t + \theta_r \times t + \sum_{t=1991}^{2013} [\mathbf{X}_m d_t]\phi_{m,t} + \nu_{m,t} \end{aligned} \tag{4}$$

Finally, I introduce flower and coffee shocks simultaneously in Equation (5):

$$\begin{aligned} violence_{m,t} &= \alpha + \beta flower_m \times log(Flower\ Price)_t + \lambda coffee_m \times log(Coffee\ Price)_t \\ &+ \gamma_m + \gamma_t + \varphi_r \times t + \sum_{t=1991}^{2013} [\mathbf{X}_m d_t]\rho_{m,t} + \epsilon_{m,t} \end{aligned} \tag{5}$$

For the coffee instrumentation, I replicate the Dube and Vargas (2013) strategy. The internal coffee price is set by the Colombian Coffee Growers Federation (Federación Nacional de Cafeteros de Colombia) and it does not vary by region, either. I use the level of rainfall and temperature to determine the coffee suitability. I then interact these climatic requirements with the volume produced by Colombia's main world competitors. Equation (6) shows the first-stage for coffee instrumentation, as described in Dube and Vargas (2013):

$$\begin{aligned} &coffee_m \times log(Coffee\ Price_t) = \\ &[\delta_1 Rain_m + \delta_2 Temperature_m + \delta_3 Rain_m \times Temp_m] \times log(Top\, Q_{coffee,world})_t \\ &+\psi_m + \psi_t + \theta_r \times t + \sum_{t=1991}^{2013} [\mathbf{X}_m d_t]\phi_{m,t} + \nu_{m,t} \end{aligned} \tag{6}$$

[20] An alternative specification uses the flower status of a municipality, thereby capturing the extensive margin of cultivation. Results with the flower indicator will be shown in the Appendix.

4 Data

4.1 Data Sources

The panel data for the violence outcomes and municipality covariates comes from the Center for the Study of Economic Development (CEDE, in its Spanish acronym), at Universidad de los Andes. It incorporates all of the municipalities[21] in Colombia (1,120) for the years 1990 to 2013.

Data to identify the geographic distribution of flower farms comes from a 2007 government registry list, publicly released by the Agriculture and Rural Development Ministry.[22] This is a cross-sectional snapshot from which I recover the entire universe of flower producers. The public registry contains information on the geographic location (municipality) of the farms, as well as the size of the land cultivated in hectares. The size variable is further broken into flowers and foliage. For the purpose of the current analysis, the total hectares will be used. I categorize a municipality as having the flower status, $flower\ status_m$, if it has at least one flower farm, cultivating a positive number of hectares, $flower\ hectares_m > 0$, as of the year 2007.

Data to measure the performance of the flower industry comes from three sources. First, the UN Com-Trade portal has data available for the volume and value of Colombian exports to the world. Second, the US Food and Agricultural Service (FAS),[23] has detailed volume and value information for Colombian exports to the US market. The FAS data expands a longer period of time than its UN counterpart. Last, there is the work put together by Marín and Rangel (2000), which combines the yearly bulletins published by the Colombian Association of Flower Growers (Asocolflores) on several production aggregates. From all sources, I retrieve the level and value of production whenever available—this is always measured at the national level. Since I chose to concentrate on bilateral trade between Colombia and the US, the analysis will be conducted using the data retrieved from the Food and Agricultural Service (FAS) administration.

I must mention that, in the context of the flower markets, an international price or flower index does not exist. Given this situation, the own production decisions of Colombian growers directly influence the value that their flower exports attain as they enter the US market. I will address concerns about the own value determination incorporating the volume of Colombia's main competitors. This later series is also retrieved from the US Food and Agricultural Service (FAS).

[21] The political administration of Colombia consists of 32 distinct autonomous Departments. Each Department groups several municipalities under its jurisdiction, totaling 1,120 over the entire territory.

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

[23] Foreign Agriculture Service, Global Agricultural Trade System (GATS), code 0795AT – fresh cut flowers.

4.2 Descriptive Statistics

Table 1 presents the summary statistics with the cross-sectional differences between flower and non-flower municipalities. I have a final sample of 1,046 municipalities for which there is complete information on all relevant measures for the analysis.

Panel A shows the unorganized violent crime outcomes by flower status. Noticeably, the average level of unorganized violence is higher in flower municipalities. The average stands at 71 homicides per 100,000 inhabitants in flower municipalities, whereas it is approximately 50 homicides per 100,000 for non-flower. Flower municipalities also suffer from higher rates of personal theft, burglary, vehicle theft and commercial theft. In Appendix Figure A.3, I have mapped the intensity and variability of the homicides over the sample period into quartiles.

Anecdotal evidence tells that the rose industry took off in more peri-urban, populated areas, as opposed to rural regions. This amorphous category of unorganized violent crime had a higher toll in the more semi-urban regions. To address concerns about a mean reversion process, I will account for the initial level of violence (homicide rate in the year 1990) interacted with a full set of year dummies. I will also generate different samples based on population restrictions in a robustness exercise.

Panel B offers insights into the conflictual violence and how it fared across flower and non-flower municipalities. Noticeably, the non-flower municipalities bore a greater burden of the civilian conflict. It is worth mentioning that the bastions for recruitment were located 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). Nonetheless, this is not to say that the conflict did not affect the flower-regions: once the FARC consolidated its presence in the countryside, it turned its attention towards Colombia's larger cities (CISAC, 2015). I will thus be controlling for the rurality level of a municipality, as an attempt to capture differential trends across the rural dimension.

In *Panel C,* I focus on the municipality characteristics to gauge the heterogeneity across flower and non-flower centers. 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 gates of exit becomes crucial. 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, medium temperatures, in line with temperate climates. Assessing their historical experiences of violence, flower municipalities were less likely to have been affected by the hostilities that erupted in *La Violencia*, an internal rebellion that occurred in the 1950s.

Continuing in *Panel C,* both flower and non-flower municipalities cultivate coffee, but flower municipalities do so more intensively. As it can be seen, coffee is a widespread agricultural activity across the nation, covering approximately 850,000 hectares, or nearly 100 times more hectares than flowers.

