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Abstract

The “Resource Curse” posits a positive association between the value of natural commodities and civil conflict. In this paper, we suggest that the value-to-violence relationship differs across commodities, and that the factor intensity of production determines whether a rise in the price of a legally traded good will exacerbate conflict. We exploit exogenous price shocks for coffee and oil to test this hypothesis, using data on politically-motivated violence in Colombia over 1988 to 2004. We find that a drop in coffee prices during the 1990s led to a disproportionate rise in conflict in the coffee areas. Poverty dynamics follow a similar pattern, while substitution into drug crops do not, which suggests that it is the fall in income rather than the drug trade that fuelled this effect. In contrast, we find that oil prices are positively related to clashes with government forces, and that state revenue is used to strengthen military presence in oil areas. Our results suggest that the income channel is critical in determining how price shocks to labor-intensive commodities affect insurgency. However, for capital-intensive goods, the revenue effect predominates in mediating how the value of the commodity affects violence.

JEL Classification: D74, Q1

Keywords: Colombia, Civil War, Resource Curse, Difference-in-Differences

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1 Introduction

The question of whether natural resources are a 'curse' for developing nations has long been a concern for development economists. The first branch of this literature builds on the seminal work of Sachs and Warner (1995) to demonstrate that commodity dependence reduces economic growth (Tornell and Lane, 1999; Sachs and Warner, 1999; Mehlum, Moene and Torvik, 2006).[1] However, a more recent branch has explored whether resources promote conflict, a notion that has been coined the 'resource-curse' hypothesis of the civil war literature. The resource curse perspective posits a positive association between dependence on valuable natural commodities and the incidence of civil war (Collier and Hoeffler, 2004). A rise in commodity prices is thus postulated to fuel greater conflict in war-torn nations.

In this paper we investigate the value-to-violence relationship empirically using within-country data, and find that some commodities exhibit the resource curse, while others do not. The factor intensity of the production technology is a key determinant of whether a price increase exacerbates or mitigates civil conflict. We exploit exogenous changes in the international price of coffee and oil to test this hypothesis for Colombia, where a civil war has persisted for over four decades. We use a unique event-based dataset which details the incidence and intensity of politically-motivated violence in over 1,000 municipalities, from 1988 to 2004.[2] This time period is well suited for the analysis since Colombia witnessed a dramatic escalation in conflict during the 1990s. Although there were a multitude of reasons behind this escalation, our identification strategy enables us to isolate the effect of shocks in the price of oil, Colombia's largest export, as well as shocks in the price of coffee, Colombia's third largest export.

Over 1998 to 2003, supply increases by Brazil and Vietnam drove down coffee prices by 73 percent in the global market, spurring the 'international coffee crisis,' when real coffee prices reached a historic low. We combine this exogenous price shock with geographic variation in the intensity of coffee cultivation across Colombian municipalities, which is determined largely by climactic conditions. Using a *difference-in-differences* estimator, we find that declines in the price of coffee have increased both the incidence and intensity of politically-motivated violence in municipalities that are more coffee-intensive, relative to those that

[1] The mechanisms linking resource abundance and economic growth are, however, more contested. For example, while Sachs and Warner emphasize the importance of Dutch Disease-type effects, other authors have proposed explanations that highlight the importance of institutions (Mehlum et al., 2006; Robinson, Torvik and Verdier, 2006).

[2] A municipality is approximately the size of a US county. There are approximately 1,120 municipalities included in our final sample.

are less dependent on coffee. Poverty dynamics follow the same pattern, rising disproportionately in coffee regions during the crisis period, which suggests that the coffee shock fuelled conflict by reducing income levels and lowering the opportunity cost of supporting rural-based illegal armed groups.

While coffee prices plummeted, oil prices increased sharply during the late 1990s. In contrast to coffee, we find that there is a *positive* relationship between oil prices and violence: when the petrol price increases, the civil war intensifies disproportionately in municipalities containing oil reserves and pipelines. Because oil prices affect clashes involving government forces but do not appear to affect one-sided attacks by illegal armed groups, we posit that an increase in the price of oil raises government revenue, which fuels conflict by financing military expansion. The contrasting evidence on coffee and oil suggests that an increase in the value of a commodity is not necessarily associated with greater violence, as implied by the resource-curse hypothesis.

Collier and Hoeffler (1998 and 2004) were the first to demonstrate a positive correlation between the ratio of primary commodity exports to GDP and the incidence of civil war in a cross-country study. They suggest that rebels use stolen rents from the export of commodities to finance their armed struggle. However, this ratio aggregates all natural commodities including agricultural goods, but does not include illicit drug crops and illegally traded goods such as diamonds, which are more commonly associated with civil war.[3] Thus, the measure largely reflects cash crops such as coffee, cocoa and wheat, as well as oil production. As shown by Fearon and Laitin (2003) and Fearon (2005), the Collier-Hoeffler result appears to be driven largely by the oil-exporting nations. These authors also suggest a different channel explaining this positive association, namely that oil exporters have weaker bureaucratic capabilities relative to other countries of a similar income level.[4] However, oil may fuel conflict by strengthening (rather than weakening) state capacity, since governments tax oil extraction and this revenue may be used to finance military operations. Although oil cannot be looted easily by rebels unless they gain control of the national distribution system, there may be additional channels through which insurgents exploit oil rents, including extortion of oil corporations, which has been a common strategy in Colombia's civil war. Thus, the literature to date has found evidence of a resource curse for petroleum commodities, but has not definitively established the mechanism through which oil rents translate into civil

[3] However, Lujala, Gleditsch and Gilmore (2005) find little support for a positive link between the presence of diamonds and the likelihood of war.

[4] Based on a case-by-case analysis of thirteen recent civil wars, Ross(2004) also finds that oil increases the likelihood of conflict, but legal agricultural commodities do not.

conflict.

The resource curse hypothesis seems less plausible for agricultural commodities. Financing through direct rebel looting is unlikely since agricultural goods are bulky and difficult to transport, and it is rare that insurgents gain control of state exporting structures. Although agriculture may also be taxed by governments and rebels operating in rural areas, the value of agricultural commodities has rarely risen sufficiently in international markets to finance insurgencies. In contrast, increases in agricultural commodity prices raise the income of rural producers, and higher income levels have been argued to reduce conflict by raising the opportunity cost of joining armed rebellion (Grossman, 1991). While earlier cross-country studies examining the effect of income on conflict are subject to criticisms of reverse causality and potential bias due to omitted variables such as institutional quality, Miguel, Satyanath and Sergenti (2004) show that negative income shocks, instrumented by rainfall, substantially raise the likelihood of conflict in Sub-Saharan Africa. However, it is difficult to shed further light on the mechanism through which income affects conflict in cross-country studies, which remain subject to the criticism that the causes and characteristics of civil war may vary greatly from one country to another.

Although within-country studies may be better suited to detail potential mechanisms, the scarcity of conflict data has limited the use of this approach. Nevertheless, the few within country empirical analyses that have undertaken also tend to find a negative association between economic conditions and violence. For example, Deininger (2003) finds that low levels of human capital are associated with greater propensity for civil strife in communities across Uganda over 1992 to 1999, which suggests that communities experience more violence when workers are ill-equipped to take advantage of market opportunities. A rise in the share of coffee producers is also found to raise conflict, which in interpreted to mean that a rise in taxable wealth finances more rebel activity. However, given that coffee prices fell sharply during the latter half of this period (see Figure 1), it is equally plausible that an increase in the share of coffee farmers proxies for higher rates of poverty in the community, and that poverty drives the positive relationship between coffee dependence and violence over the period of the study. Barron, Kaiser and Pradhan (2004) also report a positive association between violence and unemployment as well as violence and income inequality in examining the correlates of local conflict in Indonesia. While these two studies construct measures of civil strife incidence based on interviews where households are asked to distinguish between attacks that were politically-motivated versus those that were not, Do and Iyer (2006) examine determinants of Nepal's civil war intensity, as measured by the number of conflict-related deaths at the district

level. Higher rates of pre-conflict poverty and lower levels of literacy are both associated with greater intensity of the Maoist insurgency, though causality cannot necessarily be inferred from the cross-sectional specification.

To the extent that an increase in commodity prices raises income, and income is believed to reduce conflict, the resource curse can be reversed if the income effect is large enough to counter the financing effect of a commodity price increase. Which effect dominates will depend on the characteristics of the commodity. Previous studies have focused solely on the 'lootability' of a good (and thus the potential strength of the financing effect). For example, Snyder and Bhavnani (2005) note that lootability depends on the good's physical characteristics and the nature of the extraction technology. In this paper, we posit that the factor intensity of the production technology is a key determinant of the relative strength of the income and financing effects for legally traded commodities. For example, if coffee is produced with a labor intensive technology and oil is extracted with a capital intensive technology, then the standard Stolper-Samuelson theorem predicts that an increase in international coffee prices will lead to larger proportional increase in the factor price of labor (wages), relative to an increase in the price of oil. Particularly in the context of peasant-based insurgencies, the relative increase in earnings associated with a labor-intensive agricultural commodity will raise the opportunity cost of supporting the rebel group. If this effect is sufficiently strong, an increase in coffee prices will lead to lower levels of conflict. In contrast, an increase in oil prices raises revenue available for hiring more armed recruits, but this effect will not be offset by associated wage increases, which suggests a positive association between prices and conflict.

Although it may seem intuitive that the price-violence relationship will differ by commodity, to date, no study has developed a framework explaining the nature of such differences, or presented definitive micro-empirical evidence on the causal mechanisms linking commodity prices to violence within a given country. In this paper, the use of within-country data allows us to test the mechanisms through which the price shocks affect civil war. To examine the idea that the coffee crisis raised conflict by lowering income and thus the opportunity cost of supporting armed groups, we show that the price drop raised poverty disproportionately in the coffee-growing areas. This is consistent with results in Miller and Urdinola (2006), who demonstrate that infant mortality decreases disproportionately in coffee regions during coffee price falls due to the lower opportunity cost of time, which facilitates more time-intensive health investments.[5] To test the role of revenue, we similarly assess the effect on public

[5]Miller and Urdinola (2006) use an empirical strategy that is very similar to the one employed in this

investment at the municipality level. Finally, we explore a mechanism that is specific to Colombia, namely, whether the fall in coffee prices raised the economic incentive to switch to high-return illicit crops such as coca, which is used to produce cocaine. This crop substitution could lead to a rise in conflict if armed groups move into traditionally coffee areas to control rents from drug production and trade. It is especially important to explore the latter hypothesis given a recent study by Angrist and Kugler (2005) which finds that coca-growing departments in Colombia witnessed a larger increase in violent deaths once coca production shifted from other Andean nations to Colombia in the early 1990s.[6] Moreover, numerous journalistic accounts have discussed how coffee farmers have turned to coca cultivation.[7] Our data shows a dramatic rise in coca cultivation during the period of the analysis, and we replicate the Angrist and Kugler finding at the municipality level using conflict-related data rather than vital statistics data, which confirms that coca is associated with a rise in violence in traditional coca areas after 1994. However, we find no evidence of disproportionate substitution toward coca in the coffee municipalities relative to the non-coffee municipalities, which indicates that illicit crop substitution is not the mechanism through which coffee prices have led to excess violence in the coffee regions.

In contrast to coffee, we find that the relationship of oil prices to violence is mediated through the effect on government revenue. We confirm that an increase in oil prices raises public investment disproportionately in the oil-producing municipalities, which is consistent with the notion that the government finances an expansion of security-related operations to protect oil pipelines through an increase in revenue. By establishing a positive association between oil prices and conflict, and a negative association between coffee prices and conflict, we present evidence for the idea that some resources are cursed, while others are not.

The remainder of the paper is organized as follows. Section 2 provides background in two areas. First, we discuss Colombia's civil war. Then we discuss the causes of the international coffee crisis and establish that international prices have been determined by factors exogenous to Colombia's coffee production during the period of our study, which is an important assumption for our empirical strategy. In Section 3 we describe the data and include descriptive statistics. In Section 4, we present the results for coffee and conflict, and

paper. However, these two papers were developed and written independently.

[6] Over 1,100 Colombian municipalities are aggregated into 33 departments, which are equivalent to US states.

[7] Several major newspapers have provided journalistic accounts of how falling coffee prices led farmers to switch to coca in Colombia and Peru, and to heroine poppies in Colombia and Nicaragua (Bose et al., 2001; Krauss, 2001; Wilson, 2001a; Wilson, 2001b; Fritsch, 2002).

empirically explore the mechanisms linking coffee prices to violence in Section 5. We present results on how oil price shocks have affected violence in Section 6. In section 7 we conclude, discuss policy implications and possible lines of research for the future.

2 Background

2.1 Colombia's civil war

Colombia's civil war involves left-wing guerillas, right-wing paramilitaries, and government forces.[8] The origins of the current insurgency lie in *La Violencia,* a civil war that took place from 1946 to 1966, when the country was radically divided in its support for the Liberal and Conservative parties. Guerilla groups active today were formed on the basis of leftist self-defense peasant organizations originally aligned with the Liberals during *La Violencia*. While most of these organizations surrendered their weapons when offered amnesty during the late 1950s, those who continued to operate were subsequently organized by the Colombian Communist Party.

