Market Structure and Extortion:
Evidence from 50,000 Extortion Payments[*]

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Abstract

How does gang competition affect extortion? Using detailed data on individual extortion payments to gangs and sales from a leading wholesale distributor of consumer goods and pharmaceuticals in El Salvador, we document evidence on the determinants of extortion payments and the effects of extortion on firms and consumers. We exploit a 2016 non-aggression pact between gangs to examine how collusion affects extortion in areas where gangs previously competed. While the non-aggression pact led to a large reduction in competition and violence, we find that it increased extortion rates by approximately 20%. Much of the increase in extortion rates was passed-through to retailers and consumers: retailers experienced an increase in delivery fees leading to an increase in consumer prices. In particular, we find an increase in prices for pharmaceutical drugs and a corresponding increase in hospital visits for chronic illnesses. The results point to an unintended consequence of policies that reduce competition between criminal organizations.

JEL Classification: L10, K42, O17, D74

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1 Introduction

Organized crime and associated extortion is a pervasive aspect of life in many countries. Because extortion is often a main revenue source for organized crime, extortion acts as a driving force behind competition and violence between gangs worldwide (Global Initiative Against Transnational Organized Crime 2019; Konrad and Skaperdas 1998). Extortion can be a significant cost for firms and may have implications for consumer prices in countries with criminal organizations. Despite the prevalence of extortion in weak states, extortion is rarely reported to the police and is difficult to measure systematically. Due to the considerable challenges of measuring extortion, little is known about how gangs determine extortion rates, how competition between gangs for territory impacts extortion, and the resulting economic effects of extortion.

It is particularly important to understand how gang truces affect extortion. Controversial pacts or truces between gangs have been brokered by governments, religious leaders, aid workers, or gangs themselves in a variety of countries including El Salvador, Honduras, Haiti, Brazil, South Africa, Trinidad and Tobago, Japan, and Jamaica (Kan 2014; Cockayne et al. 2017). While these truces often lead to an immediate reduction in violence, it has been argued that they could allow gangs to grow stronger. It is unclear how gang truces affect extortion. On the one hand, truces may lead to a decreases in extortion if extortion is primarily used to finance confrontations for territory.[1] On the other hand, truces could potentially be viewed as a collusive agreement allowing gangs to shift resources away from fighting rivals and towards collecting extortion.

In this paper, we exploit the 2016 non-aggression pact between gangs in El Salvador to provide causal evidence on how collusion between gangs affects extortion, and to document the downstream effects of extortion on firms and consumers. In El Salvador, as in much of Northern Central America, upwards of 70% of businesses in gang-controlled territories report being extorted by gangs (Martínez et al. 2016). We leverage unique administrative data on individual extortion payments combined with detailed sales data for all goods shipped by a major Salvadoran wholesale distributor of consumer goods and pharmaceutical drugs. The data have information on over 50,000 extortion payments in which truck drivers were stopped by gangs while making deliveries to over 36,000 unique retailers between 2012 and 2019. Using these data, we show that that collusion between gangs increased extortion rates. We further show that firms respond by passing-through the increase in extortion to retailers, increasing prices for consumers. These results provide new evidence on consequences of

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[1]Additionally, stability in territory may lead to less short-term extractive practices by gangs and thereby reduce extortion. This closely follows the arguments of Olson (1993) and Tilly (2017).

gang truces for firms and consumers.

We start with a simple theoretical framework to highlight the role of competition and price discrimination in the market for extortion. The model combines insights from the literature on competition and conflict between gangs (e.g., Garfinkel and Skaperdas 2007; Castillo and Kronick 2020) with the industrial organization literature on vertical markets with market power (e.g., Spengler 1950). In the model, each gang has an incentive to use violence to expand their territory and collect additional extortion. However, gangs can realize higher profits if they can collude and agree not to compete for territory. This allows the gangs to act as monopolists and shift resources to collecting extortion. The model implies that collusion between gangs decreases violence and shows conditions under which this increases extortion and downstream prices. Furthermore, the model provides insight into how gangs may set extortion rates and price discriminate.

We then use the distributor data to provide a descriptive analysis of the main correlates of extortion. We find that extortion is higher when the value of products being delivered is higher, consistent with price discrimination. We also show cross-sectional evidence that competition between gangs is associated with higher extortion rates. However, competition is endogenous given that gangs are likely to compete over territories with larger returns from extortion.

To provide causal estimates on the effect of gang collusion, we focus on the March 2016 non-aggression pact. After the pact, the two gangs in El Salvador agreed to respect each other's existing territory rather than compete for it. This resulted in a large reduction in violent competition, lowering the homicide rate by nearly half. We examine the effect of the non-aggression pact in municipalities in which gangs previously competed compared to areas in which a gang already had a monopoly or near monopoly on territory. In our primary analysis, we define our control group as areas where only one gang was committing nearly all homicides, as these areas are unaffected by the pact. We also show results are robust to alternative definitions of gang competition prior to the pact, including measures constructed from prison records.

The non-aggression pact increased extortion rates by 20% to 25% in areas with previous gang competition relative to control areas. The results are especially large in areas with high development, which see an increase in extortion of 35%. We show that these results are robust to accounting for other government policies aimed at reducing the power of gangs. We also find evidence that gangs increased threats of violence after the pact. This is consistent with both qualitative accounts and the theoretical framework that highlight that the pact may have allowed the gangs to focus on collecting extortion.

We then provide evidence on how firms respond to higher extortion rates due to the non-aggression pact. We find no evidence that the firm adjusts its deliveries, consistent with the fact that the firm has long-standing relationships to supply retailers. However, the distributor adjusts prices in response to extortion. There is substantial pass-through of extortion to retailers. The increase in extortion raises the wholesale costs for the nearest retailer by 12%. The costs for retailers further away from the location of extortion payments also increases, but by less. We also find support for the theoretical prediction that prices increase most for goods with inelastic demand such as staple food products, suggesting that the increase in extortion may disproportionately impact poorer households. Finally, we use detailed data on retail prices for pharmaceutical drugs to examine the downstream effect for consumers. The non-aggression pact increased retail prices for drugs by 8%. We then examine hospital visits and find that for chronic diagnoses potentially affected by drug adherence, visits increase by 9%.

Our results have several implications. First, our case study provides an opportunity to understand how extortion affects firms and consumers. Our results highlight that certain goods—namely those with inelastic demand, such as staple products and pharmaceutical drugs—are particularly impacted by extortion. This provides insights into who bears the cost of extortion and which goods are particularly lucrative targets for gangs. Second, while truces often generate a short-run decline in violence, it is important to also note the counter-vailing cost imposed by higher extortion which may allow criminal organizations to become more entrenched. Given the prevalence of gang truces, this has implications for understanding gangs in a variety of countries. Finally, our results are relevant for settings outside Central America. The two main gangs we study, MS-13 and Barrio 18, are present throughout Central America, Mexico, Spain, and the United States. Gang violence and extortion have led millions of refugees to migrate from El Salvador, Guatemala, and Honduras towards developed countries (Clemens 2021; Sviatschi 2018). Thus, policies that inadvertently increase extortion and consumer prices may have important policy spillovers for developed countries.

Our study contributes to several strands of the literature. First, we contribute to the literature on the consequences of organized crime. Several papers have examined the effect of gangs on economic development via their impacts on human capital accumulation, labor markets, and state capacity (Angrist and Kugler 2008; Sviatschi 2018; Melnikov et al. 2020; Blattman et al. 2021). Our study highlights an additional mechanism: the distortionary effects of extortion on downstream firms and consumers. We show how an increase in extortion rates is passed-through to firms and consumers. This is especially important for

the case of pharmaceutical drugs, where there are significant concerns about affordability and efficient supply chains (Seiter 2010; Yamagiwa 2015).

Second, our study is related to the broader literature on the economics of illicit markets. One influential subset has focused on the market for government corruption (e.g., Shleifer and Vishny 1993; Bliss and Di Tella 1997; Ades and Di Tella 1999; Olken and Barron 2009; Foltz and Li 2021; Amodio et al. 2021). Shleifer and Vishny (1993) argued theoretically that corrupt officials should be thought of as profit maximizing agents and point out that competition between government officials can reduce bribery. Olken and Barron (2009) empirically highlighted the role of market structure in government bribes at checkpoints; they find that the payment amount depends on the number of checkpoints. A related strand of this literature has studied competition between criminal organizations in illicit drug markets (e.g., Levitt and Venkatesh 2000; Dell 2015; Castillo and Kronick 2020; Bruhn 2021). However, despite being a key revenue source for organized gangs worldwide, there is little work studying the market for extortion and how gangs compete for extortion. Previous work has relied on self-reported data on whether individuals have paid extortion (FUSADES 2016; Magaloni et al. 2020b). We leverage unique administrative panel data on individual extortion payments from a large distribution firm to provide evidence on the determinants of extortion and on the causal effect of collusion between gangs.

Finally, our work speaks to the broader industrial organization literature on collusive agreements between firms. Firms may use violence or threats of violence to enforce collusion or deter entry when incumbents collude (e.g., Clark and Houde 2013; Clark et al. 2018). A growing literature has also examined issues related to collusion and competition in developing countries (Houde et al. 2022; Bergquist and Dinerstein 2020). We provide new empirical evidence on collusion in an illegal market where gangs compete for territory. Unlike collusion in standard settings, collusion between criminal organizations reduces violence, allowing gangs to increase extortion rates.

The remainder of the paper is organized as follows. Section 2 provides background information on gangs and extortion in El Salvador, and describes the distributor's sales and extortion data. Section 3 presents the theoretical framework. Section 4 provides a descriptive analysis of the main determinants of extortion. Section 5 presents the estimates of the the non-aggression pact on extortion. Section 6 presents the pass-through estimates. Section 7 presents the effects on pharmaceutical prices and hospital visits. Section 8 concludes.

2 Background, Institutional Setting, and Data Sources

In this section, we provide background information on gang violence and extortion in El Salvador and describe the 2016 non-aggression pact. We present relevant details on the wholesale distributor that provided us with sales and extortion data as well as information on additional data sources we use in the subsequent analysis.

2.1 Gang Violence, Extortion, and Collusion in El Salvador

With a murder rate of 103 per 100,000 inhabitants—the highest murder rate worldwide in 2015—El Salvador has become known as one of the most violent peacetime countries in the world (Gagne 2016). This violence is largely driven by the fact that two gangs, Mara Salvatrucha (MS-13) and Barrio 18, fight for territory to extort firms (Papadovassilakis and Dudley 2020).[2] These two gangs account for 87% of gang membership and are estimated to have over 60,000 members and a support base equal to 8% of El Salvador's population (Aguilar et al. 2006, ICG 2017b).

Criminal organizations often use protection rackets in which they offer firms security in exchange for a fee. The gangs in El Salvador primarily rely on extortion in which they collect payment under the threat of violence. Extortion is often considered a type of protection racket in which the threat of violence comes primarily from the group offering the protection. Extortion represents the largest share of gang income, and is described as the "economic engine" behind the gangs and violence (ICG 2017a).[3] A majority of businesses in El Salvador pay extortion to gangs, with distribution and transport firms being particularly affected (Martínez et al. 2016). Extortion differs from bribes to government officials given that bribes provide access to a good or service and have ambiguous efficiency effects (Shleifer and Vishny 1993). In contrast, the negative effects of extortion and associated violence are less ambiguous. The Salvadoran central bank estimates the direct and indirect costs of gangs to be as much as 16% of GDP (Peñate Guerra et al. 2016).

To address the problem of gangs, the Salvadoran government has alternated between violent confrontations and direct negotiations with gangs (ICG 2017a; Holland 2013). Most prominently, the government negotiated a controversial truce between the two main gangs in March 2012. The immediate effect was less violence, with homicides falling by more than half (see Figure 1). The 2012 truce was called off by the government in June 2013 in response

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[2]For a discussion of the history of gangs in El Salvador, and the role of deportations, see Sviatschi (2019, 2022).

[3]Gangs in El Salvador also earn revenue from drug-trafficking, but this is thought to be much lower than the revenue from extortion. Gangs in El Salvador do not have direct control over the drug trade and only have sporadic "sub-contractual relationship" with drug traffickers (ICG 2017b).

Figure 1

Homicides and Collusion Between Gangs
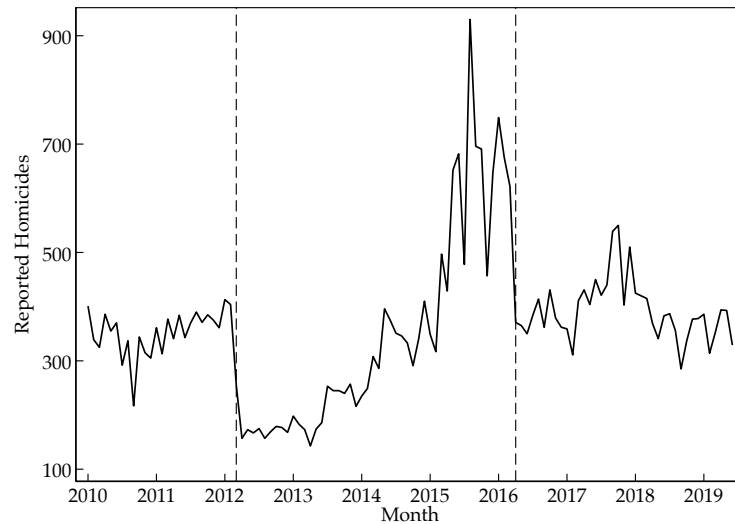
Notes: Chart shows reported homicides in El Salvador by month. Vertical lines show start of gang truce (March 2012) and non-aggression pact (April 2016).

to growing opposition within the government and across civil society (Vuković and Rahman 2018). Following the 2014 election, the newly elected government returned to a policy of violent confrontation, and violence subsequently increased.

On March 26, 2016, the leaders of the main gangs unexpectedly announced a non-aggression pact that prohibited the invasion of other gangs' territories and violence targeting members of rival gangs (Ditta 2016; Martínez 2016). Unlike the 2012 truce, the 2016 non-aggression pact was negotiated directly between gang representatives without government intermediaries. However, similar to the 2012 truce, religious leaders played an important role in the negotiations (Martínez 2016).[4] In a manner reminiscent of collusive agreements between firms, the gangs set up a 12-member "coordinating committee" that would meet to maintain exclusive territories (Martínez 2016). As one gang representative detailed: "At present, we have a non-aggression pact between us, the idea being that boundaries will be respected. There are always problems that have to be resolved. It is not perfect. There's always someone that shoots, but that is why we are here" (Martínez 2016). Homicides immediately fell by nearly half in the three subsequent months and then stayed relatively constant through 2019, as seen in Figure 1. Media reports indicate that the non-aggression pact was

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[4]The pact may have also been negotiated in response to increased enforcement measures being debated by the government at the time (Ditta 2016). Importantly for our identification, we do not observe differential changes in violence between treated and control municipalities before the pact.

still in place as of the end of our sample period (Papadovassilakis 2020).

While it is well known that both the 2012 truce and 2016 non-aggression pact affected homicides, it is possible that extortion rates were affected. Some have argued that cooperation could allow gangs to grow stronger and increase extortion. For instance, Dudley (2013) notes that "one theory [is] that the gang truce was really an effort by larger criminal interests to grant the MS-13 and Barrio 18 more breathing room for their operations." Collecting extortion requires constant monitoring of trucks and retailers and credibly threatening violence. After the non-aggression pact, gangs may have been able to focus their resources on collecting extortion (ICG 2020).

2.2 Extortion and Sales for Distribution Firm

We use extortion payment data and sales data for all goods delivered by a leading wholesale distributor for the period 2012 to 2019.[5] The distributor is a major supplier of consumer goods and pharmaceuticals. The company buys these goods in bulk from domestic and international manufacturers and delivers the products to local retailers and pharmacies. Each morning, the firm's trucks leave from San Salvador and make deliveries along one of 450 unique routes that cover the entire country. Over the sample period, the trucks go on 93,387 trips, making 2.2 million deliveries to retailers and pharmacies.
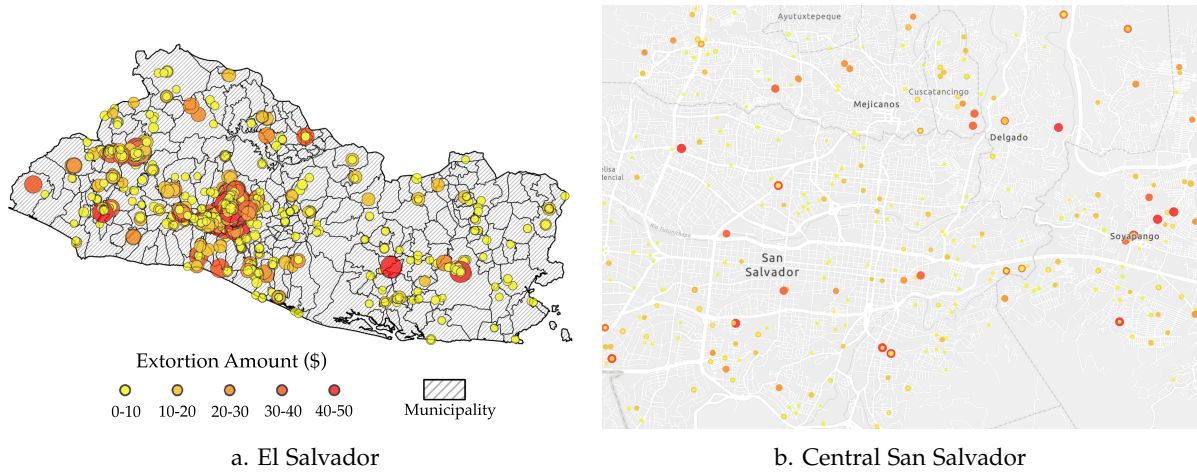
The distributor employs a security team to manage extortion payments, a common approach in the industry. Prior to making a delivery in gang-controlled territory, truck drivers will stop and meet with a gang representative collecting extortion. At this point they must call the security team and the security team confirms the extortion amount with the gang representative. This is done to reduce fraudulent claims of payments by drivers.The security team then records the payment amount and the location of payment.[6] In some cases, the extortion amount is pre-negotiated for a given period, often two months or less. While gangs are known to use violence or confiscate goods when extortion is not paid, the gangs generally prefer consistent extortion payments over extreme measures that deter trucks from returning to an area in the future. While there are many reports of gangs attacking truck drivers who do not pay, the distributor noted that they were generally successful at avoiding violent confrontation with the gangs.

