From Cocaine to Avocados: Criminal Market Expansion and Violence

Chelsea Estancona*[1] and Lucía Tiscornia†[2]

[1]Department of Political Science, University of South Carolina
[2]School of Politics and International Relations, University College Dublin

May 6, 2025

Abstract

Most of what we know about organized criminal violence comes from research about illicit narcotics markets. Yet, criminal groups also fight to capture markets for licit commodities, as evidenced by Sicilian lemons and Mexican avocados. When do organized criminal groups (OCGs) violently expand into markets for licit goods? We argue that rapid increases in the share of a good's export value create opportunities for immediate profit and future market manipulation. These opportunities provoke violence as groups expand their territorial holdings and economic portfolio. We provide subnational evidence of our mechanism using data on avocado exports from Mexico, and address reverse causality with Google Trends data about the popularity of avocado toast searches. We also provide cross-national evidence combining data from the Atlas of Economic Complexity, V-Dem, and UNODC. Our findings suggest that increases in a country's share of global export value for agricultural goods are associated with more homicides–but only where OCGs are present.[1]

*estancon@mailbox.sc.edu
†luciatiscornia@ucd.ie
Authors listed in alphabetical order, equal contribution given.

[1]We are grateful to the following readers and groups for their comments on drafts and presentations: Javier Osorio, Cecilia Farfán Mendez, Sandra Ley, Jeff Harden, Michael Weintraub, Brown University Watson Institute for International and Public Affairs Security Studies Seminar, the Carolinas Conflict Consortium, the Vanderbilt Political Economy of Conflict Workshop, and UNU WIDER Development Conference (UNIANDES).

1 Introduction

Conventional wisdom suggests that organized criminal groups (OCGs)—drug cartels, gangs, and mafias[2]—emerge to violently capture rents from illicit goods sold on informal markets.[3] Much existing knowledge about OCGs comes from illicit drug markets.[4] However, examples across time and space tell a different story: in the 1800s in Sicily, the mafia took over the market for lemons, and in the 1900s in New York, it sought to control the artichoke market. In the 1990s, street gangs in Cape Town encroached on the abalone market, and in Mexico in the 2010s drug cartels took control of the lime and avocado markets.[5] If trading in illicit goods is so highly profitable, why bother with artichokes, lemons, and shellfish?

According to existing research, OCGs attempt to control profitable markets.[6] Yet, diversification is costly: economies of scale are not always present, not all markets are complementary, not all groups are equally risk-tolerant.[7] Because research on the conditions for criminal diversification into licit markets is underdeveloped, it is unclear whether the drivers or the violence associated with diversifying into these markets are the same as those in illicit markets. To fill this gap, we develop a theory of diversification of criminal

[2]Benjamin Lessing: Conceptualizing Criminal Governance, in: Perspectives on Politics 2020, pp. 1–20, here p. 3.

[3]Michel Misse: Illegal markets, protection rackets and organized crime in Rio de Janeiro, in: estudos avançados 21.61 (2007), pp. 139–157, here p. 140.

[4]Richard Snyder/Angélica Durán-Martínez: Does illegality breed violence? Drug trafficking and state-sponsored protection rackets, in: Crime, law and social change 52.3 (2009), pp. 253–273; Angélica Durán-Martínez: The politics of drug violence: Criminals, cops and politicians in Colombia and Mexico, 2017; Guillermo Trejo/Sandra Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico, 2020; Benjamin Lessing: Making peace in drug wars: crackdowns and cartels in Latin America, 2017; Javier Osorio: The contagion of drug violence: spatiotemporal dynamics of the Mexican war on drugs, in: Journal of Conflict Resolution 59.8 (2015), pp. 1403–1432.

[5]Arcangelo Dimico/Alessia Isopi/Ola Olsson: Origins of the Sicilian Mafia: The Market for Lemons, in: Journal of Economic History 77.4 (2017), pp. 1083–1115; Lucia Tiscornia: How Climate Change Affects Organized Criminal Market Expansion, in: Studies in Comparative International Development 58.1 (2023), pp. 29–54; Kate Linthicum: Inside the bloody cartel war for Mexico's multibillion-dollar avocado industry, in: Los Angeles Times November 21 (2019); David Critchley: The origin of organized crime in America: The New York city mafia, 1891–1931, vol. 1, 2008; Omar García-Ponce/Andrés Lajous: How does a drug cartel become a lime cartel?, in: Washington Post May 20 (2014).

[6]Tom Wainwright: Narconomics: How to run a drug cartel, 2016; Lessing: Making peace in drug wars: crackdowns and cartels in Latin America (see n. 4).

[7]Cecilia Farfán-Méndez: The Structure of Drug Trafficking Organizations and Money Laundering Practices: A Risk Appetite Hypothesis, in: Journal of Illicit Economies and Development 1.3 (2019), pp. 294–311.

economic portfolios into markets for licit commodities and when diversification is likely to generate violence.

We argue that when the export value share of agricultural goods rapidly increases, OCGs seek to profit from these newly lucrative markets. Positive price shocks, specifically those to agricultural goods exported in high quantities, present unique opportunities for profit, local territorial gain, and long-term control that merit the risk of diversification, or 'criminal market capture'. Organizations capitalize on these opportunities by engaging in violence against producers, the state, and rivals to secure territorial and economic control. In developing our argument we address two interrelated questions: when does criminal diversification into markets for licit commodities happen? And, when does it produce violence?

Our work contributes to research on OCGs in four ways. First, our focus on markets for licit commodities beyond mere rent capture identifies another area of criminal involvement. In doing so, we provide a more complete understanding of the motivations behind OCGs' behavior and demonstrate that it is not only circumscribed to illicit markets.

Second, our theory of diversification and violence applies to markets of licit agricultural commodities that are territory-bound contributing to new research on the drivers of criminal governance at the local level. To control production as part of the process of diversification, OCGs seek to control the territories where commodities are grown. To increase future profit, territorial control may require violence. By leveraging the case of Mexico, we highlight the consequences of criminal attempts to control local life, furthering our understanding of criminal governance. Inasmuch as their behavior affects community behavior, it has important implications for our understanding of politics more generally.[8] Furthermore, OCGs today can produce violence comparable to that of civil wars;[9] therefore, understanding when criminal violence escalates is central to the study of peace and security.

Third, we expand our case study findings to generate a cross-national explanation of OCG behavior. Existing knowledge comes primarily from case studies, which are central

[8]Trejo/Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4).
[9]Lessing: Making peace in drug wars: crackdowns and cartels in Latin America (see n. 4).

to demonstrate causal mechanisms but are not well suited for probing general accounts. We draw on this rich case literature to develop and test a cross-national account. We shed light on international agricultural markets as an important trigger behind criminal diversification. Fourth, our study has significant policy implications: if local violence can be triggered by changes in international markets of licit goods, policies to combat OCGs should not be circumscribed to illicit markets and local military or police responses.

Our empirical strategy combines the in-depth analysis of the Mexican avocado market with the statistical analysis of a global sample of countries between 1993 and 2018. To assess the validity of our argument we use data on agricultural production, criminal threats to the state, and homicides. We complement our statistical analyses with evidence from secondary sources to demonstrate the mechanics of criminal market capture in the market of Mexican avocados.

Our strategy faces several challenges: first, we do not have a direct measure of our main theoretical mechanism–"criminal market capture"–at the global level. To mitigate this challenge, we leverage the case study of Mexico. We zoom in on the avocado market to show how criminal market capture happens by: 1) incorporating extensive field research from secondary sources as an illustration, and 2) leveraging location-specific data about criminal presence in Mexico. We address reverse causality with a plausibly exogenous global indicator of avocado export value and conduct a placebo test using corn, strawberry, and lime crops to test the importance of export value share.

Conversely, idiosyncratic features of the Mexican case may limit our ability to generalize, which we address with the cross-sectional country-level analysis. We devise a general theory and test its applicability to a large number of cases, ensuring that the implications of our argument are observable in a representative case. We consider our cross-national analysis as additional descriptive evidence, and encourage future testing of our proposed mechanism in this more generalized setting.

A second challenge arises from features of our dependent variable. Homicide statistics have limitations including under-reporting and lack of granularity in terms of perpetrators and targets. These limitations may lead to downward bias in our results, and an inability

to distinguish between violence involving OCGs and other societal violence. We accept this limitation and interpret our results with caution. A third challenge stems from possible reverse causality. We posit that OCGs capture a market following increases in export price and export share. However, it could be the case that OCGs first manipulate production and supply to influence export value and profitability in international markets. To address this concern we introduce a plausibly exogenous measure of increases in the international demand for avocados: the popularity of the search term *avocado toast* on Google Trends.

The results from the Mexican case are in line with our expectations: increases in a municipality's share of export value of avocados are associated with increases in homicides where OCGs are present. Our theory is also supported by the general statistical results: rapid increases in a state's share of agricultural goods' export value–an indicator of both immediate opportunities for profit and the plausibility of future market manipulation–are associated with more homicides, but only where OCGs threaten the state. Overall, our results demonstrate that unexpected changes in international markets for agricultural commodities are an important driver of the domestic dynamics of criminal violence.

2 Cost-effectiveness, criminal market capture and violence

We build on current research suggesting that OCGs diversify to other markets when it is cost-effective. One way to reduce costs is by having a comparative advantage. Explanations emphasizing comparative advantages posit that OCGs will diversify to areas where their expertise allows them to reduce entry costs. For example, organizations that smuggle weapons over a border may utilize their knowledge and access to routes to also smuggle drugs or migrants.[10] But it is not clear that comparative advantages in illicit markets would apply to markets of licit goods in the same way. OCGs may encounter additional challenges in markets of licit goods: the regulated economy involves taxation

[10]Wainwright: Narconomics: How to run a drug cartel (see n. 6); Peter Dale Scott/Jonathan Marshall: Cocaine politics: Drugs, armies, and the CIA in Central America, 1998.

and increased state controls, which drives up entry costs and reduces the benefits. It may also be possible that other costs, beyond standard economic inputs, operate differently, like the cost of controlling populations, or that of removing competitors. It is likely that such costs are higher in licit markets as well, given that they also increase the cost of using violence because it is more difficult to hide. In our theory, we emphasize changes in markets rather than the nature of groups as a means to generate cost-effectiveness. When a good becomes unexpectedly highly lucrative *and* offers opportunities for price manipulation in the future, organizations will prioritize that market because they can offset the costs of diversifying. When these goods are difficult to transfer to other territory, violent competition over growing areas becomes more likely.

Opportunities for expansion can generate violence as organizations compete with one another, the state, or other economic interests. Opportunities typically emerge from political shocks: for example, protection rackets—informal mechanisms for the selective application of the law[11]—are destabilized when corrupt public officials are removed after elections, and disputes over the regulation of illicit markets trigger spirals of violence. Either OCGs dispute the control of illicit markets,[12] or they fight the state, depending on how it prosecutes them.[13] The focus on illicit markets does not provide specific predictions for violence in markets for licit goods. Nor does it consider how non-political disruptions may shape patterns of violence (For an exception see dube2016maize). We propose that changes in markets for licit goods can trigger criminal violence as groups diversify and compete for access to the production and sale of these goods.

There is still the question of which markets to diversify into: features of goods, particularly their lootability, represent another mechanism to increase cost-effectiveness and

[11] Snyder/Durán-Martínez: Does illegality breed violence? Drug trafficking and state-sponsored protection rackets (see n. 4); Trejo/Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4).

[12] Idem: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4); Deborah J Yashar: Homicidal ecologies: illicit economies and complicit states in Latin America, 2018; Beatriz Magaloni et al.: Living in Fear: the Dynamics of extortion in Mexico's Drug War, in: Comparative Political Studies 53.7 (2020), pp. 1124–1174.

[13] Durán-Martínez: The politics of drug violence: Criminals, cops and politicians in Colombia and Mexico (see n. 4); Lessing: Making peace in drug wars: crackdowns and cartels in Latin America (see n. 4); Laura R Blume: Collusion, Co-Optation, or Evasion: The Politics of Drug Trafficking Violence in Central America, in: Comparative Political Studies 2022, p. 00104140211066218.

increase attractiveness to nonstate actors. When natural resources are relatively isolated, they are easier to control.[14] But a market's ease of capture does not imply it is sufficiently attractive to merit diversification. To be desirable, it must add significant value - to include profit and opportunities such as territorial, political, or social control - to an OCG's existing portfolio. Furthermore, not all natural resources are equally lootable. For example, the exploitation of raw materials such as oil or certain minerals requires higher capital investment relative to most agricultural commodities.[15] In terms of variation within agricultural goods, certain commodities have a longer growing period and cannot be easily moved. For example, avocados - the main commodity discussed in this paper - usually mature for 3 to 5 years before they consistently yield fruit.

Longstanding research indicates a strong association between commodities and conflict.[16] When commodities are highly profitable, they trigger competition over their control, which increases violence.[17] Other scholarly research casts doubt in terms of commodities' high value as a trigger behind violence and points to price shocks as a catalyst for violence. For example, negative price shocks in the international market of maize drove Mexican laborers into cultivation of illicit drugs, which in turn generated incentives for OCGs to violently dispute control over the illicit crops.[18] Furthermore, in their meta analysis, blair2021commodity find no evidence supporting a link between increased commodity prices and violence, and they find supporting evidence that when price increases for labor-intensive commodities, violence is reduced, except when commodities are simultaneously labor-intensive and lootable. Still other research suggests that how

[14]Ernesto Dal Bó/Pedro Dal Bó: Workers, warriors, and criminals: social conflict in general equilibrium, in: Journal of the European Economic Association 9.4 (2011), pp. 646–677; Michael L Ross: What do we know about natural resources and civil war?, in: Journal of peace research 41.3 (2004), pp. 337–356.

[15]Dal Bó/Dal Bó: Workers, warriors, and criminals: social conflict in general equilibrium (see n. 14); Oeindrila Dube/Juan F Vargas: Commodity price shocks and civil conflict: Evidence from Colombia, in: The review of economic studies 80.4 (2013), pp. 1384–1421.

[16]Samuel Bazzi/Christopher Blattman: Economic shocks and conflict: Evidence from commodity prices, in: American Economic Journal: Macroeconomics 6.4 (2014), pp. 1–38; Ross: What do we know about natural resources and civil war? (see n. 14).

[17]Joel Salvador Herrera/Cesar Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico, in: World Development 151 (2022), p. 105769.

[18]Oeindrila Dube/Omar García-Ponce/Kevin Thom: From maize to haze: Agricultural shocks and the growth of the mexican drug sector, in: Journal of the European Economic Association 14.5 (2016), pp. 1181–1224.

changes in illicit commodity prices affect violence depends on whether such violence is produced primarily by the state or non-state groups.[19]

Since most of this research is case- or (usually high-value) commodity- specific, we lack a general understanding of the conditions for diversification and violence across commodities and countries. We also know little about criminal actors' motivations for expansion into markets for licit goods. Much of the existing research about resource lootability and territorial control or competition focuses on civil war violence, which differs from OCG violence in its strategic purpose and goals. Rebel organizations seek territorial control for political and military advancement and the ability to engage in state-like governance.[20] Regarding resource lootability, rebels may prefer stationary banditry but continue to loot if investing in resource production is too costly or detracts from their long-term political goals.

For OCGs, however, the motivation to seize territory is the desire to expand their economic empire by reducing production and export costs of key goods and deterring state or competitor presence. Territorial control remains costly, so OCGs are unlikely to pursue it without significant opportunity for profit (whereas rebels featured in previous theories obtain other political and reputational benefits – even other economic benefits such as taxation[21]). Because territorial control itself carries fewer benefits for OCGs than for rebels, we argue that OCGs only pursue key growing territories when they provide opportunities for long-term economic expansion. Building on existing findings we propose a theoretical refinement by considering the size of the export market. We argue that where a state or territory's export value share is sufficiently large, international price increases incentivize OCGs to attempt market capture of these commodities. When such goods' value rapidly increases, this is an opening for profit and eventual market capture.

To summarize, we do not observe criminal diversification into all profitable markets, nor does diversification entail the same levels of violence when it occurs. According to our

[19] Chelsea L Estancona: Rebel Primary Commodity Markets, Price Shocks, and Supplier Victimization, in: International Studies Quarterly 65.4 (Aug. 2021), pp. 1111–1123, URL: https://doi.org/10.1093/isq/sqab073.

[20] Ana Arjona: Rebelocracy: Social Order in the Colombian Civil War, 2016.

[21] Raúl Sánchez De La Sierra: On the origins of the state: Stationary bandits and taxation in eastern congo, in: Journal of Political Economy 128.1 (2020), pp. 000–000.

argument, rapid increases in price in markets with opportunities for future control provide windows of extreme profitability. We demonstrate the importance of both short and long term incentives for diversification. We argue further that because these commodities are territory-bound, controlling production allows groups to engage in coercive governance with the ultimate goal of maximizing profit.[22] Violence, in turn, is the result of how much resistance within this territory they face in the process. We develop this argument next.

3 A theory of criminal diversification

In this section we develop a theory of criminal diversification. We explain the conditions under which OCGs decide to attempt diversification into licit markets for agricultural products and why this process generates violence. With this objective in mind, we develop a theory about the cost-benefit calculations OCGs face when deciding to engage in the process we call criminal market capture. We conceptualize the decision to diversify as resulting from considering the benefit from the potential long-term gains from market capture and the costs imposed by the resistance groups will face, which in turn shapes how much violence to expect in territory where these agricultural products are grown. In doing so, we highlight that opportunities for long-term control amplify the benefits of territorial expansion.

OCGs trade in illicit commodities because of the immense profits derived from their control. To increase their profit, they may seek to diversify by capturing additional markets of goods or services. Diversification may provide direct profit in the short term, opportunities for increasing profit in the long term, or socioeconomic control that reduces costs in the long term. The section is divided in three: we first define relevant concepts, followed by the discussion of the scope of application of our theory. We then discuss our proposed causal mechanism and outcome. Finally, we introduce observable implications. The subsequent sections contain our identification strategy and analysis.

[22] Lessing: Conceptualizing Criminal Governance (see n. 2).

Concepts

Market capture is the process of establishing control over portions of the market for a commodity. Control is decision-making power over the activities involved in a market: determining prices, establishing volumes to be sold, amounts to be harvested, or selecting wholesalers. 'Criminal market capture' means forcefully and illegally controlling portions of the market for a commodity, eventually manipulating production and prices.

Criminal markets emerge when brokers gain control, partial or complete, of the chain of production and distribution of a given product by evading regulations.[23] For example, in the 1920's the Morello-Terranova mafiosi in New York leveraged their control over the *distribution* of artichokes coming from California because they controlled the rail line and imposed a 'tax' on artichokes arriving from California by train.[24] The Sicilian mafia sought to control the *production* of lemons and manipulated prices by controlling the groves,[25] and South African gangs leveraged their *storage* capacity to manipulate local prices in the abalone market.[26]

Scope Conditions

Our theory is bound by a set of scope conditions, which include: the type of goods, the kind of price shifts, and the size of the export market share. We discuss each of these in turn. We focus on the production of territory-bound agricultural commodities in emerging markets, where producers use semi-skilled labor inputs, and where there is a high degree of asset specificity present in agricultural production (i.e. fixed investments in groves with relatively immobile labor used to harvest the products). This kind of commodities in these specific markets requires less investment and specialized knowledge relative to other contexts where agricultural commodities are produced but require high

[23] Jorge Giraldo Ramírez/Andres Rendón/Gustavo Duncan: Nuevas Modalidades de Captacion de Rentas Ilegales en Medellin, 2014; Annette Idler: The logic of illicit flows in armed conflict: Explaining variation in violent nonstate group interactions in Colombia, in: World Politics 72.3 (2020), pp. 335–376.