To alleviate concerns about the comparability of flower vs. non-flower municipalities across the entirety of the Colombian territory, I will do two things. First, I will generate differential trends by baseline characteristics. Second, I will construct alternative samples of control municipalities. These will include: (i) the sample of neighboring municipalities (non-flower municipalities that share a geographical border with flower ones); (ii) the sample of flower Departments (non-flower and flower municipalities that lie within a flower Department)[24]; (iii) a control sample of matched municipalities that meet the common support[25]; and (iv) a sample of control municipalities matched using the 10-nearest neighbor matching method.[26]

At this point, I want to emphasize that the flower-intensive locations do not overlap with the coca cultivating regions. In 1989, when the US Commerce Department accused Colombian growers of dumping practices, a *New York Times* article found that "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).[27] To evaluate this claim, Appendix Table A.8 uses the flower *coolness* requirement to evaluate the suitability of coca cultivation. The results suggest that meeting the optimal temperature criterion for growing flowers negatively affects both the likelihood of growing coca and the number of coca hectares. Thus, it seems implausible that roses could supplant the land where coca bushes were grown. Appendix Figure A.2 identifies the municipalities that grow coca.[28]

Last, *Panel D* provides figures on the performance of the flower industry over time. 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, depending on the data source. On an average year, Colombia exported $378 millions in roses, and 1000 roses attained a mean price of $178, or 0.178 cents per rose.

[24]A flower department is defined as a department that has, at least, one flower municipality.

[25]Non-flower controls are selected if their propensity score is larger than the minimum propensity score for flower municipalities.

[26]The respective panels for these subsamples with descriptive statistics can be found in the Appendix Tables A.1, A.2 and A.3

[27]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

[28]The coca indicator identifies municipalities that grew coca at any time in the period from 2000 to 2009.

5 Results

5.1 Suitability for Flowers

I begin my analysis in Table 2, which shows the suitability regression estimates, following Equation (2). Columns (1) and (2) use the extensive margin of flower cultivation, and Columns (3) and (4) focus on the intensive margin.

The temperature requirement, *coolness*, positively affects the likelihood of flower cultivation and the production intensity. I consider alternative temperature requirements in Columns (2) and (4). The regressor *hot*, which captures average annual temperatures above 24 Celsius, and the regressor *cold*, for average annual temperatures below 13, both negatively affect the flower suitability. For the remaining of the analysis, I will focus on the intensive margin of cultivation, thereby using the flower hectares as a measure of flower presence. Last, the results of the agronomic suitability for coffee cultivation, following the strategy of Dube and Vargas (2013), are presented in Appendix Table A.7.

5.2 Flower Shocks and Unorganized Violence

Next, I present visual evidence on the OLS relationship between the flower shocks and the homicide rates. I interact the flower indicator of a municipality with a full set of year dummies, and I proceed to regress the homicide rate on these interaction terms, while controlling for municipality and year fixed effects. Figure 3 plots the coefficients of these flower-year interactions. I also overlay the evolution of the price of flower exports to the USA (dollars, deflated by an export price index). Companion Figure 3b plots the same coefficients from the flower-year interactions but it overlaps the total value of Colombian exports—where the export total value better captures a scale effect, unadjusted by the volume of production.

Looking at Figure 3, the series for the flower prices and flower-year interactions appear to be mirror images of each other. As it can be seen from the second figure, Figure 3b, the growth in the total export value was also concomitant to a differential decline in the homicide rates in flower producing municipalities versus non-producing ones. Noticeably, the flower-year coefficients approach zero towards the end of the period.

Despite this suggestive evidence, the non-random location of flower farms could bias the OLS results. This is particularly concerning if highly suitable municipalities did not become flower-producing centers because of the violence situation, or if badly suitable municipalities started growing flowers because they were relatively peaceful. I thus proceed with a 2SLS strategy.

5.3 Instrumental Variables

I now turn to the core of my empirical strategy. Table 3, *Panel A,* reports the 2SLS estimates of Equation (1). Column (1) shows the OLS result for comparison purposes. Column (2) reports the base 2SLS specification, in which I only control for municipality and year fixed effects. The 2SLS results are negative, and significant: a 10 percent increase in the national flower price leads to -0.715 fewer deaths (per hectare) in the rate of homicides in flower-suitable municipalities. The estimates are highly significant and considerably larger in magnitude than their OLS counterparts.

In columns (3) to (5) I introduce differential trends by municipality characteristics. Column (3) controls for the distance to the closest market center and the distance to Bogotá, interacting them with year fixed effects. Column (4) controls for the presence of other export sectors, including coffee–this is particularly important since coffee has been shown to affect the path of conflictual violence. Last, Column (5) is a rather exhaustive specification: it incorporates differential trends by altitude, exposure to historical experiences of violence (*La Violencia* episode), the presence of other export commodities; and a regional linear time trend. The results remain highly significant and robust.[29] In Column (6) and Column (7) I 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 decreasing the male homicide rate—it should also be mentioned that there are close to 12 male homicides per female homicide in the sample.

In *Panel B* of Table 3, I report the corresponding first-stage, as specified in Equation (4). The dependent variable for the first-stage consists of the interaction between the hectares and the growth in the national export price of flowers. The instrument includes the *coolness* requirement and the (log) volume of Colombia's top competitors in the US market. The first-stage coefficients are highly significant and negative: increases in the volume produced by other competitors negatively affect the price that Colombian flowers attain in the US. It seems that the US was a buoyant market and conditions there affected the profitability of Colombian flowers.

Next, in Table 4, I proceed with the simultaneous instrumentation for flower and coffee shocks, as in Equation (5). This allows me to contrast shocks with different gender intensities. In Column (1) I replicate the flower shocks only. In Column (2) I instrument the coffee shocks. In Column (3) I instrument both flowers and coffee, simultaneously. Remarkably, I find that the rate of homicides is positively affected by coffee shocks—in clear contrast to what I found for flowers. This result is interesting in so far as positive coffee shocks had been shown to decrease the civilian conflict (Dube and Vargas, 2013), and yet, when

[29] Appendix Tables A.4, A.5 and A.6 show the corresponding 2SLS when I consider the extensive margin of flower cultivation (flower status), and when I use the growth in the value of exports (scale effect) as opposed to (log) prices. Results remain consistent when I use these alternative shocks.

considering unorganized violent crime, I find the opposite effect. Although the flower shocks lose their statistical significance in the simultaneous instrumentation, the magnitude of the coefficients remains fairly consistent.

Last, in Table (5) I analyze other violent crimes. These crimes include: property theft, burglary (residential theft), vehicle theft, commercial theft and kidnappings. The 2SLS results offer some mixed evidence on the impact of flowers on these other crimes but none of them is statistically significant.

5.4 Flower Shocks and Conflictual Violence

My goal now is to understand the correspondence between the female-friendly arrival of employment opportunities and the level of armed conflict experienced in their communities. Dube-Vargas established that positive coffee shocks reduced the incidence of the civilian conflict, via an opportunity cost mechanism. In terms of roses, I have conjectured from the conceptual framework that, to first order, they should not affect the civil conflict.