In general, gangs have exclusive control of territory, and the distributor does not choose which gang to pay when making a delivery. In this way, gangs compete over territory rather than directly compete to provide protection from their rival. Importantly, extortion payments

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[5]Due to a confidentiality agreement with the firm, we do not name the firm.

[6]In addition to using these records for their own accounting, the distributor reports extortion payments to the Attorney General's Office.

Figure 2
Geography of Extortion

Extortion Amount ($)

○ 0-10 ○ 10-20 ● 20-30 ● 30-40 ● 40-50   ▨ Municipality

a. El Salvador   b. Central San Salvador

Notes: The figure presents a map with the location of all extortion payments made by the firm between March 2012 and March 2019 in El Salvador. Points represent extortion payments and their size corresponds to the amount paid by the firm in U.S. dollars, El Salvador's official currency. Panel a. shows all of El Salvador with municipality borders in gray. Panel b. shows an example of central San Salvador.

give the distributor rights to deliver to retailers. Trucks are often stopped on side streets near the delivery location rather than on a main road, implying that the firm can pass through the area without paying extortion if they do not make a delivery. This can be contrasted with government bribes at police checkpoints which grants firms the right to pass through an area (e.g., Olken and Barron 2009). These features of extortion in El Salvador guide our model in Section 3. We provide additional details on the mechanics of extortion and gangs' internal organization in Appendix A.

The extortion payment data contain records on the amount and location of each payment made to a gang on each route from 2012 to 2019.[7] Figure 2 Panel a. shows a map of all the extortion payments recorded by the company's security team between March, 2012 and March, 2019—a total of 51,576 extortion payments. While many extortion payments occur in the San Salvador Metropolitan Area as seen in Panel b., the firm frequently makes extortion payments across many different regions of the country.[8] Table 1 presents summary statistics for the extortion data (Panel A) for the sample period a year before and after the 2016 non-aggression pact. Individual extortion payments to the gang vary between $0.50 and $140.

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[7]Information on extortion is missing for 1/2013, 2/2013, 4/2013, 5/2013, 4/2014, 4/2015, 11/2017, and 12/2017. Only two of these months are during our main period of analysis surrounding the non-aggression pact and these months are dropped from the analysis.

[8]Appendix Figure A-2 presents a map of total and average extortion paid by the firm across municipalities.

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Table 1
Summary Statistics for Extortion, Sales, Homicides, and Inmates

	Mean	SD	Min	Max
Panel A. Extortion payments:				
Extortion payment	8.10	10.62	0.50	140.0
Total extortion by trip	15.60	19.07	1.00	290.0
Total extortion by route-month	127.12	129.97	1.00	745.0
Total observations		50,695		
Panel B. Distributor sales by retailer-product-trip:				
Amount charged to retailer	31	369	0.0	189,276
Cost	26	335	0.0	187,317
Amount by trip	3,467	9,548	0.0	357,849
Cost by trip	2,921	8,154	0.0	293,858
Amount by route-month	107,362	264,033	28.8	2,773,948
Cost by route-month	90,444	211,085	23.4	2,117,466
Unique products		6,038		
Unique retailers		36,020		
Total trips		93,387		
Total observations		10,552,876		
Panel C. Homicides by municipality-month:				
Homicides by MS-13	0.69	1.26	0	17
Homicides by Barrio-18	0.55	1.23	0	15
Total homicides	4.06	5.63	1	75
Total observations		2,411		
Panel D. Inmates by municipality:				
Inmates from MS-13	21.06	63.37	0	607
Inmates from Barrio-18	20.29	70.49	0	1006
Total inmates	41.37	121.25	0	1613
Total observations		256		

Notes: All revenues, costs, and payments are reported in US dollars. Sample period is 3/2012 to 3/2019 for Panel A, and 6/2015 to 12/2017 for Panel B and C. In Panel B, minimum values are rounded to the nearest $0.1. Panel D reports summary statistics for gang-affiliated inmates arrested between 4/2013 to 4/2016.

Conditional on paying extortion, the average truck pays $14 per route in a day, equal to roughly half the daily labor cost of a truck driver.

The sales data have detailed information on what was delivered by each truck over the period 2009 to 2019. The unit of observation is a product type delivered to a retailer or pharmacy on a given trip. The data include the revenue amount for each product delivered, the cost paid by the firm to obtain each product, and the corresponding gross margin for each product delivered—the difference between the cost paid to acquire the product and the amount charged to the retailer at delivery. The data also includes the product name, retailer name, and retailer addresses where the product was delivered. Table 1 presents summary statistics for the sales data (Panel B).[9] To provide a visual example of the data set combining

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[9]Appendix Figure A-3 presents a map of total and average delivery values across municipalities for deliveries made by the firm. Deliveries occur in almost all municipalities of El Salvador.

sales and extortion payments, Figure A-1 presents a map of all of the deliveries made by the firm on a single day in 2016. The map shows the vast geographic scope of the firm's operations within a day and the prevalence of extortion payments across El Salvador.

2.3 Homicides and Incarceration Records

To construct measures of gang competition, we use data on homicides and incarceration records. Individual-level homicide data for the years 2010 to 2017 was obtained from El Salvador's National Civil Police (PNC) through a "freedom of information" request. The data include information on the date and location of each homicide recorded by the police force.

The data include information on which gang committed the homicide if the police were able to make a determination. This is based on the police investigation and may use information such as as gang-related graffiti or tattoos. Accurate gang affiliation information is critical as the government uses this information after an arrest to separate prisoners by gang affiliation. For gang-related homicides, the police were able to determine the gang responsible for 75% of cases.[10] Table 1 Panel C presents summary statistics for the homicide data aggregated to the municipality-month level for the sample period a year before and after the 2016 non-aggression pact.

As an additional validation for our measure of competition, we obtained cross-sections of all individuals in prison at the end of 2015 and 2018 from the Ministry of Justice and Public Security. These data include information on general demographics, crimes committed or accused, date of first incarceration, highly accurate gang affiliation, and municipality and department of birth and residence. We subset to all gang-affiliated inmates whose date of first incarceration occurred in the three years prior to the 2016 non-aggression pact. Table 1 Panel D presents their summary statistics.

2.4 Pharmacy Sales and Hospital Visits

In order to examine the downstream effects of extortion on consumers, we focus on retail prices at pharmacies and health outcomes. Retail pharmacy sales data for the years 2014 to 2017 are provided by the National Directorate of Medicines (DNM) of El Salvador. Due to high drug prices relative to comparable countries, the government started collecting sales data from pharmacies in 2014 with the intent of monitoring drug prices and increasing price

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[10]We analyze whether the share of homicides with no gang affiliation per municipality is correlated with our measure of gang competition defined in Section 5. We find that this correlation is statistically and economically insignificant, with an estimated coefficient of -0.006 (p-value of 0.806).

transparency for consumers. Starting in January 2016, the sales data were collected at the monthly frequency. Prior to January 2016, sales data were collected at lower frequency. We observe sales data for December 2014, March 2015, and August 2015.

The data contain information on quantity and revenue by pharmacy for over 10,000 pharmaceutical products. We discuss the sample of drugs and sample of pharmacies in more depth in Section B.4. Table A-1 presents summary statistics for the pharmacy data (Panel A) for the sample period a year before and after the 2016 non-aggression pact.

To examine how changes in pharmaceutical prices affect health, we use individual-level data on hospital visits at public health facilities for the years 2012 to 2019 obtained from the Ministry of Health (MINSAL) and the Salvadoran Social Security Institute (ISSS). MINSAL is the main public hospital system and operates 30 hospitals, while ISSS operates 11 hospitals and covers workers in the formal sector and their dependents. The data do not include information for private hospitals in El Salvador; however, only 5% of the population has private health insurance and can readily access private hospitals. Records have information on the hospital, municipality, visit date, patient characteristics (age and gender), and diagnosis code as defined by the International Classification of Diseases (ICD-10).[11] Table A-1 (Panel B) presents summary statistics for the hospital visit data for the sample period a year before and after the 2016 non-aggression pact.

We provide a description of ancillary municipality characteristics, household survey, and crime data in Appendix B.

3   Model of Gang Competition and Collusion

To help guide our empirical analysis, we start with a simple theoretical framework motivated by discussions with our partner firm and fieldwork. In the model, gangs compete over extortion territory. The model implies that gangs can increase extortion by agreeing not to compete for territory when it is costly to both collect extortion and compete with rivals.

3.1   Model Setup

A firm is the sole supplier of a homogeneous good. In the empirical setting, this firm is a distributor that sells goods to retailers.[12] The firm has marginal cost normalized to zero and faces linear demand $Q_d(p_d) = \alpha_d - \beta p_d$, where p_d is the price and Q_d is total quantity.

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[11]We observe admission date in the MINSAL data and discharge date in the ISSS data. Otherwise, the two data sources have the same information.

[12]In the context of the model, the retailers are assumed to be perfectly competitive.

Demand may differ across municipalities indexed by d and the firm may set a different price, p_d, in different municipalities. We assume $\beta > 0$ and $\alpha_d > 0$.

There are two identical gangs that use violence to compete for territory. The larger the territory a gang controls, the larger the share of firm sales they can extort. Gang g chooses violence level, h_{gd}. Territory share is increasing in own violence but there are decreasing returns to violence. This assumption is common in the theoretical literature on conflict and gangs (Skaperdas 1996; Castillo and Kronick 2020).

We assume that territory share for gang g is given by

$$s_{gd} = \frac{1}{2} + (h_{gd})^{\frac{1}{2}} - (h_{-gd})^{\frac{1}{2}} \tag{1}$$

in a period in which gang g uses violence h_{gd} and the rival gang, $-g$, uses violence h_{-gd}. This is a particular case of a difference-form contest success function.[13]

When a gang controls share s_{gd} of the territory, they can charge extortion rate e_{gd} to share s_{gd} of the firm's demand in that territory. The firm must pay given the threat of violence by the gang. The firm chooses its price (or output quantity) to maximize profit after the gang commits to an extortion rate. In this way, the gang acts like an upstream firm while the distributor is the downstream firm.[14]

Fighting a rival gang and collecting extortion are costly. We assume that gang cost is given by $\phi h_{gd} e_{gd}$ where $\phi > \frac{\alpha_d}{4}$ is a cost shifter representing police enforcement. Motivated by the discussion in Section 2.1 and Appendix A, this cost function implies that it is especially costly for gangs to both fight the rival for territory and collect extortion. This assumption about diseconomies of scope is motivated by the fact that gangs may have a limited number of gang members that specialize in activities, making it costly to both engage in extortion and fight for territory. In addition, conflict with a rival gang may make all activities more dangerous, effectively increasing the cost of collecting extortion. Finally, we assume there is a fixed cost of entry, F, for gangs to operate in a municipality. A gang will operate in a municipality when variable profit exceeds this fixed cost.

Gang profits are determined by extortion revenue in their territory, $s_{gd} e_{gd} q_{gd}(e_{gd})$, and cost, $\phi h_{gd} e_{gd}$. When gangs compete, they choose the level of violence, h_{gd}, and extortion, e_{gd}, to maximize profit and solve

$$\max_{h_{gd}, e_{gd}} \left[\frac{1}{2} \left(\frac{1}{2} + (h_{gd})^{\frac{1}{2}} - (h_{-gd})^{\frac{1}{2}} \right) e_{gd}(\alpha_d - \beta e_{gd}) - \phi h_{gd} e_{gd} \right]. \tag{2}$$

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[13]See, for example, Hirshleifer (1989), Baik (1998) and Che and Gale (2000).

[14]This vertical structure is related to the canonical model of supply-chains proposed by Spengler (1950).

Figure 3

Simulated Extortion, Prices, and Violence as a Function of Demand
Under Competition and Collusion

a. Violence (h_{gd})   b. Extortion (e_{gd})   c. Price (p_{gd})
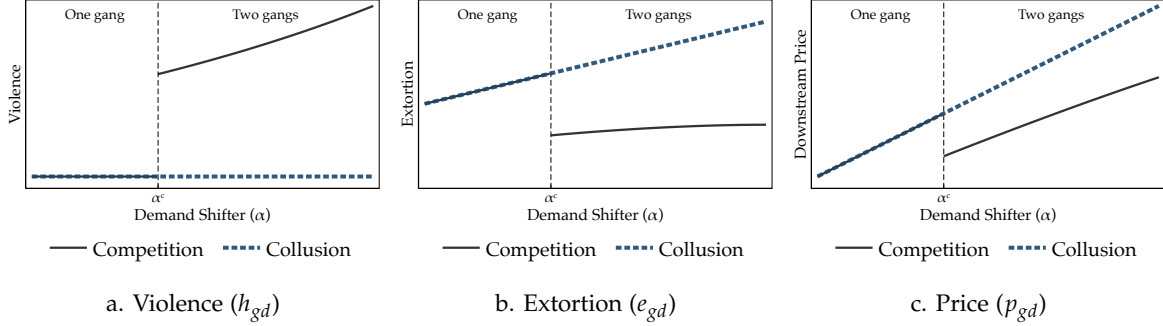
Notes: Charts show simulated outcomes for model in Section 3.1 where gangs choose violence and extortion rate. The vertical line shows the threshold, α^c, for entry by a second gang. When $\alpha < \alpha^c$, there is a monopoly gang that is unaffected by a collusive agreement. When $\alpha \geq \alpha^c$, there are two gangs that compete. In this case, collusion decreases violence and increase extortion and downstream prices. Simulation assumes $\beta = 15$, $\phi = 1$, and $F = 0.015$. The x-axis shows $\alpha \in [2.2, 3]$.

3.2 Model Equilibrium and Discussion

We begin by considering municipalities where two gangs are present. We compare the case in which the gangs compete to the case in which the two gangs collude and maximize joint profits by assigning exclusive territory. We discuss the main implications of the model below. Appendix C provides additional details.

Proposition 1. *Violence is lower when gangs collude than when gangs compete.*

When gangs compete, there is an incentive to use violence to expand territory in order to extort more of the firm's sales. Figure 3 simulates the equilibrium of the model for different levels of demand. As seen in Panel a., the gangs use more violence when α_d is large, corresponding to the case in which there is high demand for the underlying good. In other words, there is greater incentive for the gang to fight rivals for territory when extortion is more profitable.

When gangs collude they maximize joint profit and split the market rather than compete for territory, implying $s_{gd} = \frac{1}{2}$. In this case, using violence against the rival gang is unnecessary. This is consistent with the large and well-documented reduction in homicides after the start of both the 2012 truce and 2016 non-aggression pact.

Proposition 2. *Extortion is higher when gangs collude than when gangs compete.*

Gangs choose the extortion rate taking into account the fact that higher extortion will

increase consumer prices. When gangs compete, it is costly to both collect extortion and fight the rival gang for territory.

However, when gangs collude, the gang can set the same extortion rate as the case in which there is a monopoly gang in an area. In other words, they focus on extracting extortion from firms in their territory rather than expanding territory. As seen in Figure 3 Panel b., this increases the extortion rate. In Appendix C, we show that this also increases gang profits.

The model also implies that gangs price discriminate when demand differs across markets or products. Figure 3 Panel b shows extortion as a function of α_d. When the demand curve in a market is more inelastic, there is more scope for the gang to charge high extortion. This effect is exacerbated when gangs collude.

Proposition 3. *Downstream prices are higher when gangs collude.*

When gangs collude and increase extortion, this in turn increases prices for consumers relative to the case in which gangs compete. This can be seen in Figure 3 Panel c. In the model, there is double-marginalization: a gang sets the extortion rate which increases cost for the firm and then the firm adds an additional markup. In general, the degree of pass-through of extortion to downstream prices when firms have market power depends on the specific demand function and is ultimately an empirical question.

The case in which there is a single gang in a municipality is also shown in Figure 3. This is the case when $\alpha_d < \alpha_d^c$ where α_d^c is a cutoff such that a second gang cannot profitably enter a municipality. In these municipalities, collusion between the gangs has no effect on violence, extortion rates, or downstream prices since the gang is already charging the monopoly extortion rate. These municipalities form our control group in our empirical analysis.

Taken together, the model offers several implications that guide our empirical analysis. The model highlights that gangs use violence to compete for extortion territory in addition to threatening violence in order to collect extortion. The model implies that a collusive agreement between the gangs allows gangs to shift resources to collecting extortion. We examine this mechanism in our empirical analysis.

4 Descriptive Analysis

We first examine route-level extortion and deliveries and explore how extortion rates vary with respect to the value of each delivery. In line with accounts from the company's security team, we show two main results. First, extortion is higher for higher value deliveries. Second, gangs use local and observable proxies for demand when setting extortion rates.

These results shed light on how gangs use price discrimination across locations. We then analyze what municipality-level characteristics are correlated with extortion rates. These results provide initial correlational evidence consistent with the theoretical model in Section 3 and motivate our empirical strategy.

4.1 Route-Level Analysis of Extortion

Finding 1. *Extortion is increasing in delivery values*

Figure 4 presents binscatter charts showing the relationship between the log extortion payment made by the firm upon a delivery and the log value of the nearest delivery (a.) and the log value of all goods in the truck at the time of the nearest delivery (b.).