[24] Mike Dash: The First Family: Terror, Extortion and the Birth of the American Mafia, 2011; Critchley: The origin of organized crime in America: The New York city mafia, 1891–1931 (see n. 5).

[25] Dimico/Isopi/Olsson: Origins of the Sicilian Mafia: The Market for Lemons (see n. 5), pp. 1091–1098.

[26] Kimon De Greef: Booming illegal abalone fishery in Hangberg: Tough lessons for small-scale fisheries governance in South Africa, MA thesis, University of Cape Town, 2014.

investments due to high technification and the need for skilled labor.[27]

We would not expect OCGs to start exploiting a market in places with significant costs of entry. Because agricultural commodities are territory-bound and a small number of producers control them, capturing and controlling production becomes easier, reducing costs of entry.[28] Further, in emerging markets, agricultural commodities typically require lower levels of technology, labor and tailored production knowledge. Existing shipping routes, infrastructure, labor, and local markets, also reduce up-front costs.[29] These features reduce the cost of diversification, and increase profitability making them ripe for criminal investment. Because controlling production of territory-bound commodities ultimately involves controlling producers, minimizing state involvement, and expelling other criminal competitors, we expect violence at this point of the chain of production and distribution to be higher than in other points.[30]

We argue that OCGs pursue diversification when there are unusually large increases in the export value of licit goods that can be grown locally. These disruptions bring attention to the newly high value of a commodity and create an opportunity to increase short and long term profits. Our argument zeroes in on countries' global market share of agricultural commodities as an overlooked factor that creates incentives for market capture. International price increases for agricultural commodities create a significant opportunity for immediate profit. But when OCGs operate in states that hold a large portion of the international market share of these goods, rapid increases in their price provide not just immediate profit but an opportunity for eventual control and manipulation.

Because our goal is to explain the initial impetus for market capture, rather than continued control, we focus on expansion into new markets following positive shifts in price. Even though criminals could capture a market after a negative shock, work to restrict production and increase prices, this process requires time and its outcome is uncertain.

[27] We thank a reviewer for this clarification.

[28] Herrera/Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico (see n. 17).

[29] Cecilia Farfan Mendez: Opium Poppy Cultivation and Interactions between Legal and Illegal Economies in Sinaloa, Unpublished manuscript, presented at APSA 2021, 2021.

[30] Laura Ross Blume: Narco Robin Hoods: Community support for illicit economies and violence in rural Central America, in: World Development 143 (2021), p. 105464; Kendra L Koivu: In the shadow of the state: mafias and illicit markets, in: Comparative Political Studies 49.2 (2016), pp. 155–183.

A rapid increase in price provides certainty that there will be dividends in the immediate future. Groups could also attempt diversification into markets of high-price licit goods such as gold or gems in the absence of a shock, but this might require divesting from the illicit business. For example, when valuable minerals can be concealed, as with gold, OCGs need to develop additional surveillance and tax structures that increase, rather than decrease, the costs of control in the long run.[31] Focusing on high-price licit goods would also require knowledge about which markets to attempt to control and significant up-front costs, and other benefits such as political or social control resulting from criminal presence to manage production would be negligible. Although agricultural goods are not inherently valuable like diamonds, gold, or oil, they require less up-front investment in infrastructure while providing an opportunity to advance organizations' long term economic goals. Because agricultural goods require territory for growth, controlling their production can bolster OCGs' ability to build informal governance structures through territorial control—which may deter challengers in the future and aid in additional economic investment. The costs of moving or re-planting some crops with long growing periods (such as avocados, limes, olives or even asparagus) makes the territory in which they grow particularly valuable - and sparks competition and violence over this territory following changes in their markets. Our theory thus explains how changes in the value of seemingly mundane goods can trigger diversification due to the perceived opportunity for profit, expansion and control. Since OCGs' main goal is to maximize profit from illicit markets, we expect diversification to happen when a distinct opportunity arises: rapid increases in price in markets that criminals can reasonably seek to capture *and* eventually manipulate.

OCGs maximize both short-term payoff and long-term financial investment. Consequently, price shifts alone are insufficient: the available export share of the global market matters. If OCGs are primarily focused on maximizing profit, capturing a market that only represents a small share of the international economy might temporarily allow them to increase their profit by reducing that of producers, but it would not allow them to

[31] Sánchez De La Sierra: On the origins of the state: Stationary bandits and taxation in eastern congo (see n. 21).

manipulate prices as effectively. Empirical examples provide descriptive support for our argument: South Africa is the third largest producer of abalone in the world, Italy in the 19th century was a leading producer of lemons, Mexico is the world's largest producer of avocados and the second largest producer of limes. OCGs have targeted all of these markets.[32] Export share, in combination with upward shifts in price, creates a lucrative window for immediate profit and incentives for market capture. OCGs are aware of the international profitability of these markets and changes in price because they act as brokers between sellers and international buyers and as contract enforcers.[33] In synthesis, OCGs are most likely to enter licit agricultural markets when the state where they are present accounts for a sufficiently large share of global agricultural production, when such goods are territory-bound, and the good experiences a large price increase. We tie these scope conditions to examples of crops in the Mexican case in Table 2

Outcome

Groups are likely to face tensions when seizing control of newly profitable markets. Even though OCGs have an incentive to minimize violence in order to avoid attracting unwanted attention to their activities,[34] violence ensues in the process of market capture as a result of three sources of tension: disputes with other groups, resistance from producers, and resistance from the state. If a good is newly lucrative, it can spark competition between groups to seize profit quickly and ensure their access to the territory in which the good is grown. This is particularly likely when the good in question has a longer growing period or is costly to re-plant elsewhere, making the particular territory worth competing over to quickly banish other would-be OCG investors. This rush may make OCGs more violent towards one another and toward producers in an effort to coerce cooperation with

[32]Tiscornia: How Climate Change Affects Organized Criminal Market Expansion (see n. 5); Dimico/Isopi/Olsson: Origins of the Sicilian Mafia: The Market for Lemons (see n. 5); García-Ponce/Lajous: How does a drug cartel become a lime cartel? (see n. 5).

[33]Dimico/Isopi/Olsson: Origins of the Sicilian Mafia: The Market for Lemons (see n. 5); Tiscornia: How Climate Change Affects Organized Criminal Market Expansion (see n. 5).

[34]Blume: Narco Robin Hoods: Community support for illicit economies and violence in rural Central America (see n. 30); Durán-Martínez: The politics of drug violence: Criminals, cops and politicians in Colombia and Mexico (see n. 4).

their particular group.[35] OCGs may invade plantations and forcefully remove producers,[36] regulate picking season, or force producers to sell their land to them.[37] Sometimes, groups can build cooperative relationships with communities and manage to keep violence low,[38] but these arrangements take time to build, and they are often fragile, short lived,[39] and contingent on groups' territorial control.[40] At the initial stages of market capture, we expect violence to be higher due to these factors.

Variation in violence also results from the type of relationship between groups and the state.[41] When the state confronts OCGs, either to reclaim spaces under criminal control, or because the security apparatus is protecting one group versus another, violence escalates.[42] States also establish cooperative or non-confrontational relationships with OCGs.[43] If the state intentionally avoids confronting an OCG and there are no other competitors, or if law enforcement is absent from a territory, violence will be minimized.[44] Alternatively, when international demand for an important taxable product rapidly increases, the state may be likely to use force to limit criminal involvement. Because agricultural commodities are situated in rural communities, which tend to be more isolated, state awareness of the presence of OCGs in new markets, and subsequent intervention may take some time. OCGs have incentives to organize takeovers quickly, before the state has an opportunity to become an additional source of confrontation, and before it needs to be bought out.

[35] Estancona: Rebel Primary Commodity Markets, Price Shocks, and Supplier Victimization (see n. 19).

[36] Paola Palacios: Forced displacement: Legal versus illegal crops, in: Defence and Peace Economics 23.2 (2012), pp. 133–160.

[37] Eduardo Moncada: Resisting Extortion: Victims, Criminals, and States in Latin America, 2021.

[38] Blume: Narco Robin Hoods: Community support for illicit economies and violence in rural Central America (see n. 30); Gemma Dipoppa: How Criminal Organizations Expand to Strong States: Migrant Exploitation and Political Brokerage in Northern Italy, in: forthcoming, Journal of Politics 2023.

[39] Trejo/Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4).

[40] Arjona: Rebelocracy: Social Order in the Colombian Civil War (see n. 20).

[41] Yashar: Homicidal ecologies: illicit economies and complicit states in Latin America (see n. 12).

[42] Idem: Homicidal ecologies: illicit economies and complicit states in Latin America (see n. 12); Lessing: Making peace in drug wars: crackdowns and cartels in Latin America (see n. 4).

[43] Nicholas Barnes: Criminal politics: An integrated approach to the study of organized crime, politics, and violence, in: Perspectives on Politics 15.4 (2017), pp. 967–987.

[44] Yashar: Homicidal ecologies: illicit economies and complicit states in Latin America (see n. 12); Snyder/Durán-Martínez: Does illegality breed violence? Drug trafficking and state-sponsored protection rackets (see n. 4); Durán-Martínez: The politics of drug violence: Criminals, cops and politicians in Colombia and Mexico (see n. 4).

Mechanism

The mechanism connecting our observable outcome (violence) to our independent variable (positive price shifts for agricultural products representing a large portion of the export market) is the process of market capture. The opportunity created by a price increase triggers OCG actions that facilitate criminal market capture. We take the following actions as evidence of the onset of a capture process: controlling production by regulating the picking season, taking over packing plants and transportation, and taking over land. These actions afford longer-lasting benefits beyond immediate access to rents through, for example, the imposition of a 'tax', and differ from looting due to their territorial semi-permanence.

Controlling the markets of licit agricultural goods also affords OCGs opportunities to build criminal governance in the long run—mechanisms of population control to maximize profit.[45] Through market capture, OCGs can access the local communities where these markets are embedded and gain control over local institutions (municipal governments, producers' associations). Eventually, they may manipulate the electoral process, ultimately ensuring control over policies that make illicit activity easier.[46] In the long run, this dynamic can become self-reinforcing.

Even though we cannot provide a global, systematic measure of market capture, in our discussion of the Mexican case we provide qualitative evidence suggesting the presence of this mechanism. The nature of our global data is such that we cannot test for the presence of the mechanism of capture at the global level. We note this as a limitation of our work.

Observable Implications:

We expect increased violence as groups expand economically and territorially. Changes

[45] Enrique Desmond Arias: Criminal enterprises and governance in Latin America and the Caribbean, 2017; Lessing: Conceptualizing Criminal Governance (see n. 2).

[46] Trejo/Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4); Herrera/Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico (see n. 17).

in territory-bound agricultural goods' profitability and the expansion of their export markets can spark competition from other organizations, resistance from producers, or challenges from the state—all of which increase the use of violence by OCGs in these territories. Based on these expectations, we develop observable implications, which we test by leveraging our case study. To assess the extent to which our argument might apply more generally, we also test the connection between commodities' changes in export value share and criminal violence at the general level. We present observable implications here and formulate them as hypotheses within each section (case study and global sample, respectively). Table 1 summarizes our proposed evidence for the observable implications of our theory at the case and general levels.

Table 1: Observable Implications: Δ Export Value Share and Criminal Market Capture

Level of Observation	**Mechanism* / Outcome**	**Observable Implication**	**Testing Strategy**
Case	Market Capture*	OCGs regulate packing and picking seasons, control transportation or land	Interviews and case evidence via secondary sources
Municipality (Mexico)	Violence	Municipalities with an increase in the share of avocado export value see increases in homicides only if OCGs are present	Linear regression, test for reverse causality, placebo test
Cross-National	Violence	States with an increase in the share of agricultural commodities' export value see increases in homicides only if OCGs are present	Linear regression

To test implications at the case level, we leverage different sources of data. Qualitative data allows us to probe market capture as our mechanism of interest. Quantitative data, including a plausibly exogenous measure of global avocado price and exploration

of placebo crops (corn, limes, and strawberries) allows for statistical assessment of how price and export share increases jointly function as a catalyst for OCG violence. And at the general level, we leverage quantitative data to provide evidence of a relationship between increases in export value share and violence - only where criminal organizations threaten the state.

3.1 Other explanations

We propose that violent criminal expansion occurs due to our proposed mechanism of market capture following increases in export value share, but we consider three additional logics: loss of revenue, money laundering, and market disruption. First, if drug markets are less lucrative, OCGs may diversify to others to make up for lost revenue. The empirical track record does not provide support for this alternative path. The United Nations Office on Drugs and Crime (UNODC)'s World Drug Report (2022) tracks trends in drug markets and shows that drug prices have remained stable, and even increased across a variety of substances, including cocaine and synthetic drugs.[47] Even if diversification stemmed from changes in drug markets, it would not invalidate our argument. We expect groups to diversify into markets that allow them to maximize profits, and thus we offer an explanation for *which* markets they choose. Further, diversification to new markets does not imply substitution. Changes in the value and export share of agricultural goods create an opportunity for market capture as a complement to, not a substitute for drug markets. In fact, diversification may involve parallel processes of development in licit and illicit markets.[48] OCGs may respond to opportunities resulting from shifts in markets of licit commodities in addition to the profit that can be made in drug markets.

Another explanation is tied to surplus cash from illicit market activity that needs to be laundered. In this case, whether the market captured has value in itself may be less consequential, and diversification should happen in the absence of violence. OCGs may seek to launder their proceeds through legal businesses and diversification can be a

[47] Report available here.

[48] Farfan Mendez: Opium Poppy Cultivation and Interactions between Legal and Illegal Economies in Sinaloa (see n. 29).

mechanism to facilitate it. One example is the acquisition of gas stations by drug cartels in Mexico.[49]

Although the need to launder money may be a reason to diversify, there are strong incentives to engage in licit economies beyond smoke screens. Patterns of investment for money laundering are unlikely to be the same as investment for profit from the sale of goods. A recent report from the Financial Action Taskforce (FATF), an intergovernmental body to prevent money laundering, suggests that there are more efficient tools to launder large sums of cash than capturing territory-based commodities which may meet with resistance from competitors, producers, or the state. These tools include smuggling cash, using money brokers, or using the banking system. [50] Because money laundering relies on secrecy, minimizing surveillance and traceability, using newly profitable and popular goods would present additional, unwanted challenges.

Disruptions in the illicit economy constitute a third pathway. Governments frequently target illicit markets, thus, expansion into licit ones may minimize detection and loss of profit. The risk of disruption in criminal markets is high: cocaine seizures have increased worldwide over the last 20 years, but so has production (UNODC, 2022). Increased law enforcement has not impacted groups' ability to continue to profit. Other research has demonstrated that drug prices temporarily increase domestically as a result of disruptions to the illicit economy, further increasing OCGs' profit.[51] Furthermore, states have strong added incentives to limit criminal involvement in licit markets because of loss of profit, which suggests we should expect higher disruption in these markets.

In the next section we present the case of Mexico as part of our theory building exercise. We provide qualitative evidence of our mechanism of interest complemented by a quantitative analysis of the avocado market. The subsequent section presents a test of our argument beyond the Mexican case, to probe the generalizability of our argument.

[49] David Gagne: Blacklisted by the US, Mexico Gas Stations Still in Business, in: Insight Crime March 23 (2015).

[50] Report available here.

[51] Juan Camilo Castillo/Dorothy Kronick: The logic of violence in drug war, in: American Political Science Review 114.3 (2020), pp. 874–887; Jonathan P Caulkins/Peter Reuter: How drug enforcement affects drug prices, in: Crime and Justice 39.1 (2010), pp. 213–271.

4 The case of Mexico

To illustrate our mechanism of interest, we conduct sub-national analysis in Mexico combining qualitative evidence from secondary sources with data on OCGs' territorial presence, and information on avocado exports. The Mexican case offers important advantages: there is wide variation in agricultural production, as well as in the presence of OCGs and levels of violence across sub-national units. In our design, Mexico can be characterized as a typical case. Typical cases are representative of a population defined based on the scope of a theoretical argument.[52] Our argument is scoped to apply to states that are exporters of agricultural products with active OCGs.

As a way to illustrate where Mexico lies in relation to other cases within the scope of our argument, Figure 1 plots the average agricultural export value against average homicides. The cases that are labeled correspond to those countries above the threshold of 10 homicides per 100,000 population. This threshold separates countries with epidemic levels of violence, per the World Health Organization's definition, which are likely to face OCG presence.[53] As the Figure suggests, Mexico is not the only possible case for analysis. However, it is the case where data are available for all our central analytical indicators: agricultural production, violence, and OCG presence at the local level. [54] In addition, research on the dynamics of organized crime in Mexico is extensive, which allows us to triangulate our information and analyses with multiple other sources.

Mexico is one of the main world-producers of several commodities, it has widespread presence of OCGs, and homicide levels are high. If our theory is correct, booms in market share of certain agricultural products should lead us to observe criminal attempts to capture these lucrative markets. In turn, if we observe these dynamics in the Mexican

[52] Jason Seawright/John Gerring: Case selection techniques in case study research: A menu of qualitative and quantitative options, in: Political research quarterly 61.2 (2008), pp. 294–308.

[53] Guillermo Trejo/Juan Albarracin/Lucia Tiscornia: Breaking state impunity in post-authoritarian regimes: Why transitional justice processes deter criminal violence in new democracies, in: Journal of Peace Research 2018, pp. 787–809.

[54] Although indicators of the territorial presence of OCGs are also available for Colombia (Javier Osorio et al.: Mapping violent presence of armed actors in colombia, in: Advances of Cartography and GIScience of the International Cartographic Association 16.1 [2019], pp. 1–9), the database specifically tracks violent presence, which is more restrictive and also analytically closer to our dependent variable of homicides.

case, we should expect to see them in comparable cases. In the next section, we zoom in on the avocado market. We provide qualitative evidence from existing research in Michoacán, the state that concentrates the majority of avocado production in the country, and quantitative evidence of the association between criminal diversification and violence for the market of avocados, which extends beyond Michoacán. We also provide evidence for our proposed mechanism of market capture - OCGs responding to price increases in export markets that are substantial enough to allow for eventual manipulation - by comparing avocados to other Mexican crops that do not share such characteristics.