In Table 6, I apply the same empirical strategy to the study of civilian conflict. The table is divided into three panels: *Panel A* for the flower shocks, *Panel B* for coffee shocks, and *Panel C* for the simultaneous instrumentation of flower and coffee shocks. The outcomes include: the number of guerrilla attacks, paramilitary attacks, clashes, and casualties.[30]

In *Panel A*, I find that the flower shocks do not affect conflict. The flower shocks do not change the opportunity cost for males to join the illegal armed struggle, and thus it is not surprising that I do not observe any occupational shift (combatants giving up on the guerrilla warfare). If anything, a second-order decrease in conflictual violence might have occurred if males in flower households could now enjoy slightly more leisure in response to a positive flower shock. In *Panel B,* I replicate the Dube and Vargas results: coffee shocks significantly altered the course of the conflict. Last, *Panel C* proceeds to instrument both shocks simultaneously. Results remain robust.

5.5 Robustness Checks

I now begin a series of robustness checks. I first construct new samples for control municipalities. These include: (i) choosing control municipalities that are within a flower department; (ii) control municipalities matched using a 10-nearest neighbor match; (iii) control municipalities using a common support match; and (iv) control municipalities that share a geographical border with flower centers.[31] Table 7 reports the

[30]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).

[31]To help visualize the new sub-samples, Figure A.1a, in the Appendix, shows the graphical distribution of flower and non-flower municipalities in flower departments. Figure A.1b displays the flower municipalities and their neighboring non-flower

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), I use municipalities that are found within a flower department. Although results are no longer significant (there are only 615 municipalities), the magnitude of the 2SLS estimates remains very close to the full-sample result reported in Column (1). Continuing to Column (3), I use 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) I keep those non-flower municipalities that share a geographical border with flower ones.[32] The 2SLS results also remain significant with the control sample of neighboring municipalities. The descriptive statistics comparing the municipal-level covariates for these new control samples are provided in the appendix.

Next, I explore additional characteristics that could have led to differential violence trends. In Table 8, Column (1), I include differential trends by department. In Column (2) I 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 violence is meant to address any mean-reversion concerns, while the measure of rurality serves to eliminate differential trends for rural communities. Last, Columns (3)-(5) impose different restrictions based on population.[33] My estimates remain unchanged and significant. In Column (6) I leave out of the sample those municipalities that had an average population of more than 250,000 people throughout the sample—excluding the big urban centers does not affect the estimates.

I next present a falsification exercise in Table 9. I analyze the impact of flower shocks on two outcome variables that, in principle, should not have been affected by the arrival of flower jobs: the traffic death rate and the poison death rate.[34] Results show that flower shocks did not significantly affect either outcome.

Finally, I tentatively explore shocks to other agricultural commodities. I consider: cocoa, sugar cane, palm oil and bananas. All these agricultural commodities vary in their labor intensity, as seen in Table 10. I use the evolution of the international price for each of them, obtained from the International Monetary Fund commodity prices series, and proceed with an instrumentation strategy that takes into account the agronomic requirements for the cultivation of each of these crops. In Table 11, Column (1), I show the OLS coefficient estimates from the pooled regression. In Column (2) - (7), I show the 2SLS estimates for each commodity, separately. Though the evidence is mixed, results show that palm and cocoa, like coffee, also

municipalities.

[32] Additional, I tested for the presence of externalities in bordering, non-flower municipalities, but results were inconclusive.

[33] I compute the mean population for each municipality throughout the sample and establish different cutoffs to construct a sample of urban centers. This population thresholds allow me to leave out municipalities that were too rural, small, or isolated, and would have never seen the advent of the flower industry.

[34] Both causes of death are identified according to the International Classification of Diseases and Related Health Problem (ICD), and I compute the corresponding rate (adjusted per 100,000 inhabitants).

affect the homicide rates positively.

5.6 Elasticity of Violence to Local Shocks

There is a growing literature on the impact of local shocks on violence and conflict. Previous findings have made use of shocks to commodities with very different characteristics: illegal nature (coca shocks), labor intensity (coffee shocks), capital intensity (mining and oil shocks), and other non-commodity shocks (military aid). Table 12 attempts to harmonize the impact by computing the elasticity of various forms of violence to these local shocks. The results of this paper suggest that a 1 percent increase in the price of flowers leads to a -10.76 percent differential decrease in the homicide rate of flower suitable municipalities. By contrast, a 1 percent increase in coffee prices is associated with almost a 10 percent increase in the homicide rate (9.62). 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 marked difference between the impact of labor-intensive shocks (as the coffee results of Dube and Vargas, 2013), and the impact of oil or military aid shocks-—which lead to differential increases in conflictual violence via a rapacity effect (*ibid*).

6 Conclusions

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

The results that I find suggest that a 1 percentage point growth in the export price of flowers led to a differential decrease in the rate of homicides by -0.08 fewer homicides per hectare, in municipalities suitable for flower cultivation. The same flower shocks 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. My results for coffee on unorganized crime leave me 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. In addition, they strengthen the bargaining power of females, thereby reinforcing her preferences and exercise of agency. 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 have shaped other contexts historically: the arrival of females to cities in the American West is believed to have led to the "creation of an environment better suited to their interests" (*ibid*),[35] one where violence did not reign.

My results have a particular bearing on the debate over trade reforms. They show that fostering trade agreements, which increase employment opportunities for females, can become a deterrent for unorganized violence. This is particularly revealing in the context of Colombia, where anecdotal evidence encountered in the media had argued in favor of strengthening commercial ties as a means to "provide jobs for some of those now recruited into the paramilitary organizations".[36] I have shown in this study that the flower jobs did not prevent the males from joining the illegal armed conflict, but did contribute to decrease unorganized violent crime. Advancing female-friendly employment opportunities might be a key element for achieving peaceful economic prosperity.

[35]Including men "abandoning their brawling and boozing" (page 105).

[36]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

References

[1] Amador, Diego, Raquel Bernal, and Ximena Peña. 2012. "The Rise in Female Participation in Colombia: Children, Education or Marital Status". Background Paper. The World Development Report 2012. World Bank.

[2] Ambrus, Steven. 1994. "International Business : U.S. Ruling a Thorn in Colombian Rose Growers' Side : Trade: Commerce Department decision imposes punitive anti-dumping levies". Los Angeles Times, October 20, 1994. Accessed June 17, 2015. http://articles.latimes.com/1994-10-20/business/fi-52664_1_colombian-rose

[3] Angrist, Joshua D., and Adriana Kugler. 2008. "Rural Windfall or a New Resource Curse? Coca, Income, and Civil Conflict in Colombia". *The Review of Economics and Statistics*. MIT Press, Vol 90 (2), pages 191-215.