2.1.1 The Guerillas

The Armed Revolutionary Forces of Colombia (FARC by its Spanish acronym) was formed in 1964. It describes itself as Marxist-Leninist and is estimated to have between 16,000 to 20,000 combatants, making it the largest guerilla in the world. The National Liberation Army (ELN) was formed in 1965 with support from the Cuban government, and is the second largest guerilla in Colombia, with 4,000 to 6,000 combatants. These two rival organizations are largely rural and have active supporters in the countryside. Both primarily target infrastructure and government military positions. However, they also carry out bombings and road blocks for extortion purposes, which often result in civilian casualties (Restrepo and Spagat, 2004). The oil pipelines are a major target for both organizations, especially ELN. Over 1992 to 2004, the guerillas bombed the pipelines more than 1,000 times, spilling 2.9 billion barrels of crude oil (Dunning and Wirpsa, 2004). Attacks are carried out partly in opposition to the foreign multinational presence in this sector, but the rebels also aim to deprive the state of revenue associated with petrol extraction. The extent of damage inflicted suggests success along these lines: between 1990 and 2005, the damage done to one major pipeline alone, the Caño Limon-Coveñas pipeline, was equivalent to 7 percent

[8] For a detailed account of the conflict see Rabassa and Chalk (2001).

of the Colombia's total export revenues (*ibid*). Even though the guerilla aim to destroy the pipelines, they are also financed by the extraction of oil rents, through kidnapping and ransom of oil executives, and 'war taxes' collected from oil companies under the threat of bombing pipelines. In fact, the revival of ELN in the mid-1980s was orchestrated through the extortion of several million dollars from foreign oil contractors, and the group continues to rely on this type of financing today.

Drugs are a major source of finance for the FARC, which is known to tax coca crops, and to control the production, processing and export of cocaine and heroine. The FARC also collects 'war taxes' from other businesses and agricultural producers in their areas of operation, which introduces the possibility that agricultural commodities may also play a financing role in the insurgency.

Throughout the 1970s and early 1980s, the conflict effectively served as a cold war proxy, with the Soviet block supporting the guerillas and the US supporting counter-insurgency efforts. Although the early 1990s was a period of low conflict intensity, the guerillas expanded their operations dramatically in the mid-1990s, when FARC successfully seized control of the drug trade after defeating the *Medellin* and *Cali* drug cartels, and both FARC and ELN scaled up the number of kidnappings. Due to concerns about the guerillas' rising military strength, former President Pastrana initiated peace talks with the FARC in 1998 and as a concession, ceded control over five municipalities in a demilitarized zone (DMZ) south of Bogotá. The DMZ was effectively controlled by the guerrillas for over four years of peace talks. From there, the FARC continued staging attacks during the negotiations, which were thus regarded as a failure. After several high-profile kidnappings in 2002, the talks were discarded completely and the government re-launched a military campaign to gain control over the DMZ. The current president, Alvaro Uribe, was elected on the basis of taking a harder line against the guerilla.

2.1.2 The Paramilitaries

The other major armed groups active in the civil war are the right-wing paramilitaries. The first paramilitaries were organized by the military during the late 1970s, when the armed forces took advantage of a law allowing self-defense organizations to arm the civilian population for combat against insurgents. Subsequently, rural elites formed private armies which emerged on a widespread scale during the eighties when drug lords started becoming landowners and facing extortion from the guerillas. The paramilitaries were declared illegal in 1989, after which the Colombian conflict technically became three-sided. However, the

vast majority of the fighting involves the guerilla against the military and paramilitary, and there are numerous allegations of collusion between the latter two groups.

In 1997, disparate factions (including drug traffickers, disaffected former members of the armed forces and victims of the guerilla) came together under an umbrella alliance called the United Self-Defense Groups of Colombia (AUC), which contributed substantially to the dramatic expansion of conflict-activity during the 1990s. In this period, the paramilitaries acquired notoriety for their attacks against civilians. They employed a strategy of targeting the 'human infrastructure' which involved assassinating individuals who were perceived to support the leftist guerillas. At the peak of their strength, they were described to have 12,000 members.

The paramilitary were financed heavily through the drug trade, as well as business owners and landlords who faced guerilla extortion. In addition, they have been hired by foreign oil companies to protect the pipelines, and Carlos Castaño, the head of the AUC was quoted telling a newspaper that the 'paramilitaries tax the multinationals as the guerillas do' (Dunning and Wirpsa, 2004). There have also been accounts of paramilitary factions stealing oil by drilling holes in the pipelines, which is another way in which oil rents may be used to finance Colombia's illegal armed groups (*ibid*). A major demobilization of the paramilitaries was initiated in 2003, in which legal concessions such as reduced jail time and protection from extradition were granted for disbandment, although the evidence is mixed as to how effective the campaign has been in disarming these groups.

2.2 The Coffee Crisis

Coffee prices were stable and relatively high during the period from 1963 to 1989, when the International Coffee Organization (ICO) set quotas for exporters on the basis of an agreement signed by the major coffee producing nations in 1962. As discussed extensively in Bates (1997), US support for coffee price stabilization was motivated by security interests, and served as a critical reason for the ICO's success: after the Cuban revolution, the US feared that low producer prices would spread 'Castroism' in the Latin American coffee nations, including Brazil and Colombia.

However, as a consumer nation, the US had little economic incentive to continue supporting higher coffee prices after the Cold War era, which contributed to the demise of the quota system in 1989. From 1989 to 1994, excess supply drove the real price of coffee to historically low levels, with export increases among all the major producers, including Colombia. A brief

recovery was triggered after an intense Brazilian frost episode in 1994, which reduced Brazil's exports. Although prices climbed between 1994 and 1997, they plummeted sharply starting 1997 when dramatic production increases in Vietnam and Brazil triggered what has come to be called the 'international coffee crisis' of the 1990s.

From 1997 to 2003, the real price of coffee fell by 73 percent, reaching its lowest value ever. The expansion in Vietnam was fuelled by an aggressive government-led strategy, including export subsidies initiated in 1995. According to ICO (2006) Vietnam's exports had climbed from 4,000 tons in 1982 to 850,000 tons in 2001. In fact, Vietnam overtook Colombia as the second largest coffee producer in 2000. Brazil increased its output in the wake of the 1994 frost, which motivated the government to promote planting in frost-free areas. The harvest of the additional output also coincided with a 66 percent devaluation of the Brazilian currency (the Real) in January 1999 which further boosted exports (Evangelist and Sathe, 2006). Brazilian coffee exports rose from 1 million tons in 1997 to nearly 1.7 million in 2002.

Figure 1 shows the evolution of the international real price of coffee and the exports of the three main producers for the period 1994-2004.[9] In the first part of our analysis, in sections 4 and 5, we choose to focus on these years since this is when coffee price shocks have been plausibly exogenous to Colombia's production. As discussed above, Colombia's coffee exports increased from 1989 to 1994, and thus may have contributed to the price fall over this earlier period. However, prices were exogenously high from 1994 to 1997 due to the Brazilian frost, and exogenously low after 1998 due to Brazil and Vietnam's supply increases. As indicated by Figure 1, Colombia's coffee exports have been relatively stable during this 10-year period, while prices have dropped dramatically. In fact, Colombia is the only one of the three producers where a rise in coffee exports is associated with a rise in international coffee prices, leading to a small *positive* correlation between the country's exports and the international price of coffee.

This is important for our analysis because it mitigates against the possibility of reverse causality driving the results. For example, if taxes on coffee production were used to finance violence, and an increase in coffee production fuelled greater conflict and lowered the price of coffee in international markets, then we might find a spurious negative relationship between these two variables. To rule out this possibility, in we instrument the internal price of coffee in Colombia with the exports of the other coffee producers in section 5.4. Using this strategy also allows us to use data from the entire period over 1988 to 2004 in Section 6.2.

A more subtle endogeneity problem would arise if governments in Vietnam and Brazil

[9] Figure 1 plots the price of Arabica, the Colombia-relevant coffee variety.

based their coffee-relevant policy decisions on violence levels in Colombia, which in turn would be related to international prices through Colombian coffee production levels. However, this is also unlikely as the Vietnamese government consistently promoted coffee throughout the 1990s, while Colombia's civil war fluctuated, ebbing during the early 1990s and rising again during the late 1990s (Restrepo, Spagat and Vargas, 2004). Moreover, the Brazilian government's decision to promote expansion into frost-free areas was related to technological advances such as new hybrid plants and mechanization that allowed coffee to be harvested from these regions (Oxfam, 2002), while the 1999 devaluation was a major policy change that followed on the heals of the East Asian financial crisis and massive speculative pressure in capital markets. In short, these governmental policies were unlikely to be motivated by Colombia's civil war.

3 Data

3.1 Data Sources

Our data comes from several different sources. We obtain the time series of coffee prices paid to Colombian coffee growers and the international price received by exporters from the National Federation of Coffee Growers (NFCG), a quasi-governmental Colombian institution that sets the internal price and oversees the taxation of coffee exports. The price series are graphed in Figure 2 in real terms. The international price is higher than the internal price because it includes transportation and marketing costs that have to be incurred by exporters as well as the "contribución cafetera" (coffee contribution), an export tax on coffee, the revenues from which accumulate in the National Coffee Fund (NCF). The NCF has been used by the NFCG as a policy instrument to stabilize prices against the effect of external shocks and to guarantee a minimum price paid to growers. Prior to 2001, the NFCG was able to enact a price floor by guaranteeing the purchase of all coffee which met quality requirements at this price (Giovannucci et al., 2002).[10] In January 2001, the price floor had to be abandoned because plummeting international prices had reduced revenues and bankrupted the NCF. In that year, the Colombian government began offering a direct

[10] A 'fair price' was calculated on the basis of the sales price and anticipated marketing costs to exporters. If this fair price fell below the price floor which was considered the minimum necessary for coffee farmers given average nation-wide production costs, the price floor would be offered instead. Because this daily NFGC price was posted publicly, private exporters and other purchasing agents used it as a benchmark for calculating their own prices.

subsidy to growers.[11] Even though these policies protected Colombian growers to some degree by reducing price volatility, Figure 2 shows that the internal price inclusive of both policies follows the same trend as the international price. In fact, the real internal price dropped to a historical low during the crisis. The 73 percent fall in the international price of coffee from its peak in 1997 to its nadir in 2003 translated into a 49 percent fall in the real internal price paid to growers.

Although the internal price reflects the actual degree to which producers were exposed to the coffee crisis, potential endogeneity may arise if the minimum internal price set by the NFCG responds to violence levels in the coffee regions. This is especially a concern given that the FARC list agricultural prices support as one of their policy objectives.[12] Thus, throughout the analysis, we instrument the internal price with the international price, which is exogenous to the dynamics of Colombia-specific violence.

We obtain data on coffee cultivation from the NFCG's National Coffee Census, a nationwide enumeration of all coffee growers conducted once over the 1993-1997 period. Colombia has over 1,000 municipalities, which we classify as coffee growing if they contain any coffee-producing units during this period.[13] In addition we have data on the hectares of land devoted to coffee cultivation which gives us a continuous measure of the coffee intensity of each municipality. Data for coca cultivation comes from two sources. For the year 1994, we have a measure of the hectares of land devoted to coca cultivation in each municipality from *Dirección Nacional de Estupefacientes*. For 1999 to 2004, we obtain an equivalent measure from the United Nations Office of Drug Control, which collects this data on the basis of satellite imagery. Data on other municipality-specific characteristics is from CEDE, an economic research center in Bogotá. This includes a time-varying measure of poverty, available for the period 1998 to 2002, which represents the percent of people who are eligible for free health care. From the National Planning Department (NDP) we also have time-varying data on public investment directed to each municipality, which we use as a proxy for state capacity in our analysis.

For the results on oil, we obtain data on the average FOB price of oil imports from the United States Energy Information Administration. We classify municipalities as oil-related

[11] The *AGC* subsidy, which is still in operation, activates when the price of parchment coffee is below US$.80/lb and it is proportional to the gap between this floor and the actual price.

[12] However, it is worth noting that we did not find any anecdotal evidence for the idea that the National Coffee Committee of the NFCG considers security issues in setting the internal price.

[13] A coffee-producing unit does not have any particular size. It is essentially a producer who grows coffee on a plot of land, small or large.

based on data from NDP, which tells us if the municipality has oil refineries or oil pipelines.