Figure 4 a. shows that there is a positive relationship between the value of the goods being delivered and the extortion payment. This result implies that extortion rates are not fixed fees and instead vary according to what is being delivered. Furthermore, it suggests that gangs have some information about demand for the good being delivered and set an extortion rate accordingly, consistent with distributor's accounts and the model presented in Section 3. However, the correlation between extortion and delivery values is modest: a 1% increase in the value of delivery is associated with a 0.04% increase in extortion.

Figure 4
Relationship Between Extortion Rates and Delivery Values
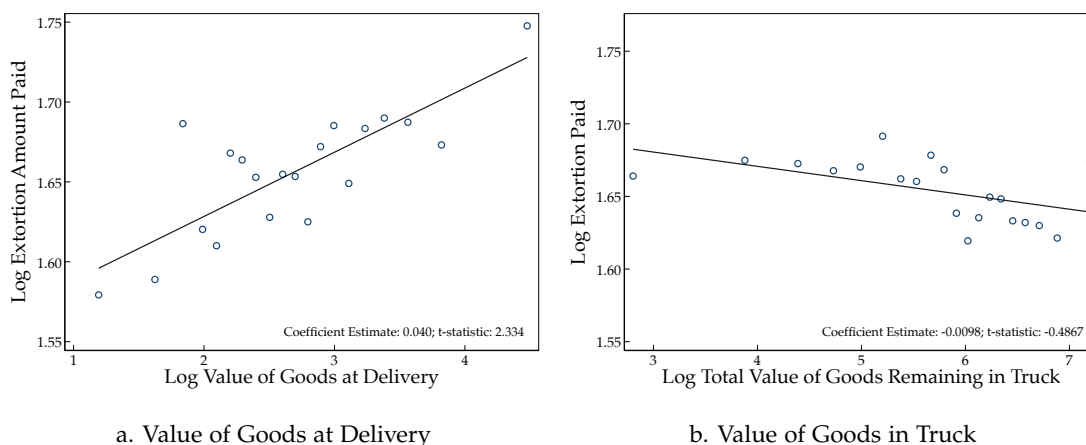
a. Value of Goods at Delivery   b. Value of Goods in Truck

Notes: The figure presents binscatters between the log of the extortion amount paid by the firm upon delivery and the value of goods delivered (a.) and the total value of goods delivered by the truck on the date (b.). The unit of observation is an extortion payment-delivery pair. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the delivery route level.

Finding 2. *Extortion rates depend on local observable characteristics*

What characteristics do gangs use to proxy for demand and price discriminate across locations? First, we ask whether gangs set local extortion rates based on all deliveries made on a route on a given day (including outside gang territory) or based on local characteristics of the deliveries/retailers. To explore this, Figure 4 b. examines whether there is a relationship between extortion and the value of goods remaining in the truck. We find that there is little relationship between the total value of goods remaining in the truck upon delivery and the extortion payment paid by the firm. This suggests that gangs do not generally set extortion based on the trucks' contents. This is consistent with conversations with the firm, where they noted that gangs rarely look inside the firm's truck before setting an extortion demand. Instead, they noted that gangs focus more on proxies of the value of a delivery (e.g. the characteristics of the retailer that is receiving the delivery) instead of vehicle contents.

To investigate the extent to which variation in extortion can be explained by local characteristics, Table A-2 presents regression estimates for the relationship between extortion amounts and the value of deliveries when we include various fixed effects. Column 1 presents estimates with no fixed effects, while columns 2-4 sequentially include municipality, route, and retailer fixed effects, respectively. Conditioning on these time-invariant characteristics increases the adjusted R^2 from less than 0.01 in column 1 to over 0.54 in column 4. The results in Table A-2 suggest that retailer characteristics explain a considerable amount of the variation in extortion amounts, consistent with gangs using local proxies for product demand to price discriminate.

Finding 3. *Extortion is unrelated to extortion payments elsewhere on a route*

How are extortion payments related to the number of extortion payments made elsewhere along a route? If gangs set extortion rates primarily using local characteristics (rather than the delivery firm's characteristics), then we would expect the amount of extortion paid to be unrelated to extortion payments elsewhere on a route. However, if gangs set extortion in a centralized manner using knowledge of the firm's delivery routes, they might extract higher extortion payments along routes facing fewer extortion payments. Similarly, if gang extortion acts as a vertical chain of "tolls", then we would expect that gangs extract more extortion along routes with fewer extortion payments. Figure A-6 presents the relationship between extortion rates and the number of extortion payments made elsewhere on a route. We find that there is little relationship between extortion rates and the number of extortion payments made elsewhere on route. The result suggests that gangs do not determine extortion rates

using characteristics of the firm's delivery routes.[15]

4.2 Municipality-Level Analysis of Extortion

Finding 4. *Extortion is positively correlated with proxies for downstream demand*

We examine how municipality-level proxies for development correlate with extortion. Figure 5 presents binscatter charts for the relationship between log of the average yearly extortion paid by the firm in a municipality and various municipality-level characteristics related to firm delivery values and economic development. Figure 5 (a.) explores the relationship between extortion and delivery values. In line with the findings in Section 4.1, extortion is higher in municipalities with higher delivery values. Figure 5 (b.) examines how the log of average nightlights per year is correlated with extortion. The results show that higher levels of economic development, which is likely correlated with higher demand for goods, are associated with higher extortion. This result provides additional evidence that gangs set extortion rates that depend on downstream demand.

Figure 5
Municipality-Level Correlates of Extortion Rates

a. Value of Deliveries   b. Nightlights
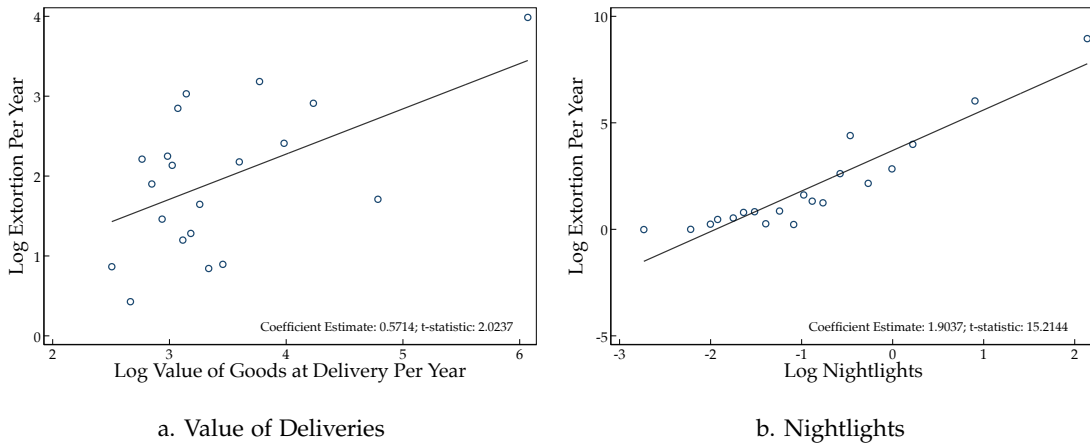
Notes: The figure presents binscatters between the log of the average yearly extortion amount paid by the firm in a municipality and: (a.) the log of the average value of deliveries, and (b.) the log of average nightlights per year. The unit of observation is a municipality. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the municipality level.

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[15]The result is consistent with conversations with the security team, who noted that extortion payments granted the firm the right to deliver to a gang-controlled area (rather than acting as a chain of "tolls" along their routes).

Finding 5. *Extortion is positively correlated with higher gang violence and competition*

Given that development is endogenous to gang presence, we next examine how extortion is related to gang competition. While we examine the causal relationship between extortion and gang competition in Section 5, we first explore the cross-sectional correlation. Figure 6 a. presents a binscatter chart showing the relationship between the average yearly extortion paid by the company and average homicides across municipalities. Figure 6 a. shows that there is a positive relationship between extortion and homicides. Figure 6 b. presents a binscatter chart showing the correlational relationship between extortion and a proxy of gang competition: a homicide Herfindahl-Hirschman Index (HHI) that uses the share of homicides in municipality committed by MS-13 or Barrio 18 in the three years prior to the 2016 non-aggression pact (defined in more detail in Section 5.2). We find that higher gang competition is correlated with higher extortion. This non-causal result is broadly consistent with the correlation found in surveys between competition and extortion (Magaloni et al. 2020b,a).

Figure 6
Relationship Between Extortion Rates and Gang Violence

a. Homicides   b. Gang Competition

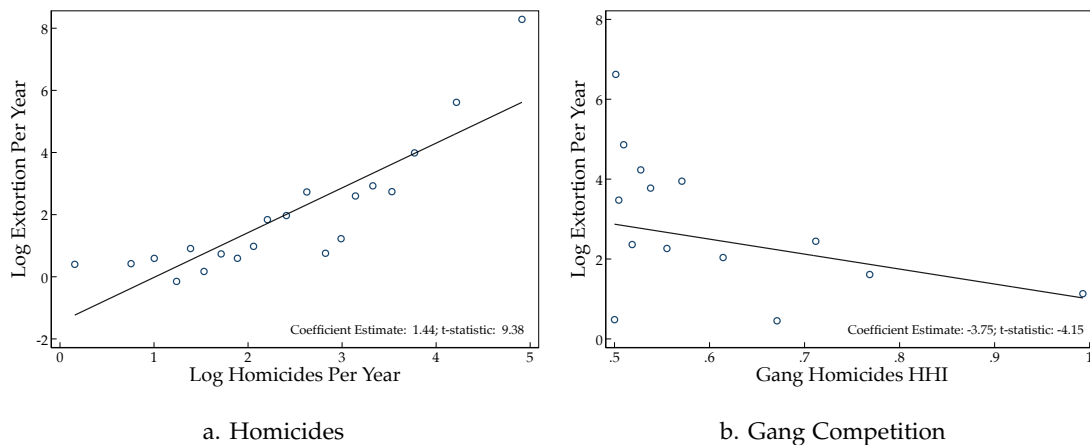*Notes:* The figure presents binscatters between the log of the average extortion amount paid by the firm upon delivery and: (a.) the log of the number of homicides per year, and (b.) the homicide Herfindahl-Hirschman Index (HHI), defined using the share of homicides in municipality committed by MS-13 or Barrio 18 in the three years prior to the 2016 non-aggression pact. The unit of observation is a municipality. The text on the top-right of figure (a.) and bottom-right of figure (b.) presents the estimated coefficients and t-statistics.

However, from these correlational results, it is difficult to determine whether gang competition causes higher levels of extortion, or whether some omitted variables determine both extortion rates and gang competition (e.g. downstream demand). In particular, the model implies that in markets with high demand (α), there is greater incentive for gangs to charge

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higher extortion and compete for territory using violence. Yet, the model also predicts that a reduction in gang competition will increase extortion. Therefore, even though there is a positive correlation between competition and extortion rates across municipalities, the causal effect of collusion could imply that competition has a negative effect on extortion.

5   Effects of the Non-Aggression Pact on Extortion

To examine the causal effect of a change in competition between gangs on extortion, we focus on the 2016 non-aggression pact between gangs. We first detail our empirical strategy and show that the non-aggression pact did induce a significant decrease in gang competition. We then show how the 2016 non-aggression pact impacted extortion.

5.1   Empirical Strategy

We exploit two sources of variation to estimate the causal effect of gang competition on extortion and prices: the timing of the 2016 non-aggression pact between the two main gangs, and cross-sectional variation in gang competition prior to the pact. We explore impacts at both the intensive and extensive margin.

The baseline specification is:

$$y_{dtr} = \beta(NonAggr_t \times Comp_d) + \gamma_t + \gamma_d + \gamma_r + \theta X_{dt} + \epsilon_{dtri} \tag{3}$$

where y_{dtr} is the outcome of interest (e.g. extortion rate) in municipality d at month t along route r; $NonAggr_t$ is an indicator variable equal to one if month t is after the non-aggression pact agreement made on April, 2016, and zero otherwise; $Comp_d$ is an indicator variable equal to one if the municipality d had gang competition prior to the pact, defined in more detail in the next section. We include municipality fixed effects, γ_d, and route fixed effects, γ_r, which control for time-invariant factors that may be correlated with extortion rates and gang competition. We also include month fixed effects, γ_t, which control for time-varying factors that may be correlated with aggregate changes in extortion across time. Additional controls, X_{dt}, include pre-pact municipality-level literacy, educational attainment, and employment interacted with year, and an indicator for whether a municipality in month t was part of Plan Secure El Salvador (PESS), an initiative that increased police enforcement that was rolled out in select areas starting in 2015. In more demanding specifications, we also include route by municipality fixed effects ($\gamma_r \times \gamma_m$) and route by post-non-aggression pact ($\gamma_r \times NonAggr_t$) fixed effects to exploit only within route changes in trends in extortion across municipalities over time (before and after the non-aggression pact). ϵ_{dtr} is a vector

of idiosyncratic random errors. To account for correlation within a municipality across time in extortion and prices, we present both standard errors clustered at the municipality level and Conley (1999) standard errors that allow for spatial correlation and temporal interdependence (Colella et al. 2019).[16]

When estimating the effect of the non-aggression pact on extortion, we focus on a relatively short period around the non-aggression pact, June 2015 to January 2018, for two reasons. First, there was a change in how extortion was recorded in June 2015. Starting in June 2015, the distributor started validating extortion payments, making the data more reliable. Second, using a relatively short period around the non-aggression pact addresses concerns about other policies that may have affected competition long before or after the pact (e.g. the 2012 truce) or longer-run effects of the non-aggression pact. Nevertheless, we show event study estimates and conduct robustness exercises using extortion data prior to June 2015.

The coefficient of interest in equation (3), β, is interpreted as the change in extortion rates due to the change in gang competition following the non-aggression pact. The main identifying assumption is that in the absence of the non-aggression pact, extortion rates would follow common trends in areas with and without competition. We use a number of methods to examine the validity of the common trends assumption, including examining trends prior to the non-aggression pact and examining the robustness of results to using the synthetic difference-in-difference approach of Arkhangelsky et al. (2021). In addition, for equation (3) to identify an effect of gang competition on extortion or prices, the non-aggression pact must have meaningfully decreased competition between gangs. We start by examining this issue in Section 5.2.

5.2 Measuring Gang Competition

To create our measure of gang competition in a municipality prior to the non-aggression pact, we construct the Herfindahl-Hirschman Index (HHI) in each municipality. There is very limited information about the location of gangs over the period. Therefore, we use homicides committed by gangs prior to 2016 to define our primary measure of competition as these are an observable and meaningful outcome of gang competition. Gangs use violence to fight rival gangs for territory as well as threaten extortion targets and other non-gang members. The basic assumption is that municipalities where both gangs are committing many homicides have gang competition.

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[16]For some outcomes of interest (e.g., gang homicides), data is at the municipality-month level rather than the municipality-route-month level. For these outcomes, we do not include route fixed effects or route by municipality fixed effects.

To construct the HHI, we define $s_{d,ms13}$ and $s_{d,b18}$ as the share of homicides in municipality d committed by MS-13 or Barrio 18 in the three years prior to the non-aggression pact.[17] We remove municipalities with one or no homicides given that gangs may not be present in these areas and competition is not well-defined, however, results are robust if we treat these municipalities as having no competition. We construct the HHI for a municipality d as $HHI_d = \sum_{g=ms13,b18} s_{d,g}^2$.[18] We then define an indicator for competition, $Comp_d$, as having a low HHI. While we explore a variety of cutoffs for defining competition, our baseline specification defines $Comp_d$ as an indicator equal to zero if HHI_d is in the top quartile of municipalities and one otherwise.

We validate this measure of gang competition in a few ways. First, we show that the non-aggression pact between the gangs affected homicides in the municipalities we define as having competition prior to the pact but not the areas without prior competition. This can be seen in Figure 7 which presents the number of homicides in which gangs were perpetrators or victims in municipalities with gang competition and without gang competition prior to the pact. Unlike municipalities with gang competition, municipalities without gang competition saw little change in the number of homicides after the pact. This is consistent with the idea that violence was mainly used as a threat against non-gang members in these areas rather than there being violence between the two gangs. This can also be seen in Column 1 of Table A-3 which present the results from estimating equation (3) on the number of homicides. Figure 7 shows that while homicide rates were higher in competing areas before the pact, there was no differential pre-trend in violence in these areas relative to areas without gang competition.

Second, the non-aggression pact did not have a statistically significant effect on other crimes that are less likely to be associated with gang competition, such as domestic violence, petty theft, and robberies. This can be seen in columns 2 to 4 of Table A-3. The results imply that the non-aggression pact mainly affected gang-on-gang violence in municipalities with prior gang competition and not crime levels more generally.

These results provide evidence that the pact reduced violent competition between the gangs in municipalities with prior competition according to our HHI measure. However, municipalities defined as not having gang competition prior to pact were largely unaffected

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[17]Barrio 18 split into two factions in the early 2010s: *Revolucionarios* in the north and *Sureños* in the south. The data do not separate homicides committed by *Revolucionarios* or *Sureños* prior to 2015; however, as implied by the respective names, the two factions of Barrio 18 tend to be geographically separated and so there is limited competition between them (Amaya and Martínez 2015). Other gangs in El Salvador commit a very small share of homicides.

[18]Appendix Figure A-2 presents municipality-level maps of homicides and homicide HHIs and Appendix Figure A-4 presents the histogram of our homicide HHI measure.

Figure 7

Gang Homicides by Competition

by the truce and form a valid control group. Nevertheless, we examine the robustness of results using alternative measures of gang competition, including an alternative HHI measure based on gang affiliation and municipality of residence of inmates incarcerated in the three years prior to the 2016 non-aggression pact.[19]

5.3 Effect on Extortion

Figure 8 presents the estimated effect of the non-aggression pact on the extortion rate by period with municipality, route, and month fixed effects. We find that in the periods before the non-aggression pact, there is no significant difference in the extortion rate in municipalities with gang competition and those without competition. Municipalities with competition had similar trends in the period prior to the non-aggression pact as municipalities without competition, supporting the parallel trends assumption.