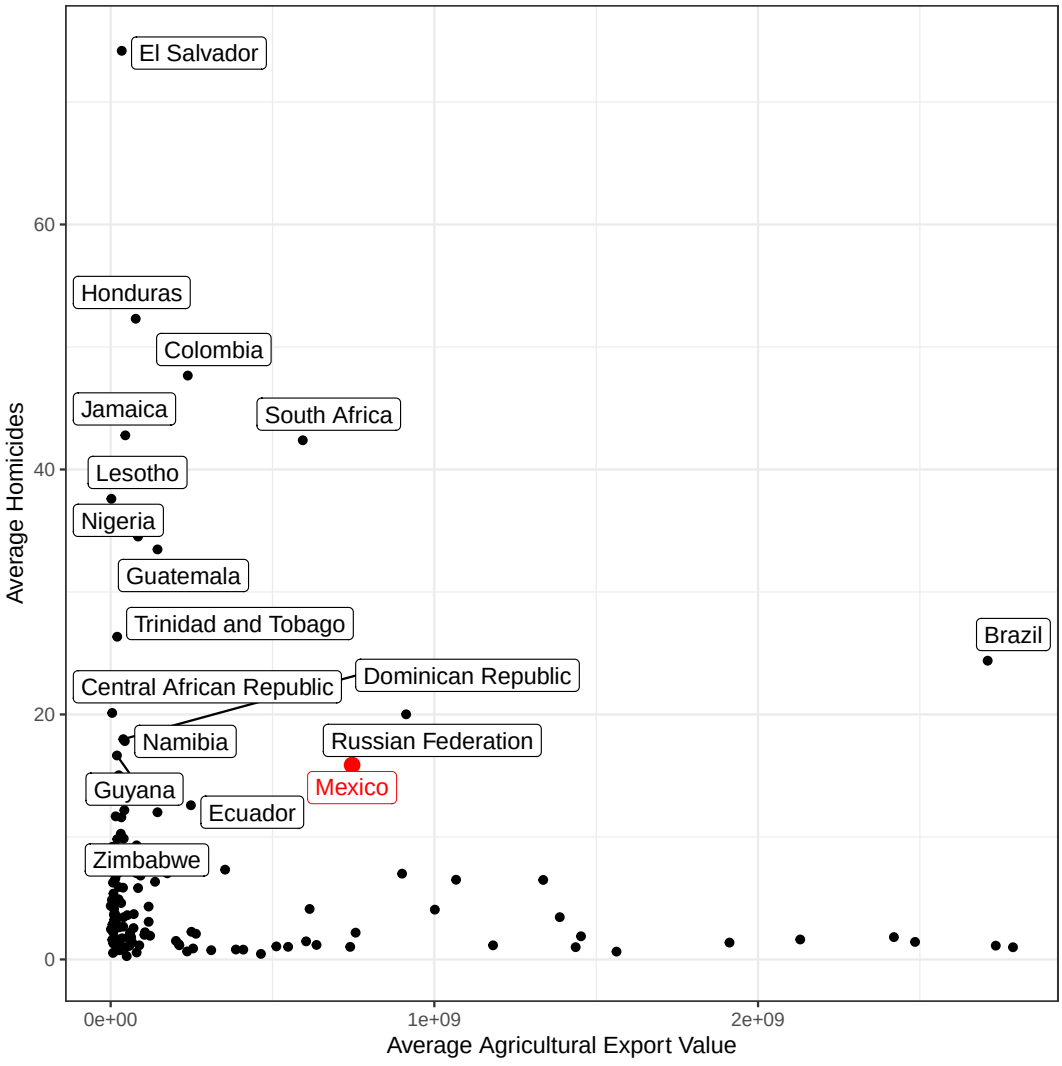


Figure 1: Case Selection

4.1 Avocado production and cartel violence in Mexico

Scholars have posited multiple mechanisms to explain the growth and violent expansion of OCGs in Mexico: changes in the international drug markets, features of the democratic transition, changes in networks of protection from the authoritarian period, increased inter-cartel competition, violent confrontations with the state.[55]

As profitable as illicit markets are, Mexican OCGs are involved in a variety of activities. Early accounts of the connections between licit and illicit markets date back to the 1940s and the parallel development of the opium and tomato industries in the state of Sinaloa.[56] Recently, in states like Michoacán, OCG violence has been linked to the avocado, berry, and citrus industries. As Michoacán produces the majority of Mexican avocados, we should observe the mechanics of our theory at work.

OCGs have been present in Michoacán since the 1950s, due to its suitability for drug cultivation and its privileged position as a transportation route.[57] Despite longstanding OCG presence, violence associated with the drug trade dates back only to the mid-1990s, and it is driven by group competition, as well as state and communal responses triggered by changes in the international drug markets.[58][59] and[60] document changes in criminal presence in Michoacán resulting in spirals of violence as a result of groups moving to capture new markets. The Valencia family, present in Michoacán in the late 1980s and into the 1990s, controlled the marijuana and poppy trade through a drug-trafficking group

[55] Trejo/Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4); Lessing: Making peace in drug wars: crackdowns and cartels in Latin America (see n. 4); David Shirk/ Joel Wallman: Understanding Mexico's drug violence, in: Journal of Conflict Resolution 59.8 (2015), pp. 1348–1376; Durán-Martínez: The politics of drug violence: Criminals, cops and politicians in Colombia and Mexico (see n. 4); Osorio: The contagion of drug violence: spatiotemporal dynamics of the Mexican war on drugs (see n. 4); Magaloni et al.: Living in Fear: the Dynamics of extortion in Mexico's Drug War (see n. 12); Sandra Ley: To vote or not to vote: how criminal violence shapes electoral participation, in: Journal of Conflict Resolution 62.9 (2018), pp. 1963–1990.

[56] Farfan Mendez: Opium Poppy Cultivation and Interactions between Legal and Illegal Economies in Sinaloa (see n. 29).

[57] Ruth G Ornelas: Organized Crime in Michoacán: Rent-Seeking Activities in the Avocado Export Market, in: Politics & Policy 46.5 (2018), pp. 759–789; Romain LeCour/Paul Frissard: Violent and Vibrant: Mexico's Avocado Boom and Organized Crime, Global Initiative Against Transnational Organized Crime, 2024.

[58] Idem: Violent and Vibrant: Mexico's Avocado Boom and Organized Crime (see n. 57).

[59] Joel Salvador Herrera: The limits of resistance to criminal governance: cyclical violence and the aftermath of the autodefensa movement in Michoacán, Mexico, in: Global Crime 22.4 (2021), pp. 336–360.

[60] Moncada: Resisting Extortion: Victims, Criminals, and States in Latin America (see n. 37).

called Milenio. In early 2000s, they were displaced by the Zetas, who took control over the lucrative market of illicit drugs, including cocaine and synthetic drugs. In turn, they were displaced by the Familia Michoacana years later. Avocado production existed in Michoacán since the 1950s, and began to rapidly increase in mid-2000s due to changes in international demand, which boosted export revenue. Even though OCGs were already present in the state, they had previously focused on controlling the drug markets.

In line with our theory, existing studies of criminal involvement in the avocado market situate it around the late-2000s, after the boom in exports.[61] This temporal dynamic is central to our argument; it suggests that the mere presence of easily accessible commodities is not enough to motivate capture. By the 2010s, the Caballeros Templarios, who displaced the Familia Michoacana, were targeting avocado production directly. Because avocado producers kept detailed information about productivity, OCGs knew how much profit they could make. Case study research shows that the Templarios had information about agricultural registers and cadasters in Michoacán.[62] Even though the mechanism of criminal market capture is not directly observable, from a process-tracing approach,[63] we can provide causal process observations using qualitative evidence of the actions that OCGs took to take over and manipulate the production of avocados. If OCGs were only interested in the territory, or in extracting rents, they would not have sought direct control of production and packaging. As documented through extensive interview evidence from secondary sources, in order to capture the avocado market, OCGs implemented a series of strategies: they took over packaging branches, intimidated farmers to give up their lands, and threatened pickers so they would delay or halt harvesting.[64] Those who resisted were killed. By 2013, the Templarios had taken over a substantial portion of the avocado production chain in Michoacán.[65]

[61] Heesun Yoo: Does "green gold" breed bloody violence? The effect of export shocks on criminal violence in Mexico, in: Social Science Quarterly 103.5 (2022), pp. 1048–1060; Moncada: Resisting Extortion: Victims, Criminals, and States in Latin America (see n. 37).

[62] LeCour/Frissard: Violent and Vibrant: Mexico's Avocado Boom and Organized Crime (see n. 57).

[63] Andrew Bennett/Jeffrey T Checkel: Process tracing, 2015.

[64] Moncada: Resisting Extortion: Victims, Criminals, and States in Latin America (see n. 37), pp. 125–127.

[65] LeCour/Frissard: Violent and Vibrant: Mexico's Avocado Boom and Organized Crime (see n. 57), p. 18.

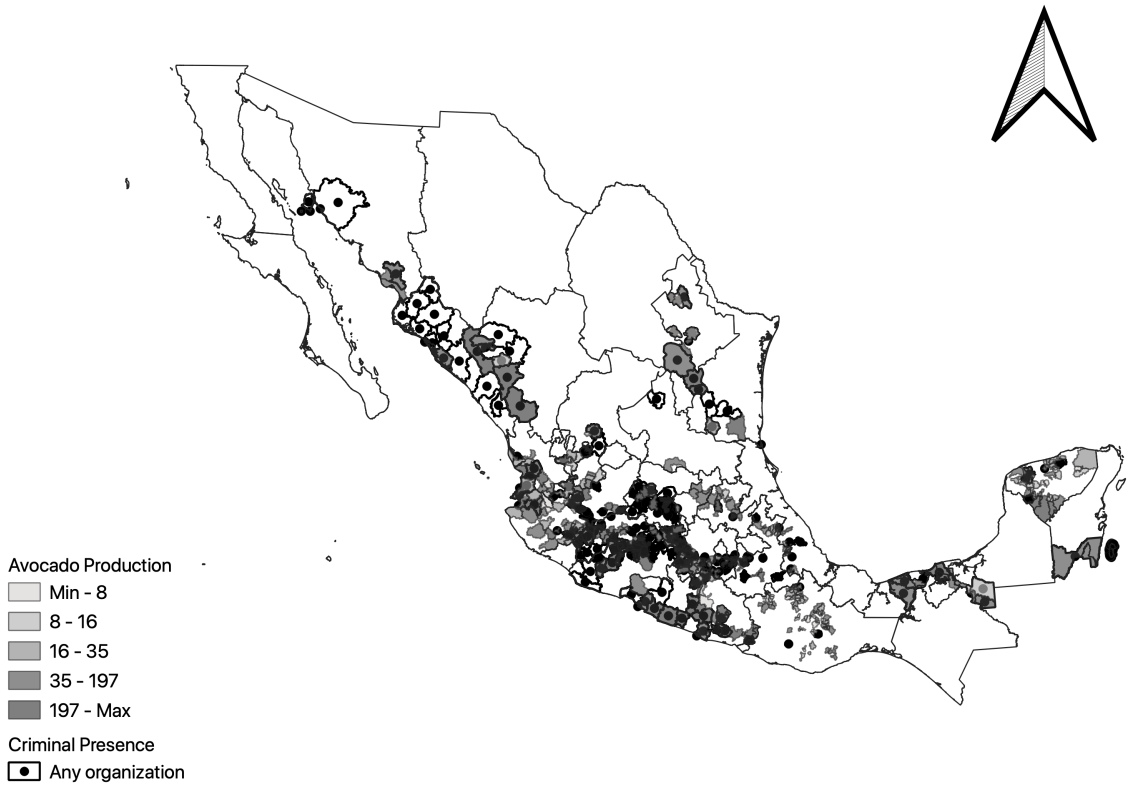


Figure 2: Avocado Production and Criminal Presence

At the time of criminal market capture in Michoacán, prospects of continued control provided an important incentive. OCGs' efforts to control commodities had the dual purpose of generating revenue and establishing criminal governance, ultimately affecting policy to continue to profit from illicit markets.[66] As a result of increased criminal market capture, violence rose dramatically.[67] Self-defense organizations sprung up in areas pressured by criminal activity in an attempt to protect farmers and communities. These areas experienced more violence as a result of clashes between such self-defense organizations and OCGs as well as between OCGs competing for prime avocado-growing territory.[68]

[66]Herrera: The limits of resistance to criminal governance: cyclical violence and the aftermath of the autodefensa movement in Michoacán, Mexico (see n. 59); Herrera/Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico (see n. 17).

[67]LeCour/Frissard: Violent and Vibrant: Mexico's Avocado Boom and Organized Crime (see n. 57); Moncada: Resisting Extortion: Victims, Criminals, and States in Latin America (see n. 37).

[68]CNDH: INFORME ESPECIAL SOBRE LOS GRUPOS DE AUTODEFENSA EN EL ESTADO DE MICHOACÁN Y LAS VIOLACIONES A LOS DERECHOS HUMANOS RELACIONADAS CON

Table 2: Characteristics of Key Mexican Agricultural Exports

	Large Intl. Market Share	Price Increase	Territory-Bound
Corn		X	
Strawberries	X		
Limes	X		X
Avocados	X	X	X

Beyond qualitative evidence at the micro-level, there is little systematic exploration of the relationship between changes in agricultural markets and criminal control in Mexico.[69] We probe our argument by focusing on the avocado market beyond Michoacán, combining homicide data at the municipality level with data on exports of avocados from Mexican municipalities and criminal presence. Figure 2 represents the spatial distribution of avocado cultivation and criminal presence. As the figure shows, in addition to Michoacán, Mexican avocados are produced in other states and OCGs are present in many areas where avocados are grown for export.

According to our argument, Mexican cartels should be attracted to agricultural markets when there are large, rapid changes in export value of agricultural goods for which Mexico represents an important portion of the global market. Mexico accounts for approximately 40% of the world's supply of avocados, which it exports primarily to the United States. [70] Violence results from challenges from competitors, state security forces, or avocado producers, as OCGs expand to new markets and specific growing territory. In a later section, we conduct placebo tests replacing avocados with corn, limes, and strawberries to assess the importance of the size of the export market, changes in price, and mobility/territorial bounded-ness of the crop. Table 2 highlights the differences between these crops and avocados, clarifying why we expect increased homicides in the case of avocados but not these other goods. There is no relationship between the production of these other crops and homicides.[71]

EL CONFLICTO, 2016.

[69]For exceptions see (Herrera/Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico [see n. 17]) and (Dube/García-Ponce/Thom: From maize to haze: Agricultural shocks and the growth of the mexican drug sector [see n. 18]).

[70]See here: USDA 2020 Avocado

[71]Here, 'territory bound' indicates that moving or replanting the crop from its existing territory would disrupt profits. While some agricultural goods can be quickly replanted and harvested, others may provoke competition over particular growing areas due to their long growing periods before prof-

Our Mexico-specific hypothesis is as follows:

H1$_{local}$: Increases to a municipality's share of avocado export value are associated with an increase in OCG violence in that municipality.

5 Sub-national analysis: change in avocado export value share and homicides

We assess the impact of change in the export market for an increasingly important export for Mexico—avocados—on criminal violence. Our argument is that OCGs observe *local* changes in opportunity for economic capture and territorial control resulting from changes in a country's position within the global market for exports. Our subnational test addresses this proposed mechanism by testing how increases in a commodity's export value affect OCGs' use of violence to seize economically strategic territory and capture the opportunity for market expansion. Subsequently, our cross-national approach allows us to establish a relationship between increases in countries' agricultural export value share of agricultural products and criminal violence and assess the plausibility of our argument beyond Mexico.

Our data ranges between 2005 and 2010 and totals 11,440 observations at the municipality-year level for the full model. As our dependent variable is the number of homicides, we conduct OLS regressions with standard errors clustered by municipality.[72] The dependent variable is led one year relative to all independent variables with the exception of a dummy indicator for municipal elections in the current year.

Our independent variables of interest are the change in a municipality's share of avocado's export value, taken from the Servicio de Información Agroalimentaria y Pesquera

itability.

[72]Because we are interested in the change in a municipality's share of avocado export value, two-way fixed effects are inappropriate as this would change the model's interpretation to that of an acceleration model. To account for unobserved municipal level components, we cluster standard errors. As an additional robustness check despite the different interpretation, we include models with two-way fixed effects in our appendix. Results remain consistent.

(SIAP), and the presence of OCGs, taken from Coscia and Ríos coscia2012knowing. We use increases in municipality-level export share as a local indicator of territorial and economic attractiveness to OCGs seeking short-term profit and long-term manipulation of an expanding portion of avocado exports. As evidenced by the case of Michoacán discused above, OCGs violently compete to expand into up-and-coming growing areas. For each municipality/year, we calculate Δ_{evs-a}, a measure of the change in each municipality's share of the export value of avocados from Mexico:

$$\Delta_{evs-a} = \frac{\text{Municipality Export Value}_t}{\text{Total Mexican Export Value}_t} - \frac{\text{Municipality Export Value}_{t-1}}{\text{Total Mexican Export Value}_{t-1}}$$

Larger, positive values of Δ_{evs-a} indicate that a municipality's importance as an exporter of avocados has increased substantially in the past year. Because avocados are grown in many Mexican municipalities and OCGs compete over control of these areas (see Figure 2), we can expect organizations to respond to new opportunities to seize profit and territory. When an avocado producing municipality accounts for an increasing portion of avocado exports, gaining such territory should be a lucrative prize that better enables an OCG to edge out competitors in the future. OCGs' use of violence to capture avocado-growing territory and export profits depends on existing competition and other municipal characteristics.

We capture the degree to which each municipality is threatened by OCGs with data from Coscia and Rios coscia2012knowing. The authors use web content to identify areas of operation of Mexican drug trafficking organizations between 1990 and 2010. However, our additional independent variables–including avocado export information–are recorded only from 2004 onward, which limits our time frame to 2005–2010. To assess the extent of criminal threat to a municipality, we use the number of OCGs present in the municipality/year. We expect no increases in violence in municipalities without OCGs, and increased violence in those where OCGs are present, as they compete with the state,

other producers, and one another for market access and territorial control. [73][74]

For our dependent variable, we use homicides at the municipal level from the National Institute of Statistics and Geography (INEGI).[75] As with our subsequent cross-national case, we recognize that unattributed homicides is an imperfect measure of criminal violence. However, if increases in homicides following changes to the avocado market are driven by factors other than criminal violence, we should not observe a difference in criminally-threatened municipalities vs. municipalities without OCGs. The raw count of homicides likely under-counts strategic criminal violence, making it a difficult test of our argument. We also control for population size, which can impact the baseline level of violence.[76] [77]We expect local state capacity to influence competition from the state or other producers. To account for it, we control for income and the number of prosecutors at the municipal level, following.[78] [79] [80] Because research has shown that OCG violence is linked to elections at the local level,[81] we include dummy variables for local election years. [82] [83] Table 3 presents the results of our subnational analysis.

Table 3 provides support for our Mexico-specific hypothesis. Increases in a municipality's share of the export value of avocados are associated with increases in homicides,

[73]The appendix includes models with an alternative measure of criminal threat. For each municipality, we code the percentage of years when at least one OCG is present in 1990–2003. This is an indicator of the municipality's baseline attractiveness to OCGs and how likely it is to experience criminal presence.

[74]The Mapping Criminal Organizations Project covers additional years, but at the state rather than municipality level; others are available for only certain municipalities, or a limited time frame. An extended and more recent set of years would be ideal, but there is insufficient variation in criminal presence to test our hypotheses using state-level data.

[75]Available here.

[76]Data on population from INEGI.

[77]We also include models using homicide rate - dividing homicide counts by municipal population - in the appendix.