Finally, the conflict data comes from the Conflict Analysis Resource Center (CERAC by its Spanish acronym), a Bogotá-based conflict think tank. This dataset is unique in charting geographically-disaggregated conflict dynamics within a given country over a long period of time. The methodology for the dataset construction is described extensively in Restrepo et al. (2004), which also reports the aggregate dynamics of the conflict over time. The data is event-based, and covers over 21,000 civil-war related incidents over the period 1988-2005. For each event, the dataset records the date, location, type, perpetrator, and victims involved in the incident. In term of type, it records whether the incident was an uncontested *attack,* carried out by an identified politically-motivated armed group against a specific military or civilian target, or a *clash*, which involves an exchange of fire between two or more groups. In terms of perpetrators, it records whether attacks were carried out by the guerilla, the paramilitary or the government, and details the groups involved in a clash.[14] In terms of victims, it reports the number of casualties separately for combatants and civilians. The number of guerrilla attacks, paramilitary attacks and clashes give us municipality-level measures of the *incidence* of conflict, while the number of casualties give us a municipality-level measure of conflict *intensity.*

The dataset is constructed mainly on the basis of events listed in the annexes of periodicals published by two Colombian NGO's, *CINEP* and *Justicia y Paz.* Most of the event information in these annexes comes from two primary sources, a network of priests from the Catholic Church, with representation in almost all of Colombia's 1,120 municipalities, and over 25 newspapers with national and local coverage. The CERAC data includes every municipality that has ever experienced an attack or a clash based on these sources. The inclusion of reports from the Catholic priests, who are often located in rural areas that are unlikely to receive press coverage, broadens the municipality-level representation, giving us violence data for 966 municipalities in the country. CERAC follows a stringent regime to guarantee the quality and representativeness of the data. As a first step it randomly samples a large number of events and compares these against the original source, to check for correct coding from the annexes into the dataset. Second, it looks up a different random sample in press archives to confirm whether incidents should have been included in the annexes. This step checks the quality of the raw information provided by the NGO's, which turns out to

[14] The vast majority of attacks are carried out by the illegal groups, although there are very rare incidents of government attacks. Most clashes involve the government forces, although there are a few events when just the paramilitary and guerilla exchange fire.

be quite high. Third, the largest events associated with the highest number of casualties are carefully investigated in press records. Finally, without double-coding, CERAC complements the dataset with additional events provided in reports by human rights NGOs and by Colombian Government agencies.

3.2 Descriptive Statistics

Based on the 1997 National Coffee Survey, we classify just over half of the 1,120 municipalities as coffee producing, which gives us 581 coffee municipalities, and 539 non-coffee municipalities. Table 1 summarizes descriptive statistics for key variables in these two types of regions. The coffee municipalities are smaller in terms of population and have, on average, lower levels of public investment. This reflects the fact that most of the large urban centers are not coffee-producing.[15] The total land devoted to coffee production is 1600 hectares per municipality, while the average coffee farm size is 1.7 hectares. This shows that, on average, coffee farming in Colombia is characterized by smallholder production. We map the variation of the land devoted to coffee production across municipalities in Figure 5 to show that coffee production is not exclusively concentrated in one specific part of the country.

The average hectares of land devoted to coca is almost 10-fold larger in the non-coffee areas relative to the coffee areas. It is surprising to find this differential in mean coca production given extensive anecdotal discussions in the press about the extent to which coffee farmers have substituted toward coca in the years of the coffee crisis (see references in footnote 7). This will be analyzed further in the results subsection where we examine the mechanism through which coffee prices are linked to violence.

Mean poverty levels, as measured by the share of people eligible for free health care, are somewhat higher in the coffee municipalities relative to the non-coffee areas but this difference is very small. Government military initiative, as measured by the combination of government attacks and the number of clashes initiated by the government (i.e., clashes that do not respond to a previous attack in the same location within a narrow window of time) is very similar in the two sets of municipalities. Finally, for the aggregate period, all four measures of conflict are higher in the coffee regions. However, we begin the discussion of our empirical strategy by examining the mean levels of violence in the pre-coffee crisis and crisis years.

[15] However, these differences are not significant at conventional levels due to the large variation within both coffee and non-coffee municipalities.

4 Results: Coffee and Conflict

4.1 Identification Strategy

We begin by presenting a simple two-by-two table that describes the essence of our identification strategy. Table 2 reports the means of our four outcome variables in coffee municipalities and non-coffee municipalities for the period before the crisis (1994 to 1997) and the period of the crisis (1998 to 2004). Attacks by guerrilla groups are described on the top-left quadrant of the table. Before the crisis, the average number of guerrilla attacks per municipality was 0.55 per year in coffee-growing areas and 0.47 in non-coffee areas. This pre-crisis difference of 0.09 is not significant at conventional levels. Violence levels surged upward in both types of municipalities in the post-crisis period, but increased disproportionately in the coffee areas. Guerilla attacks increased by 0.21 more per municipality per year in the coffee growing regions, and this difference is significant at the 1 percent level. This *difference-in-differences* (DD) analysis summarizes the essence our empirical strategy. The results are similar for the other two measures of conflict incidence (paramilitary attacks and the number of clashes). For casualties, the results are even stronger in the sense that coffee municipalities had approximately 0.47 *fewer* casualties than non-coffee areas before the crisis, which is reversed in the crisis period. Table 2 also documents an overall increase in conflict activity in Colombia from 1998 to 2004. This trend has been described by Restrepo et al. (2004) and could be associated with a large set of explanations.[16] However, our empirical strategy allows us to estimate the impact of the world coffee crisis on conflict activity. Our results can be interpreted as causal under the assumption that violence levels would not have changed differently in coffee and non-coffee areas in the absence of the coffee price shock.

To investigate the validity of this assumption, we plot the four measures of violence over time in Figure 4, distinguishing between coffee and non-coffee areas. For this visual representation, we go back as far as our violence data allows, starting in 1988. Figure 4 shows that conflict incidence and intensity follow common trends in the two types of regions prior to the price shock, but diverge with the onset of the crisis. The northwest quadrant shows that the average number of guerilla attacks diverged in coffee and non-coffee areas in 1998, and that the gap starts closing in 2003, when the price of coffee begins its slow recovery (see Figure 2). The same pattern applies to the other three measures of political violence,

[16] We illustrate the magnitude of the violence upsurge in Figure 6 where we map the number of guerrilla attacks in every municipality for 1994 (before the start of the coffee crisis) and 2002 (the worst crisis year as measured by the level of the real coffee price).

although the divergence starts one year later, in 1999, for paramilitary attacks and clashes. For casualties, mean casualties in coffee regions overtake those in non-coffee regions starting 2000 and continue diverging over 2001 to 2002, which are the worst years of the crisis.

4.2 Benchmark DD

In this next section, we build on the visual representation in Figure 4 and generalize the result based on means in Table 2 into a regression framework. We estimate a DD model that includes both municipality and year fixed-effects, which exploits variation over time within a given municipality. In particular, the municipality fixed effect removes any unmeasured time-invariant municipality-specific characteristics that may be correlated with coffee production and political violence. For example, coffee tends to be grown in more rural areas where the bulk of attacks are targeted, and the terrain can be more hilly in coffee areas, which may confer strategic military advantage. In addition, year fixed effects control for arbitrary annual change in conflict levels. We estimate:

$$y_{it} = \alpha_i + \beta_t + (Coffee_i \times Crisis_t)\delta + X_{it}\phi + \varepsilon_{it} \quad (1)$$

where y_{it} is the measure of conflict incidence or intensity in municipality i and year t; α_i and β_t are the municipality-specific and year-specific effects respectively. $Coffee_i$ is a dummy variable that equals 1 for coffee-producing municipalities and $Crisis_t$ is a dummy variable that equals 1 for the years from 1998 to 2004. X_{it} is a vector of time-varying controls. In particular, it is important to control for the time-varying 'scale' of the municipalities. For this we use (the log of) population. The main quantity of interest is the coefficient on the interaction of the $Crisis$ and $Coffee$ dummies, δ. This is the DD estimate, or the differential increase in violence in coffee regions relative to non-coffee regions during the crisis.

Estimates for δ are presented in Table 3. In all specifications, we cluster the standard errors at the department level.[17] Given that Colombia's 1,120 municipalities are aggregated into 33 departments, this is a fairly stringent step which controls for any potential autocorrelation over time and across all municipalities within a given department. The coefficient is positive and significant at the 1% level for all four measures of political violence. On average,

[17] Bertrand, Duflo and Mullainathan (2004) point out that serial correlation may drive down standard errors in the DD context, particularly when the treatment changes very little within a unit over time. Our formulation of the price shock as a pre-crisis and crisis dummy variable is subject to this criticism. The standard errors reported in Table 3 are indeed bigger than those we obtain when failing to cluster at the department level (not reported).

guerrilla attacks increased by 0.31 more in coffee areas relative to non-coffee areas in the post-crisis years. This number is quite substantial considering that the annual mean of guerrilla attacks across all municipalities is 0.51 in the pre-crisis period. The equivalent DD estimate for paramilitary attacks is 0.12. Because the annual mean paramilitary attacks is 0.05 over 1994 to 1997, this coefficient actually implies a larger percentage change in paramilitary attacks, relative to guerilla attacks. The disproportionate upsurge in paramilitary activity in coffee areas helps account for the positive coefficient (of 1.68) in the casualties model, since the bulk of paramilitary attacks are massacres of civilians. Multiplied by 581 (the number of coffee producing municipalities in our dataset) this coefficient implies that the coffee region experienced 976 additional casualties per year, relative to the non-coffee areas. Finally, the DD estimate for clashes is 0.32 and should be compared with an overall pre-crisis average of 0.55, and translates into 186 additional clashes per year in the coffee municipalities.

4.3 Price and Coffee Intensity DD

One limitation of specification (1) is that it represents the coffee crisis as a single categorical variable and thus leads to potentially subjective classifications about which years should be included in the crisis period. For instance, the international price of coffee reverses its downward fall in 2003, which marks the beginning of a period of slow recovery (see Figure 2). Similarly, the use of the coffee municipality dummy doesn't account for the variation in the intensity with which coffee is cultivated in each municipality. In this section, we address the limitation of this simple DD framework in two steps. First, we exploit the full time-variation in our data and link the analysis more explicitly to the level of coffee prices by replacing the simple *Crisis* dummy with the continuous price of coffee. Second, we show that the results remain unchanged when we replace the *Coffee* dummy with a (continuous) measure of the coffee intensity of the municipality, as measured by hectares of land devoted to coffee production in the year before the start of the coffee crisis.

Table 4 extends the DD estimation presented in Table 3. In panel A, the treatment effect is now the interaction of the *Coffee* dummy and the price of coffee. The essence of this estimation strategy is to assess whether changes in coffee prices induce a differential change in political violence in coffee versus non-coffee municipalities. Therefore, we estimate:

$$y_{it} = \alpha_i + \beta_t + (Coffee_i \times CoffeePrice_t)\delta + X_{it}\phi + \varepsilon_{it} \tag{2}$$

where $CoffeePrice_t$ is the internal price *instrumented by the international price* in year t.

The results presented in panel A of Table 4 confirm those reported in Table 3. One again, we cluster the standard errors at the department level.[18] Note, however, that in contrast to Table 3, the signs on the estimated δ are now negative. The negative coefficient suggests that a *higher* coffee price translates into differential *declines* in conflict incidence and intensity in coffee municipalities relative to non-coffee municipalities, which is exactly analogous to a differential rise of conflict in coffee areas during the crisis years when the price of coffee was low. Contrary to the resource-curse argument which postulates a positive association between the value of primary commodities and civil strife, these results establish a negative association between coffee prices and politically-motivated violence in Colombia. The magnitude of the effect implied by the coefficients in panel A is again quite substantial, though somewhat smaller than those presented in Table 3. The cumulative additional guerrilla attacks per coffee-growing municipality due to the price fall over 1998-2003 is 1.1. The corresponding figure is 0.4 for paramilitary attacks and 2.0 for clashes. For casualties, the cumulative average additional casualties is 7.9 in coffee-growing areas over the period 1998-2003. Multiplied across the 581 municipalities of the sample in this regression, this translates into 767 additional lives lost per year in the coffee regions.

Thus far, we have assigned any municipality that grows any amount of coffee into the 'treatment' group through a simple indicator variable. In panel B of Table 4 we exploit cross-sectional variation in the intensity of coffee production, as measured by the hectares of land devoted to coffee cultivation during 1993-1997. The production structure represented by these quantities thus reflects the potential vulnerability of each municipality to the price shock and does not reflect the differential impact of the crisis on the amount of coffee cultivated in the growing areas in the post 1998 period. We estimate:

$$y_{it} = \alpha_i + \beta_t + (CoffeeQuantity_i \times CoffeePrice_t)\delta + X_{it}\phi + \varepsilon_{it} \tag{3}$$

where $CoffeeQuantity_i$ is the hectares of land devoted to coffee production in each municipality.[19] Our DD estimate is now the interaction between this variable and the (instrumented)

[18] Even though serial correlation will be less of a concern since coffee prices change over time within a given geographic unit, it is nonetheless important to account for the potential correlation of standard errors across municipalities within a department.