Once the gangs agreed to the non-aggression pact, the extortion rate increased in municipalities where gangs previously competed relative to those where gangs did not previously compete as seen in Figure 8. Interestingly, the increase in extortion was gradual and becomes significant about four months following the non-aggression pact, suggesting that there might be adjustment costs for gangs as they reallocate resources. About a year after the pact, the

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[19]Appendix Figure A-5 shows the strong correlation between the two HHI measures.

increase in the extortion rate exceeds 20%.

Figure 8
Impact of Non-Aggression Pact on Extortion
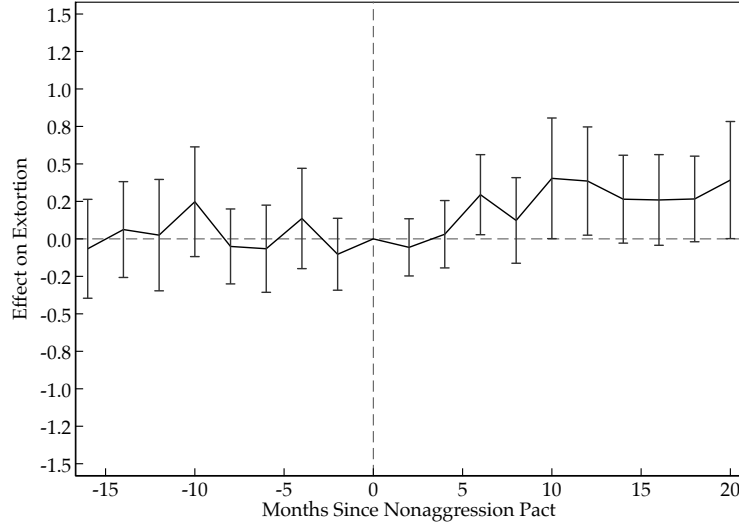
Notes: Vertical line shows start of non-aggression pact (April 2016). Figure shows bimonthly point estimates using the difference-in-difference specification with log extortion amounts as the outcome. Specification includes month fixed effects, municipality fixed effects, and route fixed effects as in the baseline specification (3). The period prior to the start of the non-aggression pact between MS-13 and Barrio 18 is omitted. The sample period is October 2014 to January 2018. Bimonthly periods are chosen because extortion payments sometimes cover periods of 4 to 6 weeks. Error bars indicate 95% confidence intervals using standard errors clustered at the municipality level.

Table 2 presents the average effect on the extortion rate following the non-aggression pact. We present results using different measures of competition: Panel A defines gang competition using the homicide *HHI* while Panel B uses the inmate *HHI*. In a specification with month, municipality, and route fixed effects (column 1), we find that collusion between gangs increases extortion by 22.5%. This estimate is statistically significant, including when accounting for spatial correlation. We include municipality by route fixed effects in column 2 to control for differences across routes and find that results are similar, implying a 30% increase in extortion rates.

Table 2 column 3 includes fixed effects for routes interacted with an indicator for whether a month is after the non-aggression pact to account for potential changes in routes post-pact. This specification compares the trend in extortion rates—before and after the non-aggression pact—for the portions of a route that fall inside municipalities with gang competition to the trend along the same route for the portions of the route that fall in municipalities with little to no gang competition. The results presented in column 3 imply that the non-aggression

pact increased extortion rates by approximately 23%, very similar to our baseline estimates. We also find very similar estimates using our alternative measure of competition using the inmate *HHI*: results in Panel B suggest that extortion increased between 24% to 28% in municipalities with prior competition following the non-aggression pact.

A potential confounding factor is the implementation of Plan Secure El Salvador (PESS). The initiative increased police enforcement and was rolled out in select areas starting in 2016 (see Appendix Section A.2). In columns 4-6 of Table 2, we directly control for the implementation of PESS in a municipality. While the program was only implemented in a small number of areas, interestingly, we find suggestive evidence that increased enforcement from PESS may have led to a modest decrease in extortion rates. This result is consistent with the theoretical prediction of a change in gang cost. Nonetheless, we find that the estimated effect of the non-aggression pact on extortion is robust to accounting for the implementation of PESS.

We also examine whether the non-aggression pact affected the number of extortion payments and find little evidence of an extensive margin effect. We present the impacts of the non-aggression pact on the probability of paying extortion in Panel A of Table A-4. The point estimates imply that the pact increased the probability of at least one extortion in a municipality-route by 0.3%; however, these results are not statistically significant. We also examine the effects of the pact on the number of extortion incidents and find no evidence that the average number of extortion incidents changed following the pact (see Panel B of Table A-4). These results suggest that while gangs increased extortion rates after the pact, they did not begin to collect extortion significantly more or less frequently.

5.4   Understanding the Increase in Extortion

Overall, the results in Section 5.3 show that extortion payments substantially increase when gangs collude. The model and qualitative evidence highlight that gangs may shift resources towards extortion when gangs collude given that it is costly to both collect extortion and fight rival gangs. In this section, we examine this mechanism empirically and explore alternative mechanisms.

Shifting Resources to Extortion – Gangs may devote more resources towards collecting extortion following the pact. In particular, gangs may be able to increase extortion rates by shifting resources towards monitoring and credibly threatening extortion targets.[20] We examine whether reports of violent threats by gangs increase following the non-aggression pact. In Table A-5 we find a significant increase in reports of gang-related arrests for threats

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[20]In Appendix A, we discuss how gangs use threats to ensure compliance and maximize extortion demands.

Table 2

Effect of Non-Aggression Pact on Extortion

in Municipalities with Gang Competition

	Outcome: log(Extortion+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: $Comp_d$ Using Homicide Composition					
$NonAggr_t \times Comp_d$	0.225**	0.301***	0.234***	0.224**	0.304***	0.235***
	(0.097)	(0.095)	(0.085)	(0.097)	(0.096)	(0.085)
	[0.079]	[0.089]	[0.094]	[0.079]	[0.089]	[0.096]
$PESS_{dt}$				−0.044	−0.136	−0.106
				(0.107)	(0.113)	(0.115)
				[0.079]	[0.084]	[0.084]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-$NonAggr_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	1.95	1.96	1.96	1.95	1.96	1.96
Adjusted R2	0.490	0.642	0.646	0.490	0.643	0.646
Observations	2,314	2,166	2,166	2,314	2,166	2,166
	Panel B: $Comp_d$ Using Inmate Composition					
$NonAggr_t \times Comp_d$	0.237**	0.275***	0.286***	0.235**	0.279***	0.291***
	(0.093)	(0.092)	(0.088)	(0.094)	(0.094)	(0.088)
	[0.087]	[0.092]	[0.109]	[0.087]	[0.093]	[0.111]
$PESS_{dt}$				−0.028	−0.137	−0.118
				(0.112)	(0.117)	(0.116)
				[0.083]	[0.086]	[0.085]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-$NonAggr_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	1.96	1.97	1.97	1.96	1.97	1.97
Adjusted R2	0.493	0.645	0.650	0.493	0.645	0.650
Observations	2,281	2,137	2,137	2,281	2,137	2,137

Notes: The unit of observation is a route-municipality-month. The outcome variable is the log of the amount of extortion paid in a route-municipality-month in dollars plus one. The sample period is June 2015 to January 2018. The sample is comprised of all municipality-routes visited by the firm during the sample period. In Panel A, $Comp_d$ is defined using the gang affiliation and location of homicides in El Salvador in the three years prior to the non-aggression pact. In Panel B, $Comp_d$ is defined using the gang affiliation and location of residence for inmates in El Salvador arrested in the three years prior to the non-aggression pact. For both, we construct an HHI_d and define $Comp_d$ as an indicator variable equal to zero if HHI_d is in the top quartile of the HHI for municipalities and one otherwise. $PESS_{dt}$ is an indicator variable equal to one if the municipality was part of Plan Secure El Salvador (PESS) at month t and zero otherwise. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Covariates include census municipality characteristics – literacy, educational attainment, employment – interacted with year. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

and no increase in non-gang related threats. This suggests that gangs devote more resources to threaten violence following the non-aggression pact, allowing them to increase extortion rates.

Second, we examine whether the degree of price discrimination by gangs changes following the non-aggression pact. If gangs are dedicating more resources to their extortion business, gangs might have better information on retailers and the associated demand for delivered goods, and might be able to better price discriminate. We present the results in Table A-6; we find that suggestive evidence that after the pact, gangs increase extortion more for deliveries at retailers with higher delivery values.

Finally, we explore how firm delivery times change following the pact. If gangs are devoting more resources to extracting high extortion rates, it is possible that delivery times will increase given that collecting extortion may be more difficult when rates are higher. We present the results in Table A-7; we find suggestive evidence that the time between extortion payments and deliveries increases following the pact, consistent with the idea that gangs are willing to spend more time demanding higher payments.

Changes in Downstream Demand— The model and the results in Section 4.2 highlight that higher downstream demand is associated with higher extortion. Therefore, extortion might have increased if the reduction in violence due to the non-aggression pact considerably increased downstream demand. In Appendix Table A-8, we directly examine the effect of the non-aggression pact on per-capita household incomes, expenditures, and nightlight intensity and find no statistically significant effect in our sample period. This suggests that downstream demand did not increase substantially in the short-run following the pact.

Firm Adjustments— We also explore whether the results might be explained by the firm adjusting delivery locations or routes following the non-aggression pact. We find little evidence that the firm adjusted their routes or the retailers served following the pact (see Figures A-7 and A-8). Furthermore, we explore how the firm responds to the increase in extortion in detail in Section 6 and find that the distributor mostly adjusts via prices rather than along the extensive margin following the non-aggression pact. This is because the firm often has enduring delivery relationships with retailers, and is the sole distributor for many goods. These firm-level findings suggest that changes in the composition of routes used or retailers served is unlikely to explain the findings.

Price Competition— It could be the case that, when there is gang competition, firms choose to pay the gang that provides "protection" for the lowest cost. However, conversations with the distributor highlight that the firms paying extortion cannot choose which gang to pay for protection; instead, firms must pay whichever gang is in control of the territory where

they are making a delivery. For these reasons, we argue that the increase in extortion was primarily because gang collusion allowed gangs to focus resources on extortion rather than fighting for territory.

5.5 Heterogeneous Effects on Extortion

Figure 9
Effect of Non-Aggression Pact on Extortion
Heterogeneous Effect by Geographic Characteristics
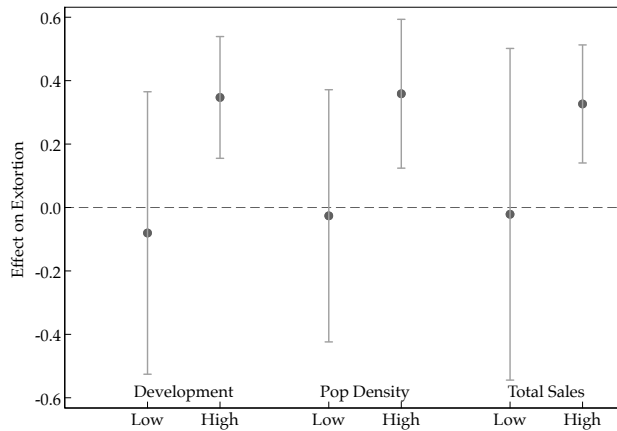
Notes: Shows point estimates and 95% confidence intervals for difference-in-difference model. Standard errors are clustered at the municipality level. Low (high) characteristics are defined as being below (above) the median value in the pre-period. Standard errors are clustered at the municipality level. All specifications include municipality fixed effects, route fixed effects, month fixed effects, and controls for PESS and census municipality characteristics interacted with year.

One implication of the theoretical model is that collusion between gangs is predicted to have a larger effect on extortion in markets with higher demand for the goods being extorted. In order to examine this, we estimate separate regressions by geographic characteristics that are likely to reflect demand conditions.

Figure 9 shows the estimated effect on extortion by geographic characteristics. First, we examine the results by municipality development as measured by nightlights. The non-aggression pact is estimated to increase extortion by 35% in municipalities with above median development, but the effect is not statistically significant in municipalities with below median development. Similarly, there is a larger effect on extortion in municipalities with high population density. Finally, we examine total sales in the surrounding canton. The non-aggression pact has a larger effect in areas with above median total sales, although the difference is not statistically significant.

Taken together, these results suggest that the non-aggression pact allowed gangs to in-

crease extortion most in regions with higher (or more inelastic) demand, consistent with the theoretical predictions in Figure 3 Panel B.

5.6 Robustness

One of the primary concerns is that results are driven by the definition of gang competition prior to the non-aggression pact. We address this concern by estimating specifications using alternative measures of competition.

The cutoff used to define competition in our baseline estimates was chosen to reflect the areas most likely to be affected by the non-aggression pact. However, we examine how the estimated effect on extortion differs for a wide range of cutoffs for defining competition. The estimates, presented in Appendix Table A-9, are quite similar to the baseline, ranging from 18% (50th percentile) to 30% (80th percentile).

It is possible that areas defined as not having competition are still somewhat affected by the pact, leading to an underestimate of the effect. Rather than use a binary measure of competition, we also estimate an alternative model using HHI_d as a continuous treatment measure. The results, which are qualitatively similar to the baseline specification, are presented in Appendix Table A-10. The point estimates, which are all significant, imply that if a municipality were to go from a duopoly in which the two gangs split the market equally ($HHI_d = 1/2$) to fully collusive ($HHI_d = 1$), extortion would increase by approximately 50%. Relatedly, there is concern that areas without homicides should be included in the control group. Interestingly, results are quite similar to the baseline results when we include municipalities without homicides as part of the control group (see Table A-11). Additionally, we show that the results are similar when we expand the sample period to include the full period for which we have extortion data (see Table A-12).

Note that one strength of using the HHI measure to define competition—where we use the *composition* of homicides or inmates rather than *levels*—is that it is more robust to concerns about mean reversion following the non-aggression pact. Nevertheless, in Table A-14 we show that the results are robust to using an HHI defined various years before the non-aggression pact. This is consistent with the fact that the HHI measure is quite stable over time.

We also show that the results are robust to recent synthetic differences-in-differences estimators that weaken the reliance on parallel trend assumptions (Arkhangelsky et al. 2021). This method also addresses concerns about testing for parallel trends (Roth 2022). We present the results in Table A-13. These results are also similar to the baseline specification.

Finally, to address the concern that gang competition also varies within a municipality, we replicate our analysis using smaller geographic units of analysis. The 262 municipalities are subdivided into 2,286 cantons. Using the address of each homicide, we determine the canton for the event and construct our measure of gang competition at the canton level rather than the municipality level. We then replicate our previous analysis at the canton level and present the results in Table A-15. Despite concerns about measurement error due to geocoding, estimates are largely similar to the baseline specification and imply an increase in extortion of between 17% and 22%.

6 Effect on Distributor Behavior

It is important to understand how extortion affects downstream firms and consumers in order to shed light on who bears the cost of extortion. In this section, we examine whether the distributor increased prices or changed deliveries in response to the increase in extortion due to gang collusion. In particular, we examine whether the non-aggression pact and resulting increase in extortion affected the distributor's margin on goods sold to retailers and pharmacies. This provides insight into the incidence of extortion. We also examine whether the distributor changed the number of deliveries in response to the non-aggression pact. In Section 7 we directly examine the effect on consumer prices for a subset of the goods using administrative data from pharmacies.

6.1 Effects of Extortion on Distributor Margins

To examine the causal effect of gang competition on the behavior of the distributor, we modify our baseline difference-in-differences specification to take advantage of the richness of the distributor sales data. We estimate the following specification:

$$y_{dtji} = \beta NonAggr_t \times Comp_{dj} + \gamma_t + \gamma_d + \gamma_j + \theta X_{dt} + \epsilon_{dtji} \tag{4}$$

where y_{dtji} is the outcome of interest (e.g. gross margin) for a delivery i for retailer j in municipality d at month t. We include retailer fixed effects, γ_j, to finely control for time-invariant unobservables. In particular, retailer fixed effects address concerns that the non-aggression pact affected the composition of retailers. As an additional robustness check we include route fixed effects. The remaining variables are defined as in equation (3).

In order to examine whether extortion causes the distributor to increase prices for retailers, we focus on the gross margin as the primary outcome. The gross margin is defined as

the difference between revenue amount (paid by the retailer to the distributor) and procurement cost (paid by the distributor to the manufacturer) for a given product. For instance, the distributor may sell $200 of acetaminophen 500 mg tablets to a retailer that it purchased from a manufacturer from $150. In this case the margin is $50. While we do not observe quantity or price per unit for each good (e.g., price per tablet), the margin captures a key measure of cost to the retailer. From the perspective of retailers, the distributor margin can be thought of as the delivery fee for a given product.

Table 3 presents the estimated effect of the 2016 non-aggression pact on the distribution firm's gross margin. In all cases, we link extortion and retailers for deliveries occurring on the same date and same route. In columns 1 and 2 we focus on retailers closest to an extortion payment, who are the most likely to be affected by an increase in extortion. Extortion payment may also affect prices for multiple nearby retailers and we examine retailers 1km and 5km away from an extortion payment in columns 3 to 6.

Columns 1 of Table 3 shows that after the non-aggression pact, the distributor's margin increased by 11.6% for deliveries that occur closest to extortion payments. Using the estimated effect of the pact on the level of extortion in Table 2, this implies that a $1 increase in extortion leads to a nearly $1 increase in the amount charged to retailers. In column 2, which includes route fixed effects, we find a slightly larger increase in the margin due to the pact.

Retailers further from the extortion saw a smaller increase in gross margins. While the estimates for sales within 1km are similar, we find only a 5.0% increase in the gross margin for deliveries within 5km of extortion payments. With route fixed effects, the point estimate implies a 1.8% increase in the gross margin. These estimates are not statistically significant.

Overall, these estimates are broadly consistent with the model presented in Section 3. When the distributor pays higher extortion due to collusion between the gangs, they raise prices (and gross margin). The increase in prices largely affected retailers closest to the extortion payments.