[78]Guillermo Trejo/Sandra Ley: High-profile criminal violence: Why drug cartels murder government officials and party candidates in Mexico, in: British Journal of Political Science 51.1 (2021), pp. 203–229.

[79]Data on municipal income comes from (Gerardo Maldonado/Marc Grau: Elecciones, Violencia y Estructura Social (EVES): Base Integral de Municipios Mexicanos, 2013) and INEGI.

[80]Data on the number of prosecutors from (ibid.).

[81]Trejo/Ley: High-profile criminal violence: Why drug cartels murder government officials and party candidates in Mexico (see n. 78); Ley: To vote or not to vote: how criminal violence shapes electoral participation (see n. 55).

[82]Data on local elections combined from (Maldonado/Grau: Elecciones, Violencia y Estructura Social (EVES): Base Integral de Municipios Mexicanos [see n. 79]) and (Eric Magar: Recent Mexican Election Vote Returns Repository, 2018, URL: `https://github.com/emagar/elecReturns`).

[83]Following Gelman Gelman2008, we scale regression inputs by dividing them by two standard deviations.

Table 3: Change in Avocado Export Value Share, Criminal Threat, and Homicides

	(Homicides)	(Homicides)
Δ Export Value Share	-0.018**	-0.013*
	(0.007)	(0.005)
Criminal Threat	0.180***	0.062***
	(0.026)	(0.016)
Δ Export Value Share × Criminal Threat	0.015***	0.008**
	(0.004)	(0.003)
Election Year		-0.009*
		(0.005)
Municipal Wages		0.231
		(0.212)
Population		0.239
		(0.175)
Federal Prosecutors		0.168
		(0.133)
(Intercept)	0.007	-0.018+
	(0.006)	(0.009)
Num.Obs.	13469	11440
Std.Errors	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

but only in areas where OCGs are present. Elsewhere, these increases in value have a dampening effect on homicides. Figure 3 shows the marginal effect of increases in avocado export share over the range of the criminal threat variable. This effect is positive where OCGs are present.[84] Figure 4, produced using Model 2 in Table 3 illustrates predicted homicides as the share of avocado export value increases in municipalities with no criminal threat vs. predicted homicides in municipalities with many OCGs.[85] Where OCGs are present—and likely to observe opportunities to boost their profit and influence—increases in the municipality's share of avocado export value are associated with increases in the number of homicides. This effect, however, is not observed in municipalities with no criminal threat. Municipalities that are expanding their avocado exports and experience the

[84]Figure 3 and Figure 9 in the appendix are produced using the Interflex package (J. Hainmueller/ J. Mummolo/Y. Xu: How Much Should We Trust Estimates from Multiplicative Interaction Models? Simple Tools to Improve Empirical Practice. In: Political Analysis 27.2 [2019], pp. 163–192), which allows for better assessment of the conditional effects of the independent variable (Δ export value share) given the support of the moderator (criminal threat). Although the modal value of criminal threat in our data is 0 as represented by the rug at the bottom of Figure 3, there are many municipalities with 4-6 criminal organizations present, and few with 7-9.

[85]All confounding variables are set at their median value for prediction.

maximum threat from OCGs are predicted to experience over 50 homicides per year—a sobering, but substantively significant effect, especially considering that the median number of homicides per municipality/year is 0 and the mean is 9.[86]

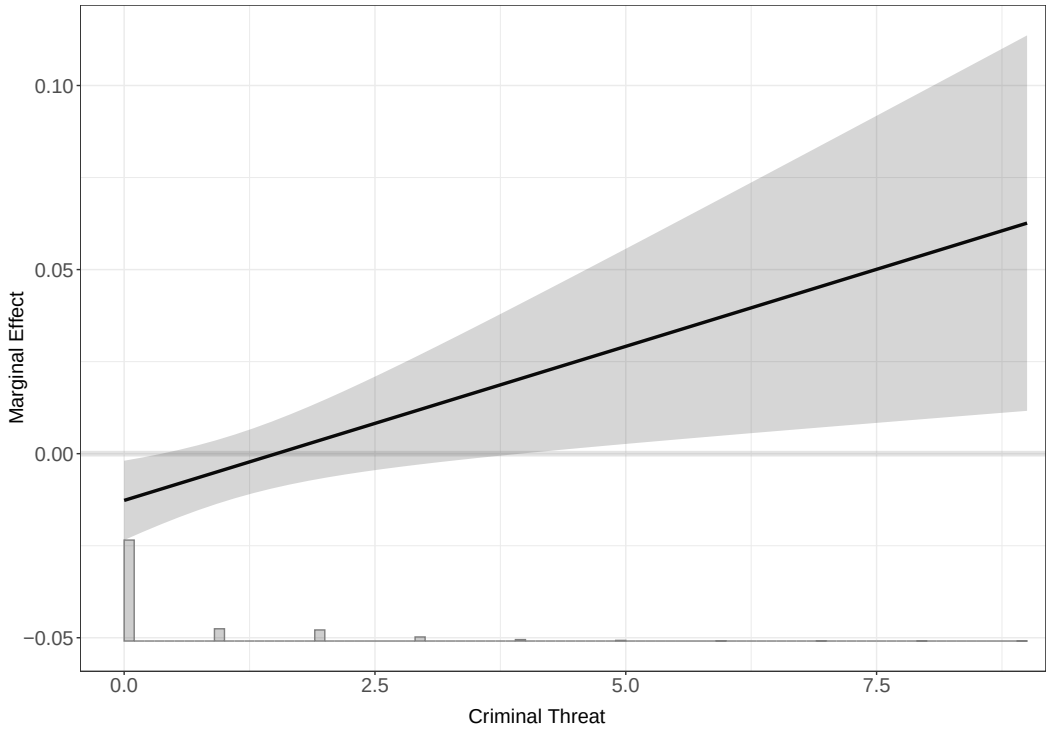


Figure 3: Marginal Effect of Change in Avocado Export Share (from model 2 in Table 3)

5.1 Avocado toast and endogeneity

Endogeneity between OCG presence, a municipality's production of avocados, and their corresponding international price is a concern for a causal interpretation of our results. It may be that, rather than seizing a newly lucrative market, OCGs seize the market first, and then manipulate supply and price. In the case of Mexico, this would mean that OCGs first manipulated the production of avocados to influence their export value in global markets.

To address this concern, we sought an alternate measure of export value share capturing the international demand for avocados that is also exogenous to OCG manipulation.

[86]This number comes from Figure **??**. It is worth noting that while we use the maximum number of OCGs - 9 - for illustration, the predicted count of homicides is similar for 6, 7, or 8 organizations as well.

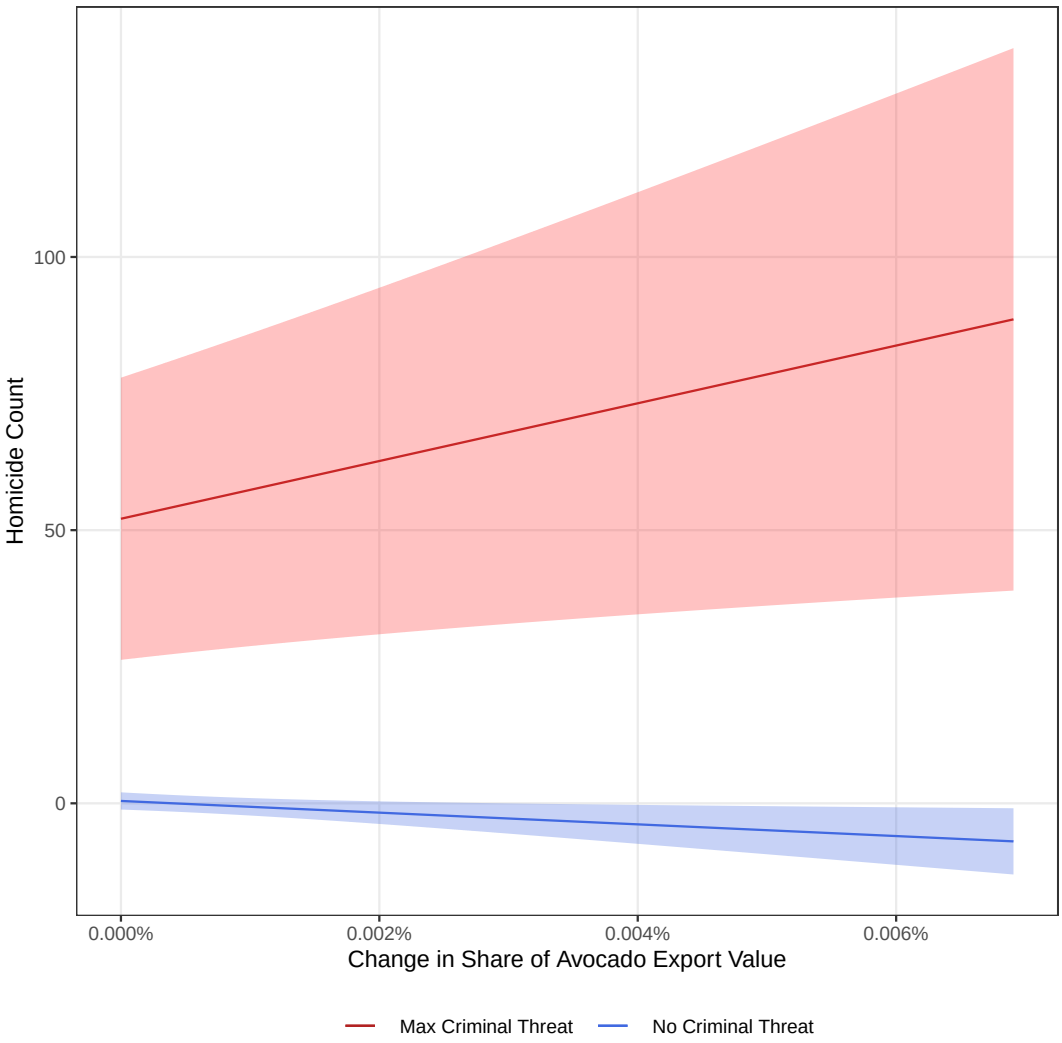


Figure 4: Predicted Homicides by Change in Avocado Export Share (from model 2 in Table 3)

The second condition eliminates international avocado price, which changes based on both demand for avocados (plausibly exogenous) and supply (manipulable by OCGs). Instead, we use the popularity of the search term "avocado toast" on Google Trends.

Consumer behavior drives the demand for avocados in international markets; the popularity of avocado toast illustrates this behavior. Avocado toast gradually became a staple at trendy cafes in mid to late 2000s, taking hold in the United States—Mexico's main avocado importer—in 2006–2007. Figure 5 demonstrates the divergence in homicides by municipality type in Mexico following this shift in demand.[87] Google Trends

[87]Sources such as InSight Crime (Patrick Corcoran: Study of 2010 Mexico Murder Trends Offers Important Policy Clues, 2014, URL: https://insightcrime.org/news/analysis/study-of-2010-mexico-murder-trends-offers-important-policy-clues/) suggest that 2010 was a particularly

captures "interest in a particular topic from around the globe".[88] Searches for "Avocado Toast" reflect the world's obsession with a new means of consuming avocados, which corresponds to overall trends in consumption.[89] In the United States, per-capita consumption of avocados more than doubled in the 2010-2020 period.[90] The Trends data scales the relative popularity of a search term over time from 0 to 100, providing information about global demand for avocados that is plausibly exogenous to other factors driving changes in criminal homicides. Although the overall popularity of avocados and avocado toast increases over this time period, there are fluctuations in the popularity of the search.[91] To mimic our previous sections using changes in agricultural or avocado export value, we assess how increases in 'avocado toast' search popularity affect criminal violence in municipalities that export avocados as compared to elsewhere.[92][93]

Because the popularity of this search term captures the international demand for avocados, the measure is not municipality-specific. However, changes in international demand should exert greater effect on criminal violence in avocado-exporting municipalities than elsewhere. The number of OCGs, our other independent variable, varies by municipality but does little to ease concerns about endogeneity. The factors driving changes in avocado exports also provoke changes in criminal presence and competition. To avoid this complication, we use an alternate measure of criminal threat: the proportion of years prior to our observation when OCGs are present in a municipality. This modification allows us to avoid post-treatment bias from changes in the attractiveness

violent year for Mexico. Specifically, violence near border regions drives 2010's high homicide totals, which likely explains the higher value for homicides in municipalities without avocados in this year.

[88] Trends Help, 2022, URL: https://support.google.com/trends/answer/4365533?hl=en.

[89] Jayne Orenstein: How the Internet Became Ridiculously Obsessed with Avocado Toast, 2016, URL: https://www.washingtonpost.com/news/wonk/wp/2016/05/06/how-the-internet-became-ridiculously-obsessed-with-avocado-toast/.

[90] Lauren Manning: Avocado consumption hits record highs, driven by health trends, 2021, URL: https://www.fooddive.com/news/avocado-consumption-hits-record-highs-driven-by-health-trends/600858/.

[91] We include a year index to account for time trends.

[92] The minimum change in popularity is about -5 while the maximum change is about 20.

[93] We use global Google Trends data to account for changes in consumer trends - and thus changes in demand - in the global market as a whole to capture changes in the export value share of this global market independent from OCG manipulation. However, Google Trends data over the same time period for just the U.S., which should reflect consumer demand in Mexico's largest international market for avocados, is extremely highly correlated to global interest in avocado toast with a correlation coefficient of .997.

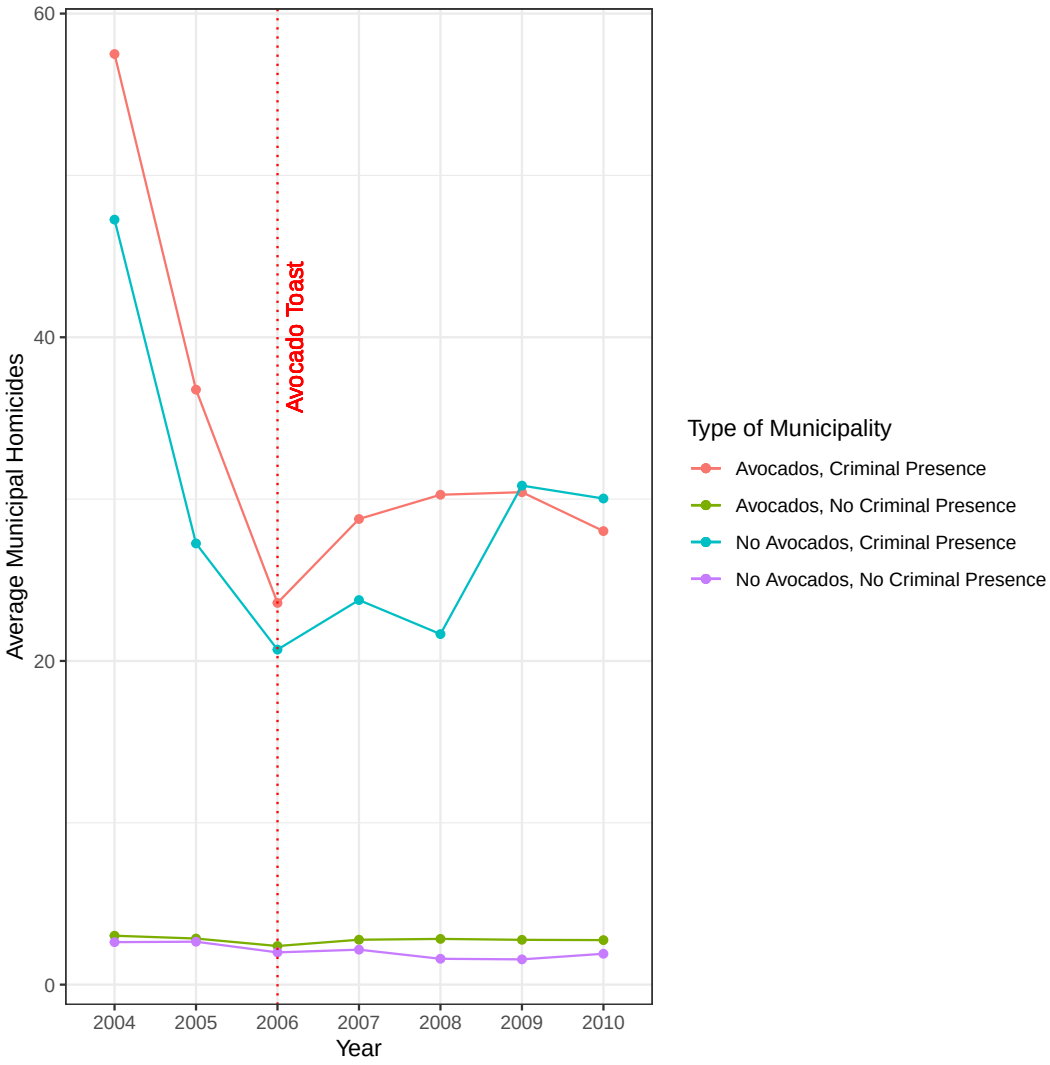


Figure 5: Avocado Production, Criminal Threat and Homicides Over Time

of a municipality when assessing the impact of increases in international demand for avocados in municipalities that are prone to criminal activity.[94] [95]

Table 4 and Figures 6a, 6b and 7 provide support for our causal explanation: increases in global demand for avocados provided an opportunity for violent criminal capture of a newly lucrative business. An increase in the popularity of "Avocado Toast" leads to about 70 more homicides in avocado-exporting municipalities that face the highest level of criminal threat. It is important to note that the median value of criminal threat is 0. A smaller increase in homicides is also predicted in municipalities that do not

[94] Because international demand cannot be observed at the municipal level, a classic instrumental variable approach is not appropriate.

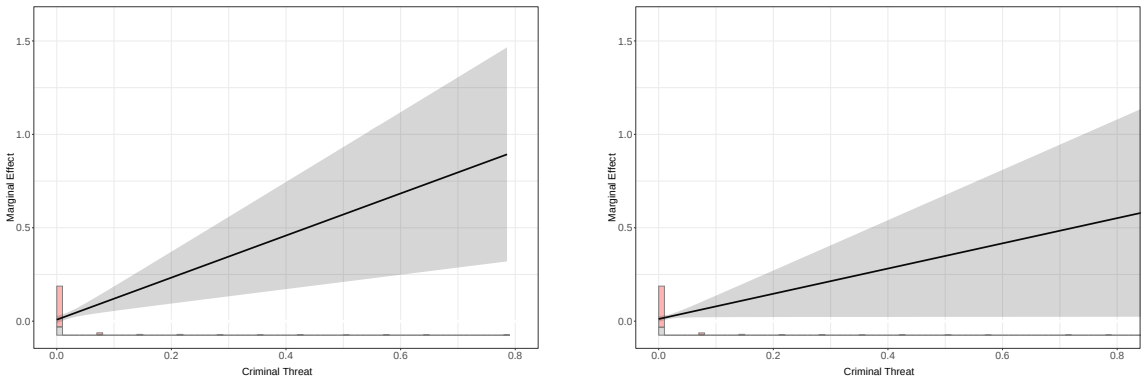
[95] We include a year index to capture time trends and cluster standard errors at the municipality level.