[19] Hectares of coffee production is the appropriate measure of intensity rather than hectares normalized by total land because the municipality could contain inhabitable areas. For example, consider two municipalities each with the same population, but one of which is entirely habitable while the second is only half habitable, with the habitable areas being of equal size. If all of the habitable land is devoted to coffee production in both municipalities, the normalized variable would inapproporately yield a coffee intensity that is half as large for the second municipality, relative to the first municipality. However, they should be classified as

internal price. Once again, the coefficient on the interaction term is significant at the 1% level for all of the conflict measures. Considering the fall in the internal price of coffee from 1998 to 2003, a municipality with the mean coffee intensity within the coffee regions experienced 0.6 additional guerilla attacks, 0.3 additional paramilitary attacks and 0.8 additional clashes. The coefficient for casualties implies 4.2 additional deaths in the average coffee municipality for the 1998-2003 period.

4.4 Potential Confounding Factors

4.4.1 Controlling for *Plan Colombia*

In this section, we explore the possibility that other regime changes contemporaneous with the coffee crisis may have induced a differential change in the violence levels of coffee versus non-coffee areas. First, we address the possible confounding effect of *Plan Colombia,* a US-backed aid package launched in 2000 that was initially directed toward eradicating coca and poppy crops. As we will show in section 5.2, coca strongholds and core coffee areas have traditionally had little overlap in Colombia. If coca production is associated with more violence (see Angrist and Kugler, 2005), this raises the possibility that a successful eradication program may be accompanied by a reduction of violence in the non-coffee regions. In other words, our results may reflect an eradication-induced reduction in the violence level of the 'control' group rather than a coffee-induced rise in violence within the 'treatment' group.

To control for this potential contamination, we include the interaction of pre-crisis coca intensity with the price of coffee as an additional control.[20] We estimate:

$$y_{it} = \alpha_i + \beta_t + (CoffeeQuantity_i \times CoffeePrice_t)\delta + (CocaQuantity_i \times CoffeePrice_t)\eta + X_{it}\phi + \varepsilon_{it} \quad (4)$$

where *CocaQuantity* is the hectares of land devoted to coca cultivation in 1994 and is thus a measure of the municipality's coca intensity prior to the policy change. Thus, the interaction between this variable and the price of coffee controls for any differential changes

having the same intensity, because ultimately, what we are trying to capture is coffee production per capita. In the absence of production data, the land devoted to coffee production with a control for log of population on the right hand side is the best approximation.

[20] The coca intensity variable is a municipality-specific measure of the land devoted to growing coca in 1994.

in violence in the traditional coca areas that were contemporaneous with changes in coffee prices. Panel A of Table 5 reports the results from estimating this specification. First, the interaction of the coca intensity with coffee price is of interest on its own. If *Plan Colombia* reduced violence in the (pre-coffee crisis) coca regions, we should see a positive and significant DD estimate for this interaction. Moreover, if this effect were driving our previous results, then the coefficient on the coffee intensity interaction should fall in magnitude and possibly in terms of significance. Comparing the coefficient on the coffee intensity interaction in Panel B of Table 4 and Panel A of Table 5 shows that for all violence outcomes the coefficient estimates remain significant. For casualties, guerilla attacks and paramilitary attacks the coefficients are reduced slightly in magnitude. However, for clashes, the magnitude actually increases. An examination of the DD coefficient for coca in Panel A of Table 5 explains this outcome. First, this coefficient is only significant for clashes and casualties. It actually has a *negative* sign for clashes, indicating that clashes *increased* disproportionately during the coffee crisis in coca-producing municipalities. This, in turn, explains why the DD estimate on coffee actually increases in magnitude after we include the coca control in the clashes model. As for casualties, the DD estimate on coca does indeed suggest that casualties fell in the control group during the coffee crisis, but this effect only reduces the magnitude of the originally estimated DD effect by 12 percent. One plausible interpretation of the opposite coefficients in these two models is that more military was stationed in the traditional drug crop areas as a result of *Plan Colombia* (during the coffee crisis years), which resulted in more clashes but also reduced casualties by limiting the activity of illegal armed groups in these areas.

4.4.2 Eliminating Municipalities Affected by 1999 Earthquake

Panel B deals with the potentially confounding effect of a major earthquake which hit the heart of the coffee producing regions in 1999. Theoretically, the earthquake may upward or downward bias the estimated coefficient. On the one hand, illegal groups may have decided to take advantage of the chaos generated by the earthquake and the availability of relief resources to predate upon the state and launch more attacks in earthquake-affected municipalities, which would exert an upward bias on our results. On the other, illegal groups might refrain from attacking towns that were recently affected by a natural disaster, in which case including the earthquake affected municipalities would downward bias the results. Thus, we estimate model (3) after eliminating the 27 municipalities affected by this disaster, which are all coffee-producing. The resulting DD coefficients are slightly higher for

all conflict measures, except for paramilitary attacks (Table 5, panel B), which suggests that the predation story is unlikely, and that previous results were, if anything, downward biased. However, the difference with the benchmark estimates presented in Table 4 is not significant for any of the four measures at conventional levels.

4.4.3 Controlling for Department-Specific Linear Time Trends

If violence has different degrees of persistence over time due to unobserved region-specific factors, then the results may be subject to bias due to potential omitted variables. We control for this by including linear time trends for each department. We estimate:

$$y_{its} = \alpha_i + \beta_t + t\gamma_s + (CoffeeQuantity_i \times CoffeePrice_t)\delta + X_{it}\phi + \varepsilon_{its} \quad (5)$$

where γ_s is the coefficient of the time trend for department s. We report the results in panel C of Table 5. The DD coefficient remains significant in all four models, although the size and level of significance are mitigated for guerrilla and paramilitary attacks, relative to those presented in Panel B of Table 4. The implied impact on these variables for an average coffee-municipality in cumulative terms for the period 1998-2003 is 0.46 additional guerrilla attacks and 0.19 additional paramilitary attacks.

4.4.4 Addressing Change in Government Regimes

Finally, we address the issue that the rise in violence coincides with the time of the peace talks from 1998 to 2002, while the ebb in violence begins in 2003 when Uribe's hard-line government took over. If one makes the additional assumption that the coffee areas are more strategically valuable because they are centrally located within the country (see Figure 5), then this introduces the possibility that it was the weaker stance of the Pastrana government (rather than low coffee prices) that resulted in greater violence in the coffee areas. However, the peace talk years do not seem to be associated with a retraction of military power, since the dynamics of government clashes follow the same trend as the attacks by illegal groups, rising from 1998 to their peak in 2002, but declining after 2003 (see Figure 4). If the government was retracting during this period, we would expect to see a rise in attacks by illegal groups along with a decline in government-related clashes. To explore this hypothesis further, we create a new variable that represents government military activism. This variable combines very rare incidents of government attacks with clashes that are not carried out in response to a previous attack but rather are actively initiated by the government, which is a distinction

recorded within our conflict dataset. First, we look at the mean of this variable throughout our sample and confirm that it increased each year from 1998 to 2002, and like the other conflict measures, declined during the start of the Uribe regime in 2003. Then, we re-estimate equation (3) with government military initiative as the outcome variable, and eliminate the Uribe years (2003 and 2004) from the analysis. The results, summarized in Panel C of Table 5, show a significant negative coefficient on the coffee interaction term, confirming that when the price of coffee fell, conflict incidence initiated by state forces increased disproportionately in the coffee areas, which runs counter to the notion that the Pastrana government scaled down military presence in the strategic coffee municipalities. Thus, we find little evidence behind the idea that changes in government regime are driving the results.

4.5 Instrumental Variables DD

4.5.1 Instrumenting Coffee Price with non-Colombia Exports

In this section, we address potential endogeneity in coffee prices. In the analysis so far, we have instrumented the internal price of coffee with the international price as it is possible that the internal price may reflect local conditions correlated with violence levels. However, if Colombia's coffee export levels are affected by violence and also influence the international price, this would raise a concern of potential reverse causality. *A priori*, a bias of this form could go in either direction. The estimate would be upward biased (in absolute value) if taxing coffee producers were an important source of finance for the illegal groups, and a rise in coffee production were used to finance more violence and lowered the international price of coffee. On the other hand, the estimate would be downward biased (in absolute value) if violence results in lower coffee cultivation, which raises the international coffee price, mitigating the true negative relationship between prices and violence. We address this issue by estimating equation 2, but instrumenting the internal price of coffee with the exports of all coffee producers besides Colombia. The instrumental variables (IV) results are presented in Panel A of Table 6, and suggest that previous estimates were slightly downward biased in absolute value. A comparison to Panel A of Table 4 shows that the estimates in the instrumental variables regression are larger in magnitude for all four conflict measures. This suggests that if anything, less coffee is exported when violence escalates in Colombia.

4.5.2 Instrumenting Coffee Growing with Coffee-Ecology

In this subsection, we deal with the potential endogeneity of coffee production. By using the 1997 National Coffee Survey as the basis of our coffee measure, we treat coffee intensity as a time invariant feature of a municipality. However, coffee cultivation changes over time. A potential endogeneity concern may arise if the decision to grow coffee in 1997 were a response to previous conflict incidence, which in turn, may depend on previous periods of low or high coffee prices. Moreover, previous price regimes could also have a direct impact on how much coffee is grown in each municipality in 1997. For example, farmers may have stopped producing coffee in areas that witnessed high violence levels prior to 1997, and these municipalities may experience less conflict after 1997 if territorial control had already been achieved through previous fighting. Alternatively, if the most productive coffee farmers decided to continue planting coffee in 1997 while the least productive farmers stopped planting coffee in response to a previous low price period, then violence may increase in places with greater coffee intensity because the guerilla want to target areas where they can tax the most productive farmers.

To address these potential concerns, we instrument the actual presence of coffee production with the ecological conditions needed for growing coffee in Colombia. In particular, a municipality is classified as potentially coffee producing if rainfall ranges between 1,800-2,800 cubic millimeters per year and if the temperature is between 16 and 26 degrees Celsius. This classification is based on de Graaf (1986). We re-estimate equation 2, but simultaneously instrument the price with world exports and instrument actual coffee growing status with the ecology-based classification described above. Panel B of Table 6 reports these IV results. Because our instrument is the dichotomous presence or absence of coffee, we again compare the results with Panel A of Table 4. The instrumented results are very similar in magnitude to the baseline specification. The coefficient estimates are slightly smaller for clashes, but slightly larger for the other three conflict measures.

5 Exploring the Mechanisms

In this section, we explore the channels through which a price shock on agricultural commodities such as coffee can affect the dynamics of an internal conflict. Discussion on the civil war literature in section 1 points toward two key mechanisms: a reduction in income can affect violence by reducing the opportunity cost of rebel support, while a rise in revenue

associated with commodity taxation can raise resources available to finance the civil war. We test these two predictions by assessing the effect of the coffee crisis on poverty and public investment at the municipality level in sections 5.1 and 5.2 below. Because within-country studies of conflict allow us to consider factors that are idiosyncratic to a particular country or commodity, in section 5.3, we explore a third potential mechanism that has been widely publicized by the international press (see references in footnote 7): crop substitution from coffee to coca.

5.1 Income Shock

In Colombia, the coffee price shock reduced the income of coffee farmers, who are largely smallholder producers planting, on average, 1.7 hectares of coffee. However, there is considerable geographic variation in the size of the landholdings: the department of Magdalena averages 7.3 hectares, reflecting the presence of some larger coffee plantations, while Nariño department averages .60 hectares per coffee farmer.

The fall in coffee prices is also likely to affect the income of casual agricultural laborers who work in the coffee industry. For the arabica coffee variety, labor input usually represents 40 percent of total production costs (De Graaf, 1986). Two forms of labor are required for coffee cultivation in Colombia. Harvest-related labor is required to pick and process berries on the farm during the two harvesting seasons: October to December, which is the primary harvest, and April to May, which is a smaller harvest.[21] Coffee cherries have to be hand-picked because coffee cultivation on steep hillsides renders mechanized harvesting impossible. The initial processing can also be labor-intensive on smaller farms, where hand pulpers and basins are used to loosen and wash the pulp before it is dried (*ibid*). Most coffee farms employ outside labor during harvesting season, who are either day laborers living nearby or seasonal migrant workers (Ortiz, 1999).[22] A survey of harvesters in Risaralda and Cundinamarca departments suggests that 41 percent of the harvest labor are migrant workers (*ibid*). However, non-harvest labor is required for plant maintenance, including weeding and pruning. While smallholders do not need to hire outside non-harvest labor, larger farms hire local landless workers who are paid piece-rate or hourly wages for these tasks. Approximately half of the total labor input is for non-harvest labor,[23] which suggests

[21] The primary and secondary harvests are reversed in a subset of the coffee regions.

[22] The exception are smallholder families with two or more sons who supply their own harvest labor.

[23] However, this share is increasing with the proportion of *caturra* coffee plants, the high-intensive variety requiring greater maintenance throughout the year.

that in total, approximately 80 percent of all coffee laborers are locals rather than migrants. Given labor input requirements in the coffee production function and the drop in coffee prices in the late 90s, it is reasonable to posit that the coffee price shock lowered the wages paid to casual agricultural employees who worked on coffee farms.