6.2 Heterogeneous Effects of Extortion on Distributor Margins

When extortion increases due to gang collusion, which products are most effected by the increase in prices? The theoretical model implies that there may be a larger effect for products with relatively inelastic demand. In order to examine this, we estimate separate regressions by product groups that are likely to differ in their demand elasticity. To define product groups, we focus on the 500 most common products delivered by the distribution firm and divide them into five categories: staple food products, non-staple foods, cleaning supplies,

Table 3
Effect of Non-Aggression Pact on Distribution Margin

	Nearest Sale		Sales within 1km		Sales within 5km	
	(1)	(2)	(3)	(4)	(5)	(6)
NonAggr$_t \times$ Comp$_d$	0.121**	0.154***	0.121**	0.086**	0.059	0.034
	(0.055)	(0.048)	(0.052)	(0.041)	(0.049)	(0.022)
	[0.032]	[0.033]	[0.045]	[0.061]	[0.020]	[0.022]
Municipality FEs	Yes	Yes	Yes	Yes	Yes	Yes
Route FEs	No	Yes	No	Yes	No	Yes
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Retailer FEs	Yes	Yes	Yes	Yes	Yes	Yes
Outcome Mean	1.03	1.03	0.99	0.99	0.99	0.99
Adjusted R2	0.443	0.445	0.444	0.447	0.439	0.442
Observations	34,571	34,570	40,447	40,444	143,194	143,194

Notes: The unit of observation is a delivery. Distributor margin is defined as the difference between wholesale price and manufacturer price. Columns (1) and (2) show the effect on sales closest to where a extortion payment was made. Columns (3) and (4) show the effect on sales within 1km of an extortion payment while columns (5) and (6) show effect on sales within 5km of an extortion payment. Specifications include controls for PESS and census municipality characteristics interacted with year. The sample period is June 2015 to January 2018. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

toiletries, and non-pharmaceutical health products. We exclude pharmaceutical health products as we examine these directly in the Section 7.

Figure 10 panel a. shows the estimated effects of the non-aggression pact on extortion payments made near deliveries with different types of products. These results imply a similar increase in extortion across the product groups. These results are consistent with the qualitative evidence that gangs do not look inside the trucks and set a different extortion rate based on the products being delivered, rather the gangs use observable characteristics of overall demand to set extortion (such as the characteristics examined in Figure 9).

However, the results in Figure 10 panel b. show evidence of heterogeneous adjustment effects by the distributor by product groups. Distributor margins increase the most for goods that likely have inelastic demand such as staple foods. The distributor does not significantly adjust prices for toiletries and non-pharma health products, which may have more elastic demand.

Taken together, the results presented in Figure 10 suggest that the non-aggression pact did not lead to heterogeneous increases in extortion by product type, but did induce hetero-geneous downstream adjustments by the distributor. The results suggest a larger increases in

Figure 10
Effect of Non-Aggression Pact on Extortion and Distribution Margins
Heterogeneous Effects by Product
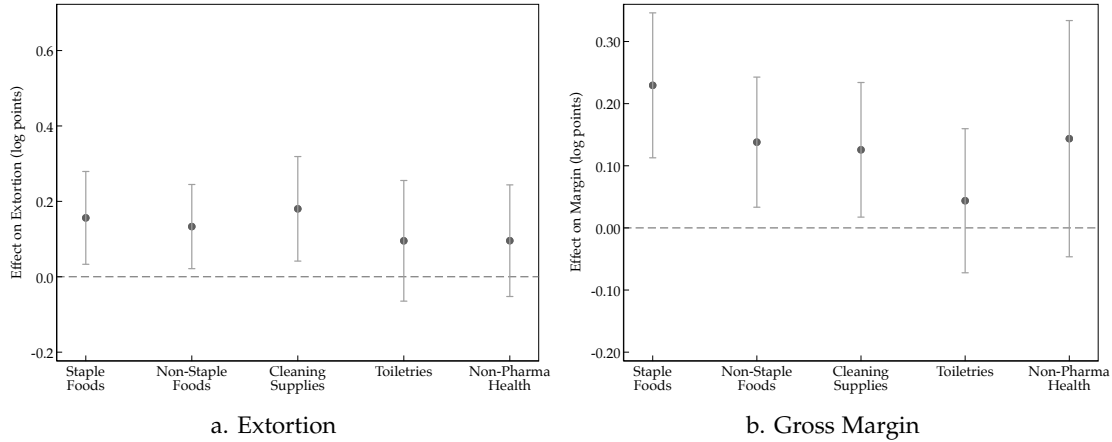
a. Extortion   b. Gross Margin

Notes: Shows point estimates and 95% confidence intervals for difference-in-difference model. Standard errors are clustered at the municipality level. Distributor margin is defined as the difference between wholesale price and manufacturer price. The sample period is 6/2015 to 1/2018. Standard errors clustered at the municipality level. All specifications include municipality fixed effects, route fixed effects, month fixed effects, retailer fixed effects, and controls for PESS and census municipality characteristics interacted with year.

distributor margins for inelastic products, consistent with the theoretical predictions in Figure 3 Panel c. Additionally, by affecting staple food products the most, the results suggest that increases in extortion due to gang collusion may disproportionately negatively impact poorer households, potentially exacerbating inequality and reducing economic development.

6.3 Effects of Extortion on Firm's Extensive Margin

In addition to adjusting prices, the distributor may respond to extortion by changing the quantity or type of deliveries. In Figure A-7 we examine the effect of the non-aggression pact by period on total cost, total deliveries, unique products, and unique retailers in a municipality-route-month as in equation (3). For each of these outcomes we find no evidence of pre-trends and no significant effect of the non-aggression pact. This is consistent with the fact that the distributor is contractually obligated to make deliveries and is often the exclusive distributor for certain products. Given the long-standing contracts, these outcomes are unlikely to adjust within our sample period. In addition, we also explore if the distributor changed the number of routes served per municipality after the pact and find no change (Figure A-8). Therefore, when extortion increases in a municipality, the distributor increases prices rather than adjusting deliveries.

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7 Effect on Retailers and Consumers

In the previous section we show that the increase in extortion causes the distributor to raise prices, affecting retailers' cost. In this section, we examine if this is then passed-through to consumers. To analyze this issue, we focus on pharmacies, a subset of the retailers with detail information on consumer prices. The distributor is a major supplier of both drugs from local manufacturers and international pharmaceutical companies. Drug prices in El Salvador have historically been substantially higher than in comparable countries, making drug prices the focus of much political debate. It is important to understand whether extortion is a factor driving high drug prices, especially given the potential implications for health.

7.1 Effect on Pharmacy Prices, Exit, and Entry

We employ a similar identification strategy as our baseline specification and examine the effect of the 2016 non-aggression pact on pharmacy prices. Columns 1 and 2 of Table 4 present the effect for all drugs at all pharmacies in the sales sample. In column 1 we include drug fixed effects to address concerns that changes in the composition of drugs could affect average prices. This specification implies that gang collusion resulted in a 7.6% increase in retail prices for pharmaceutical drugs. To address the concern that results may be driven by changes in the set of pharmacies over time, we also show results are robust to the inclusion of pharmacy fixed effects in Column 2. This is consistent with the fact that we find no evidence that the pact affected the number of pharmacies during our period of analysis (see Table A-17). Furthermore, Figure A-9 a. presents the estimated effect by period and shows no evidence of differential trends in the pre-period.

Many of the pharmacies in the sample are supplied by other distributors that are likely to also pay extortion. We examine the differential effect for the distributor that is the focus of this study by interacting the treatment indicator with an indicator for the distributor that provided the extortion data.[21] The coefficients in the second row of Table 4 are very small and insignificant, implying no differential effect for the drugs supplied by this distributor. This result is consistent with all distributors being similarly affected by the increase in extortion rates. In this way, the results suggest that other distributors in El Salvador are similarly affected by extortion.

We also examine the subset of drugs that are important for managing chronic diseases, including diabetes, hypertension, coronary heart disease, and asthma. The cost of diabetes

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[21]We identify this subset using the name and location of pharmacies. Note that these pharmacies may have drugs supplied by multiple distributors; however, we are not able to identify the specific drugs supplied by the distributor given that the distributor sales data do not contain a comparable drug identifier.

Table 4

Effect of Non-Aggression Pact on Consumer Prices at Pharmacies

	All Pharmacies/Drugs		Drugs for Managing Chronic Diagnoses	
	(1)	(2)	(3)	(4)
NonAggr$_t \times$ Comp$_d$	0.076**	0.058**	0.052**	0.044**
	(0.035)	(0.028)	(0.025)	(0.022)
	[0.008]	[0.013]	[0.013]	[0.018]
NonAggr$_t \times$ Comp$_d \times$ Distr	−0.015	0.003	−0.002	0.000
	(0.026)	(0.025)	(0.024)	(0.023)
	[0.007]	[0.009]	[0.017]	[0.018]
Municipality FEs	Yes	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes	Yes
Retailer FEs	No	Yes	No	Yes
Drug FEs	Yes	Yes	Yes	Yes
Outcome Mean	-1.11	-1.11	-0.82	-0.82
Adjusted R2	0.869	0.880	0.862	0.870
Observations	1,755,366	1,755,366	190,269	190,269

Notes: The unit of observation is a drug-pharmacy-month and the outcome is log(Price). The second row shows the coefficient on the treatment interacted with an indicator for whether the distributor of the drug is the firm that is the focus of our prior analysis. The sample period with available data on drug prices is December 2014 to December 2017. For the period prior to January 2016, data is available for December 2014, March 2015, and August 2015. The outcome is the price per unit (pill, milliliter, or gram depending on the product). Covariates include PESS and census municipality characteristics interacted with year. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

drugs are of particular concern given that 9% of the Salvadorean population has diabetes, almost double the world average (see WHO Diabetes Country Profile, 2020). There is concern that many drugs to treat chronic conditions are unaffordable given high drug prices in El Salvador relative to incomes. For this sample of drugs, we also find a positive and significant effect on prices due to the nonaggression pact as seen in Table 4.

These results indicate that the non-aggression pact led to an increase in pharmaceutical prices for consumers. This could be due to pass-through of upstream extortion to final consumers or an increase in direct extortion of the pharmacies. According to the Ministry of Health, which oversees pharmacies, direct extortion of pharmacies is much less common than extortion of suppliers, suggesting that extortion of distributors is playing an important role. Overall, the results show that the non-aggression pact further exacerbated high pharmaceutical prices in El Salvador.

Table 5
Effect of Non-Aggression Pact on Hospital Visits

	All Diagnoses		Injuries		Chronic Diagnoses Affected by Drug Adherence	
	(1)	(2)	(3)	(4)	(5)	(6)
NonAggr$_t \times$ Comp$_d$	0.017	0.011	−0.017	−0.016	0.086***	0.085***
	(0.014)	(0.014)	(0.023)	(0.023)	(0.031)	(0.030)
	[0.008]	[0.009]	[0.009]	[0.010]	[0.023]	[0.032]
Municipality FEs	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	No	Yes	No	Yes
Outcome Mean	233.11	233.11	12.29	12.29	14.99	14.99
Observations	4,588	4,588	4,588	4,588	4,588	4,588
Clusters	148	148	148	148	148	148

Notes: The outcome is the number of inpatient visits in a municipality-month. Results are from Poisson regressions since the outcome is a count variable. Covariates include census municipality characteristics interacted with year. Standard errors clustered at the municipality level in parentheses and spatial standard errors calculated using a 100 km cut-off window are presented in brackets (Bertanha and Moser 2016). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

7.2 Effect on Health

To examine whether the increase in prices due to the gang non-aggression pact affected health outcomes, we examine visits to public hospitals in Table 5. Given that the outcome of interest is number of visits, we employ Poisson regressions. We first examine visits for all diagnoses and find a small, statistically insignificant effect. This is not surprising given that many hospital visits are unlikely to be affected by drug prices. In addition, the decrease in violence due the non-aggression pact may have decreased visits, counteracting the effect due to higher drug prices. Focusing on visits for chronic conditions treated by the drugs analyzed in Table 4, we find that hospital visits increase by about 8%. As seen in Column 5 and 6, this result is significant and robust to including controls for demographic characteristics. In Appendix Table A-16 we estimate the effect on visits for individual diagnoses that may be affected by an increase in drug prices. The results are particularly large and significant for diabetes, a common chronic condition in El Salvador. This is consistent with the fact that, if untreated, diabetes can cause kidney failure, heart attacks, blindness, and stroke.

The fact that there is a significant effect on hospital visits for diagnoses plausibly affected by high drug prices and not for other diagnoses, such as injuries, helps confirm that the increase in visits is due to the effect of the non-aggression pact on drug prices. Finally, Figure A-9 b. examines the effect on visits for chronic conditions by period. Results imply that the effects are not driven by trends prior to the non-aggression pact.

Extortion may impose a large cost on consumers by increasing prices across a range of goods. We highlight that in the case of pharmaceutical drugs, the increase in extortion due to the pact had important downstream effects. The model in Section 3 implies that the effect on consumers may be exacerbated by double-marginalization. While the non-aggression pact drastically reduced violence, the evidence implies health was indirectly affected by this increase in prices.

8   Conclusion

Policy makers have often resorted to truces to reduce violence between gangs. In this paper, we highlight an additional effect of cooperation between gangs that has been largely ignored. When criminal organizations are able to collude, they significantly increase extortion. We also shed light on the broader economic consequences of extortion and find that consumers bear a large burden from upstream extortion given the pass-through to retailers and consumer prices. The non-aggression pact led to larger price increases for goods with inelastic demand, such as staple foods and many pharmaceutical drugs, implying that extortion may particularly impact poorer households and exacerbate unequal access to healthcare. These results may help reconcile why truces tend to lack popular support or face political backlash.[22]

While we primarily focus on the effect of the 2016 non-aggression pact on one distributor, the results likely have broader implications. Our results suggest a similar increase in prices for pharmaceutical drugs supplied by other distributors, implying that other firms were similarly affected by the pact. Other pacts between criminal organizations, including the 2012 truce in El Salvador, also reduced competition between gangs and may have had similar effects. Understanding the unintended consequences of gang truces is particularly important given that international organizations have promoted gang pacts in the past.[23]

Extortion is present in many countries and there is a need to develop policies that target the root causes of extortion. We argue that considering the market structure for extortion is important for understanding extortion rates and the downstream consequences. Our model and findings also suggest that certain goods, such as staple products, are more likely to be impacted by extortion, and protecting these goods from extortion could reduce gang profits and the incentives to compete for territory. Overall, these results show how insights from industrial organization can inform our understanding of criminal organizations and

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[22]For example, in a public opinion survey, 47% of Salvadorans said that the 2012 truce mainly benefited the gangs while only 16% said it benefited the general population (Cawley 2013).

[23]For instance, the Organization of American States supported the 2012 El Salvador pact.

extortion.

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Online Appendix

A Extortion in El Salvador

In this section, we provide an overview of extortion and protection and the behavior of gangs in El Salvador. We also discuss how this compares to other countries. We then overview the response by the El Salvador government.

A.1 Extortion Logistics

The main revenue source for gangs in El Salvador is extortion. This is similar to many criminal organizations in other settings, including the Mafia in Italy, Russia, Japan, China, and the US (Gambetta 1996; Varese et al. 2005; Wang 2013). Protection rackets involve selling security from potential threats. Extortion is often considered a type of protection racket in which the threat comes exclusively from the organization offering protection (Gambetta 1996, 2011). While there are some limited examples of El Salvador gangs offering protection from other threats, the gangs largely engage in straightforward extortion in which they explicitly threaten targets with violence.[24]

A large literature has discussed the parallels between criminal organizations and the state. Both may have a "monopoly of violence" and there are important similarities between extortion collected by gangs and bribes or taxes collected by the state (Olson 1993; Tilly 2017). In an influence book on the Sicilian Mafia, Gambetta (1996) argues that there are limitations to this comparison. Unlike a state, criminal organizations are often independent organizations that sometimes form pacts or cartels. Bribes are paid to government officials to provide a good or service that provides some benefit to the individual. There is at least the possibility that bribes "grease the wheels" and allow scarce government resources to go to those with the highest willingness-to-pay (Lui 1985; Beck and Maher 1986). In contrast, extortion is paid to avoid the threat of violence created by the gang itself, and there is little potentially for an increase in efficiency. This can also be contrasted with taxes, which provide protection from international threats. Finally, Gambetta (1996) points out that gangs maximize profit, whereas the objective of states is often more complicated, especially democratically-elected

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[24]The gangs often have exclusive territory, thus protecting an extortion target from being extorted by a rival gang in the same location. In this way, the gangs indirectly provide protection from rival gangs.

governments that should serve constituents. In this way, Gambetta (1996) and others argue that gangs are more like individual firms than a state. This latter description of gangs is more in line with descriptions of gangs in El Salvador (e.g. Dudley et al. 2018).

The El Salvador gangs are large organizations with a complex structure that helps maintain territorial control. Both MS-13 and Barrio 18 have national leaders (*ranfleros*) that often dictate and negotiate larger gang policies, including the 2012 truce and 2016 non-aggression pact. Operations are organized around neighborhood cliques (*clicas*). A clique, which may comprise ten to hundreds of members, is tied to a set geographic perimeter within a municipality, often a neighborhood (*colonia*) in urban settings (Dudley et al. 2018). Cliques sends a portion of their extortion revenue to the *ranfleros*. The *ranfleros* provide clique members with promotion opportunities, protection to their relatives (inside and outside prisons), and funds for gang operations. *Ranfleros* leaders also provide coordination across clique territories, help settle disputes, and sanction murders of gang members suspected of cooperating with the police Dudley et al. (2018); Weiser (2021). In large urban areas, such as the capital San Salvador, there are numerous cliques from both MS-13 and Barrio 18. In our context, the delivery firm may pay extortion to multiple cliques from the same gang within one municipality.