[4] Becker, Gary. 1968. "Crime and Punishment: An Economic Approach". *The Journal of Political Economy*, 76, 169-217.

[5] Becker, Gary. 1993. "Nobel Lecture: The Economic Way of Looking at Behavior". *The Journal of Political Economy*, 101:3, 385-409.

[6] Bardhan, Pranabh, and Christopher Udry. 1998. *Development Microeconomics*. Oxford University Press. New York, U.S.

[7] Blattman, Christopher, and Edward Miguel. 2010. "Civil War". *The Journal of Economic Literature*, 48:1, 3-57.

[8] Browning, Martin, P. Chiappori, Y. Weiss. 2014. *Economics of the Family: Cambridge Surveys of Economic Literature*. Cambridge University Press.

[9] Center for International Security and Cooperation (CISAC). 2015. Revolutionary Armed Forces of Colombia - People's Army. Mapping Militant Organizations. Retrieved on June 1st, 2015. http://web.stanford.edu/group/mappingmilitants/cgi-bin/groups/view/89

[10] Cubides, F., A.C. Olaya, C.M. Ortiz. 1998. *La violencia y el municipio colombiano: 1980-1997*. Centro de Estudios Sociales. Bogotá, Colombia. Utópica Ediciones.

[11] Dube, Oeindrila, and Suresh Naidu. 2014. "Bases, Bullets and Ballots: The Effect of U.S. Military Aid on Political Conflict in Colombia". NBER working paper 20213.

[12] Dube, Oeindrila, and Juan Vargas. 2013. "Commodity Price Shocks and Civil Conflict: Evidence from Colombia". *The Review of Economic Studies*, 80:4, 1384-1421.

[13] 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

[14] Editorial. "Pass the Colombian Trade Pact". *New York Times*, November 18, 2008. Accessed January 17, 2014. http://www.nytimes.com/2008/11/18/opinion/18tue1.html

[15] Elson, D. and Pearson, R. 1981. "Nimble fingers make cheap workers: An analysis of women's employment in third world export manufacturing". *Feminist Review*. 7, Spring: 87-107.

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

[17] Figueroa, Alicia, Adriana Lima and Elizabeth McCraken. 2012. "Are Colombian Flowers Experiencing a US drought?". Knowledge@Wharton article series. Wharton School of the University of Pennsylvania.

[18] Friedemann-Sánchez, Greta. 2006. *Assembling Flowers and Cultivating Homes: Labor and Gender in Colombia*. Lanham: Lexington Books, 2006.

[19] Gaviria, César. "The Americas: To Save Colombia from Cocaine, Buy Its Roses". *The Wall Street Journal* US Edition, November 2, 1990. Accessed October 10, 2013. Retrieved from Factiva INC.

[20] Heath, Rachel, and A. Mushfiq Mobarak. 2012. "Does Demand or Supply Constrain Investments in Education? Evidence from Garment Sector Jobs in Bangladesh". Working Paper.

[21] Ksoll, Christopher, Rocco Macchiavello and Ameet Morjaria. "Guns And Roses: Flower Exports and Electoral Violence in Kenya". R&R at Review of Economics and Statistics. 2014.

[22] Kristof, Nicholas D. "Better Roses Than Cocaine". *New York Times*, April 24, 2008. Accessed October 12, 2013. http://www.nytimes.com/2008/04/24/opinion/24kristof.htm

[23] Lipton, E. and S. Weisman. "Wide Net Cast by Lobby for Colombia Trade Pact". *New York Times*, April 8, 2008. Accessed January 17, 2014. http://www.nytimes.com/2008/04/08/washington/08lobby.html

[24] Mammen, Kristin, and Christina Paxon. 2000. "Women's Work and Economic Development". *The Journal of Economic Perspectives*, 14:4, 141-164.

[25] Marín Ángel, M.J. , and J.E. Rangel Aceros. 2000. "Comercialización Internacional de Flores: Antecedentes y Evolución 1990-1999". Dissertation, Universidad Nacional de Colombia.

[26] Meier, Verena. 1999. "Cut-Flower Production in Colombia: A Major Development Success Story for Women?". *Environment and Planning*. A 31: 273 – 89.

[27] Mejía, Daniel, and Pascual Restrepo. "Bushes and Bullets: Illegal Cocaine Markets and Violence in Colombia". 2014. Working Paper.

[28] Méndez, José. 1991. "The Development of the Colombian Cut Flower Industry". Working Papers on Trade Policy, WPS 660. The World Bank.

[29] Miller, Grant, and B. Piedad Urdinola. 2010. "Cyclicality, Mortality and the Value of Time: The Case of Coffee Price Fluctuations and Child Survival in Colombia". *Journal of Political Economy*. 118: 1, 113-155.

[30] Ministry of Agriculture and Rural Development and Asocolflores. 2008. *Colombian Grown: The Finest Quality Cut Flowers in the World*. Diseño Editorial.

[31] National Federation of Coffee Growers of Colombia (Federación Nacional de Cafeteros de Colombia). http://www.federaciondecafeteros.org/particulares/en/

[32] Neumayer, Eric. 2005. "Commentary: The Economic Business Cycle and Mortality". *International Journal of Epidemiology*. 34: 6, 1221-1222.

[33] Passell, Peter. "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

[34] Pinker, Steven. 2011. *The Better Angels of Our Nature*. New York: Viking.

[35] Talcott, Molly. 2004. "Gendered Webs of Development and Resistance: Women, Children, and Flowers in Bogotá". *Signs*. 29:2, 465-489.

[36] United Nations Department for Policy Coordination and Sustainable Development (DPCSD). Promotion and Protection of the Rights of Children: Impact of Armed Conflict on Children. 1996.

[37] United Nations Office on Drugs and Crime (UNODC). Databases. http://www.unodc.org/gsh/en/data.html

[38] United Nations Office on Drugs and Crime (UNODC). 2011. Global Study on Homicide: Trends, Contexts, Data.