Table 4: Homicides, Avocado Toast Search Popularity and Criminal Threat

	(Avocado Exports)	(No Avocado Exports)
Increase, Avocado Toast Search Popularity × Criminal Threat	1.134**	0.676*
	(0.380)	(0.343)
Criminal Threat	1.059	0.155
	(0.794)	(0.423)
Increase, Avocado Toast Search Popularity	-0.005	0.002
	(0.009)	(0.007)
Municipal Election	-0.001	-0.007
	(0.008)	(0.006)
Municipal Wages	0.509	0.232
	(0.479)	(0.214)
Population	-0.506	0.327+
	(0.402)	(0.169)
Federal Prosecutors	0.657**	0.031
	(0.228)	(0.131)
Year Index	0.007	0.005*
	(0.005)	(0.002)
(Intercept)	-0.012	-0.037*
	(0.017)	(0.015)
Num.Obs.	3277	8163
Std.Errors	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

export avocados. However, in Figure 6b, the marginal effect of an increase in search term popularity on homicides is statistically indistinct from 0 across many of the values of criminal threat. Increases in international demand for avocados have a positive and substantively meaningful effect on homicides in avocado-exporting municipalities with consistent criminal presence, but may also affect criminal violence elsewhere as groups compete for territory and future profit.



(a) Avocado Exports (b) No Avocado Exports

Figure 6: Marginal Effect of Increases in Avocado Toast Search Popularity

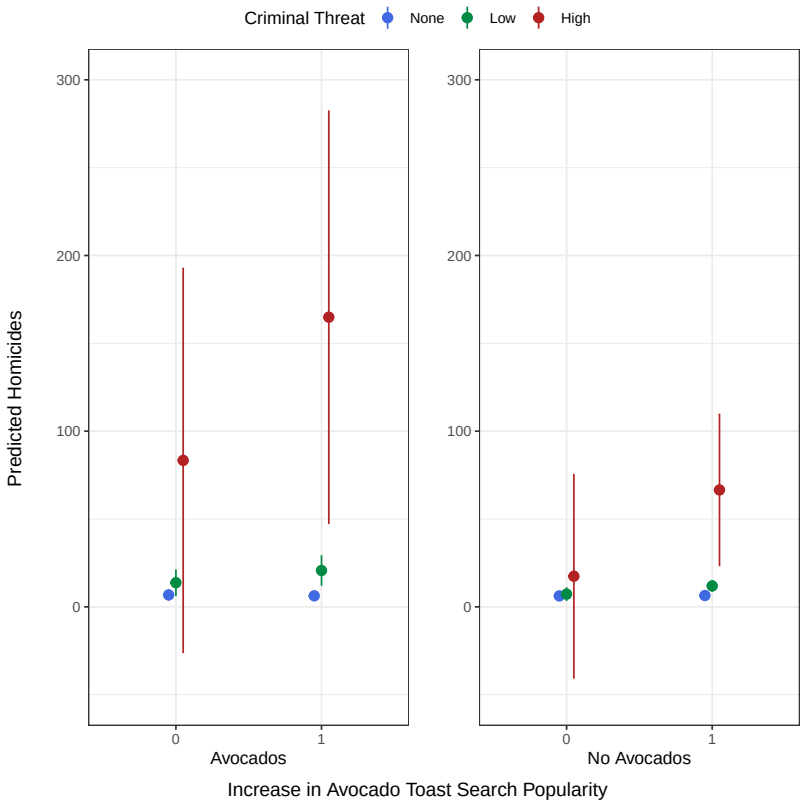


Figure 7: Avocado Toast and Predicted Homicides

6 Δ Price vs. Δ Export Value Share: The Case of Corn, Strawberries, and Limes

Global or local increases in the price of a commodity, all else equal, should make it more attractive for OCGs to invest that particular commodity.[96] However, we argue that increases in the value of commodities that also provide an opportunity for OCGs to eventually control a substantial portion of the market uniquely provoke higher levels of competition and violence. To probe this difference, we make use of placebo tests.[97] We replace our treatment of changes in avocado export value share with changes in the value of other key agricultural commodities in Mexico.

The first, corn, had a significant increase in global price, but Mexican exports consti-

[96] In our appendix, we include models replacing our independent variable with the change in export value as well as the change in local price of avocados. Neither is statistically significantly associated with an increase in homicides.

[97] We follow (A. Eggers/G. Tuñon/A. Dafoe: Placebo Tests for Causal Inference, in: American Journal of Political Science 68.3 [2024], pp. 1106–1121) in defining a placebo test as "tools for assessing the plausibility of the assumptions underlying a research design relative to some departure from those assumptions."

tute small portion of the global market. Over the period 2005-2008, the global price of corn more than doubled (95.98 USD per metric ton in November 2005 to 287.13 USD in June 2008).[98] Brazil and the United States are the primary exporters of corn, capturing a substantial portion of the global market. Mexico is not a top exporter of corn, meaning that changes in global price do not present an opportunity for OCGs to become price makers rather than price takers. If our argument about the importance of export value share holds true, we should not observe any relationship between changes in corn production value and criminal violence. The second, strawberries, is a significant export for Mexico[99] but did not experience an upward shift in global price during this time period making the crop more attractive for capture.[100] We further include limes to explore an additional characteristic of agricultural goods. Corn and strawberries grow quickly - their time from planting to profit is minimal, meaning that they could be quickly planted in new territory to capitalize on global market shifts. Limes, however, like avocados, require two to three years of growing time before their fruit can be harvested and sold, making the territory in which they grow particularly worthy of competition. Although Mexico is the main global exporter of limes,[101] limes did not change significantly in price during the time of our analysis.[102][103] Comparing these commodities to avocados allows us to vary key characteristics - international market share, significant global price increases, and competition over specific growing territory - to provide evidence for our particular mechanism of export market expansion.

As seen in Table 5, even during the years of significant increase in global price, there was no increase in violence where criminal groups were active and these alternative crops

[98] International Monetary Fund: Global price of Corn [PMAIZMTUSDM], 2024, URL: https://fred.stlouisfed.org/series/PMAIZMTUSDM.

[99] An Overview of Mexican Strawberry Exports, 2022, URL: https://producepay.com/blog/an-overview-of-mexican-strawberry-exports/.

[100] U.S. Bureau of Labor Statistics: Average Price: Strawberries, Dry Pint (Cost per 12 Ounces/340.2 Grams) in U.S. City Average [APU0000711415], 2025, URL: https://fred.stlouisfed.org/series/APU0000711415.

[101] USDA Foreign Agriculture Service: Production: Lemons and Limes, 2025, URL: https://www.fas.usda.gov/data/production/commodity/0572120.

[102] U.S. Bureau of Labor Statistics: Producer Price Index by Commodity: Farm Products: Citrus Fruits [WPS011101], 2025, URL: https://fred.stlouisfed.org/series/WPS011101.

[103] While an international indicator of lime price is not available, one for citrus fruits is, which does not see a significant upward trend in price.

Table 5: Corn, Strawberry, and Lime Production, Criminal Threat, and Homicides in non-Avocado Growing Municipalities

	Corn	Strawberries	Limes
Criminal Threat	0.033***	-0.004	-0.033
	(0.009)	(0.018)	(0.027)
Δ Production Value Corn	-0.054		
	(0.044)		
Δ Production Value Corn × Criminal Threat	0.037		
	(0.050)		
Δ Production Value Strawberries		0.212+	
		(0.091)	
Δ Production Value Strawberries × Criminal Threat		-0.432***	
		(0.059)	
Δ Production Value Limes			0.015
			(0.010)
Δ Production Value Limes × Criminal Threat			-0.004
			(0.008)
Election Year	-0.004	-0.021	-0.030*
	(0.003)	(0.025)	(0.014)
Municipal Wages	-0.322*	0.295*	0.643**
	(0.144)	(0.116)	(0.221)
Population	0.647***	1.283**	0.165
	(0.097)	(0.318)	(0.214)
Federal Agents	0.200	-1.383*	-0.106
	(0.124)	(0.505)	(0.090)
(Intercept)	-0.015*	-0.051+	-0.020
	(0.007)	(0.025)	(0.018)
Num.Obs.	9156	38	1123
Std.Errors	by: Municipality	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

are grown.[104] Although imperfect, this test provides additional evidence that OCGs engage in territory-claiming violence for a specific purpose: eventual market capture and manipulation of newly lucrative exported agricultural commodities. When assessed independently of one another, price increases (corn), a large export market share (strawberries or limes), and territory-boundedness (limes) have no effect on increases in OCG homicides in growing territories.

7 External Validity: Changes in export value share and homicides at the Cross-National Level

In the previous section, we provided evidence suggestive of the plausibility our theory. In this section, we extend our analysis beyond Mexico with the aim of corroborating our argument in a general setting. We hypothesize that large, unexpected increases in a state's share of a commodity's export value—how much profit OCGs could expect in the future from capturing a substantial portion of the good's international market—are associated with increases in criminal violence. To test our hypothesis at the cross-national level, we compiled data about the value of commodities, OCGs' threat to the state, and the number of homicides per year. OCGs seize opportunities for diversification into booming licit markets for agricultural goods. To test the validity and generalizability of our claims, we analyze the relationship between changes in a country's share of a commodity's export value and changes in homicides at the country-year level. We use a global sample of countries between 1993 and 2018.[105] We include this test as descriptive, cross-national evidence of the relationship between changes in agricultural export value share and criminal violence.

At the general level, we assess one specific hypothesis:

H1$_{general}$**:** Unexpected increases to a state's share of an agricultural commodity's export

[104] Municipal level export values of corn, strawberries, and limes are not available, however, production value should better capture concerns about the importance of both local and global price as the real driver of criminal attention and violence.

[105] Our panel is unbalanced due to missingness in homicide data and controls.

value are associated with an increase in OCG violence in that state.

To estimate if meaningful changes in commodity markets are associated with increases in OCG violence we first address some empirical challenges. The areas where these commodities are present may be very different from those where they are not. If these differences are correlated with our dependent variable they can induce bias in our analyses. To ameliorate these endogeneity issues, following,[106] we assume that global demand shifts in price, which drives changes in exporting countries' global share of markets, are exogenous to domestic violence levels. We then analyze how unexpected changes in agricultural commodities' global markets affect violence within and across countries. We lead our dependent variable by one year relative to all predictors, and cluster our standard errors at the country level to account for idiosyncratic variation across countries and over time.[107]

Another limitation is that we lack information about OCGs' location relative to each product within each state. We also do not have knowledge *ex ante* about which products will experience significant shifts in global demand and coding each prominent commodity for each country lies outside of the scope of this project. Our cross-national results should be viewed as evidence of a positive relationship between changes in a country's share of products' export value and homicides in the following year, which should only be present in countries with an active criminal threat. Building on our extensive sub-national tests in Mexico, this global test is a proof of concept that opportunities for expansion into export markets for licit goods can provoke increases in homicides where OCGs threaten the state.

Combined, our sources yield a data frame of 47,652 observations covering a global sample of countries over the years 1993–2018. Our dependent variable—the count of homicides—takes on a wide range of positive values, making standard OLS, with standard errors clustered by country, an appropriate modeling strategy. We discuss data sources, concept measurement, and confounders next.

[106] Herrera/Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico (see n. 17).

[107] We do not include two-way fixed effects for the same reason as in the Mexico case. Nonetheless, models with two-way fixed effects can be found in the appendix as a robustness check.

7.1 Dependent variable

We operationalize our dependent variable—OCG violence—as the count of homicides per year by country, and we measure it using UNODC's yearly homicide data.[108] A notable limitation is that these data capture all homicides, rather than only those attributable to OCGs. While the UNODC also collects data about homicides attributed to OCGs, there are concerning levels of bias and extensive missingness. When data are available, they represent a small fraction of the broader homicide data, missing or under-counting observations from countries where criminal presence is rampant.

Nevertheless, using counts of homicides offers an important advantage: it captures the multiple manifestations of OCG violence. Homicides attributable to OCGs result from confrontations between groups, with the state, producers, or from the death of bystanders. Even though OCGs may operate in the absence of homicides, when homicides occur in large scale, they result from an alteration in the status quo. For our purposes this is important, as we seek to capture the impact of unexpected changes in international markets on domestic violence levels. Previous work, such as[109] ,,[110] and,[111] has used general homicide data as an indicator of OCG activity. We follow these scholars' lead in our use of this measure.

To validate our choice we assess the correlation between robberies resulting in homicides and changes in export value share for a limited sample of countries with available data. Homicides resulting from robberies are different from OCG homicides, and unlikely to follow the same patterns. If more 'random' violence, such as robberies, is associated with changes in our independent variable, the effect we observe may be the result of alternative pathways. As expected, robbery-driven homicides and changes to export value share are not significantly correlated in our sample. Furthermore, in Colombia, where homicides are high and OCGs pose a significant threat to the state, the (non-statistically

[108] UNODC: Country Homicide, 2019, URL: https://dataunodc.un.org/content/data/homicide/homicide-rate.

[109] Trejo/Albarracin/Tiscornia: Breaking state impunity in post-authoritarian regimes: Why transitional justice processes deter criminal violence in new democracies (see n. 53).

[110] Yashar: Homicidal ecologies: illicit economies and complicit states in Latin America (see n. 12).

[111] Yoo: Does "green gold" breed bloody violence? The effect of export shocks on criminal violence in Mexico (see n. 61).

significant) association between robbery-driven homicides and increases in export value share is negative. Although this is one case and one alternative driver of homicides it provides more confidence in our assertion that higher homicides following increases in the share of agricultural products' export value are driven by OCGs rather than other sources of violence.

Our data may under-count homicides from OCGs due to difficulty in observing clandestine violence or the risk of retribution from reporting, but under-reporting of homicides should bias *against* our findings. Finally, homicide data offer an advantage to conduct cross-national analyses over time, as they provide comparable information for a large number of countries, across many years.

7.2 Independent variables

Following our theory, our primary independent variable must reflect changes in OCGs' perceived opportunity to profit from newly lucrative agricultural products. We make use of the Atlas of Economic Complexity International Trade Data,[112] which tracks yearly information about countries' export value for individual goods, export diversity, and trade sophistication, based on the United Nations' Statistical Division (COMTRADE) Standard International Trade Classification scheme of products. We use the export value of a set of goods: non-processed food products, raw paper materials, and animal or vegetable based oils.[113] We make several adjustments to capture moments of lucrative economic opportunity that OCGs may seize. Our primary measure mimics Δ_{evs-a} used to capture changes in the municipal share of avocado export value. For each country/year/product, we calculate Δ_{evs}, a measure of the change in each country's share of the export value of each good in the above categories:

[112]The Growth Lab: International Trade Data (SITC, Rev. 2), version V4, 2019, URL: https://doi.org/10.7910/DVN/H8SFD2.

[113]A full list of included SITC categories can be found in the appendix. We include any category that can be considered agricultural commodities, including plant and animal products. Each of the types of commodities can also carry a territorial advantage (eg holding lucrative cattle grazing lands). Nonetheless, we consider this an inclusive first cut and encourage future scholars to refine and investigate the importance of different types of commodities.

$$\Delta_{evs} = \frac{\text{Country Export Value}_t}{\text{Global Export Value}_t} - \frac{\text{Country Export Value}_{t-1}}{\text{Global Export Value}_{t-1}}$$

Larger, positive values of Δ_{evs} indicate that the country's portion of the growth in export value of a particular agricultural good has increased substantially in the past year. Large values of Δ_{evs} provide windows of opportunity for OCGs to enter these newly booming markets to gain immediate profit and to employ strategies such as those outlined in the Michoacán case to engage in long-term capture. [114] We expect OCGs operating in or near territory that produces these commodities to violently seize control of production and exports as a means of increasing their income and local clout.

Our proposed mechanism centers around the presence of OCGs in countries profiting from increased agricultural export wealth. Increases in global export share of agricultural goods in countries without criminal presence should not be associated with an uptick in homicides. To distinguish countries under criminal threat from those where criminal presence is not strong, we rely on data from the V-Dem project.[115] We use the variable coding "anti-system" movements that are "heavily engaged in criminal activity, e.g. narcotics, bootlegging, illegal exploitation of natural resources, extortion, kidnapping" (196). The variable is averaged over coders' decisions of 0: no criminal threat or 1: the threat to the state is criminal in nature. Values close to 0 indicate that it is unlikely that OCGs are a significant threat to the state, while values closer to 1 indicate consensus that OCGs are present and active.

Because in the majority of states OCGs do not represent a full "anti-system" threat against the central state, the mean value of this measure is close to zero (0.07). In contrast, states where OCGs present a significant challenge to governance score higher: Mexico averages 0.38, Honduras 0.36, Colombia 0.72 and the Philippines 0.54. We take this index as a conservative measure of criminal presence and threat, as countries where

[114] As an additional robustness check, the appendix includes positive shocks to Δ_{evs}. We use a 3-year moving standard deviation to capture expected changes in export value share, and code any increase in Δ_{evs} greater than two standard deviations as a positive shock. We then create a dummy variable capturing whether the country experiences a positive shock to their share of the export value of any agricultural goods in a given year. Results are robust to this alternate specification of 'large and rapid' changes.

[115] Varieties of Democracy Project: V-Dem Codebook v11.1, version V2, 2021.

OCGs operate but do not significantly challenge the state are likely to be under-scored (for example, South Africa averages only 0.04). However, under-scoring criminal threats would bias against any statistically significant findings rather than amplify the relationship between criminal threat, changes in export markets for licit goods, and homicides.[116]

Our argument is that OCGs engage in violence when expanding their territorial and economic presence in markets for licit goods. Thus, we expect increases in homicides in countries with a clear criminal threat following growth in the country's share of a commodity's export value. In contrast, countries without active OCGs should not experience a significant uptick in violence. Given this expectation, we interact the criminal presence variable with the change in products' export value share.

7.3 Confounders

Other country-level factors may influence changes in the number of yearly homicides in states. We account for these confounders by including: GDP per capita, to account for connections between country wealth and violence; population, given that more populous states experience more homicides; proportion of the labor force employed in agriculture as an indicator of the importance of agricultural commodity production for a state's welfare. These variables are taken from the World Bank's Development Indicators.[117]

We expect that the importance of a given commodity to a state's economic well-being impacts whether OCGs are able to compete economically and territorially for its control. Export diversification promotes economic growth,[118] and diversified export portfolios lead to stronger states, which are better able to provide access to more employment and economic opportunities, disincentivizing crime. Stronger, more capable states might also be more effective at crime detection and deterrence. Conversely, when countries are depen-

[116]In the appendix, we employ an alternate measure of OCG presence: whether the state is a major narcotics producer according to UNODC. Because many OCGs are active in illicit narcotics trade prior to (and during) diversification into markets for licit goods, this proxy should represent the presence of the largest OCGs but may neglect smaller groups or groups not engaged in narcotics production. Results are robust to this proxy for OCG presence.

[117]World Bank: Development Indicators, 2019, URL: https://data.worldbank.org/indicator.

[118]Khodayi Hamed/Darabi Hadi/Khodayi Hossein: Export diversification and economic growth in some selected developing countries, in: African Journal of Business Management 8.17 (2014), pp. 700–704; Heiko Hesse: Export diversification and economic growth, in: Breaking into new markets: Emerging lessons for export diversification 2009, pp. 55–80.

dent on few commodities, states may guard market entry for key products more closely, making it more difficult for OCGs to take advantage of demand shocks for goods that are central to the economy. Therefore, we should expect higher competition, and violence, in countries with minimal export diversity. We include the Economic Complexity Index from the Atlas of Economic Complexity[119] as an indicator of a country's export diversity.