Extortion is a complex activity that requires gangs to continually identify potential victims and collect extortion while evading authorities and credibly threatening violence or other repercussions if victims do not pay. In El Salvador, gangs rely on their extensive territorial control – often of whole urban neighborhoods – and an extensive network of collaborators and informants, to identify potential targets, collect information on these targets, and continually collect extortion payments (Dudley et al. 2018; Neu 2019; Global Initiative Against Transnational Organized Crime and InSight Crime 2019). Gangs often invest in a "relationship" with their victims, so they can credibly threaten violence and maintain future extortion payments (Ponce 2021). In an example from sentencing of gang members in El Salvador, extortion victims were sent a WhatsApp message saying that they should pay "otherwise their two children would end up in black bags." The gang member said he "knew where the victim worked, where their children studied, and information on their relatives and that they had no way of escaping."[25] In addition, maintaining the reputation of the gang for following-through on threats is important for ensuring that the threats are credible and victims do not go to the police (Ponce 2021).[26] The wholesale distributor that

[25]The original text comes from sentence 238-3-2018 from the First Court of Sentence in San Salvador available through El Salvador's Judicial Documentation Center (accessed on July 13, 2021).

[26]Since extortion has become a part of daily life in countless neighborhoods in El Salvador, it has also lead to numerous copycats in which opportunistic individuals, usually non-gang members, imitate the gangs' extortion tactics (Global Initiative Against Transnational Organized Crime and InSight Crime 2019). However, this is often

is the focus of this paper uses trucks that do not identify the name of the company in order to try to have some anonymity. However, the company told us that certain gang cliques implied they knew where they had their warehouse and could impose a large cost on the firm if they did not agree to extortion demands. For these reasons, collecting extortion is not a trivial task and can require a significant resources and expertise.

Gang extortion and violence tend to be intricately linked (Dudley et al. 2018). Moreover, it's been argued that gangs rationally use violence as a necessary input to collect extortion or engage in other illegal behavior (Gambetta 1996; Castillo and Kronick 2020). Collecting a small extortion payment is relatively low cost since firms might not protest the small fee, and the police would not find it worth their time to go after the gang members. However, demanding higher extortion requires a high threat of violence, which requires resources on the part of the gang (e.g., more members or weapons to credibly threaten violence). Furthermore, as noted above, collecting higher extortion requires closely monitoring firm activities and monitoring (or potentially bribing) police. Additionally, high gang extortion might temp other gangs to try to overtake the territory, further increasing violence.

While there are firms that try to protect themselves from gangs, most firms have a strong incentive to acquiesce. Prior to 2010, there were cases in which the distributor used armored trucks and heavy security details when delivering in gang territory in order to avoid paying extortion. This was an expensive and dangerous approach. Over our period of analysis, the firm set up a security team to monitor regular extortion payments to the gangs, helping ensure the safety of drivers. Other firms in El Salvador often use a similar approach (Martínez et al. 2016).

Finally, we note that trucks are often stopped on a side street prior to a delivery rather than on a main road. This can be contrasted with government bribes such as those analyzed by Olken and Barron (2009). Unlike bribes paid at police checkpoints, the distributor generally pays a single gang to make a delivery given that gangs have exclusive control over a territory.

A.2   Government Responses to Extortion

The main anti-gang initiative of the government between 2015 and 2019 was Plan Secure El Salvador (PESS). The initiative increased police enforcement and was rolled out in select areas starting in January 2016. PESS targeted a small number of areas and was implemented in three phases. However, phase three was never rolled-out. The program targeted 50 municipalities chosen using proxies of gang presence and crime (Asmann 2018).

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less successful than extortion by gangs.

Additionally, following the non-aggression pact between gangs, the Sánchez Cerén administration announced a set of "extraordinary measures" in April 2016 that had two main components: a security component, and a prison policy component. The prison policy component was the main component (Lohmuller 2016). The first component regarding security involved a strengthening of the Plan Safe El Salvador (*Plan El Salvador Seguro*, PESS). In particular, the extraordinary measures increased the number of officers involved in the same municipalities of the first phase of PESS. The measures involved the additional deployment of the elite units, mainly of the Territory Intervention Forces (*Fuerzas de Intervención de Territorios*, FIRT) and the Immediate Reaction Special Forces (*Fuerzas Especiales de Reacción Inmediata*, FES), in 10 municipalities concentrated in the Metropolitan Area of San Salvador – the same municipalities intervened by Phase I of PESS. For this reason, we control throughout for the implementation of Plan El Salvador Seguro (PESS). The second component of the extraordinary measures, regarding prison policies, consisted of (i) moving gangs leaders from low risk prisons to maximum security prisons, (ii) eliminating visits to any incarcerated gang member, abd (iii) further reducing access to cellphones or other means of communications near prisons (i.e., the PNC cut electricity for antennas near prisons). This policies were meant to make gang coordination harder to sustain (Lohmuller 2016); however, qualitative evidence suggests that gangs were still able to coordinate and prison leaders were still able to communicate with outsiders and sustain the non-aggression pact (Ditta 2016; Lohmuller 2018).

B   Supporting Data Sources

B.1   Municipality Characteristics

We use various sources to construct municipality characteristics that might be correlated with extortion payments. We construct yearly municipality-level measures of nightlight intensity and population density using data from National Oceanic and Atmospheric Administration (2020) and WorldPop (2020), respectively. Additionally, we use the 2007 population census of El Salvador to calculate municipality-level literacy, education, and employment rates (Dirección General de Estadística y Censos 2007). We present summary statistics for these municipality characteristics in Table A-1 (Panel C).

B.2   Household Surveys

From DIGESTYC, we obtained the microdata for the annual household surveys (EHPM) administered between 2014 and 2018. Each year, DIGESTYC surveys around 15 thousand

households. The surveys include a comprehensive set of questions related to demographic and socioeconomic household characteristics. To measure possible changes in demand, we analyze the information on household income and expenditure per capita. These variables draw from individual-level questions on income and expenditures, and are aggregated to the household level by DIGESTYC.

B.3 Crime Reports

The homicide data described in Section 2.3 ends in early 2017. We complement it with data from "scene of the crime" reports collected by El Salvador's National Civil Police (PNC) from 2017 to 2019. These reports on homicides differ slightly from the homicide data described in Section 2.3, as the former is recorded as an event happens and the latter is an *ex-post* recollection.[27] Aside from this reporting difference, there are no major differences in the data sources: both collect the same variables, including date, time, geographic location, and potential gang involvement.

From the PNC, we also obtained event data on other crimes, including theft, robberies, and domestic violence. These data cover the decade from 2010 to 2017 and detail the date and municipality of occurrence.

B.4 Pharmacy Sales

From the National Directorate of Medicines (DNM), we obtained sales data from pharmacies. There are over 10,000 unique products, defined as a specific molecule-brand-size. Since different size pill packs for the same drug are defined as separate products, we standardize quantity by dividing by the number of pills per pack (or number of milliliters or grams). Drug products are then defined as a molecule-brand. Products that cannot be standardized, constituting 29 percent of the sample, are removed. While the government aimed to collect data from all pharmacies, there were some pharmacies for which the government was not able to obtain data. According to conversations with DNM, these tend to be small or niche pharmacies.

C   Model Details

In this section, we provide additional details on the model and derivation of equilibrium violence, extortion, and downstream prices under competition and collusion.

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[27]Our results hold just using homicide data prior to 2017.

The downstream firm chooses its price (or output quantity) to maximize profit after gang g commits to an extortion rate e_{gd} in municipality d. Demand for the good being extorted is given by $Q_d(p_d) = \alpha_d - \beta p_d$. The first-order condition for the firm, $\frac{\partial \tilde{\pi}_{gd}}{\partial p_{gd}} = 0$, implies

$$p^*_{gd}(e_{gd}) = \frac{1}{2\beta}(\alpha_d + \beta e_{gd}), \quad q^*_{gd}(e_{gd}) = \frac{1}{2}(\alpha_d - \beta e_{gd}). \tag{A-1}$$

Gangs set the violence level, h_{gd}, and the extortion rate, e_{gd}, to maximize profit. The share of territory controlled by each gang is given by the contest success function in equation 1. Gang profits are determined by extortion revenue in their territory, $s_{gd}e_{gd}q_{gd}(e_{gd})$, minus cost, given by $\phi h_{gd}e_{gd}$. In general, gangs wish to choose the vector of violence, $\mathbf{h}_{gd}$, and extortion, $\mathbf{e}_{gd}$, in order to maximize discounted profit over an infinite horizon given by

$$\max_{\mathbf{h}_{gd}, \mathbf{e}_{gd}} \sum_{t=1}^{\infty} \delta^{t-1} \left[\frac{1}{2} \left(\frac{1}{2} + (h_{gdt})^{\frac{1}{2}} - (h_{-gdt})^{\frac{1}{2}} \right) e_{gdt}(\alpha_d - \beta e_{gdt}) - \phi h_{gdt}e_{gdt} \right]. \tag{A-2}$$

where t indexes time and δ is the discount factor. There is a fixed cost of entry, F, for gangs to operate in a municipality. We now consider three cases.

One Gang (Monopoly)

If variable profit is π^{NC}_{gd} when two gangs compete (under the non-collusive equilibrium) in a municipality and π^{M}_{gd} when there is only one gang, then a second gang will not wish to enter in a territory when $\pi^{NC}_{gd} - \pi^{M}_{gd} < F$. In this case, there is a monopolist gang that solves

$$\max_{h_{gd}, e_{gd}} \left(e_{gd}(\alpha_d - \beta e_{gd}) - \phi h_{gd}e_{gd} \right). \tag{A-3}$$

Noting that it is optimal for the gang to set $h_{gd} = 0$ and considering the first-order condition (FOC) with respect to extortion, it is optimal for the gang to charge extortion rate $\frac{\alpha_d}{2\beta}$. Substituting the extortion rate into equation A-1, downstream prices are $\frac{3\alpha_d}{4\beta}$. This can be compared to downstream prices without extortion, given by $\frac{\alpha_d}{2\beta}$. Profits of the gang in this case are given by $\pi^{M}_{gd} = \frac{\alpha_d^2}{8\beta}$.

Competitive Equilibrium with Two Gangs

Now consider the case in which $\pi^{NC}_{gd} - \pi^{M}_{gd} > F$, so there are two gangs that can profitable enter a municipality. We start by examining the case in which the two gangs compete. In a period in which a gang chooses violence and extortion, profits are given in equation 2.

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First, we consider the FOC with respect to violence given by

$$\frac{1}{4} h_{gd}^{-1/2} e_{gd} (\alpha_d - \beta e_{gd}) - \phi e_{gd} = 0 \tag{A-4}$$

which implies

$$h_{gd} = \left(\frac{\alpha_d - \beta e_{gd}}{4\phi} \right)^2. \tag{A-5}$$

The FOC with respect to extortion is

$$\frac{1}{2} \left(\frac{1}{2} + (h_{gd})^{\frac{1}{2}} - (h_{-gd})^{\frac{1}{2}} \right) \alpha_d - \left(\frac{1}{2} + (h_{gd})^{\frac{1}{2}} - (h_{-gd})^{\frac{1}{2}} \right) \beta e_{gd} - \phi h_{gd} = 0. \tag{A-6}$$

Solving the FOC and noting that gangs are symmetric, and therefore $h_{gd} = h_{-gd}$, implies that extortion is given by

$$e_{gd} = \frac{\alpha_d - 4\phi h_{gd}}{2\beta}. \tag{A-7}$$

Substituting equation A-5 into the above, we obtain the equilibrium extortion rate given by

$$e_{gd}^{NC} = \frac{2\sqrt{4\phi^2 - \alpha_d \phi} + \alpha_d - 4\phi}{\beta}. \tag{A-8}$$

Substituting this into equation A-5 and equation A-1, we find the equilibrium violence and downstream prices. These are given by

$$h_{gd}^{NC} = \frac{\left(4\phi - 2\sqrt{4\phi^2 - \alpha_d \phi} \right)^2}{16\phi^2} \tag{A-9}$$

and

$$p_{gd}^{NC} = \frac{2\sqrt{4\phi^2 - \alpha_d \phi} + 2\alpha_d - 4\phi}{2\beta}. \tag{A-10}$$

Note that we assume $\phi > \frac{\alpha_d}{4}$ such that the solution is well-behaved.

Gang profits under competition can be obtained by substituting equation A-8 and equation A-9 into equation 2 and are given by

$$\pi_{gd}^{NC} = \frac{\left(2\sqrt{4\phi^2 - \alpha_d \phi} + \alpha_d - 4\phi \right)^2}{4\beta}. \tag{A-11}$$

This implies there is threshold α_d^c such that $\pi_{gd}^{NC} - \pi_{gd}^M < F$ for $\alpha_d < \alpha_d^c$.

Collusive Equilibrium with Two Gangs

If identical gangs collude and maximize joint profit then they split the market in each municipality ($s_{gd} = \frac{1}{2}$) and do not need to use violence ($h_{gd} = 0$). Collusive profits for gang g are given by

$$\pi_{gd}^C = \frac{1}{4} e_{gd}(\alpha_d - \beta e_{gd}). \tag{A-12}$$

The first-order condition, $\frac{\partial \pi_{gd}^C}{\partial e_{gd}} = 0$, implies $e_{gd}^C = \frac{\alpha_d}{2\beta}$, the same as the case with a monopolist gang. This results in gang profits of $\frac{\alpha_d^2}{16\beta}$.

Compared to the case in which gangs compete, gang collusion decreases violence. The decrease in violence is given by equation A-9. Collusion increases extortion by

$$\frac{1}{2\beta}\left(8\phi - 4\sqrt{\phi}\sqrt{4\phi - \alpha} - \alpha\right), \tag{A-13}$$

and increases downstream prices by

$$\frac{1}{4\beta}\left(8\phi - 4\sqrt{\phi}\sqrt{4\phi - \alpha_d} - \alpha_d\right). \tag{A-14}$$

Furthermore, gang profits under collusion increase by

$$\frac{\alpha_d^2 - 4\left(2\sqrt{\phi}\sqrt{4\phi - \alpha_d} + \alpha_d - 4\phi\right)^2}{16\beta}. \tag{A-15}$$

We note that a feature of the model is double-marginalization, a coordination failure that arises in vertical markets when a downstream firm and upstream firm have market power and set margins independently (Spengler 1950). Double marginalization implies that downstream prices are higher than what would be set by gangs if they set prices directly. Consequently, double marginalization induces deadweight loss from extortion, especially when gangs collude. It is well known that double-marginalization can be eliminated using non-linear pricing, however the literature has identified a number of reasons why non-linear pricing may be difficult in practice. The gang could theoretically charge a single annual fixed fee equal to the downstream firm's profit, however this is not seen in practice.

D   Additional Figures and Tables

Table A-1

Summary Statistics for Pharmacies, Hospital Visits, and Municipality Characteristics

	Mean	SD	Min	Max
Panel A. Pharmacy sales by drug-pharmacy-month:				
Revenue (all pharmacies)	20.7	61.4	0.0	16,171
Cost (all pharmacies)	4.0	36.9	0.0	11,703
Price (all pharmacies)	14.5	20.2	0.0	2,620
Revenue (pharmacies supplied by distributer)	19.8	65.3	0.0	13,894
Cost (pharmacies supplied by distributer)	3.8	33.1	0.0	6,596
Price (pharmacies supplied by distributer)	14.3	20.9	0.0	2,446
Unique pharmacies		323		
Unique drugs		10,756		
Total observations		1,935,960		
Panel B. Hospital visits by municipality-month:				
Hospital visits	143	225	1	2,314
Hospital visits (injuries)	8	12	0	106
Hospital visits (diabetes)	4	8	0	115
Hospital visits (respiratory)	1	2	0	52
Hospital visits (hypertension)	2	4	0	39
Hospital visits (coronary)	1	2	0	40
Total observations		18,611		
Panel C. Municipality characteristics:				
Nightlights	0.86	2.11	0	17
Population density	4.21	9.04	0	64
Literate share (%)	91.35	5.10	77	100
Educated	1.51	0.07	1	2
Employed share (%)	28.61	9.70	3	52
Total observations		263		

Notes: All revenues, costs, and payments are reported in US dollars. Sample period is 6/2015 to 12/2017. In Panel A, minimum values are rounded to the nearest $0.1.

Figure A-1

Example Routes, Deliveries, & Extortion Payments on a Single Day
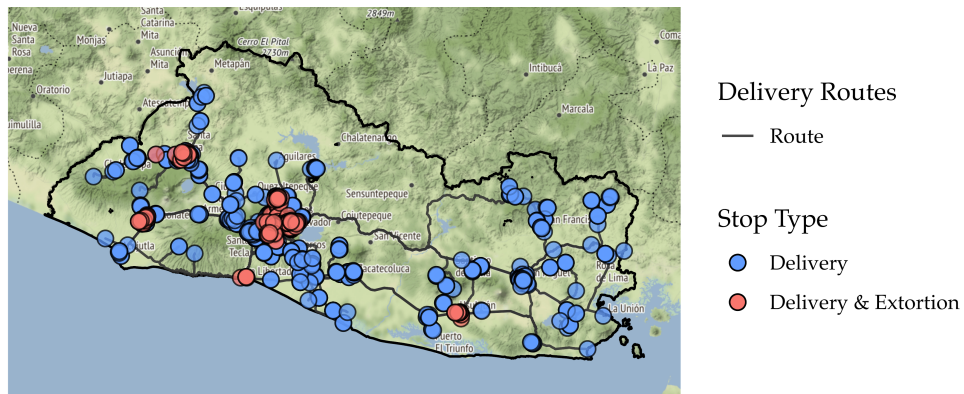
Notes: Map shows example of all truck routes, deliveries to retailers, and extortion payments to gangs on a single day in December, 2016.