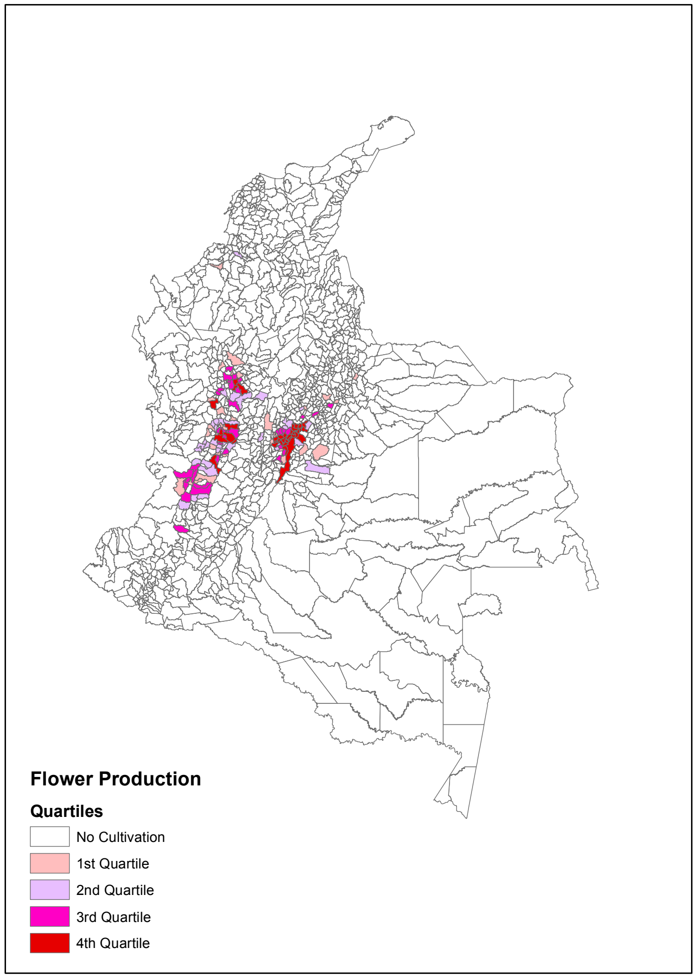
[39] United Nations Office on Drugs and Crime (UNODC). 2013. Global Study on Homicide: Trends, Contexts, Data.

[40] Urrutia, Miguel. 1985. *Winners and Losers in Colombia's Economic Growth of the 1970s*. New York: Oxford University.

[41] Vargas Meza, Ricardo. 1998. "The FARC, the War and the Crisis of the State". NACLA Report on the Americas, 31:5, 22-28.

[42] World Health Organization (WHO). 2006. Interpersonal Violence and Alcohol. WHO Policy Briefing.

Figure 1: Distribution of Flower Municipalities



Map with the municipalities of Colombia. I identify the municipalities cultivating flowers as of 2007, and categorize them by the intensity of flower cultivation. The flower municipalities are those municipalities that have at least one flower farm, cultivating a positive number of flower hectares, $hectares > 0$. *Sources:* Shape-file from DANE; flower hectare distribution from the Ministry of Agriculture and Rural Development. Demographic and Health Surveys (DHS).

Figure 2: Flower Industry Performance

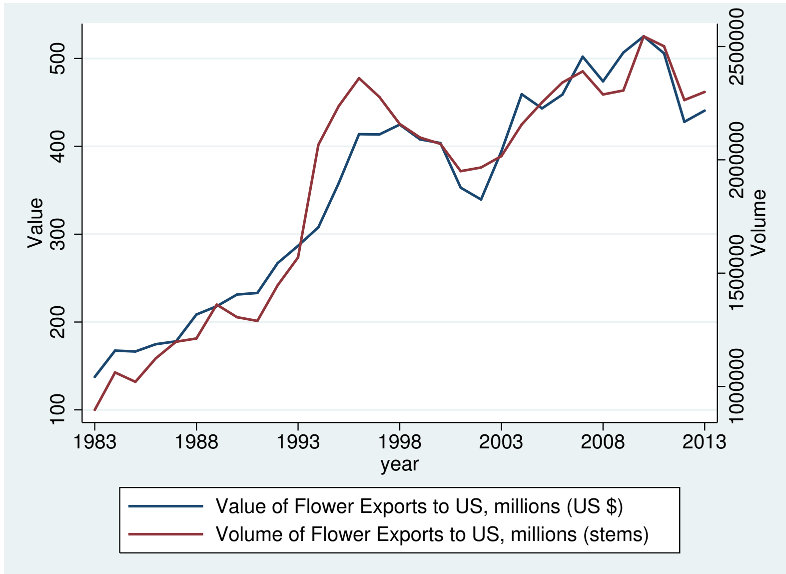


Figure 2a: Value and Volume of Flower Exports

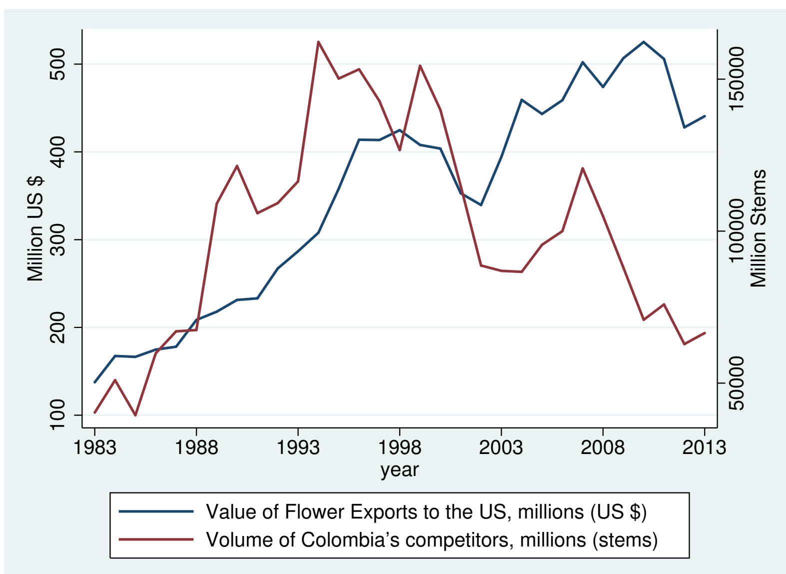


Figure 2b: Volume of Flower Exports from Colombia's competitors

Top Figure shows the evolution of Colombian flower exports in terms of value and volume. The bottom figure overlaps the volume exported by Colombia's competitors in the US market. *Sources:* United States Department of Agriculture (USDA) - Agricultural Marketing Service for the temporal series on flower exports.