We intend to use household survey data to directly test for the effect on wages and employment. However, as a first step, we assess the effect of the coffee crisis on poverty at the municipality level, and assess whether poverty increased disproportionately in the coffee areas during the worst years of the crisis. Our municipality-level measure of poverty is the share of the population eligible for free health services at state clinics, and is available for the 1998-2002 period.

In Panel A of Table 7, we estimate equation (3), but with poverty as the dependent variable. The highly significant negative estimate on the coffee interaction term confirms that poverty increased more in coffee-dependent municipalities during the crisis years. Although poverty was increasing throughout Colombia during the late-90s due to a recession, the coefficient indicates that the rise in poverty was 22% higher for a municipality with average coffee intensity, relative to non-coffee areas. Because our poverty measure is available for just four years, we also re-estimate (3) with violence measures for this sub-sample, and confirm that our core results hold for all four conflict measures over these years (results not shown). Taken together, these results demonstrate that the drop in coffee prices induced an increase in poverty and in violence, which suggests that the income channel is a mechanism through which the price shock has affected Colombia's civil conflict.

We posit that the price fall and associated increase in poverty lowered the opportunity cost of supporting illegal armed actors. Support for armed actors can range from providing supplies and information, to actively joining the armed ranks of the group (Kalyvas, 1999). For example, besides its core army of fighters, FARC also has additional militias employing 5,000 individuals, who are much less active, and have less firepower (Sanín, 2006). The prospects for compensation vary substantially from one illegal actor to another. The FARC generally do not give direct payment to their soldiers, but do provide them with food and equipment. This is not a trivial inducement considering that most FARC recruits come from impoverished backgrounds (Marin, 2006). Payment may be given for short periods if there is strong competition for recruits with another armed actor. However, deception is another common tactic, when the organization promises to provide a salary, but does not subsequently fulfill this commitment. In contrast, the ELN soldiers are reported to either receive a salary or some form of compensation for their families (Human Rights Watch,

2003).

The paramilitaries also pay their recruits. Although it is extremely difficult to obtain consensus around the amount of compensation, $200 per month has been put forward as a reasonable estimate (Gutierrez, 2006). This figure is slightly higher than the 2006 legal minimum wage: $175. Most recruits come from lower income backgrounds, but participation in the paramilitary has at times enabled them to climb the ranks and eventually become landowners, which suggests that participation in the paramilitary may present opportunities for upward mobility (*ibid*). Given direct compensation and potential indirect economic benefits associated with recruitment, a decline in the employment prospects of casual agricultural workers could directly affect the incentive to join paramilitary ranks.

Given that the vast majority of coffee workers are local laborers rather than migrant workers, it is not unreasonable to posit that there is a link between the coffee intensity of a municipality and the extent of rebel support that takes place in that municipality. The FARC have roughly 12 geographic zones of operation, and divisions tend to operate within a given region, which suggests that recruits stay local in a limited sense. However, it should be pointed out that a rise in municipal-level violence associated with greater recruitment does not necessarily mean that those enlisted are employed immediately to attack the locality they are from. Rather, the guerilla and the paramilitary may target localities that have experienced an economic shock for recruiting purposes, and perpetuate attacks as they enter an area to signal their strength.

5.2 State Capacity

If a commodity is taxed by illegal armed groups or the state, then a rise in its international price may worsen conflict if it finances the rebels or expands state military capacity, which would suggest a positive relationship between commodity prices and violence. To the extent that we have already established that there is a negative association between coffee prices and violence, we know that if this positive revenue effect exists, it is dominated by the negative income effect described in section 5.1. However, in this section, we examine how municipal public investment changed in coffee areas relative to the control groups during the coffee crisis, to see if there is indeed a countervailing positive revenue effect. This effect would imply that public expenditures decreased disproportionately in the coffee areas during the crisis, potentially weakening state strength and exerting a negative pull on the amount of state-initiated conflict.

We estimate (3), but with total municipality-specific public investment as the outcome variable, available for the 1994-2002 period. Panel B of Table 7 presents these results. Column 1 includes the entire sample and column 2 eliminates the four largest municipalities that had a population greater than 1 million in 1997. In both columns, the coefficient on the coffee treatment is found to be *negative*, indicating that government expenditure increased disproportionately in the coffee areas when the price of coffee fell. These results suggest that in the case of coffee, government revenue was reallocated in a countercyclical manner such that the revenue and income effect actually re-inforced one another. When prices fell, this reduced income, facilitating recruitment into armed groups. In addition, state revenue was re-allocated to the coffee areas, which could have potentially bolstered local law enforcement and strengthened state capacity. In theory, this might explain why the onset of the coffee crisis is associated with a rise in clashes involving government forces, along with a rise in one-sided attacks by the guerilla and paramilitaries. However, the disproportionate increase in public investment implied by the estimate reported in Panel B of table 7 is quite small in magnitude: for the average coffee municipality, the additional increase represents 3.5 percent of the mean pre-crisis spending level. This reinforces the idea that state capacity is unlikely to play a determinant role in explaining how coffee prices affected violence .[24]

5.3 Crop Substitution

In this subsection, we examine the crop substitution hypothesis, that low coffee prices led farmers to plant coca, which is able to survive under a variety of ecological conditions including those apt for coffee cultivation. As suggested by Angrist and Kugler (2005), violence in turn thrives from the competition of illegal armed groups over proceeds from the drug trade.

To examine the role of coca, we first use a crude indicator variable for whether the municipality produces coca in a given year, and then employ an intensity measure of the hectares of land devoted to coca production. Simple cross-tabulations using the indicator variable show that the number of coffee municipalities that also produced coca have in fact increased from 18 in 1994 to 66 in 2002. However, this increase was even greater for the non-coffee areas, and the equivalent figures are 38 in 1994 and 102 in 2002. Thus, the relevant

[24] One additional caveat must be added to the analysis in this section. We look at total municipal investment, but do not currently have data on the NFCG investments. It could be the case that the sum of public and Federation investments move in a procyclical manner, instead of the countercyclical manner found here.

question is whether the rise in coca cultivation has been greater in coffee areas relative to non-coffee areas, and we turn to our coca intensity variable to explore this question.

The time-varying data on coca cultivation is only available for a subset of years: 1994, and 1999-2002. Thus, we begin by re-estimating (2) for this smaller sample, and confirm that the DD coffee coefficient remains statistically significant with all four violence outcomes in this subset of years (results not presented). Next, we test for the crop-substitution hypothesis by re-estimating equation (2), but with coca intensity rather than violence as the outcome measure. Panel C of Table 7 reports these results, in column 1. The coefficient on the coffee interaction term is statistically insignificant and zero in magnitude. These two findings indicate that although the coffee price induced a greater increase in violence in the coffee areas during this period, it did not induce greater crop substitution in more coffee dependent regions. In the remaining four columns of Panel C, we re-estimate equation (2) with the four violence outcomes, but after eliminating the 128 coffee producing municipality that were ever recorded as producing coca during the years in this sub-sample. Although the coefficients are smaller in magnitude, the effect is still statistically significant which further confirms that crop substitution is not the central mechanism linking coffee prices to conflict in Colombia.

6 Results: Oil and Conflict

In this section, we examine the effect of oil price shocks on violence levels in municipalities that have oil extraction plants or oil pipelines, in comparison to those that have neither. Our motivation for looking at oil is to assess whether the effect of price shocks on violence differ based on the type of commodity used for the analysis. While a fall in the price of a labor intensive commodity such as coffee is likely to affect the rural-based insurgency through its effect on the earnings of rural producers, the income channel is likely to be less important for a capital-intensive commodity such as oil. On the other hand, it is possible that oil may play a potential financing role for all three parties in the Colombian conflict: the guerilla extort oil executives and derive 'protection rents' under the threat of bombings. Paramilitaries derive similar 'protection rents' as they are reportedly hired to protect oil pipelines, and journalistic accounts have indicated that they steal and re-sell petroleum for financing purposes. This suggestive evidence accords with the Collier and Hoeffler (2004) notion that rebel groups finance conflict by looting natural commodities. If this is true of the Colombian case, and if oil rents represent an important financing source for the illegal

armed groups, then we should see a rise in oil prices lead to a disproportionate increase in the number of one-sided guerilla and paramilitary attacks as groups move in to control this resource in the oil municipalities. Moreover, if the guerilla bomb the pipelines to reduce state revenue, this would be an additional reason to expect a larger increase in the number of guerilla attacks in oil areas when the value of oil increases.

Besides rebel financing, oil may also represent an important source of revenue for the state through taxation, as petrol is the country's largest export. Prior to 2001, foreign oil companies were required to enter a 50-50 production partnership with *Ecopetrol*, the state-owned enterprise, and to pay the government 20 percent of their production share in royalties. New regulations in 2001 allowed foreign companies to keep up to 70 percent of the oil extracted and lowered the royalty payments to 8 percent (Leech, 2004). A revenue sharing agreement determines the proportion of royalties that go to the central government, the department level government, and the municipalities. In our analysis, we include municipalities with oil pipelines in the treatment group because we posit that state revenue plays an important role in how oil affects conflict, and Colombian municipalities receive additional funding from the central state not only if they extract petroleum but also if they contain pipelines. While Colombian law stipulates that royalty payments be used for social and economic programs, to the extent that revenue is fungible, these payments can free up resources that are used to finance government military expenditures. Moreover, a direct link between oil and military might arise from 'war taxes' that foreign oil companies pay directly to the state's armed forces, an arrangement which has facilitated greater military presence in the oil-producing regions since 1992 (Dunning and Wirpsa, 2004). If these royalties and direct payments play an important role in financing state strength, then a rise in the price of oil should be associated with a rise in two-sided clashes involving government forces, and a rise in the government military initiative variable.

6.1 Fixed Effects DD Estimates for Oil

Figure 3 shows the price of oil (along with the price of coffee) over 1988 to 2004. Two basic trends are discernible. Oil prices are falling for most of the 1990s but rise sharply starting 1999. OPEC production cuts are largely responsible for rising prices in 1999 and 2000, coupled with growing unrest in the Middle East during 2001. A general strike in Venezuela and rising concern over anticipated military action in Iraq heightened the climb over 2002, followed by oil supply interruptions after military action commenced in Iraq in

2003. Because Colombia's production does not affect world petroleum prices, we are able to use all years of data from 1988 to 2004 in analyzing how changes in oil prices affect conflict dynamics in oil municipalities versus non-oil areas. We estimate:

$$y_{it} = \alpha_i + \beta_t + (Oil_i \times OilPrice_t)\lambda + X_{it}\phi + \varepsilon_{it} \quad (6)$$

where *Oil* is a categorical variable that equals 1 if the municipality contains oil reserves or pipelines, and *OilPrice* refers to the average price of petrol imports in the US. Panel A of Table 8 presents the results from this analysis. First, the oil DD coefficient is positive for all four models, indicating that an increase in the value of oil leads to greater increases in violence in the oil-related areas. However, the coefficient is insignificant for the model of guerilla and paramilitary attacks, and significant at the 1 percent level for casualties, clashes and government military initiatives. This suggests that an increase in the value of oil affects conflict at least in part through government military capacity, since the government intervention variable represents clashes involving government forces that are not responses to an attack, and rare events of government attacks. For the period of the oil boom, there are on average 0.1 additional clashes per year in oil-related municipalities relative to municipalities without oil reserves or pipelines.[25] Since the incidence of clashes are partly a function of how active guerillas and paramilitary groups are, the results should not be taken to mean that changes in oil prices have no effect on the actions of these groups. Indeed, the rise in clashes leaves open the possibility that the armed illegal groups may move into oil areas when the price of oil rises. However, given that there is no significant effect on the number of guerilla and paramilitary attacks, we are left to conclude that if the illegal groups do move into oil areas when oil price rise, they are unable to carry out intended attacks in the face of a strengthened military force. This is consistent with the idea that an increase in the price of oil has a stronger effect on the relative strength of the state forces, in comparison to the illegal armed groups. It is perhaps not surprising to see this effect given that a rise in oil prices translates into more direct revenue increases for the government through taxes, in comparison to revenue increases of the guerillas and paramilitaries, through demands for larger ransom in the kidnappings of oil executives or the derivation of 'protection rents.'

To explore the idea that the effect of oil prices on state military capacity is mediated through government revenue, in Panel B of Table 8, we re-estimate (6) but using total public investment as the outcome variable. The first column includes all municipalities

[25] Casualties also increase disproportionately in oil municipalities during the oil boom. The annual average per municipality for the period of the oil boom is 0.3 additional casualties.

while the second column eliminates the four largest Colombian municipalities. In both cases, the positive significant coefficient indicates that when oil prices increase, public investment increases more in the oil municipalities relative to the non-oil municipalities. This is in direct contrast to the case of coffee, where the opposite relationship held. Although the public investment variable does not capture the direct funding allocated from oil multinationals to the state military, this finding does confirm that in contrast to the coffee municipalities, the oil municipalities have more funding at their disposal when oil prices rise, which may facilitate greater investments in the security apparatus. Also in contrast with the coffee case, the magnitude implied by the estimated coefficient is substantial. For the average coffee municipality, the oil boom results in additional municipal expenditures that represent 34.5 percent of the annual public investment of oil municipalities prior to 1999.