Figure A-2
Extortion, Homicides, and Gang Competition Across Municipalities

a. Average Extortion Payment

b. Total Extortion

c. Yearly Homicides
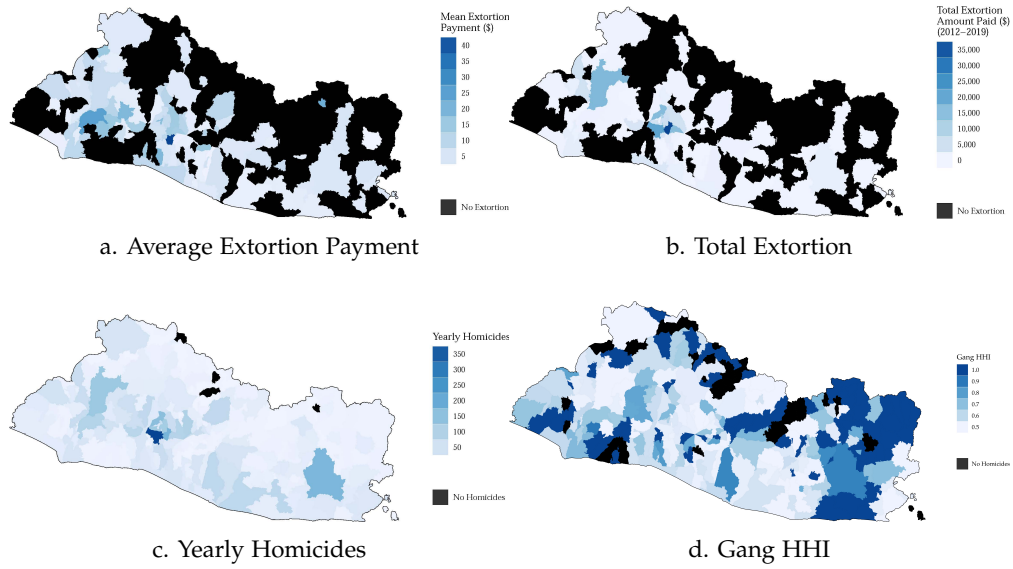
d. Gang HHI

Notes: Gang HHI defined using MS-13 and Barrio-18 homicides.

Figure A-3
Delivery Frequencies and Values Across Municipalities

a. Number of Deliveries

b. Deliveries Per Month

c. Total Delivery Value

d. Monthly Delivery Value
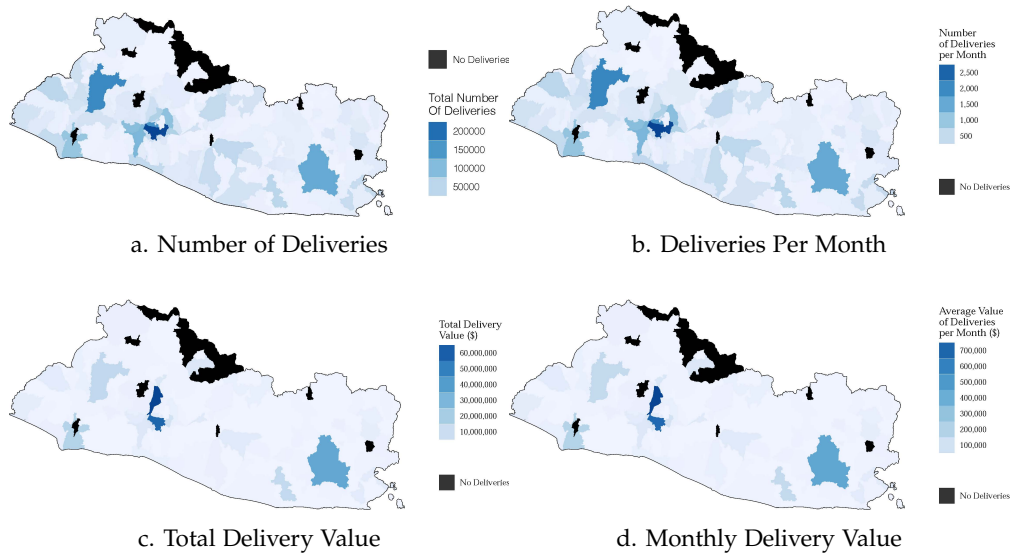
Notes: Data is from 2012-2019.

Table A-2
Relationship between Extortion and Delivery Values

	log(Extortion)	log(Extortion)	log(Extortion)	log(Extortion)
log(Value of Delivery)	0.040**	0.023**	0.014*	0.022***
	(0.017)	(0.011)	(0.008)	(0.006)
Municipality FEs	No	Yes	Yes	Yes
Route FEs	No	No	Yes	Yes
Retailer FEs	No	No	No	Yes
Outcome Mean	1.66	1.66	1.66	1.65
Adjusted R2	0.0013	0.1889	0.3630	0.5444
Observations	62,798	62,787	62,783	59,965
Clusters	119	119	115	113

Notes: The unit of observation is a delivery on a route. Standard errors clustered at the route level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure A-4
Histogram of Homicide HHI prior to Non-Aggression Pact

a. Municipality level   b. Canton level
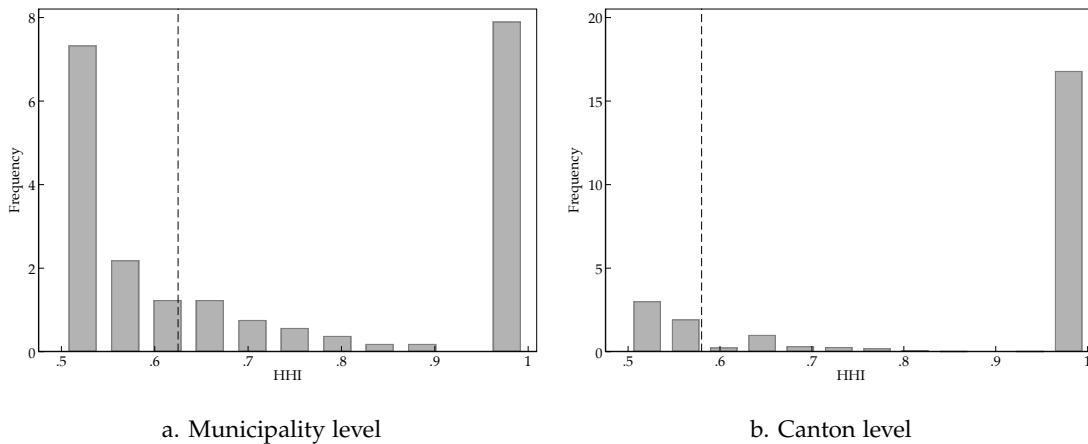
Notes: Vertical line shows preferred cutoff for defining areas with competition.

Figure A-5
Correlation between Homicide HHI and Inmate HHI
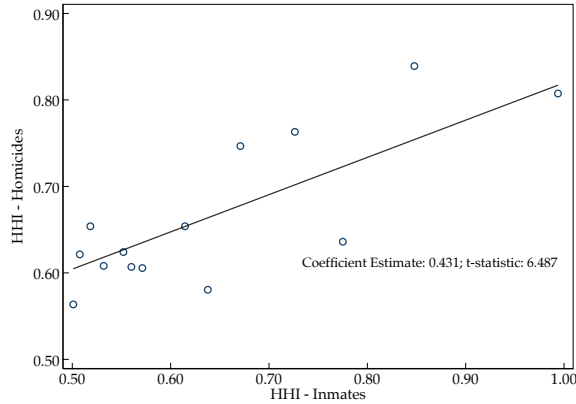
Figure A-6
Relationship Between Extortion Rates and Number of Extortion Payments
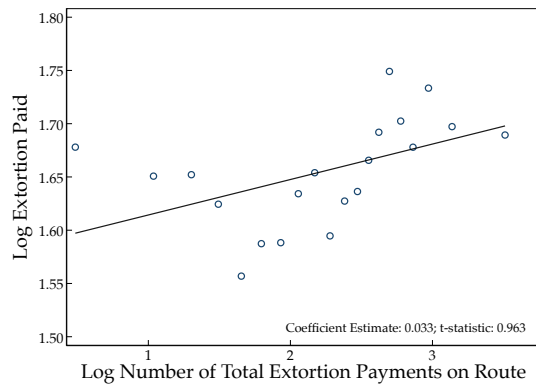
Notes: The figure presents binscatters between the log of the extortion amount paid by the firm upon delivery and the log number of extortion payments made on a route on the same day. The unit of observation is an extortion payment-delivery pair. The regressions include route fixed effects. The bottom-right of each figure presents the estimated coefficient and t-statistic. Standard errors are clustered at the delivery route level.

Table A-3
Effect of Non-Aggression Pact on Crime
in Municipalities with Gang Competition

	Gang Homicides	Theft	Robbery	Domestic Violence
	(1)	(2)	(3)	(4)
$\text{NonAggr}_t \times \text{Comp}_d$	−0.321**	−0.160	−0.180	0.111
	(0.141)	(0.354)	(0.225)	(0.634)
	[0.137]	[0.355]	[0.212]	[0.650]
Municipality FEs	Yes	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes	Yes
Outcome Mean	0.86	0.38	0.28	0.17
Observations	3,872	3,534	3,441	3,472

Notes: The unit of observation is a municipality-month. Gang homicides includes the sample of homicides in which MS-13 or Barrio 18 was a perpetrator or victim. The sample period is 6/2015 to 1/2018. Results from Poisson regressions. Municipalities in which the outcome is zero for all periods are dropped. Covariates include 2007 census municipality characteristics – literacy, education, employment – interacted with year, and control for the implementation of Plan El Salvador Seguro (PESS). Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window are presented in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Impact of Non-Aggression Pact on Sales

a. Total cost

b. Total deliveries

c. Unique products

d. Unique retailers
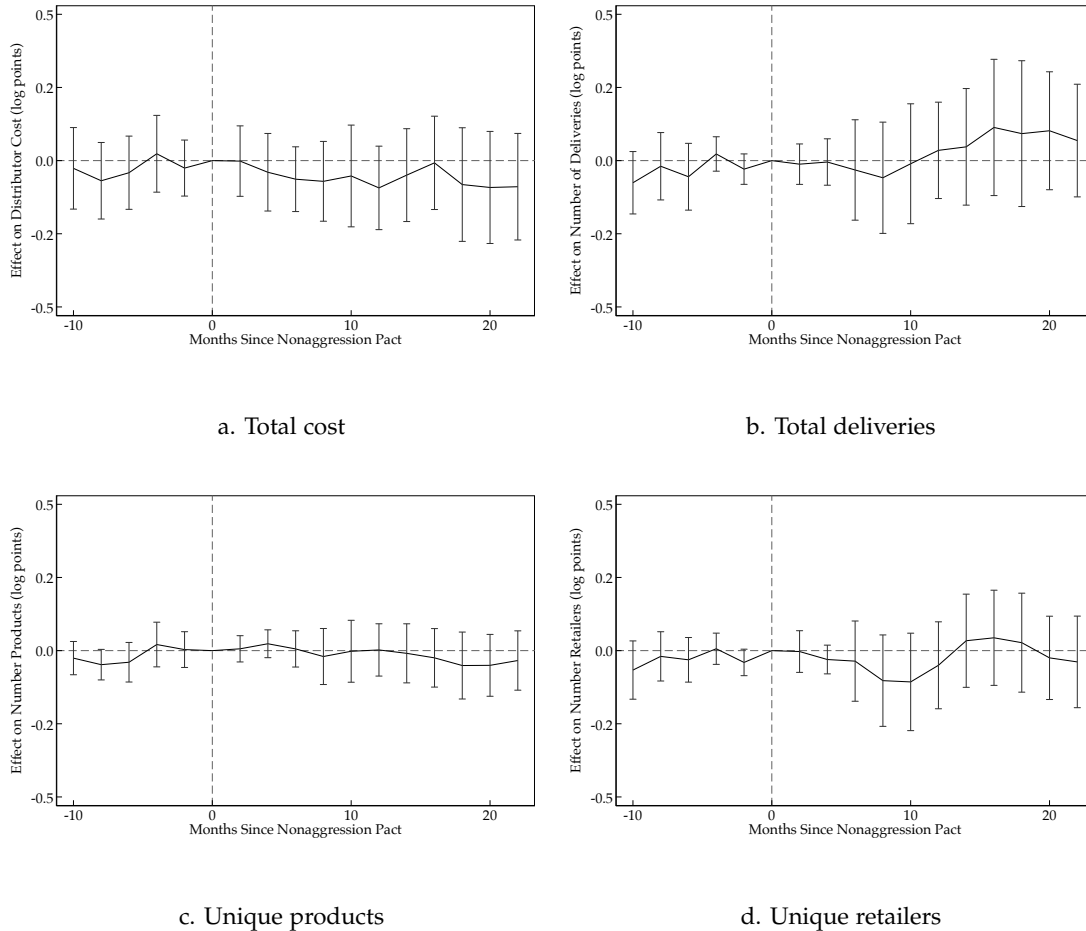
Notes: Vertical line shows start of non-aggression pact (April 2016). Panel a. and b. show bimonthly point estimates from the difference-in-difference specification with log total cost and log total trips by municipality-route-month as the outcome. Panel c. and d. show the results with the number of products and number of retailers by municipality-route-month as the outcome. Specification includes month fixed effects, municipality-route fixed effects, and controls for census municipality characteristics interacted with year. The period prior to the start of the non-aggression pact is omitted. Estimates from OLS regression for cost and deliveries and Poisson regression for count outcomes. Error bars indicate 95% confidence intervals using standard errors clustered at the municipality level.

Figure A-8

Impact of Non-Aggression Pact on Delivery Routes

a. Any Visit

b. Number of Routes
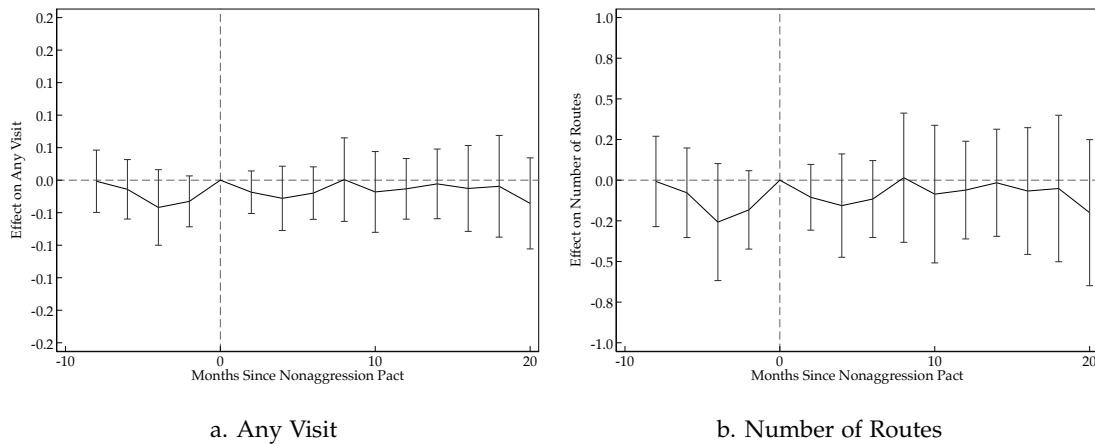
Notes: Vertical line shows start of non-aggression pact (April 2016). Shows bimonthly point estimates using the difference-in-difference specification. The unit of observation in (a) is a municipality-route-month, where the sample is comprised of all municipality-routes ever visited by the firm during the sample period. The outcome in (a) is an indicator equal to 1 if the firm made a delivery in a municipality-route-month; specification includes month, municipality, and route fixed effects. The unit of observation in (b) is a municipality-month, and the sample is comprised of all municipality-routes ever visited by the firm during the sample period. The outcome in (b) is the number of routes by the firm that made visits to a municipality-month; specification includes month fixed effects and municipality fixed effects. The period prior to the start of the non-aggression pact is omitted. Error bars indicate 95% confidence intervals using standard errors clustered at the municipality level.