Figure 3: Flower Shocks and Differential Impact on Homicides

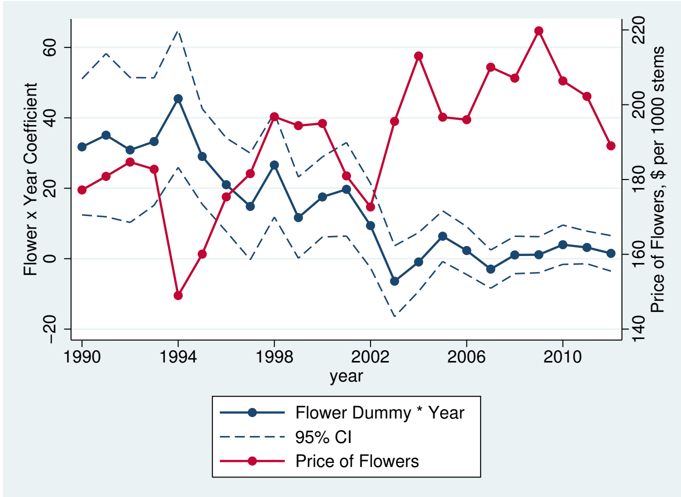


Figure 3a: Flower-Year Interactions and Flower Prices

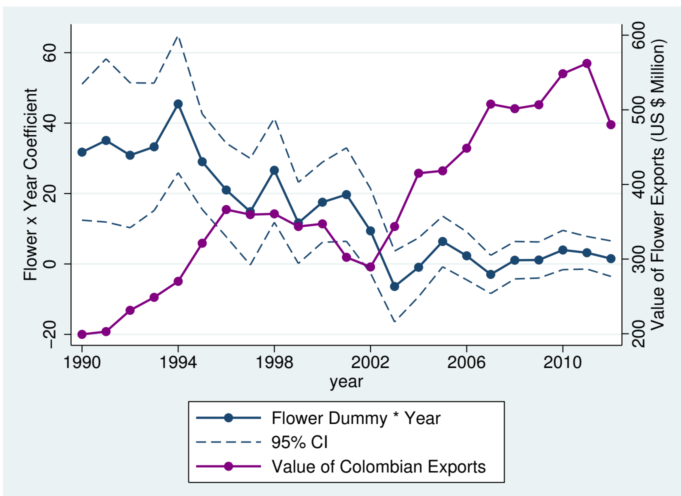


Figure 3b: Flower-Year Interactions and Total Export Value

Top 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. I overlap the evolution of the Colombian flower prices (US dollars per 1000 stems exported), shown on the secondary axis. Bottom Figure shows the same coefficient estimates, but I overlap the evolution of the total value of Colombian flower exports (US million dollars) to the US market, shown on the secondary axis. *Sources:* United States Department of Agriculture (USDA) - Agricultural Marketing Service for the temporal series on flower exports. Banco de la República for the currency series.

Table 1: Summary Statistics

	Non-Flower			Flower		
	Mean	SD	Count	Mean	SD	Count
Panel A: Violence Variables						
<u>Homicides</u>						
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
<u>Other Violent Crimes</u>						
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						
Flower Hectares (2007)	0	0	906	62.41	133.85	140
Number of Flower Firms	0	0	906	14.76	34.76	140
Coffee Hectares	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 (Million US$)	378	110	24			
Value Flower Imports by US (Million US $)	608	165	24			
Flower Stems Exported (Millions)	2090	351	24			
Flower Stems imported by US (Millions)	2600	485	24			
Internal Coffee Price (Colombian Pesos)	1345	820	24			
Coffee Exported by Colombia (1000s bags)	11498	2272	24			

Notes: The homicide outcomes in *Panel A* span the period 1990-2013. The other violent crimes cover 2003-2013. Conflictual violence outcomes in *Panel B* cover the period 1988-2005.

Table 2: Flower Suitability

	Flower Status		Flower Hectares	
	(1)	(2)	(3)	(4)
Coolness	0.194***		13.66***	
	(0.019)		(2.955)	
Hot		-0.195***		-12.97***
		(0.017)		(2.627)
Cold		-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 are reported in parentheses. OLS suitability results for flower cultivation. The outcome variables reflect both the extensive margin of cultivation, flower status, as well as the intensive margin, 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 as of the year 2007. Hectares corresponds to the number of hectares under flower cultivation. The 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. I add a dummy *Hot* for temperatures that exceed 24 Celsius and a dummy *Cold* for temperatures that are below 13 Celsius as alternative requirements.

Table 3: Flower Shocks on Homicides

Panel A: OLS and Second-Stage Results	(OLS)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	(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							
		Flower Hectares × (Log) Flower Price					
Coolness		-2.253***	-1.102***	-3.506***	-1.558***	-2.237***	-2.237***
× (Log) Export Volume of 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. The main regressor consists of the interaction between the number of flower hectares and the (log) price of Colombian flower exports. The instrument is made of the interaction between the volume exported by other competitors in the US market, and the *coolness* requirement for flower suitability (temperature criterion 13-24 Celsius). All value series are deflated by a price index. In Column (1) I report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the 2SLS results for the base specification. I 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. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal). 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. I also add 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.

Table 4: 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) 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. The 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. The sample period covers the years 1990 - 2013. All specifications include year and municipality fixed effects (FE). In Column (1) I report the 2SLS estimates where I instrument the flower intensity and (log) flower prices with the *coolness* requirement and the export volume of other main competitors that Colombia faces in the US market. In Column (2) I proceed to instrument the coffee regressor as in Dube and Vargas (2013), and use temperature and rainfall interacted with the volume produced by main worldwide coffee competitors. Column (3) reports the results of instrumenting both regressors simultaneously. I 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 series are deflated by the relevant price index.

Table 5: 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 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). The main 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. The 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: Flower and Coffee Shocks on Civil Conflict

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. I 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* I provide the 2SLS estimates for the interaction of flower prices and flower intensity; in *Panel B* I 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. I follow the Dube-Vargas instrumentation strategy for coffee using temperature and rainfall and interacting them with the volume produced by main worldwide competitors. In *Panel C* I instrument both endogenous regressors simultaneously. All specifications 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: 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) I report the 2SLS results for all the municipalities of Colombia. In Column (2) I 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) I keep as controls those municipalities that share a geographical boundary with the flower ones. All specifications include year and municipality fixed effects. I construct differential time trends for the remoteness of a municipality, altitude, presence of other main export commodities, historical experiences of violence. I also incorporate a regional linear time trend.

Table 8: Flower Shocks with Additional Controls

	(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) I include differential trends by department. In Column (2) I account for the initial level of violence in the sample (year 1990) and an index of rurality. In Columns (3) - (6) I impose different restrictions based on population cutoffs.

Table 9: Falsification Test: 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. International Classification of Diseases and Related Health Problems (ICD).

Table 10: 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*: 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 11: Other Agricultural Shocks

	(OLS)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Homicide Rate						
Flower × Log(Price)	-0.079	-6.754***					
	(0.054)	(2.301)					
Coffee × Log(Price)	-0.002*		0.442***				
	(0.001)		(0.107)				
Cocoa × Log(Price)	0.009***			0.046**			
	(0.003)			(0.022)			
Sugar × Log(Price)	-0.002				0.004		
	(0.002)				(0.018)		
Palm Oil × Log(Price)	-0.001					0.009*	
	(0.001)					(0.005)	
Banana × 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. I incorporate flower, coffee, cocoa, sugar, palm and banana shocks. I instrument for the presence of cocoa, sugar, palm oil and banana plantations with agronomic requirements.