Whether a state is embroiled in violent conflict influences overall levels of violence, therefore, we include a dummy variable taking a value of 1 if a country/year experiences civil war, and 0 otherwise.[120] Finally, a state's ability and willingness to enforce the law influences both OCGs' ambitions and the homicide rate. We include two measures from V-Dem to capture the extent of law enforcement and accountability of public officials: an index of the rule of law, and an indicator of how likely public officials are to engage in corruption.

7.4 Results

Our results provide strong evidence in favor of a positive relationship between changes in export value share and homicides in criminally threatened states. As the models in Table 6 show, when OCGs threaten a state, increases in that state's share of agricultural goods' export values are associated with a significant increase in homicides. Model 1 provides basic evidence of this relationship, Model 2 includes the confounders discussed in the previous section. Larger increases in a country's export value share of agricultural goods correspond to much higher counts of homicides in countries where OCGs are active in the following year.

Figure 8 illustrates the predicted value of homicides over the range of Δ_{evs} produced using the complete model in Table 6.[121] Sharp increases in homicides result from large, positive changes to products' export value share in countries where OCGs threaten the state. Two issues are relevant for interpretation: First, the median homicide count is just

[119] The Growth Lab: International Trade Data (SITC, Rev. 2) (see n. 112).
[120] Therese Petersson/Magnus Oberg: Organized violence, 1989-2019, in: Journal of Peace Research 2020.
[121] All confounders are set at their median values.

Table 6: Change in Export Value Share, Criminal Threat, and Homicides

	(Homicides)	(Homicides)
Δ Export Value Share	3.319***	1.308**
	(0.634)	(0.478)
Criminal Threat	0.846***	0.563***
	(0.016)	(0.014)
Δ Export Value Share $\times$ Criminal Threat	16.916**	17.964***
	(6.348)	(4.785)
Population		0.485***
		(0.003)
GDPPC		-0.073***
		(0.005)
%Employed in Agriculture		-0.210***
		(0.005)
Conflict Dummy		0.175***
		(0.005)
ECI		-0.004
		(0.003)
Rule of Law		0.900***
		(0.016)
Corruption		0.976***
		(0.017)
(Intercept)	0.115***	-0.823***
	(0.002)	(0.017)
Num.Obs.	48510	47652
Std.Errors	by: Country	by: Country

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

over 300, while the maximum count is 65,000. Figure 8 demonstrates that in countries experiencing even a moderate criminal threat, a 15% change in a country's export value share of key products is associated with a predicted 10,000 homicides in the following year. When there is no change to export value share, fewer than 3,000 homicides are predicted. Further, in countries where the threat from OCGs is high, the predicted increase in homicides after a 15% change in an agricultural product's export value share in the previous year is stark: over 40,000 at the maximum level of threat. The states falling above the 'mean threat' level are prime examples of OCG hubs—El Salvador, Honduras, Colombia. Thus, in environments where OCGs are a salient threat, a larger increase in these states' export value share of agricultural products is associated with substantial increases in homicides.

Our results corroborate the plausibility of our theoretical argument in a cross-national setting.

8 Conclusion

Research has focused on understanding diverse features of OCGs and violence in connection with markets for illicit goods. This paper sheds light on an under-studied phenomenon: the conditions under which OCGs violently target markets for licit commodities. We develop and test a theory of criminal diversification to markets for licit goods, focusing on agricultural commodities. We show that when there are increases in local share of a good's export value, OCGs seek market control resulting in higher violence. This seems to be particularly true for territory-bound goods with a long growing horizon such as avocados and limes. We provide multiple sources of evidence, including quantitative analysis of Mexican avocado exports, qualitative evidence of market capture of avocados, and a proof-of-concept descriptive test of the relationship between export value share and criminal homicides at the cross-national level. In all analyses, the evidence supports our argument. Cross-national, cross-temporal data provide generalizable evidence of our proposed theoretical relationship. The case of Mexico provides direct evidence of

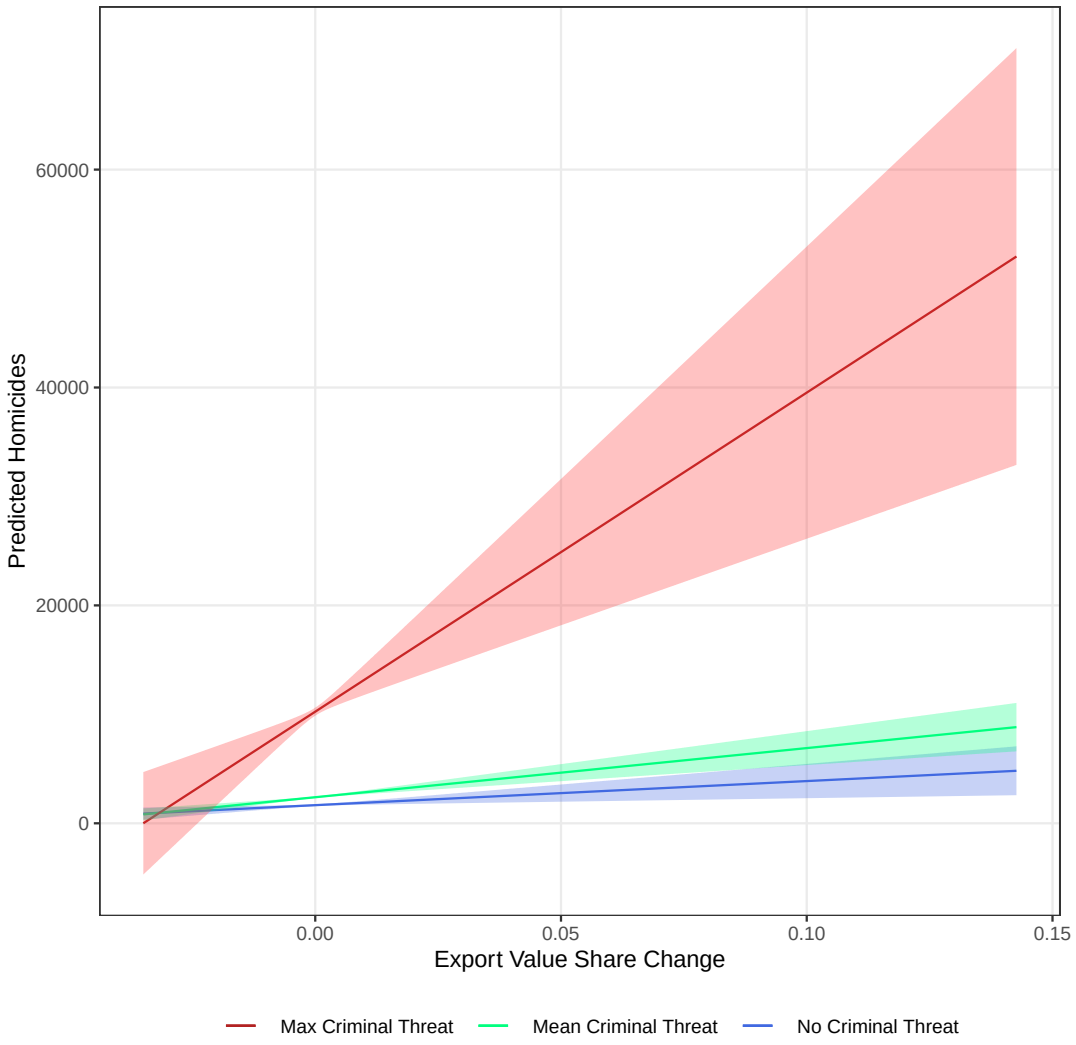


Figure 8: Predicted Homicides, Export Value Change and Criminal Threat (Produced from Model 2 in Table 6)

the presence of OCGs and their attempts to control markets beyond illicit ones. A placebo test with other commodities - corn, strawberries, and limes - in Mexican municipalities helps isolate and provide evidence of our mechanism. Finally, measuring international demand with avocado toast popularity helps mitigate concerns about reverse causality.

We show that violence is not circumscribed to the underworld of illicit goods. Scholars have demonstrated that criminal violence can be as deadly as civil war violence. However, these analyses focus on illicit markets. By providing evidence of the conditions for violent takeovers of licit markets we extend our current understanding of OCG behavior and its consequences. We propose a specific mechanism—increases in price where significant export share allows for eventual market capture—and argue that it is an important

measure of groups' motivation to seize markets for immediate profit as well as eventual control and manipulation.

We generate a systematic explanation of OCG behavior in a cross-national setting, currently an underdeveloped area of research. Taking advantage of an area where there is access to cross–national, cross–temporal data to test our argument, we rely on existing knowledge from case studies as rich sources of theory development and use it to generalize beyond individual cases.

Our project sparks questions about the nature of diversification and highlights the need for systematic data collection. There is little information about OCGs' revenue streams. Criminal markets are "global chains of local operations",[122] and revenue flows at the top may not reflect the bottom of the chain. Besides, not all OCGs are powerful cartels; diversification can help OCGs better distribute cash among members at the local level. Because diversification is not necessarily about substitution but long-term investment opportunities,[123] research using fine-grained data on group features is necessary to better understand what types of groups can diversify.

Finally, we contribute relevant insights for future research on criminal violence and governance. Dominant accounts describe organized crime as primarily an urban and drug-related phenomenon. We show here that this understanding might be biased. OCGs deal in a wide variety of products beyond drugs, and the capture of natural resources implies that these dynamics extend to rural areas. OCGs compete to regulate licit and illicit markets, but the nature and degree of violence depends on the market and the point in the chain of production and distribution. Controlling agricultural production may require a different level of territorial control and violence than certain illicit drugs. Variation in economic behavior has implications for criminal governance; whether the same mechanisms apply in rural and urban settings and across market segments is a question for future research.

[122] Trejo/Ley: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico (see n. 4).
[123] Farfan Mendez: Opium Poppy Cultivation and Interactions between Legal and Illegal Economies in Sinaloa (see n. 29).

References

An Overview of Mexican Strawberry Exports, 2022, URL: https://producepay.com/blog/an-overview-of-mexican-strawberry-exports/.

Arias, Enrique Desmond: Criminal enterprises and governance in Latin America and the Caribbean, 2017.

Arjona, Ana: Rebelocracy: Social Order in the Colombian Civil War, 2016.

Barnes, Nicholas: Criminal politics: An integrated approach to the study of organized crime, politics, and violence, in: Perspectives on Politics 15.4 (2017), pp. 967–987.

Bazzi, Samuel and Christopher Blattman: Economic shocks and conflict: Evidence from commodity prices, in: American Economic Journal: Macroeconomics 6.4 (2014), pp. 1–38.

Bennett, Andrew and Jeffrey T Checkel: Process tracing, 2015.

Blume, Laura R: Collusion, Co-Optation, or Evasion: The Politics of Drug Trafficking Violence in Central America, in: Comparative Political Studies 2022, p. 00104140211066218.

Blume, Laura Ross: Narco Robin Hoods: Community support for illicit economies and violence in rural Central America, in: World Development 143 (2021), p. 105464.

Castillo, Juan Camilo and Dorothy Kronick: The logic of violence in drug war, in: American Political Science Review 114.3 (2020), pp. 874–887.

Caulkins, Jonathan P and Peter Reuter: How drug enforcement affects drug prices, in: Crime and Justice 39.1 (2010), pp. 213–271.

CNDH: INFORME ESPECIAL SOBRE LOS GRUPOS DE AUTODEFENSA EN EL ESTADO DE MICHOACÁN Y LAS VIOLACIONES A LOS DERECHOS HUMANOS RELACIONADAS CON EL CONFLICTO, 2016.

Corcoran, Patrick: Study of 2010 Mexico Murder Trends Offers Important Policy Clues, 2014, URL: https://insightcrime.org/news/analysis/study-of-2010-mexico-murder-trends-offers-important-policy-clues/.

Critchley, David: The origin of organized crime in America: The New York city mafia, 1891–1931, vol. 1, 2008.

Dal Bó, Ernesto and Pedro Dal Bó: Workers, warriors, and criminals: social conflict in general equilibrium, in: Journal of the European Economic Association 9.4 (2011), pp. 646–677.

Dash, Mike: The First Family: Terror, Extortion and the Birth of the American Mafia, 2011.

De Greef, Kimon: Booming illegal abalone fishery in Hangberg: Tough lessons for small-scale fisheries governance in South Africa, MA thesis, University of Cape Town, 2014.

Dimico, Arcangelo, Alessia Isopi, and Ola Olsson: Origins of the Sicilian Mafia: The Market for Lemons, in: Journal of Economic History 77.4 (2017), pp. 1083–1115.

Dipoppa, Gemma: How Criminal Organizations Expand to Strong States: Migrant Exploitation and Political Brokerage in Northern Italy, in: forthcoming, Journal of Politics 2023.

Dube, Oeindrila, Omar García-Ponce, and Kevin Thom: From maize to haze: Agricultural shocks and the growth of the mexican drug sector, in: Journal of the European Economic Association 14.5 (2016), pp. 1181–1224.

Dube, Oeindrila and Juan F Vargas: Commodity price shocks and civil conflict: Evidence from Colombia, in: The review of economic studies 80.4 (2013), pp. 1384–1421.

Durán-Martínez, Angélica: The politics of drug violence: Criminals, cops and politicians in Colombia and Mexico, 2017.

Eggers, A., G. Tuñon, and A. Dafoe: Placebo Tests for Causal Inference, in: American Journal of Political Science 68.3 (2024), pp. 1106–1121.

Estancona, Chelsea L: Rebel Primary Commodity Markets, Price Shocks, and Supplier Victimization, in: International Studies Quarterly 65.4 (Aug. 2021), pp. 1111–1123, URL: https://doi.org/10.1093/isq/sqab073.

Farfan Mendez, Cecilia: Opium Poppy Cultivation and Interactions between Legal and Illegal Economies in Sinaloa, Unpublished manuscript, presented at APSA 2021, 2021.

Farfán-Méndez, Cecilia: The Structure of Drug Trafficking Organizations and Money Laundering Practices: A Risk Appetite Hypothesis, in: Journal of Illicit Economies and Development 1.3 (2019), pp. 294–311.

Fund, International Monetary: Global price of Corn [PMAIZMTUSDM], 2024, URL: https://fred.stlouisfed.org/series/PMAIZMTUSDM.

Gagne, David: Blacklisted by the US, Mexico Gas Stations Still in Business, in: Insight Crime March 23 (2015).

García-Ponce, Omar and Andrés Lajous: How does a drug cartel become a lime cartel?, in: Washington Post May 20 (2014).

Giraldo Ramírez, Jorge, Andres Rendón, and Gustavo Duncan: Nuevas Modalidades de Captacion de Rentas Ilegales en Medellin, 2014.

Hainmueller, J., J. Mummolo, and Y. Xu: How Much Should We Trust Estimates from Multiplicative Interaction Models? Simple Tools to Improve Empirical Practice. In: Political Analysis 27.2 (2019), pp. 163–192.

Hamed, Khodayi, Darabi Hadi, and Khodayi Hossein: Export diversification and economic growth in some selected developing countries, in: African Journal of Business Management 8.17 (2014), pp. 700–704.

Herrera, Joel Salvador: The limits of resistance to criminal governance: cyclical violence and the aftermath of the autodefensa movement in Michoacán, Mexico, in: Global Crime 22.4 (2021), pp. 336–360.

Herrera, Joel Salvador and Cesar Martínez-Alvarez: Diversifying violence: Mining, export-agriculture, and criminal governance in Mexico, in: World Development 151 (2022), p. 105769.

Hesse, Heiko: Export diversification and economic growth, in: Breaking into new markets: Emerging lessons for export diversification 2009, pp. 55–80.

Idler, Annette: The logic of illicit flows in armed conflict: Explaining variation in violent nonstate group interactions in Colombia, in: World Politics 72.3 (2020), pp. 335–376.

Koivu, Kendra L: In the shadow of the state: mafias and illicit markets, in: Comparative Political Studies 49.2 (2016), pp. 155–183.

Labor Statistics, U.S. Bureau of: Average Price: Strawberries, Dry Pint (Cost per 12 Ounces/340.2 Grams) in U.S. City Average [APU0000711415], 2025, URL: https://fred.stlouisfed.org/series/APU0000711415.

Labor Statistics, U.S. Bureau of: Producer Price Index by Commodity: Farm Products: Citrus Fruits [WPS011101], 2025, URL: https://fred.stlouisfed.org/series/WPS011101.

LeCour, Romain and Paul Frissard: Violent and Vibrant: Mexico's Avocado Boom and Organized Crime, Global Initiative Against Transnational Organized Crime, 2024.

Lessing, Benjamin: Conceptualizing Criminal Governance, in: Perspectives on Politics 2020, pp. 1–20.

Idem: Making peace in drug wars: crackdowns and cartels in Latin America, 2017.

Ley, Sandra: To vote or not to vote: how criminal violence shapes electoral participation, in: Journal of Conflict Resolution 62.9 (2018), pp. 1963–1990.

Linthicum, Kate: Inside the bloody cartel war for Mexico's multibillion-dollar avocado industry, in: Los Angeles Times November 21 (2019).

Magaloni, Beatriz et al.: Living in Fear: the Dynamics of extortion in Mexico's Drug War, in: Comparative Political Studies 53.7 (2020), pp. 1124–1174.

Magar, Eric: Recent Mexican Election Vote Returns Repository, 2018, URL: https://github.com/emagar/elecReturns.

Maldonado, Gerardo and Marc Grau: Elecciones, Violencia y Estructura Social (EVES): Base Integral de Municipios Mexicanos, 2013.

Manning, Lauren: Avocado consumption hits record highs, driven by health trends, 2021, URL: https://www.fooddive.com/news/avocado-consumption-hits-record-highs-driven-by-health-trends/600858/.

Misse, Michel: Illegal markets, protection rackets and organized crime in Rio de Janeiro, in: estudos avançados 21.61 (2007), pp. 139–157.

Moncada, Eduardo: Resisting Extortion: Victims, Criminals, and States in Latin America, 2021.

Orenstein, Jayne: How the Internet Became Ridiculously Obsessed with Avocado Toast, 2016, URL: https://www.washingtonpost.com/news/wonk/wp/2016/05/06/how-the-internet-became-ridiculously-obsessed-with-avocado-toast/.

Ornelas, Ruth G: Organized Crime in Michoacán: Rent-Seeking Activities in the Avocado Export Market, in: Politics & Policy 46.5 (2018), pp. 759–789.

Osorio, Javier: The contagion of drug violence: spatiotemporal dynamics of the Mexican war on drugs, in: Journal of Conflict Resolution 59.8 (2015), pp. 1403–1432.

Osorio, Javier et al.: Mapping violent presence of armed actors in colombia, in: Advances of Cartography and GIScience of the International Cartographic Association 16.1 (2019), pp. 1–9.

Palacios, Paola: Forced displacement: Legal versus illegal crops, in: Defence and Peace Economics 23.2 (2012), pp. 133–160.