6.2 Simultaneous Effect of Coffee, Coca and Oil

Given that the positive shock in oil prices was contemporaneous with the negative coffee price shock, in this section, we combine the two analyses to ensure that these contemporaneous price changes exerted independent effects on Colombia's civil war. We look at the 1988-2004 period in its entirety. To address potential endogeneity concerns regarding coffee prices over 1989 to 1994, we instrument the internal price of coffee by the export levels of the other coffee producers, as in section 4.5**.** Moreover, we also control for the role of coca in this combined analysis, since the expansion of the drug trade has been held responsible for financing much of the Colombian conflict. In contrast to coffee and oil, the price of coca in international markets cannot be regarded as exogenous, since Colombia produces a large share of the global cocaine supply. Thus, instead of using coca price changes, we use the approach of Angrist and Kugler (2005), by looking at the increase in violence associated with a 1994 policy change, when increasing air interdiction by the American military shifted coca cultivation from the other Andean nations to Colombia. Thus we estimate:

$$\begin{aligned} y_{its} &= \alpha_i + \beta_t + t\gamma_s + (CoffeeQuantity_i \times CoffeePrice_t)\delta + (Oil_i \times OilPrice_t)\lambda \\ &\quad + (CocaQuantity_i \times Post1994_t)\xi + X_{it}\phi + \varepsilon_{its} \end{aligned} \tag{7}$$

where *Post1994* is a categorical variable that equals 1 for the years after 1994. We also include linear time trends by department in this specification, as represented by $t\gamma_s$, and as in all other specifications, cluster the standard errors by department. Table 9 summarizes

the results. First, the coca interaction is positive and highly significant for casualties, which confirms the results of Angrist and Kugler (2006) who used a different dataset based on population statistics to examine the effect on violent deaths. Moreover, it shows that their department-level results also hold at the disaggregated municipality level.

The oil interaction also remains positive and highly significant for clashes and casualties, and the coefficients are almost identical in magnitude to results that do not control for either the coffee or coca shocks, presented in Panel A of Table 8. Finally, the coefficient on the coffee interaction remains highly significant for all four measures of conflict, although the magnitudes are slightly smaller in comparison to those presented in the benchmark results of Panel A in Table 4. The results over this longer period confirm that the coffee crisis not only affects casualties and clashes, but also the number of one-sided guerilla and paramilitary attacks. This points to the relative importance of the income channel in the case of coffee, indicating that the support to illegal armed groups increases when the price of this agricultural commodity falls in international markets.

The estimate on casualties is significant for the three cases indicating that the oil boom, the coffee crisis and the coca expansion of the 1990s have all undermined human security. When estimating all simultaneously, we conclude that the oil boom has resulted in 0.3 additional casualties per year in oil municipalities; the coca expansion has brought 1.3 more victims per year in municipalities growing illegal crops since 1994; and the coffee crisis has brought about .9 additional deaths per municipality per year.

7 Conclusion

Our analysis has shown that Colombia faced two price shocks in the late 1990s that escalated the incidence and intensity of civil war: a sharp drop in coffee prices exacerbated conflict by increasing poverty while a sharp rise in oil prices generated revenue that facilitated state military expansion to protect oil pipelines.

For coffee, Colombia appears to face a resource curse in reverse. The higher value of this commodity in international markets eases social unrest, while a lower value exacerbates politically-motivated violence. We show that this result is not confounded by the 1999 earthquake in the coffee-growing regions, or the launch of *Plan Colombia*. Our results are also robust to the use of a geography-based instrument that predicts potential coffee cultivation, which shows that the findings do not reflect potential endogeneity in the coffee production variable. Moreover, we find no evidence of disproportionate crop substitution in the coffee

regions, but do find evidence that a larger share of the population became impoverished, which points to the role of income in mediating this effect.

This analysis has a number of policy implications. First, it challenges the resource curse perspective that an increase in the value of a commodity necessarily leads to an increase in conflict, and suggests that the income effect of price shocks may outweigh the effect on conflict financing for particular commodities. This implies that social programs designed to mitigate against poverty and unemployment may also have a moderating effect on violence, when workers face a commodity shock that reduces income associated with a legal activity. Second, it suggests that price stabilization of labor-intensive primary commodities can play a role in reducing politically-motivated violence. For Colombia, we estimate the extent to which the NFCG's policies have moderated the rise in violence by estimating the number of casualties that would have arisen if the internal price of coffee had fallen by as much as the international price (in percentage terms). Relative to the 767 additional casualties in the coffee municipalities in our baseline estimate, the coffee price shock would have resulted in 1,680 additional casualties under this counterfactual scenario. In other words, violence intensity would have been more than twice as high if coffee prices had fallen by 73 percent internally, as they did in the global market.

The findings on coffee present a clear contrast to the findings on oil, where an increase in the value of the commodity is associated with an escalation of security-related conflict. The expansion of these military operations may have been motivated by stepped up guerilla and paramilitary presence in oil areas, contributing to a rise in clashes with government forces. Thus, for Colombia, there appears to be a positive association between the value of oil and political violence. The contrast between the effect of price shocks in coffee and oil can be considered in light of the different factor intensities of the two commodities. Given that coffee is labor-intensive, a fall in the price of coffee has a substantial effect on the income of agricultural producers, which affects the decision to support the rural-based insurgency. Given that oil is capital-intensive, most rents do not accrue to labor, which reduces the importance of the income channel. Rents are channeled partly into government revenue, which finances greater military expansion aimed at exerting greater control in the oil municipalities.

Our results are consistent with the findings of Miguel et al (2004) in the sense that a loss of income associated with coffee price declines are found to spur civil strife. On the other hand, we go beyond these findings to suggest that the effect of economic shocks on conflict is determined by how these shocks affect the distribution of income. In the case of commodity

price shocks, the critical consideration is which factor benefits from the rise in commodity value. Finally, while factor intensity may be the critical consideration for legally traded commodities, the analysis will differ for commodities such as coca, which are not traded legally in international markets. It is not clear if quantity responds to price in the same way for goods in this category, since contract enforcement occurs through violence. In this case, we might expect to see a rise in labor income associated with a rise in violence, which is consistent with the findings of Angrist and Kugler (2006). Combining the factor intensity and legality dimensions into a unified framework should be the subject of further research. Our current research suggests that for legally traded commodities, the value-violence relationship is mediated critically through factor intensity, which determines who gains, and who loses, from a rise in the value of a commodity in international markets.

Tables

Table 1. Descriptive Statistics

	Years	Coffee	Non-Coffee	|Difference|
Log Population[a]	1994-2004	9.65	9.79	0.14
		(1.05)	(1.05)	(1.48)
Coffee Farm Size[b]	1997	1.70	—	—
		(1.75)		
Coffee Land[c]	1997	1.61	—	—
		(1.96)		
Coca Land[c]	1994 & 1999-2004	0.03	0.25	0.22
		(0.29)	(1.14)	(1.17)
Public Investment[d]	1994-2002	4.18	11.25	7.07
		(18.75)	(133.91)	(135.22)
Poverty[e]	1998-2002	0.49	0.46	0.03
		(0.32)	(0.28)	(0.43)
Gov. Initiative[f]	1994-2004	0.15	0.13	0.02
		(0.67)	(0.62)	(0.91)
Guerrilla Attacks[f]	1994-2004	0.75	0.53	0.22
		(1.82)	(1.64)	(2.45)
Paramilitary Attacks[f]	1994-2004	0.13	0.10	0.03
		(0.55)	(0.46)	(0.72)
Clashes[f]	1994-2004	0.64	0.50	0.14
		(1.53)	(1.41)	(2.08)
Casualties[f]	1994-2004	2.53	2.52	0.01
		(8.09)	(8.34)	(11.62)

Standard errors in parentheses. (a)Thousands, (b)Hectares, (c)Thousand of hectares, (d)Billions of 2000 pesos, (e)Percentage, (f)Count.

Table 2. Mean Violence in Coffee and Non-coffee Municipalities Before and During Crisis

	Crisis	Pre-crisis	Difference	Crisis	Pre-crisis	Difference
	Guerrilla Attacks			*Paramilitary Attacks*		
Coffee Municipalities	0.867	0.553	0.314	0.176	0.045	0.131
	(0.028)	(0.037)	(0.046)***	(0.008)	(0.011)	(0.014)***
Non-Coffee Mun.	0.568	0.467	0.101	0.134	0.054	0.080
	(0.033)	(0.043)	(0.054)*	(0.009)	(0.013)	(0.016)***
Difference	0.299	0.086	0.213	0.042	-0.009	0.051
	(0.043)***	(0.057)	(0.071)***	(0.013)***	(0.017)	(0.021)**
	Clashes			*Casualties*		
Coffee Municipalities	0.770	0.421	0.349	3.199	1.345	1.854
	(0.024)	(0.031)	(0.039)***	(0.132)	(0.174)	(0.219)***
Non-Coffee Mun.	0.513	0.489	(0.024)	2.967	1.811	1.156
	(0.028)	(0.037)	(0.046)	(0.153)	(0.203)	(0.254)***
Difference	0.257	-0.068	0.325	0.232	-0.466	0.699
	(0.036)***	(0.048)	(0.060)***	(0.202)	(0.267)*	(0.335)**

* Significant at 10%, ** Significant at 5%, *** Significant at 1%. Standard errors in parentheses.

Table 3. Benchmark Fixed Effects DD Estimates

	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties
Coffee Mun.×Crisis Period	0.311	0.124	0.316	1.684
	(0.098)***	(0.041)***	(0.080)***	(0.472)***
Observations	10,389	10,400	10,400	10,400

* Significant at 10%, ** Significant at 5%, *** Significant at 1%. All regressions include municipality and year fixed effects and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Table 4. Continuous Price and Coffee Intensity Fixed Effects DD Estimates

	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties
Panel A: Coffee dummy and continuous price				
Coffee Mun.×Coffee Price	-0.306	-0.126	-0.592	-2.303
	(0.112)***	(0.041)***	(0.131)***	(0.695)***
Observations	10,389	10,400	10,400	10,400
Panel B: Coffee intensity and continuous price				
Coffee Intensity×Coffee Price	-0.104	-0.045	-0.138	-0.767
	(0.038)***	(0.011)***	(0.038)***	(0.196)***
Observations	10,143	10,158	10,158	10,158

* Significant at 10%, ** Significant at 5%, *** Significant at 1%. Internal price instrumented with international price. All regressions include municipality and year fixed effects and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Table 5. Addressing Potential Confounders.

	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties
Panel A: Controlling for Plan Colombia				
Coffee Int.×Coffee Price	-0.08	-0.035	-0.143	-0.675
	(0.036)**	(0.015)**	(0.042)***	(0.219)***
Coca 1994×Coffee Price	0.045	-0.002	-0.118	0.59
	(0.067)	(0.017)	(0.042)***	(0.258)**
Observations	9,844	9,855	9,855	9,855
Panel B: Eliminating municipalities affected by 1999 earthquake				
Coffee Int.×Coffee Price	-0.107	-0.044	-0.18	-0.844
	(0.041)***	(0.015)***	(0.038)***	(0.209)***
Observations	9,883	9,894	9,894	9,894
Panel C: Controlling for department-specific linear time trends				
Coffee Int.×Coffee Price	-0.083	-0.035	-0.143	-0.676
	(0.037)**	(0.015)**	(0.042)***	(0.219)***
DObservations	10,147	10,158	10,158	10,158
Panel D: Controlling for change in government regime				
		Government Military Initiative		
Coffee Int.×Coffee Price		-0.043		
		(0.009)***		
Observations		8,291		

* Significant at 10%, ** Significant at 5%, *** Significant at 1%. Internal price instrumented with international price. All regressions include municipality and year fixed effects and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Table 6. Instrumental Variables DD Estimates

	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties
Panel A: Coffe price instrumented with world exports...				
Coffee Mun.×IV Coffee Price	-0.508	-0.229	-0.638	-3.16
	(0.180)***	(0.079)***	(0.171)***	(0.949)***
Observations	10,389	10,400	10,400	10,400
Panel B: ...and Coffee presence instrumented with coffee-ecology				
IV Coffee Mun.×IV Coffee Price	-0.472	-0.223	-0.506	-2.957
	(0.172)***	(0.070)***	(0.145)***	(0.719)***
Observations	10,247	10,258	10,258	10,258

* Significant at 10%, ** Significant at 5%, *** Significant at 1%. Coffee price in Panel A instrumented with the coffee exports of all (ICO affiliated) coffee-producing countries. Coffee presence in Panel B instrumented with average temperature and rainfall of munipalities (details of instrument in the text). All regressions include municipality and year fixed effects and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Table 7. Exploring the Mechanisms For Coffee