Table 12: Elasticities for Different Types of Local Shocks

Computed Elasticity of Local Shock on Violence	2SLS Coefficient	Percentage Response	Paper Source
Homicide Rate			
Flower Price	-8.249*	-10.76	
Flower Value	-3.87*	-5.04	
Coffee Price	0.365***	9.62	
Coca Revenue	0.423***	0.423	Restrepo and Mejía (2014)
Conflict			
Coffee Price on Guer. Attacks	-0.611**	-1.9	Dube and Vargas (2013)
Coffee Price on Param. Attacks	-0.160***	-3.20	Dube and Vargas (2013)
Coffee Price on Clashes	-0.712***	-2.29	Dube and Vargas (2013)
Coffee Price on Casualties	-1.8282*	-1.47	Dube and Vargas (2013)
Oil Shocks on Guer. Attacks	0.7	0.12	Dube and Vargas (2013)
Oil Shocks on Param. 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)
Military Aid on Guer. Attacks	-0.266	-0.45	Dube and Naidu (2014)
Military Aid on Param. Attacks	0.305**	2.97	Dube and Naidu (2014)
Military Aid on Gov. 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 to obtain 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.

Appendix

Table A.1: Municipalities within Flower Departments

	Non-Flower			Flower		
Flower Departments	Mean	SD	Count	Mean	SD	Count
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: Descriptive statistics for municipalities that lie within a flower department. Flower departments are defined as departments for which the total departmental number of hectares > 0.

Table A.2: Control Municipalities Matched with 10-nearest Neighbor

	Non-Flower			Flower		
10-Nearest Neighbor Controls	Mean	SD	Count	Mean	SD	Count
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: The sample of non-flower producing municipalities was obtained using a 10-nearest neighbor match.

Table A.3: Neighboring Municipalities

	Non-Flower			Flower		
Neighboring Municipalities	Mean	SD	Count	Mean	SD	Count
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: The sample of non-flower municipalities is restricted to those municipalities that share a geographic border with flower producing centers.

Table A.4: 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 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. The main 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 series are deflated. The instrument is made of the interaction between the volume of flower exports of other top competitors faced by Colombia in the US market, and the *coolness* requirement for flower suitability (temperature criterion 13-24 Celsius). In Column (1) I report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the 2SLS base specification. I build upon this base specification by including differential time trends based on municipal characteristics (interacting the characteristic with year dummies). Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal). Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence and altitude. I also add a regional linear time trend.

Table A.5: 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) 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. The main 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 series are deflated. The instrument is made of the interaction between the volume of flower exports of other top competitors faced by Colombia in the US market, and the *coolness* requirement for flower suitability (temperature criterion 13-24 Celsius). In Column (1) I report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the 2SLS base specification. I build upon this base specification by including differential time trends based on municipal characteristics (interacting the characteristic with year dummies). Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal). Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence and altitude. I also add a regional linear time trend.

Table A.6: 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) 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. My main regressor of interest consists of the interaction between the flower status of a municipality (extensive margin) and the dollar (log) value of Colombian flower exports to the US. The total value of exports captures a scale effect (not adjusted by volume of production). All monetary series are deflated. My instrument is made of the interaction between 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) I report the OLS results for the base specification, which always incorporates year and municipality fixed effects. Column (2) provides the 2SLS base specification. I build upon this base specification by including differential time trends based on municipal characteristics (interacting the characteristic with year dummies). Column (3) accounts for remoteness of the municipality, incorporating separately distance to Bogotá and distance to the main market centre. Column (4) accounts for the presence of other export commodities (coffee, gold, petrol, and coal). Finally, Column (5) puts together all the municipal characteristics described in Columns (3)-(4), as well as a measure of historical violence and altitude. I also add a regional linear time trend.

Table A.7: Coffee Suitability

	Coffee Status	Coffee Hectares
	(1)	(2)
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: Flower *Coolness* on Coca Suitability

	Coca Status (1)	Coca Hectares (2)
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, *coolness*, affects coca cultivation. This captures whether the average annual temperature deemed to be optimal for flower growth 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 coca bushes at any point between 2000 and 2009. The coca hectares refers to the number of hectares under cultivation. I present this regression as a robustness check to assess whether flowers could be displacing coca cultivation.

Figure A.1: Additional Control Samples

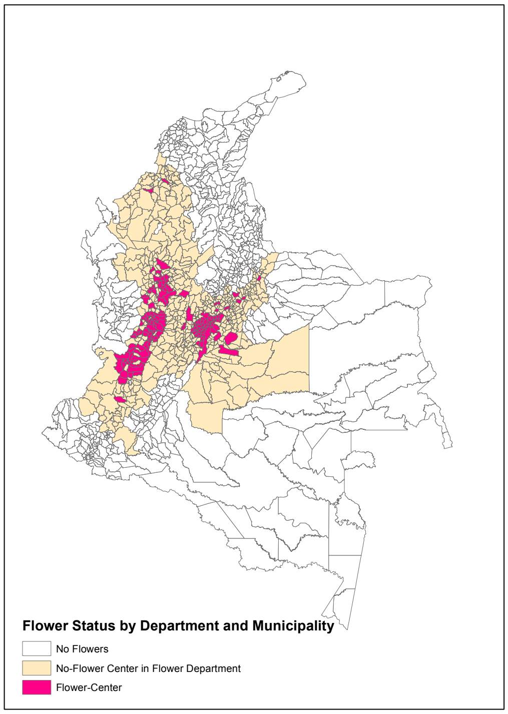


Figure A.1a: Flower Departments

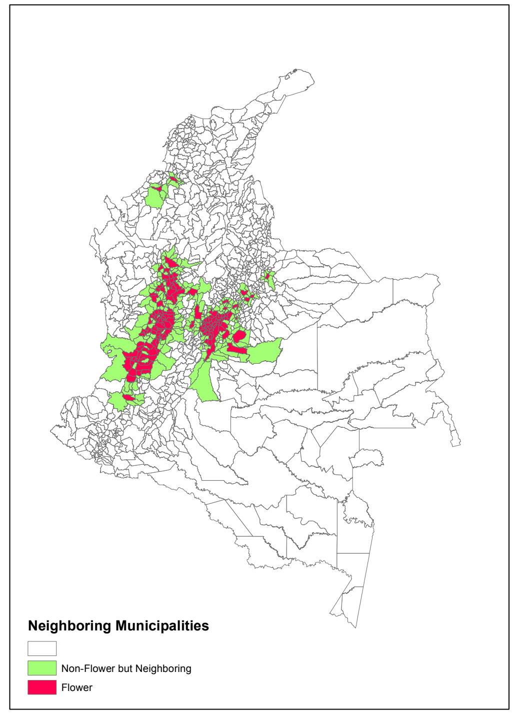


Figure A.1b: Neighbor Municipalities

The figure on the left shows the distribution of flower farms at the municipality level for the sample of departments that have flower presence. The right 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. Flower municipalities are identified as those municipalities that have at least one flower farm as of 2007. 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. *Source:* Shape-file from DANE; flower hectares distribution from the Ministry of Agriculture and Rural Development.