Table A-4
Effect of Non-Aggression Pact on Extensive Margin of Extortion

	Panel A: Outcome: Has Extortion					
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{NonAggr}_t \times \text{Comp}_d$	0.003	0.003	0.002	0.008	0.007	0.006
	(0.033)	(0.017)	(0.027)	(0.030)	(0.017)	(0.030)
	[0.026]	[0.024]	[0.022]	[0.026]	[0.023]	[0.022]
PESS_{dt}				1.198***	1.092***	1.048***
				(0.073)	(0.089)	(0.091)
				[0.067]	[0.064]	[0.064]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-NonAggr$_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	0.18	0.18	0.18	0.18	0.18	0.18
Observations	12,847	12,847	12,847	12,847	12,847	12,847
	Panel B: Outcome: log(Number of Extortion Payments+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{NonAggr}_t \times \text{Comp}_d$	−0.004	−0.004	−0.025	0.003	0.002	−0.018
	(0.062)	(0.027)	(0.049)	(0.058)	(0.031)	(0.055)
	[0.050]	[0.044]	[0.047]	[0.048]	[0.042]	[0.046]
PESS_{dt}				2.020***	1.722***	1.637***
				(0.193)	(0.229)	(0.227)
				[0.189]	[0.166]	[0.159]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-NonAggr$_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	0.29	0.29	0.29	0.29	0.29	0.29
Observations	12,847	12,847	12,847	12,847	12,847	12,847

Notes: The unit of observation is a route-municipality-month. The outcome variable in Panel A is an indicator variable equal to one if a route-municipality-month paid any extortion, and zero otherwise. The outcome variable in Panel B is the log of the number of extortion payments made in a route-municipality-month. The sample period is 6/2015 to 1/2018. The sample is a balanced panel comprised of all municipality-routes ever visited by the firm during the sample period. $PESS_{dt}$ is an indicator variable equal to one if the municipality was part of Plan Secure El Salvador (PESS) at month t and zero otherwise. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Covariates include census municipality characteristics – literacy, educational attainment, employment – interacted with year. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-5

Effect of Non-Aggression Pact on Arrests for Threats

	All Threats	Gang-related Threats	Non-gang related Threats
	(1)	(2)	(3)
NonAggr$_t \times$ Comp$_d$	−0.010	0.844**	−0.082
	(0.095)	(0.421)	(0.097)
	[0.094]	[0.417]	[0.097]
Municipality FEs	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes
Outcome Mean	1.21	0.10	1.11
Observations	4,495	2,945	4,495
Clusters	145	95	145

Notes: The unit of observation is a municipality-month. The outcome is the number of arrests for threats ("amenazas") in a municipality-month. Results from Poisson regressions. The sample period is 6/2015 to 1/2018. Municipalities in which the outcome is zero for all periods are dropped. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Covariates include 2007 census municipality characteristics – literacy, education, employment – interacted with year, and control for the implementation of Plan El Salvador Seguro (PESS). Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window are presented in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-6

Effect of Non-Aggression Pact on Price Discrimination by Gangs

	log(Extortion)	log(Extortion)
NonAggr$_t \times$ Comp$_d$	0.090	0.289***
	(0.103)	(0.089)
	[0.067]	[0.082]
NonAggr$_t \times$ Comp$_d \times$ Value$_r$	0.125**	0.131***
	(0.058)	(0.033)
	[0.048]	[0.039]
Municipality FEs	Yes	Yes
Month-Year FEs	Yes	Yes
Route FEs	No	Yes
Outcome Mean	1.59	1.59
Adjusted R2	0.283	0.375
Observations	36,810	36,807

Notes: The unit of observation is an extortion payment. Value$_r$ is the value of deliveries for retailer r in \$1,000s. The sample period is 6/2015 to 1/2018. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-7

Effect of Non-Aggression Pact on Time between Extortion Payments

	Delivery Time	Delivery Time
$\text{NonAggr}_t \times \text{Comp}_d$	7.014	6.465**
	(4.868)	(2.838)
	[3.016]	[2.538]
Municipality FEs	Yes	Yes
Month-Year FEs	Yes	Yes
Route FEs	No	Yes
Outcome Mean	59.95	59.95
Adjusted R2	0.109	0.120
Observations	7,781	7,777

Notes: The unit of observation is an extortion payment. The dependent variable is the time between extortion payments in minutes as recorded by the wholesaler. The sample period is 6/2015 to 1/2018. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-8

Effect of Non-Aggression Pact on
Development, Population, Household Incomes, and Household Expenditures

	Nightlight Intensity	log(Nightlight Intensity)	Population Density	log(Population Density)	Household Income	Income Per Capita	Household Expenditure	Expenditure Per Capita
$\text{NonAggr}_t \times \text{Comp}_d$	0.003	−0.030	−0.048	−0.003	−4.787	−2.056	7.092	2.607
	(0.053)	(0.020)	(0.101)	(0.007)	(18.206)	(8.357)	(7.864)	(2.607)
	[0.070]	[0.020]	[0.113]	[0.007]	[17.416]	[8.386]	[6.971]	[2.551]
Municipality FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Outcome Mean	1.32	-0.41	6.21	1.08	492.30	152.56	331.24	102.90
Adjusted R2	0.99	0.99	1.00	1.00	0.69	0.66	0.81	0.83
Observations	740	740	740	740	666	666	666	666
Clusters	148	148	148	148	136	136	136	136

Notes: The unit of observation is a municipality-year. The sample period is 2014 to 2018. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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Table A-9
Effect of Non-Aggression Pact on Extortion
Alternative Cutoffs for Defining Competition

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	50th Percentile	60th Percentile	70th Percentile	80th Percentile
	log(Extortion + 1)	log(Extortion + 1)	log(Extortion + 1)	log(Extortion + 1)
NonAggr$_t \times$ Comp$_d$	0.181**	0.265***	0.225**	0.297***
	(0.081)	(0.074)	(0.097)	(0.084)
	[0.077]	[0.071]	[0.079]	[0.093]
Month-Year FEs	Yes	Yes	Yes	Yes
Municipality FEs	Yes	Yes	Yes	Yes
Route FEs	Yes	Yes	Yes	Yes
Outcome Mean	1.95	1.95	1.95	1.95
Adjusted R2	0.489	0.492	0.490	0.491
Observations	2,314	2,314	2,314	2,314

Notes: The unit of observation is a route-municipality-month. The outcome variable is the log of the amount of extortion paid in a route-municipality-month in dollars plus one. The sample period is 6/2015 to 1/2018. The sample is comprised of all municipality-routes visited by the firm during the sample period. Covariates include census municipality characteristics – literacy, educational attainment, employment – interacted with year. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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Table A-10
Effect of Non-Aggression Pact on Extortion
Continuous Measure of Competition

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	Outcome: log(Extortion+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
NonAggr$_t \times$ HHI$_d$	−1.079***	−1.430***	−0.878**	−1.071***	−1.436***	−0.877**
	(0.378)	(0.233)	(0.339)	(0.379)	(0.237)	(0.336)
	[0.368]	[0.394]	[0.462]	[0.368]	[0.394]	[0.461]
PESS$_{dt}$				−0.044	−0.134	−0.105
				(0.106)	(0.113)	(0.116)
				[0.080]	[0.084]	[0.085]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-NonAggr$_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	1.95	1.96	1.96	1.95	1.96	1.96
Adjusted R2	0.491	0.643	0.645	0.490	0.644	0.646
Observations	2,314	2,166	2,166	2,314	2,166	2,166

Notes: The unit of observation is a route-municipality-month. The outcome variable is the log of the amount of extortion paid in a route-municipality-month in dollars plus one. The sample period is 6/2015 to 1/2018. The sample is comprised of all municipality-routes visited by the firm during the sample period. HHI_d is defined using the gang affiliation and location of homicides in El Salvador in the three years prior to the non-aggression pact. $PESS_{dt}$ is an indicator variable equal to one if the municipality was part of Plan Secure El Salvador (PESS) at month t and zero otherwise. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Covariates include census municipality characteristics – literacy, educational attainment, employment – interacted with year. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-11
Effect of Non-Aggression Pact on Extortion
Alternative Specifications

	Outcome: log(Extortion + 1)			
	Control for Development Proxies		Municipalities without Homicides in Control	
	(1)	(2)	(3)	(4)
$\text{NonAggr}_t \times \text{Comp}_d$	0.221**	0.230**	0.236***	0.153*
	(0.096)	(0.090)	(0.077)	(0.087)
	[0.078]	[0.090]	[0.068]	[0.082]
Development Proxies	Yes	Yes	No	No
Month-Year FEs	Yes	No	Yes	No
Municipality FEs	Yes	No	Yes	No
Route FEs	Yes	No	Yes	No
Municipality-Route FEs	No	Yes	No	Yes
Route-NonAggr$_t$ FEs	No	Yes	No	Yes
Outcome Mean	1.95	1.96	1.92	1.93
Adjusted R2	0.490	0.645	0.507	0.653
Observations	2,314	2,166	2,458	2,295

Notes: The unit of observation is a route-municipality-month. The outcome variable is the log of the amount of extortion paid in a route-municipality-month in dollars plus one. The sample period is 6/2015 to 1/2018. Development Proxies include annual municipality-level nightlight intensity and population density and census municipality characteristics interacted with year. The sample is comprised of all municipality-routes visited by the firm during the sample period. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-12
Effect of Non-Aggression Pact on Extortion
Expanded Sample Period

	Outcome: log(Extortion+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: $Comp_d$ Using Homicide Composition					
$NonAggr_t \times Comp_d$	0.217*	0.285***	0.192**	0.214*	0.287***	0.193**
	(0.113)	(0.085)	(0.083)	(0.114)	(0.086)	(0.085)
	[0.078]	[0.086]	[0.108]	[0.079]	[0.087]	[0.110]
$PESS_{dt}$				−0.039	−0.179	−0.164
				(0.100)	(0.109)	(0.112)
				[0.071]	[0.072]	[0.073]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-NonAggr$_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	1.93	1.93	1.93	1.93	1.93	1.93
Adjusted R2	0.454	0.665	0.667	0.454	0.666	0.668
Observations	6,593	6,187	6,187	6,593	6,187	6,187
	Panel B: $Comp_d$ Using Inmate Composition					
$NonAggr_t \times Comp_d$	0.272**	0.293***	0.262***	0.271**	0.295***	0.264***
	(0.117)	(0.077)	(0.083)	(0.119)	(0.080)	(0.086)
	[0.083]	[0.086]	[0.112]	[0.084]	[0.087]	[0.114]
$PESS_{dt}$				−0.006	−0.179	−0.166
				(0.103)	(0.113)	(0.114)
				[0.072]	[0.073]	[0.073]
Month-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Municipality-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-NonAggr$_t$ FEs	No	No	Yes	No	No	Yes
Outcome Mean	1.93	1.94	1.94	1.93	1.94	1.94
Adjusted R2	0.459	0.666	0.668	0.458	0.666	0.669
Observations	6,390	6,017	6,017	6,390	6,017	6,017

Notes: The unit of observation is a route-municipality-month. The outcome variable is the log of the amount of extortion paid in a route-municipality-month in dollars plus one. The sample period is March 2012 to March 2019. The sample is comprised of all municipality-routes visited by the firm during the sample period. In Panel A, $Comp_d$ is defined using the gang affiliation and location of homicides in El Salvador in the three years prior to the non-aggression pact. In Panel B, $Comp_d$ is defined using the gang affiliation and location of arrest for inmates in El Salvador arrested in the three years prior to the non-aggression pact. For both, we construct an HHI_d and define $Comp_d$ as an indicator variable equal to zero if HHI_d is in the top quartile of the HHI for municipalities and one otherwise. $PESS_{dt}$ is an indicator variable equal to one if the municipality was part of Plan Secure El Salvador (PESS) at month t and zero otherwise. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Covariates include census municipality characteristics – literacy, educational attainment, employment – interacted with year. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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Table A-13
Effect of Non-Aggression Pact on Extortion
Synthetic Difference-in-Difference Method

| | Outcome: log(Extortion + 1) | | | |
| | Standard DD | | Synthetic DD | |
	(1)	(2)	(3)	(4)
$\text{NonAggr}_t \times \text{Comp}_d$	0.381**	0.355**	0.318**	0.328**
	(0.160)	(0.156)	(0.155)	(0.149)
Month-Year FEs	Yes	Yes	Yes	Yes
Municipality-Route FEs	Yes	Yes	Yes	Yes
Covariates	No	Yes	No	Yes
Outcome Mean	1.92	1.92	1.92	1.92
Observations	3,132	3,132	3,132	3,132

Notes: The unit of observation is a route-municipality-month. The outcome variable is the log of the amount of extortion paid in a route-municipality-month in dollars plus one. The sample period is 6/2015 to 1/2018. The results use the synthetic difference-in-difference approach from Arkhangelsky et al. (2021). The approach requires a balanced panel, therefore we fill in extortion for route-municipality-month without sales or extortion using surrounding months. Specification (1) and (2) show the results using this balanced panel using a standard DiD approach. Specification (3) and (4) use the jackknife procedure from Arkhangelsky et al. (2021) clustering at the municipality-route level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-14
Effect of Non-Aggression Pact on Homicides
Alternative Periods for Defining Competition

| | HHI Defined 1–4 Years Prior | HHI Defined 1–6 Years Prior |
	(1)	(2)
$\text{NonAggr}_t \times \text{Comp}_d$	−0.315**	−0.311**
	(0.149)	(0.148)
	[0.143]	[0.143]
Municipality FEs	Yes	Yes
Month-Year FEs	Yes	Yes
Outcome Mean	0.94	0.89
Observations	3,391	3,679
Clusters	124	137

Notes: The unit of observation is a municipality-month. Outcome is number of homicides in which MS-13 or Barrio 18 was a perpetrator or victim. The first two columns define the gang HHI measure using homicides over 4/1/2012 to 4/1/2015 while the last two columns use 4/1/2010 to 4/1/2015. Results from Poisson regressions. Municipalities in which the outcome is zero for all periods are dropped. Standard errors clustered at the municipality level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window are presented in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-15
Effect of Non-Aggression Pact on Extortion
using Gang Competition Defined at Canton Level

| | Outcome: log(Extortion+1) |
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{NonAggr}_t \times \text{Comp}_d$	0.175	0.180**	0.225**	0.165	0.183**	0.222**
	(0.124)	(0.075)	(0.105)	(0.123)	(0.077)	(0.108)
	[0.095]	[0.077]	[0.102]	[0.096]	[0.078]	[0.104]
PESS_{dt}				−0.153	−0.142	−0.166
				(0.118)	(0.142)	(0.127)
				[0.085]	[0.097]	[0.092]
Canton FEs	Yes	No	No	Yes	No	No
Month-Year FEs	Yes	No	No	Yes	No	No
Route FEs	Yes	No	No	Yes	No	No
Canton-Route FEs	No	Yes	Yes	No	Yes	Yes
Route-NonAggr_t FEs	No	No	Yes	No	No	Yes
Outcome Mean	1.99	2.01	2.01	1.99	2.01	2.01
Adjusted R2	0.484	0.617	0.622	0.485	0.618	0.623
Observations	1,935	1,849	1,844	1,935	1,849	1,844

Notes: The unit of observation is a route-canton-month. The outcome variable is the log of the amount of extortion paid in a route-canton-month in dollars plus one. The sample period is 9/2014 to 1/2018. The sample is comprised of all canton-routes visited by the firm during the sample period. $PESS_{dt}$ is an indicator variable equal to one if the municipality was part of Plan Secure El Salvador (PESS) at month t and zero otherwise. Regressions drop "singleton" groups when including additional fixed effects (Correia 2015). Standard errors clustered at the canton level in parentheses and Conley (1999) standard errors calculated using a 100 km cut-off window with a 20-month temporal auto-correlation window are presented in brackets (Colella et al. 2019). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-16
Effect of Non-Aggression Pact on Hospital Visits
Individual Diagnosis Categories

	Diabetes Diagnosis (1)	Hypertension Diagnosis (2)	Coronary Diagnosis (3)	Respiratory Diagnosis (4)
$\text{NonAggr}_t \times \text{Comp}_d$	0.119***	0.016	0.076	0.120*
	(0.031)	(0.058)	(0.068)	(0.069)
	[0.035]	[0.040]	[0.042]	[0.078]
Municipality FEs	Yes	Yes	Yes	Yes
Month-Year FEs	Yes	Yes	Yes	Yes
Outcome Mean	1.72	4.69	1.34	1.72
Observations	4,588	4,588	4,557	4,557
Clusters	148	148	147	147

Notes: Results from Poisson regressions in which the outcome is the number of visits in a municipality-month. Covariates include PESS and census municipality characteristics interacted with year. Standard errors clustered at the municipality level in parentheses and spatial standard errors calculated using a 100 km cut-off window are presented in brackets (Bertanha and Moser 2016). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure A-9

Effect of Non-Aggression Pact on Drug Prices and Associated Visits

Dynamic Effects

a. Drug Prices   b. Hospital Visits
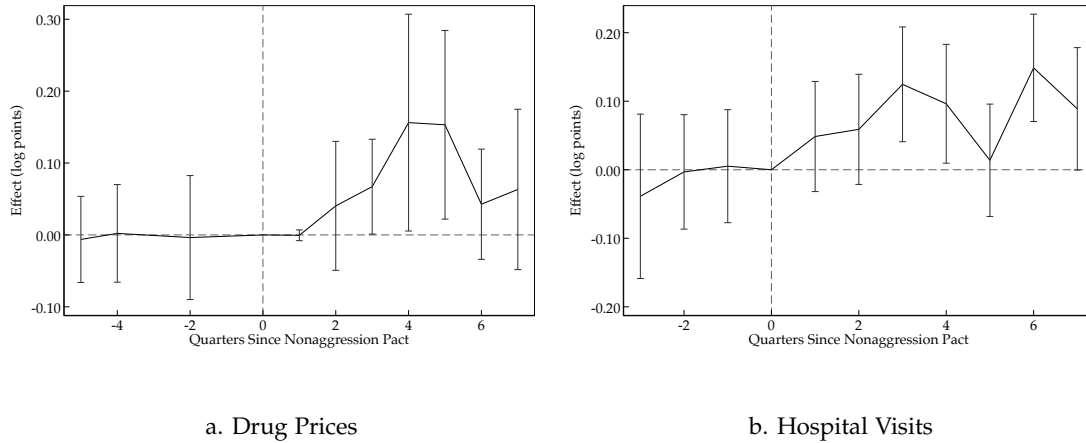
Notes: Shows point estimates for each period using the difference-in-difference model. Figure a. shows the effect on pharmaceutical prices. Figure b. shows the effect on hospital visits for chronic conditions affected by drug adherence. The omitted period is the quarter prior to the start of the non-aggression pact between MS-13 and Barrio 18. Standard errors are clustered at the municipality level. All specifications include municipality fixed effects, month fixed effects, and controls for PESS and census municipality characteristics interacted with year. Error bars indicate 95% confidence intervals using standard errors clustered at the municipality level.

Table A-17

Effect of Non-Aggression Pact on the Number of Pharmacies

in Municipalities with Gang Competition

	Total Number of Pharmacies	Number of Pharmacies that purchase from Distributor
NonAggr$_t \times$ Comp$_d$	0.002	-0.051
	(0.012)	(0.044)
Municipality FEs	Yes	Yes
Year FEs	Yes	Yes
Covariates	Yes	Yes
Outcome Mean	13.81	6.62
Observations	3,540	2,201

Notes: Results from Poisson regressions where the unit of observation is a municipality-month. In first column, the outcome is the number of pharmacies that are operating in a municipality-month obtained from pharmacy registration data. In the second column, the outcome is the number of pharmacies in a municipality-month in the distributor sales data. All specifications control for PESS and census municipality characteristics interacted with year. The sample period is 6/2015 to 1/2018. Standard errors clustered at the municipality level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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