Panel A: Poverty increase

	Poverty Rate
Coffee Int.×Coffee Price	-0.119
	(0.012)***
Observations	4,467

Panel B: Weak state capacity

	Total Public Investment	
	(1)	(2)
Coffee Int.×Coffee Price	-.0970	-1.242
	(0.452)**	(0.194)***
Observations	7,150	7,057

Panel C: Crop substitution

	Coca Crop	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties
Coffee Int.×Coffee Price	0.000	-0.092	-0.034	-0.134	-0.467
	(0.005)	(0.039)**	(0.008)***	(0.036)***	(0.083)***
Observations	6,488	7,510	7,510	7,510	7,510

* Significant at 10%, ** Significant at 5%, *** Significant at 1%. Panel B, column (1) uses the whole sample; column (2) excludes the 4 largest cities (population over 1 million). Panel C, Columns 2 to 5 eliminate all coffee municipalities that ever produced coca from 1994 to 2004. All regressions include municipality and year fixed effects and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Table 8. Fixed Effects DD Estimates for Oil

Panel A: Oil boom and violence

	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties	Gov. Initiative
Oil Mun.×Oil Price	0.002	0.001	0.007	0.021	0.002
	(0.003)	(0.001)	(0.001)***	(0.006)***	(0.001)***
Observations	15,945	15,962	15,945	15,962	15,962

Panel B: Mechanism – Oil boom and public investment

	Total Public Investment	
	(1)	(2)
Oil Mun.×Oil Price	0.114	0.134
	(0.058)*	(0.022)***
Observations	8,071	7,975

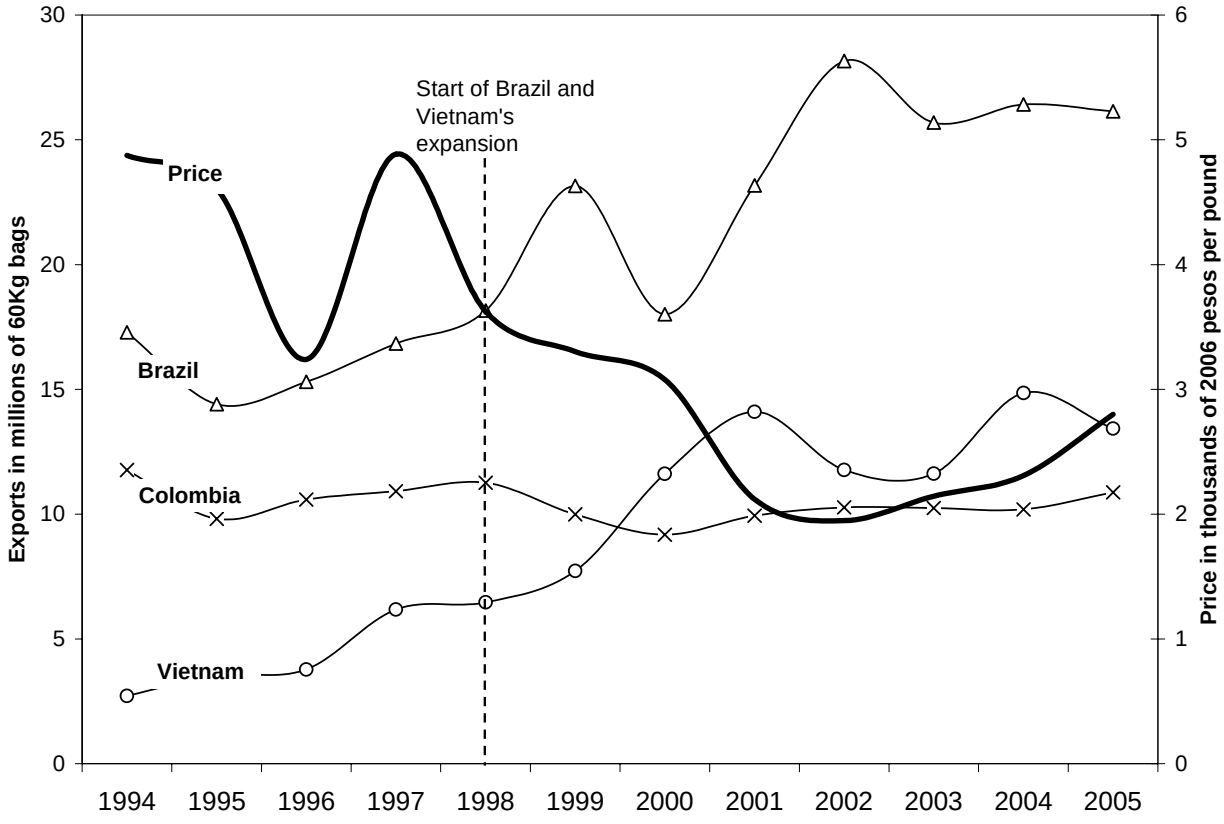
* Significant at 10%, ** Significant at 5%, *** Significant at 1%. All regressions include municipality and year fixed effects and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Table 9. The Simultaneous Effect of Coffee, Coca and Oil: 1988-2004

	Guerrilla Attacks	Paramilitary Attacks	Clashes	Casualties
Oil Mun.×Oil Price	0.002	0	0.008	0.02
	(0.003)	(0.001)	(0.002)***	(0.006)***
Coca Int.1994×Post 1994	0.071	0.007	0.047	0.939
	(0.059)	(0.013)	(0.047)	(0.151)***
Coffee Int.×Coffee Price	-0.152	-0.098	-0.149	-0.985
	(0.060)**	(0.033)***	(0.071)**	(0.344)***
Observations	15,178	15,195	15,195	15,195

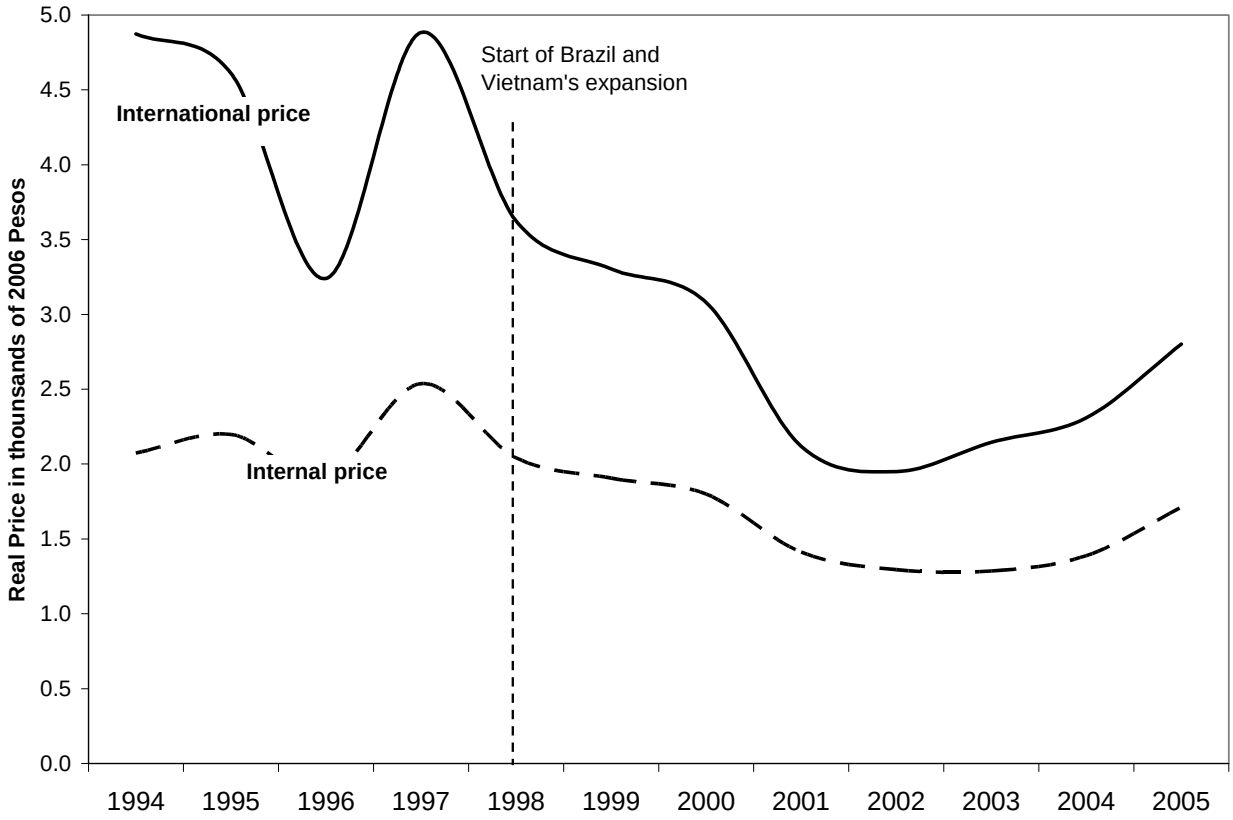
* Significant at 10%, ** Significant at 5%, *** Significant at 1%. Coffee price instrumented with the coffee exports of all (ICO affiliated) coffee-producing countries. All regressions include municipality and year fixed effects, department-specific linear time trends and control for the log of population. Robust standard errors are in parentheses and are clustered at the department level.

Figure 1. Coffee Exports of Main Producers and Real International Price



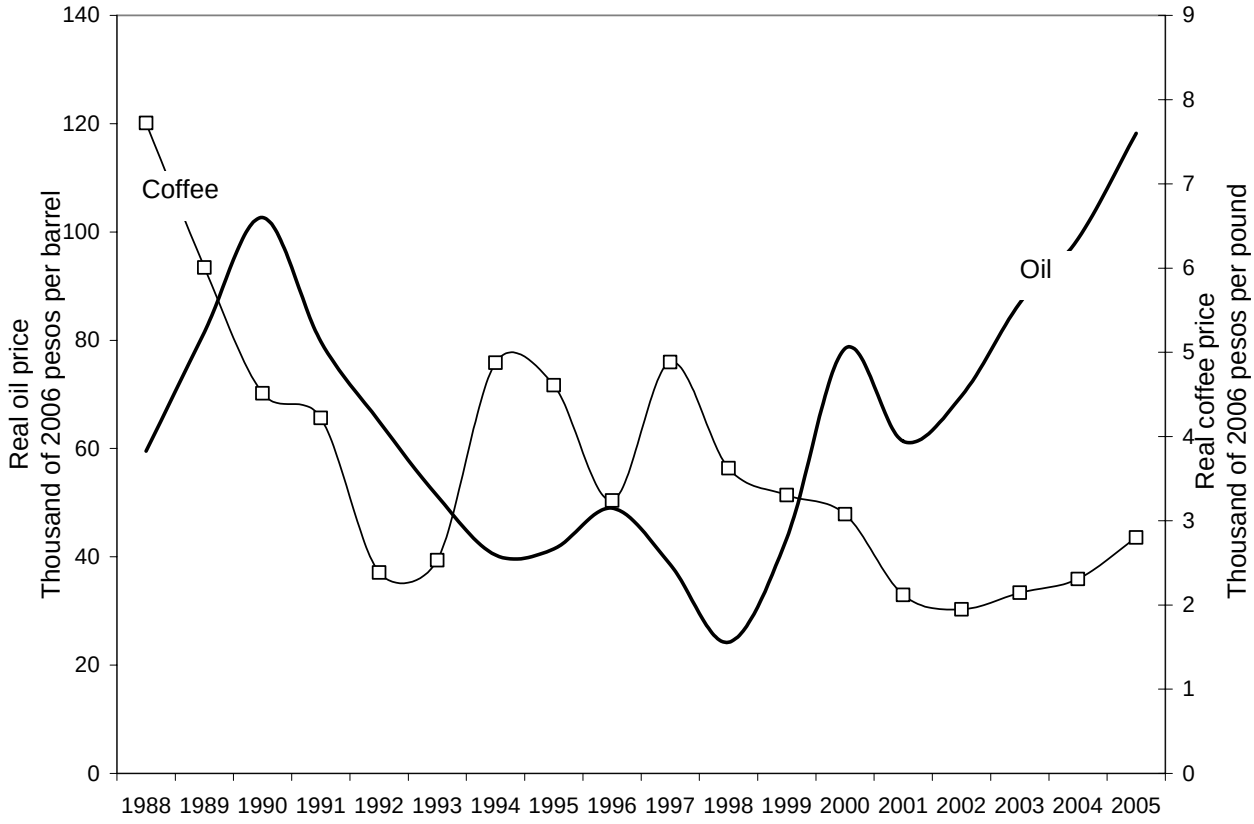
Source: International Coffee Organization and National Federation of Coffee Growers