Figure A.2: Coffee and Coca Municipalities

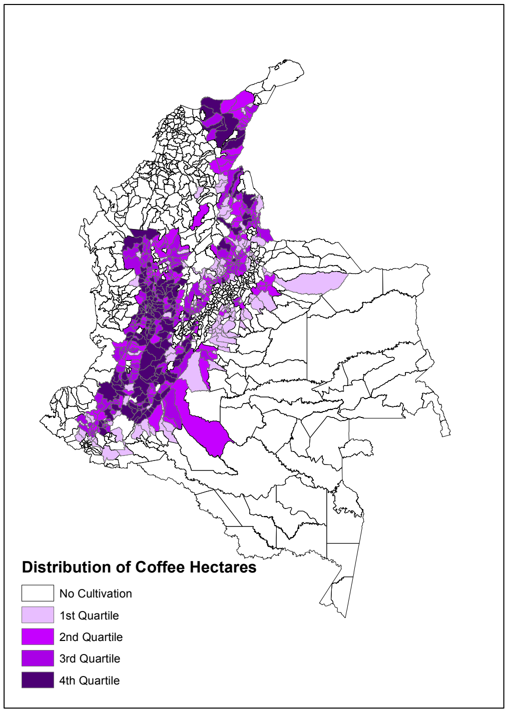


Figure A.2a: Coffee Municipalities

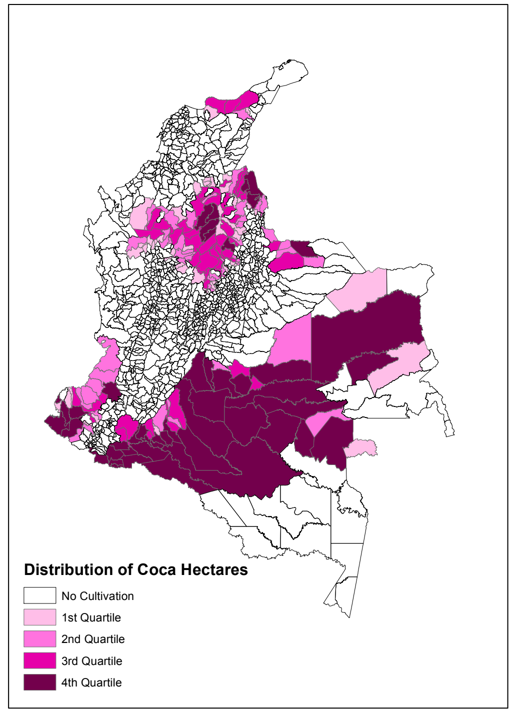


Figure A.2b: Coca Municipalities

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 1,300 hectares, approximately. 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.

Figure A.3: Homicide Rate - Mean and Standard Deviation

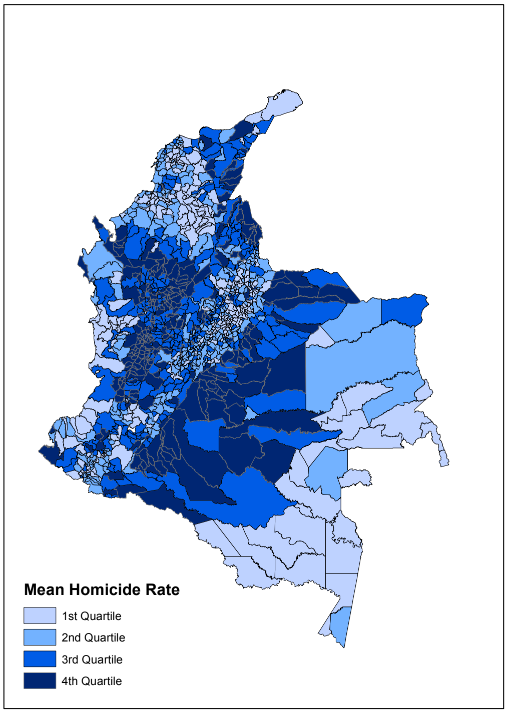


Figure A.3a: Mean Homicide Rate

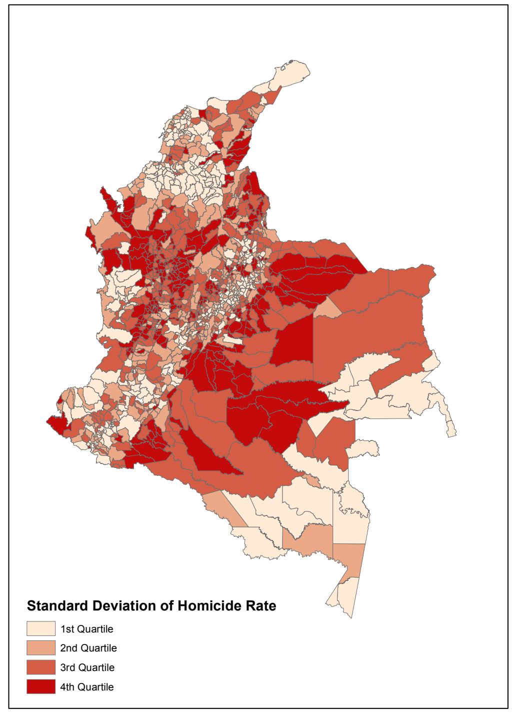


Figure A.3b: Standard Deviation

These figures categorizes the mean homicide rate and standard deviation of the homicide rate for the sample years 1990-2013. For each municipality I compute its mean homicide rate across the period and the corresponding standard deviation. The left panel categorizes municipalities according to their mean homicide rate. The right panel categorizes municipalities according to their standard deviation. These two figures allow me to identify the municipalities affected more intensively by homicides, as well as those that show the greatest variability in homicides throughout the period. *Sources:* Shape-file from DANE; violence outcomes from CEDE.