Petersson, Therese and Magnus Oberg: Organized violence, 1989-2019, in: Journal of Peace Research 2020.

Ross, Michael L: What do we know about natural resources and civil war?, in: Journal of peace research 41.3 (2004), pp. 337–356.

Sánchez De La Sierra, Raúl: On the origins of the state: Stationary bandits and taxation in eastern congo, in: Journal of Political Economy 128.1 (2020), pp. 000–000.

Scott, Peter Dale and Jonathan Marshall: Cocaine politics: Drugs, armies, and the CIA in Central America, 1998.

Seawright, Jason and John Gerring: Case selection techniques in case study research: A menu of qualitative and quantitative options, in: Political research quarterly 61.2 (2008), pp. 294–308.

Service, USDA Foreign Agriculture: Production: Lemons and Limes, 2025, URL: https://www.fas.usda.gov/data/production/commodity/0572120.

Shirk, David and Joel Wallman: Understanding Mexico's drug violence, in: Journal of Conflict Resolution 59.8 (2015), pp. 1348–1376.

Snyder, Richard and Angélica Durán-Martínez: Does illegality breed violence? Drug trafficking and state-sponsored protection rackets, in: Crime, law and social change 52.3 (2009), pp. 253–273.

The Growth Lab: International Trade Data (SITC, Rev. 2), version V4, 2019, URL: https://doi.org/10.7910/DVN/H8SFD2.

Tiscornia, Lucia: How Climate Change Affects Organized Criminal Market Expansion, in: Studies in Comparative International Development 58.1 (2023), pp. 29–54.

Trejo, Guillermo, Juan Albarracin, and Lucia Tiscornia: Breaking state impunity in post-authoritarian regimes: Why transitional justice processes deter criminal violence in new democracies, in: Journal of Peace Research 2018, pp. 787–809.

Trejo, Guillermo and Sandra Ley: High-profile criminal violence: Why drug cartels murder government officials and party candidates in Mexico, in: British Journal of Political Science 51.1 (2021), pp. 203–229.

Idem: Votes, Drugs, and Violence: The Political Logic of Criminal Wars in Mexico, 2020.

Trends Help, 2022, URL: https://support.google.com/trends/answer/4365533?hl=en.

UNODC: Country Homicide, 2019, URL: https://dataunodc.un.org/content/data/homicide/homicide-rate.

Varieties of Democracy Project: V-Dem Codebook v11.1, version V2, 2021.

Wainwright, Tom: Narconomics: How to run a drug cartel, 2016.

World Bank: Development Indicators, 2019, URL: https://data.worldbank.org/indicator.

Yashar, Deborah J: Homicidal ecologies: illicit economies and complicit states in Latin America, 2018.

Yoo, Heesun: Does "green gold" breed bloody violence? The effect of export shocks on criminal violence in Mexico, in: Social Science Quarterly 103.5 (2022), pp. 1048–1060.

Appendix

Contents

8.1 Additional models, Avocados and Criminal Violence

Table 7: Change in Avocado Export Value Share, Criminal Threat, and Homicides, Fixed Effects Included

	(Homicides)	(Homicides)
Δ Export Value Share	-0.009	-0.006
	(0.006)	(0.005)
Criminal Threat	0.071***	0.047***
	(0.015)	(0.011)
Δ Export Value Share × Criminal Threat	0.007*	0.005*
	(0.003)	(0.002)
Election Year		-0.003
		(0.003)
Municipal Wages		0.940***
		(0.202)
Population		-1.342+
		(0.799)
Federal Prosecutors		-0.001
		(0.030)
Num.Obs.	13469	11440
Std.Errors	by: Municipality	by: Municipality
FE: Year	X	X
FE: Municipality	X	X

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Change in Avocado Export Value

	(Homicides)	(Homicides)
Δ Export Value	0.000	0.000
	(0.000)	(0.000)
Criminal Threat	0.181***	0.063***
	(0.026)	(0.017)
Δ Export Value x Criminal Threat	0.000	0.000+
	(0.000)	(0.000)
Election Year		-0.010*
		(0.004)
Municipal Wages		0.213
		(0.198)
Population		0.238
		(0.159)
Federal Prosecutors		0.185
		(0.134)
(Intercept)	0.011*	-0.016+
	(0.005)	(0.009)
Num.Obs.	15662	13414
Std.Errors	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 9: Change in Local Avocado Price

	(Homicides)	(Homicides)
Δ Local Avocado Price	0.000	0.000
	(0.000)	(0.000)
Criminal Threat	0.196***	0.133**
	(0.048)	(0.050)
Δ Local Avocado Price × Criminal Threat	0.000	0.000
	(0.000)	(0.000)
Election Year		-0.014+
		(0.007)
Municipal Wages		-0.024
		(0.241)
Population		-0.095
		(0.189)
Federal Prosecutors		0.633***
		(0.084)
(Intercept)	0.007	0.004
	(0.007)	(0.004)
Num.Obs.	2672	2420
Std.Errors	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 10: Change in Avocado Export Value Share, Criminal Threat, and Homicides Scaled by Population

	(Homicide Rate)	(Homicide Rate)
Δ Export Value Share	-0.000014	-0.000010
	(0.000008)	(0.000011)
Criminal Threat	0.000235+	0.000196
	(0.000130)	(0.000126)
Δ Export Value Share × Criminal Threat	0.000022*	0.000017**
	(0.000009)	(0.000007)
Election Year	0.000029	
	(0.000041)	
Municipal Wages	-0.000378+	
	(0.000219)	
Federal Prosecutors	-0.000003	
	(0.000039)	
(Intercept)	0.000155***	0.000133***
	(0.000022)	(0.000015)
Num.Obs.	11440	13459
Std.Errors	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 11: Change in Avocado Export Share and Criminal Threat, No Interaction Term

	(Homicides)	(Homicides)
Δ Export Value Share	0.008	0.001
	(0.010)	(0.006)
Criminal Threat	0.180***	0.064***
	(0.026)	(0.016)
Election Year		-0.007
		(0.005)
Municipal Wages		0.488***
		(0.131)
Number of Federal Prosecutors		0.187
		(0.133)
(Intercept)	0.007	-0.015+
	(0.006)	(0.009)
Num.Obs.	13469	11444
Std.Errors	by: Municipality	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 12: Homicides and Change in Corn Production Value During Price Jump

	(Homicides, 2005-2008)
(Intercept)	-0.006+
	(0.004)
Δ Production Value Corn	0.042
	(0.035)
Criminal Threat	0.039***
	(0.011)
Election Year	-0.005
	(0.004)
Municipal Wages	-0.382**
	(0.139)
Population	0.496***
	(0.092)
Federal Agents	0.385*
	(0.163)
Δ Production Value Corn × Criminal Threat	-0.062
	(0.046)
Num.Obs.	5067
Std.Errors	by: Municipality

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

8.2 Additional Plots, Mexico

The plot below, Figure 9, shows the marginal effect of a change in avocado export value share given the values of criminal threat (number of criminal organizations). It is important to note that although the majority of municipality-years experience no criminal activity, there are a substantial number with 4 or more criminal organizations. For example, 151 municipality-years have 4 criminal organizations present, while over 60 have 5. The maximum number of criminal organizations present in a municipality-year is 9.

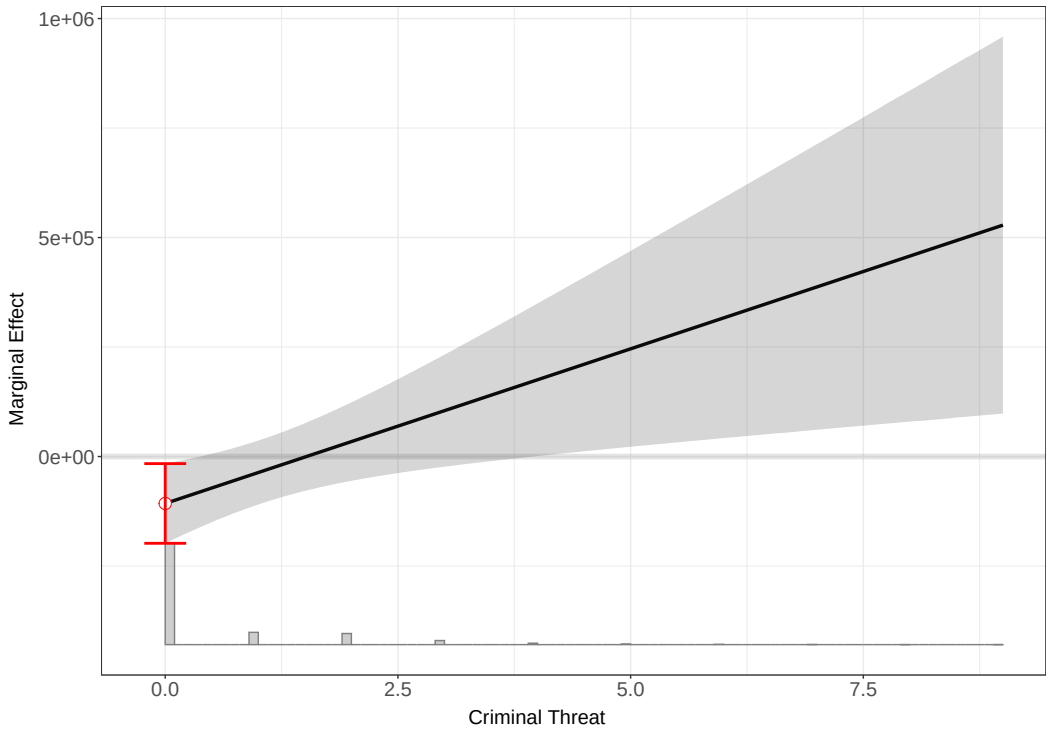


Figure 9: Marginal Effect of Change in Avocado Export Value Share

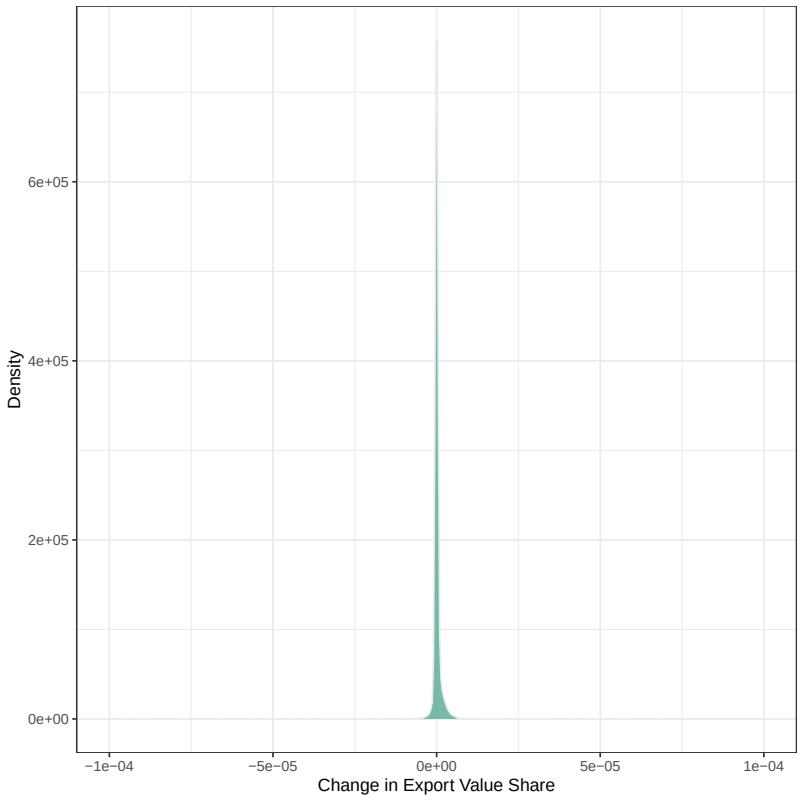


Figure 10: Density Plot, Δ Avocado Export Share

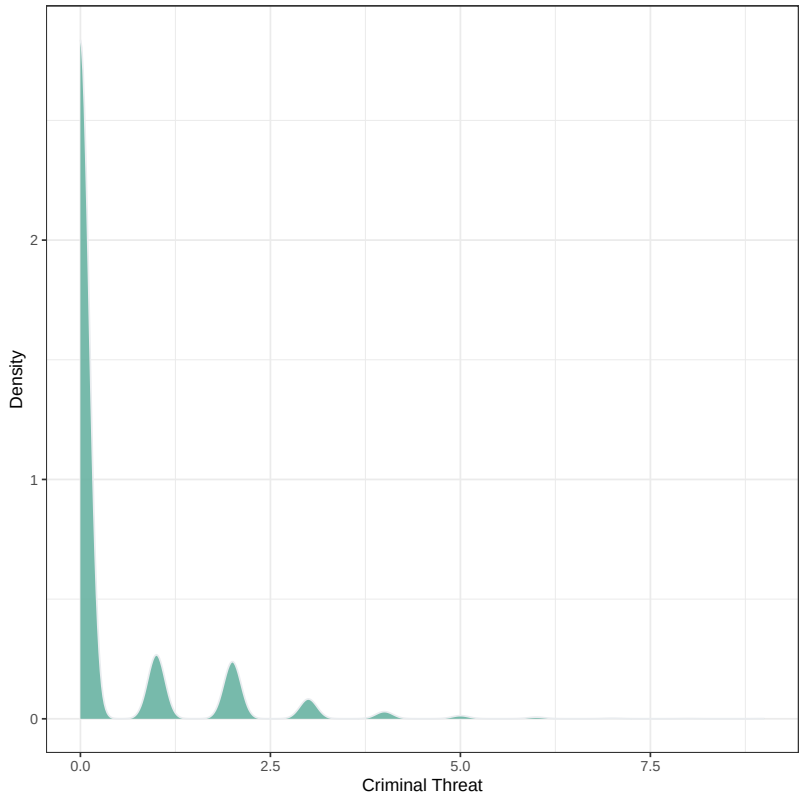


Figure 11: Density Plot, Number of Criminal Organizations

8.3 Alternate Measure of Criminal Threat in Mexico: Proportion of Years with Criminal Activity Pre-2004

This section supplements the Mexico analysis in the paper, in which we use the number of OCGs present in a municipality as an indicator of criminal threat. Because OCGs may move to a municipality due to changes in the market, this measure may suffer from post-treatment bias. We thus provide a robustness check here against this possibility by using the proportion of years in which a muncipality experiences criminal violence *prior* to our window of observation. This measure captures the attractiveness of a municipality for criminal violence prior to observed changes in avocado export value.[124] Results are consistent with those found in the main text.

[124]However, because this measure does not change during the time observed, a two-way fixed effect strategy including municipal fixed effects is not possible.

Table 13: Change in Avocado Export Value Share, Criminal Presence, and Homicides

	Dependent variable:		
	Homicide Count		
	(1)	(2)	(3)
	(0.009)	(0.007)	(0.003)
Criminal Presence	2.886***	1.302***	1.293***
	(0.033)	(0.038)	(0.038)
Δ Export Value Share	-0.002	-0.009	-0.009
	(0.005)	(0.006)	(0.006)
Δ Export Value Share × Criminal Presence	0.276+	0.537***	0.543***
	(0.151)	(0.124)	(0.125)
Municipal Election Year		-0.006	-0.009
		(0.007)	(0.006)
Municipal GDP		0.179***	0.197***
		(0.023)	(0.023)
Population		0.223***	0.212***
		(0.018)	(0.018)
Federal Prosecutors		0.152***	0.152***
		(0.009)	(0.009)
(Intercept)	0.053***	0.011	-0.005
Num.Obs.	22157	11440	11440
Year Fixed Effects?	Yes	Yes	No

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

8.4 Alternate Test of Avocado Toast Searches and Criminal Threat in Mexico

Our final empirical section relies on plausibly exogenous independent variables to test the direction of the relationship between increased international demand for avocados, criminal presence, and homicides. Specifically, we interact a measure of criminal presence that should not be affected by changes in the local market (the proportion of years a municipality experiences a criminal threat prior to the time period studied) with a measure of international demand for avocados that should not be manipulable by OCGs (popularity of 'Avocado Toast' as a search term). However, because our primary Mexico test uses another measure of criminal threat - the number of organizations present in a municipality - we provide a robustness check here interacting the number of OCGs present in a municipality in the year prior with the changes in Google Trends data. Results hold.

Table 14: 'Avocado Toast' Search Popularity, Number of OCGs, and Homicides

	(Avocado Exports)	(No Avocado Exports)
Criminal Threat	0.190***	0.152***
	(0.012)	(0.008)
Δ "Avocado Toast" Searches	0.319	0.291
	(1.224)	(0.633)
Criminal Threat × Δ "Avocado Toast" Searches	4.176**	1.551
	(1.556)	(1.014)
(Intercept)	-0.008	0.010
	(0.011)	(0.006)
Num.Obs.	3701	9768

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

8.5 SITC categories included in Cross-National Analysis

- 00: Live animals other than animals of division 03
- 01: Meat and meat preparations
- 02: Dairy products and birds' eggs
- 03: Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates and preparations thereof
- 04: Cereals and cereal preparations
- 05: Vegetables and fruit
- 06: Sugars, sugar preparations and honey
- 07: Coffee, tea, cocoa, spices and manufactures thereof
- 08: Feeding stuff for animals (not including unmilled cereals)
- 09 Miscellaneous edible products and preparations
- 21: Hides, skins and furskins, raw
- 22: Oil seeds and oleaginous fruits
- 23: Crude rubber (including synthetic and reclaimed)

- 24: Cork and wood
- 25: Pulp and waste paper
- 26: Textile fibres (other than combed wool) and their wastes (notmanufactured into yarn or fabric)
- 27: Crude fertilizers, other than those of division 56, and crude minerals (excluding coal, petroleum and precious stones)
- 28: Metalliferous ores and metal scrap
- 29: Crude animal and vegetable materials, n.e.s.
- 41: Animal oils and fats
- 42: Fixed vegetable fats and oils, crude, refined or fractionated
- 43: Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.

8.6 Descriptive Statistics, Cross-National Analysis

Table 15: Descriptive Statistics, Dep. Var. and Continuous Indep. Vars.