Figure 2. Real International Price and Internal Price



Source: National Federation of Coffee Growers

Figure 3. Real International Price of Coffee and Oil



Source: National Federation of Coffee Growers and US Department of Energy

Figure 4. Mean Violence in Coffee and Non-coffee Municipalities

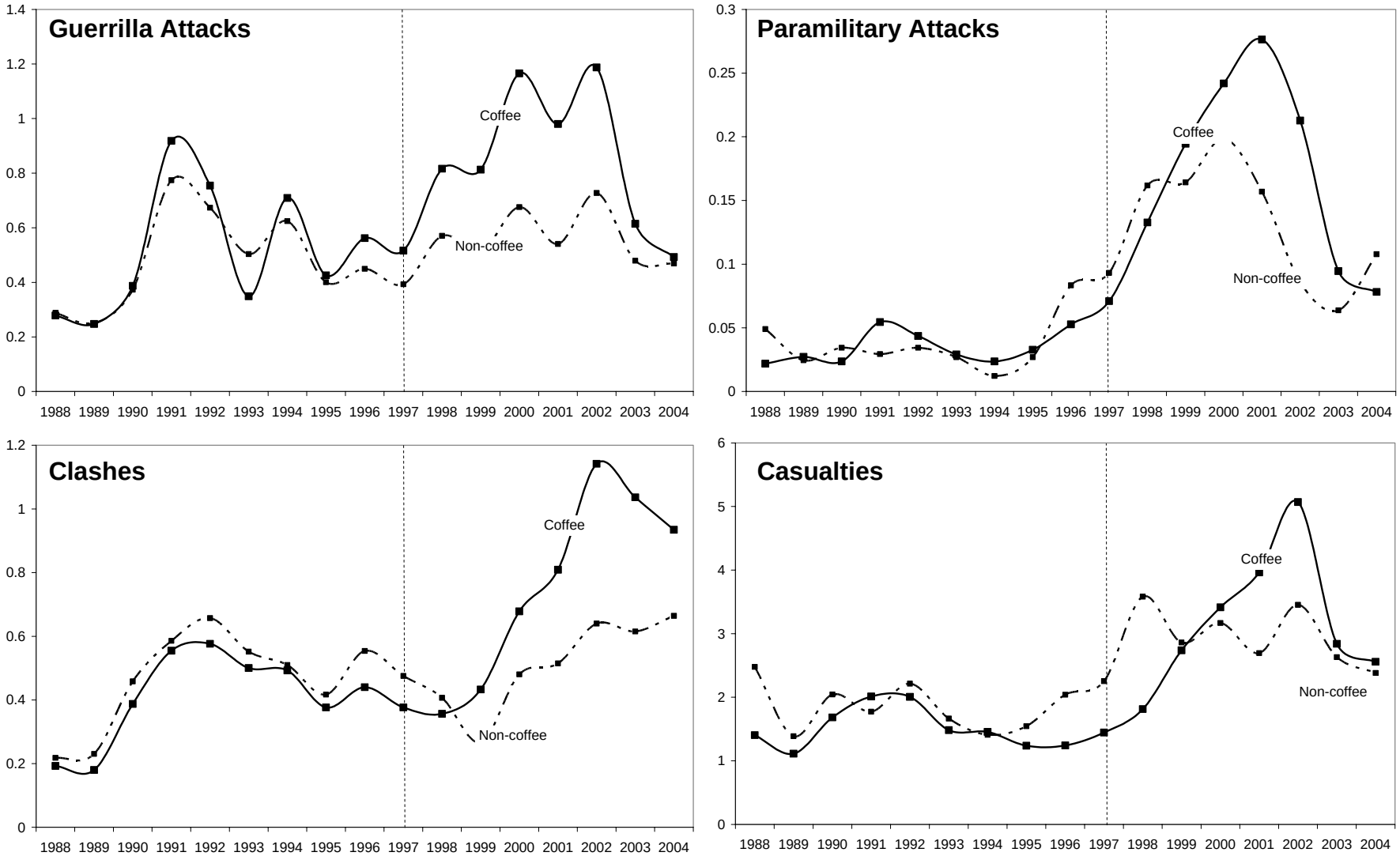
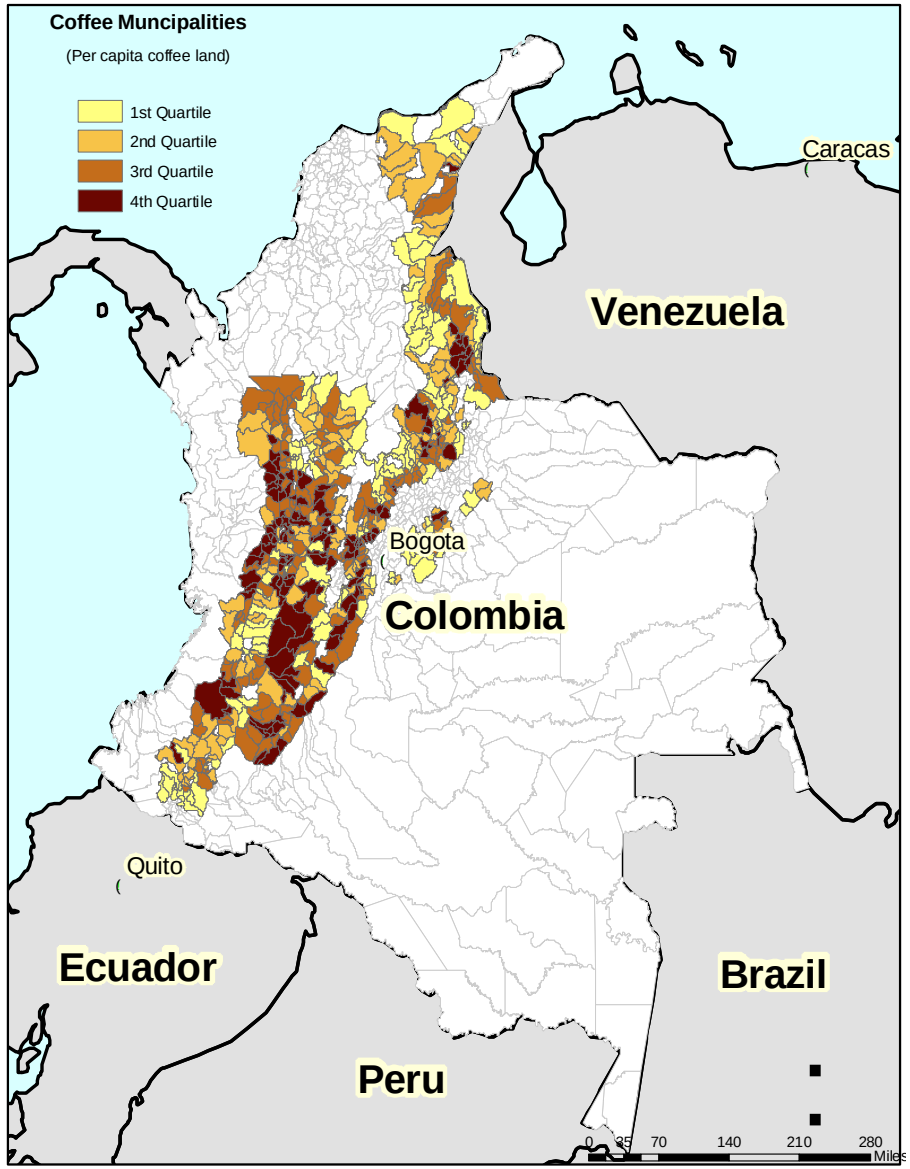
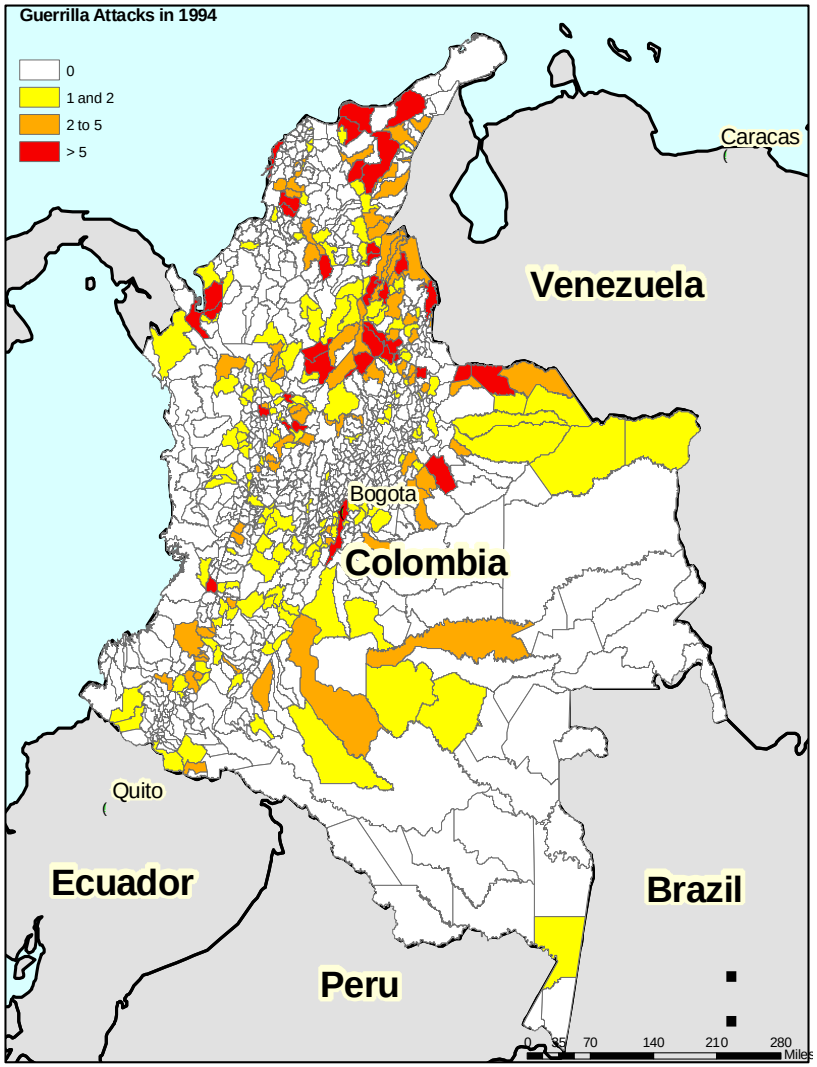


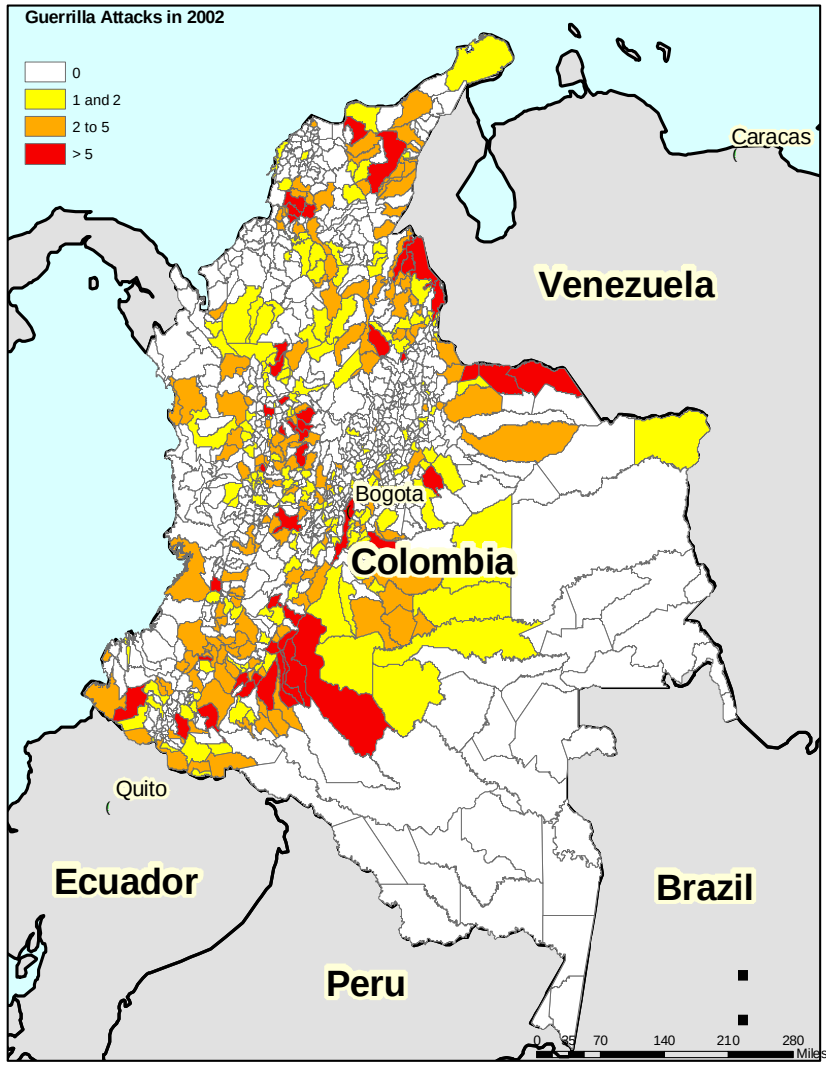
Figure 5. Map of Coffee Municipalities



Source: National Federation of Coffee Growers

Figure 6. Guerrilla Attacks by Municipalities in 1994 and 2002





Source: CERAC

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