	Min.	Median	Mean	Max.
Population (Standardized)	0.00	0.03	0.18	4.79
GDPPC (Standardized)	0.01	0.17	0.41	2.82
Percent Employed in Agriculture	0.00	0.31	0.48	1.95
ECI	-3.83	0.13	0.21	2.87
Criminal Presence (Av. Coder)	0.00	0.00	0.07	0.86
Rule of Law	0.03	0.67	0.64	1.00
Corruption	0.00	0.39	0.41	0.96
Homicide Count (Standardized)	0.00	0.02	0.17	3.83

8.7 Additional Plots and Tests, Cross-National Analysis

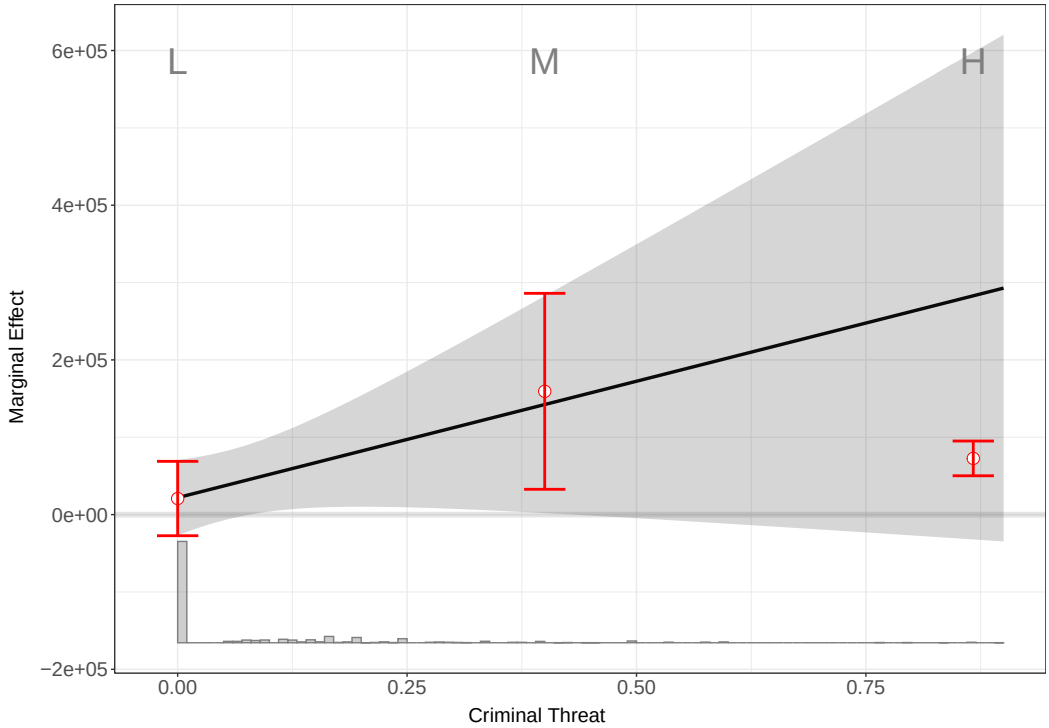


Figure 12: Marginal Effect of Change in Export Value Share over Criminal Threat, Cross-National Analysis

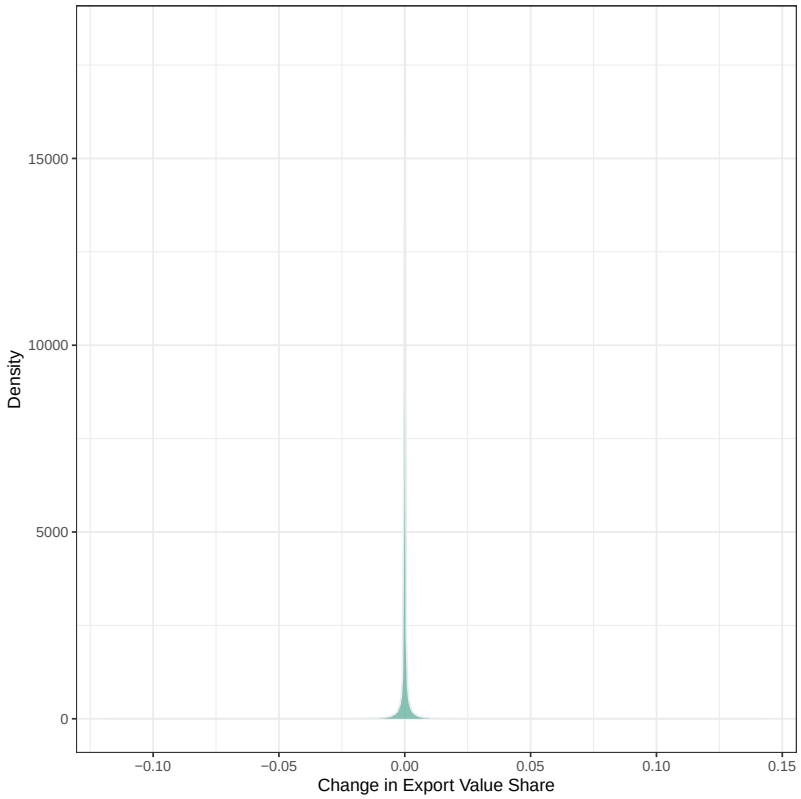


Figure 13: Density Plot, Δ Export Value Share

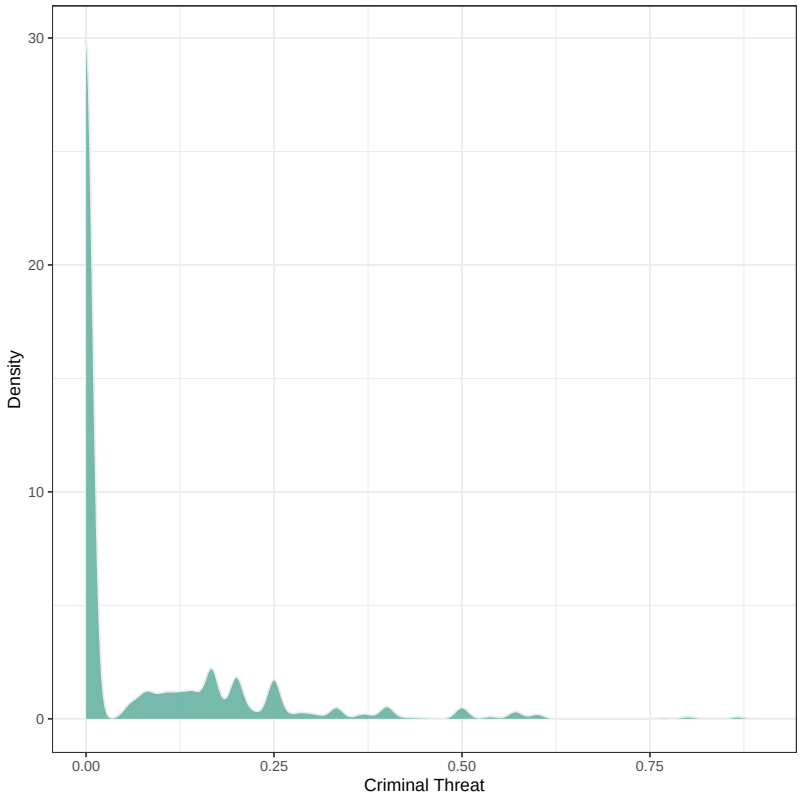


Figure 14: Density Plot, Δ Criminal Threat

Table 16: Change in Export Value Share, Criminal Threat, and Homicides, no Interaction Term

	(Homicides)	(Homicides)
Δ Export Value Share	4.017***	2.050***
	(0.577)	(0.436)
Criminal Threat	0.846***	0.562***
	(0.016)	(0.014)
Population		0.485***
		(0.003)
GDPPC		-0.073***
		(0.005)
% Employed in Agriculture		-0.210***
		(0.005)
Conflict Dummy		0.175***
		(0.005)
ECI		-0.004
		(0.003)
Rule of Law		0.899***
		(0.016)
Corruption		0.976***
		(0.017)
(Intercept)	0.115***	-0.823***
	(0.002)	(0.017)
Num.Obs.	48510	47652
Std.Errors	by: Country	by: Country
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 17: Change in Export Value Share, Criminal Threat, and Homicides, Fixed Effects Included

	(Homicides)	(Homicides)
Δ Export Value Share	-0.731+	-0.618*
	(0.414)	(0.288)
Criminal Threat	0.102	0.098
	(0.188)	(0.178)
Δ Export Value Share $\times$ Criminal Threat	9.935*	9.023*
	(4.712)	(4.258)
Population		-0.206
		(0.205)
GDPPC		-0.068
		(0.083)
% Employed in Agriculture		0.004+
		(0.002)
Conflict Dummy		-0.016
		(0.015)
Economic Complexity		0.005
		(0.038)
Rule of Law		0.599+
		(0.335)
Corruption		0.579+
		(0.306)
Num.Obs.	48510	47652
Std.Errors	by: Country	by: Country
FE: year	X	X
FE: Country	X	X

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

8.8 Alternative Cross National Tests: Shocks to Export Value Share

Table 18: Discrete Independent Variables, Alternative Tests

	No	Yes
Conflict	34584	6006
Shock to Export Value Share	15598	24992

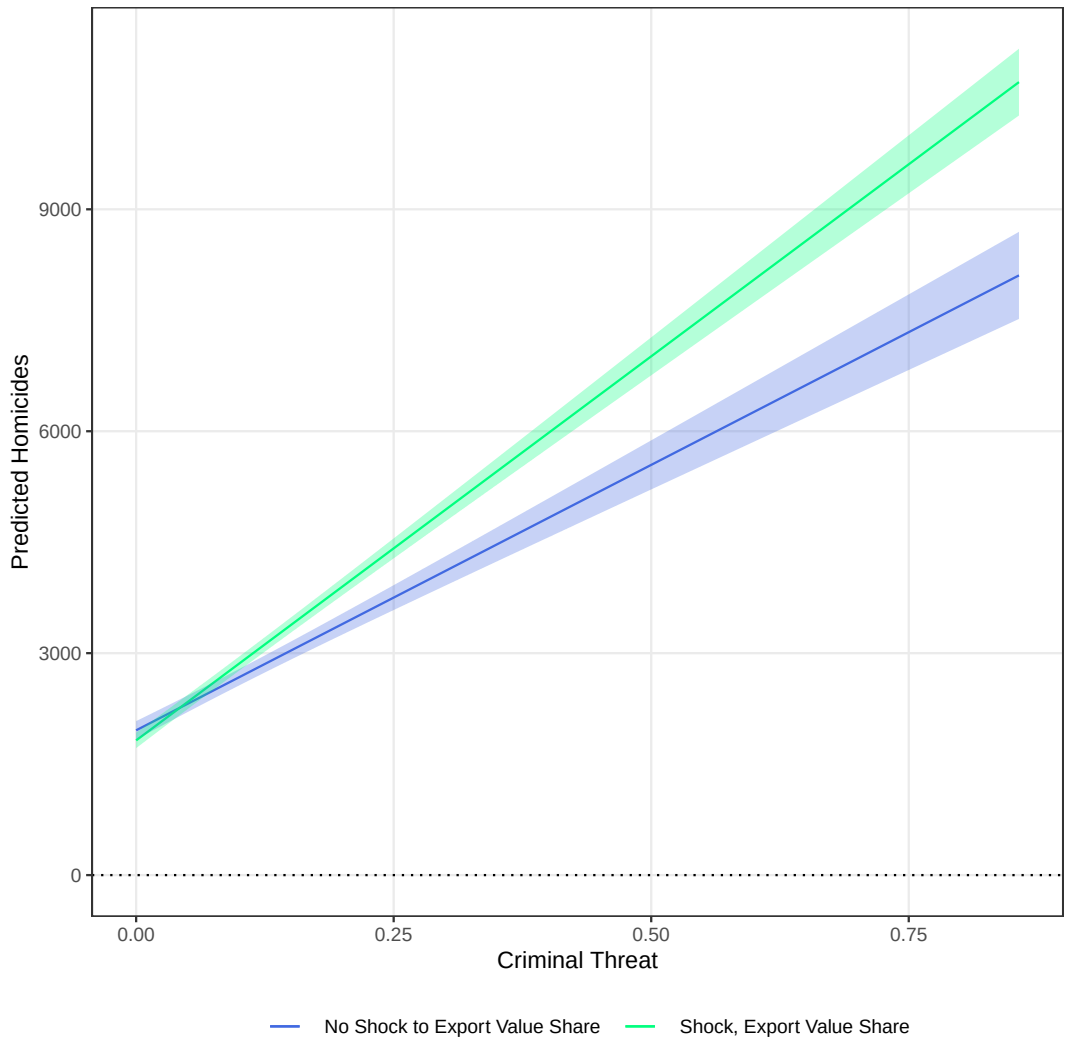


Figure 15: Predicted Homicides and Criminal Threat (Produced from Model 2 in Table 19

Table 19: Homicides, Criminal Threat and Shocks to Export Value Share

	Dependent variable:	
	Homicides	
	(1)	(2)
Shock in Export Value Share	0.044^{***}	-0.005
	(0.005)	(0.004)
Criminal Threat	0.782^{***}	0.449^{***}
	(0.029)	(0.023)
Shock in Export Value Share x Criminal Threat	0.112^{***}	0.185^{***}
	(0.036)	(0.027)
Population		0.470^{***}
		(0.003)
GDPPC		-0.059^{***}
		(0.005)
% Employed in Agriculture		-0.194^{***}
		(0.006)
Conflict Dummy		0.147^{***}
		(0.006)
ECI		-0.009^{***}
		(0.003)
Rule of Law		0.964^{***}
		(0.017)
Corruption		1.026^{***}
		(0.018)
Constant	0.082^{***}	-0.896^{***}
	(0.004)	(0.018)
Observations	41,206	40,590
Note:	*p<0.1; **p<0.05; ***p<0.01	

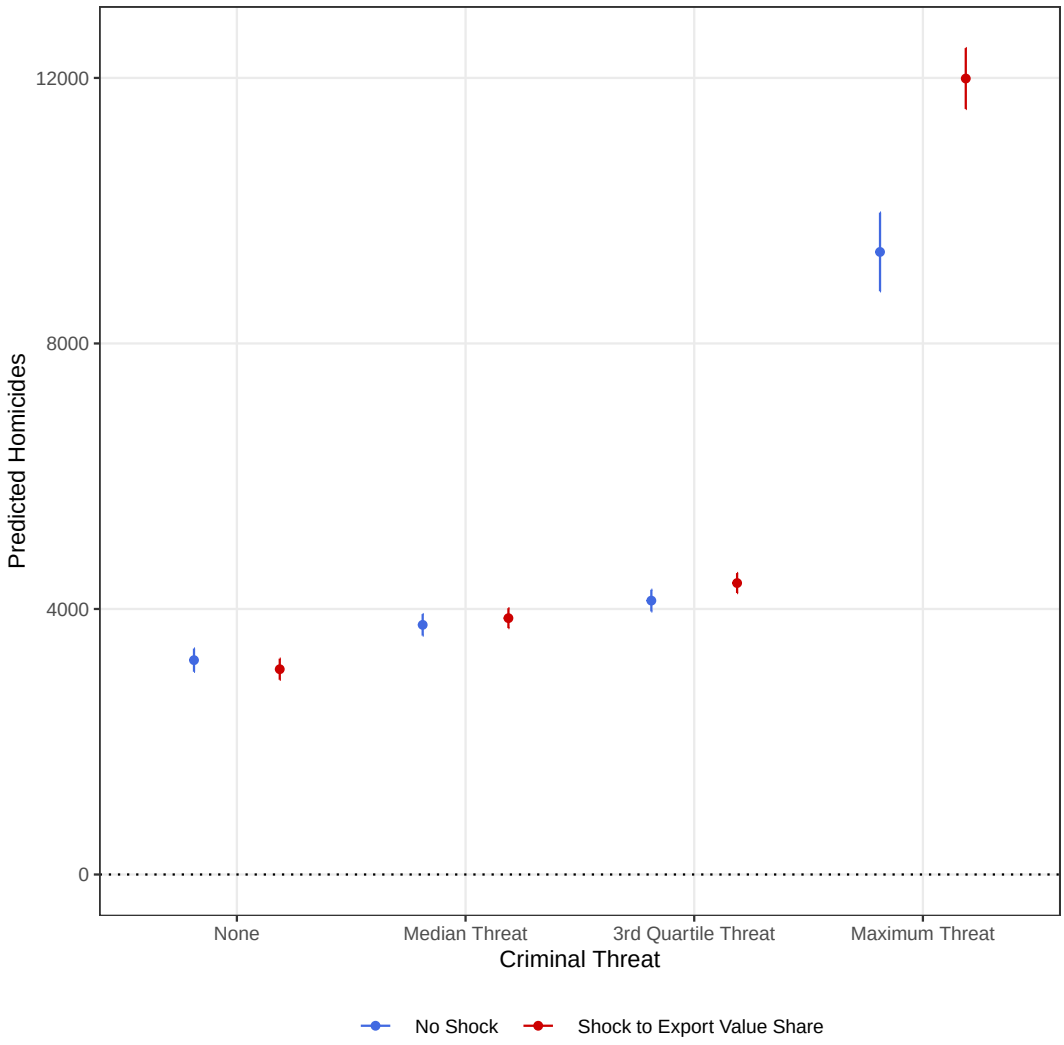


Figure 16: Predicted Homicides, Criminal Threat Categories

8.9 Alternate Measure of Global Criminal Threat: Narcotics

In addition to the measure of criminal presence used in the main text (criminal threat to the state coded by the V-Dem project) we also proxy for the location and activity of OCGs with a dummy for whether the country is a narcotics producer. We make this choice for two reasons. First, it matches well with our theoretical expectations and motivating examples in which extant drug cartels expanded into the legal market for food products. Second, although drug production is not always an indication of organized crime, accounting only for criminal activity in the limited number of drug producing states should bias against our results. We interact this dummy indicator with the share of export value change. When positive shocks to agricultural export value share occur

in drug-producing countries, we expect an increase in homicides as a result of criminal expansion. However, similar shocks in non-narcotic states where such groups are less likely to be present should not see a similar escalation of homicides. The results of these additional models - which confirm the results in the main text - can be found in table 20 below.

Table 20: Drug Producing Countries and Homicides, Shock to Export Value Share

	Dependent variable:	
	Homicides	
	(1)	(2)
Shock in Export Value Share	-0.005^{***}	-0.0004
	(0.001)	(0.001)
Drug Producing Country	0.142^{***}	0.043^{***}
	(0.014)	(0.014)
Shock in Export Value Share x Drugs	0.026^{***}	0.023^{***}
	(0.005)	(0.005)
Population	-0.236^{***}	
	(0.011)	
GDPPC	-0.069^{***}	
	(0.009)	
% Employed in Agriculture	0.203^{***}	
	(0.011)	
Conflict Dummy	-0.022^{***}	
	(0.003)	
ECI	0.009^{***}	
	(0.002)	
Rule of Law	0.670^{***}	
	(0.018)	
Corruption	0.617^{***}	
	(0.016)	
Constant	-0.910^{***}	0.062^{***}
	(0.025)	(0.011)
Observations	40,876	41,492
Note:	*p<0.1; **p<0.05; ***p<0.01	

8.10 Alternative Cross National Test: Change in Price

Table 21: Change in Product Export Price, Criminal Threat, and Homicides

	(Homicides)	(Homicides)
Δ Export Price	0.000***	0.000
	(0.000)	(0.000)
Criminal Threat	0.853***	0.575***
	(0.016)	(0.013)
Δ Export Price × Criminal Threat	0.000***	0.000***
	(0.000)	(0.000)
Population		0.496***
		(0.003)
GDPPC		-0.080***
		(0.005)
% Employed in Agriculture		-0.214***
		(0.005)
Conflict Dummy		0.182***
		(0.005)
ECI		-0.001
		(0.002)
Rule of Law		0.865***
		(0.016)
Corruption		0.949***
		(0.016)
(Intercept)	0.116***	-0.786***
	(0.002)	(0.017)
Num.Obs.	53438	52448
Std.Errors	by: Country	by: Country
Note:		*p<0.1; **p<0.05; ***p<0.01