

# ***Cartelnomics: The Impact of Drug Trafficking Organizations on Business Dynamics in Mexico***

## **1. Introduction**

One of the main consequences of the democratic transition in Mexico is the increasing violence due to the loss and the instability of protection networks for Drug Trafficking Organizations (DTOs) in government at the state and municipal levels (Trejo and Ley, 2022). Since then and amplified by the War on Drugs started in December 2006, the levels of criminal violence have escalated to unprecedented levels since the Mexican Revolution.

The United States Department of Justice defines DTOs as complex organizations with highly defined command-and-control structures that produce, transport, and/or distribute large quantities of one or more illicit drugs (US DOJ, 2010). A drug cartel may be composed of several DTOs, and their organization may be complex. Given this, I use the terms cartel and DTO as interchangeably.

The violence generated by private armies executed against other DTOs and the police or Military forces may have harmful outcomes (Herrera and Martinez-Trejo, 2022; Trejo and Ley, 2022). This violence impacts in many ways, such as the criminal activities DTOs perform, and has negative consequences in social dynamics, such as loss of human life, displacement, and disappearances, but also economic activity may be affected.

In addition to criminal violence, the mere presence of DTOs can put economic activity at risk and modify the decisions of multiple agents, such as businesspeople, and entrepreneurs, due to the extraction of rents, through extortion and loss of human capital due to violence. This article documents the economic effects of DTOs in Mexico, focusing on the effect on the creation and destruction of firms. This analysis is relevant because little is known about the behavior of firms and entrepreneurs with the presence of criminal groups in emerging economies such as Mexico.

The effect can be in two ways. First, DTOs can decrease the number of firms by reducing their profits through extortion and human capital loss as a result of the potential or realized violence associated with DTO presence. Second, DTOs can increase the number of firms in a particular industry, such as security or related services.

To analyze the resulting effect of DTO presence on the number of firms and other labor market outcomes, I use difference-in-difference methods. However, since adoption is staggered because DTOs enter different municipalities in different periods. However, the two-way fixed effects estimator might generate biased estimators if the treatment effect of the presence of DTOs is not homogeneous. To resolve to this, I use imputation methods

to estimate average treatment effects and event studies that assess the parallel trend assumption in difference-in-difference methods.

For the presence of Drug Trafficking Organizations (DTOs), the data comes from a municipal-year panel dataset developed by Sobrino (2020), which monitors 79 different criminal organizations in Mexico from 1990 to 2020. This dataset identifies the presence of specific cartels in each municipality for each year. Additionally, I used data from the *Atlas de Complejidad Económica*, which includes annual information on formal employment, wages, and the number of firms by municipality and industry from 2004 to 2014. Furthermore, I incorporated data from the Mexican Social Security Institution (IMSS), which provides monthly records on employer characteristics such as economic sector, wage bill, and size by municipality, available since July 1997.

The results indicate that the number of firms and formal employees decreased with the presence of DTOs in the municipalities, as did wages and, consequently, the wage bill. This suggests that the overall climate of uncertainty and potential or realized violence created by the mere presence of a cartel, as well as the extortion practices of criminal organizations on entrepreneurs and businesspeople, affect their investment and hiring decisions. Mechanistically, the presence of DTOs likely introduces a pervasive environment of fear and instability, deterring new business ventures and discouraging expansion among existing firms. This atmosphere of insecurity can lead to a reluctance to invest in long-term projects, resulting in lower employment levels and suppressed wages across the affected regions.

Furthermore, the analysis reveals that the adverse impacts are not uniform across economic sectors. Industries with high fixed costs and significant upfront capital investments, such as manufacturing and construction, appear more vulnerable to the disruptive influences of DTOs compared to less capital-intensive sectors like retail and services. This heterogeneity underscores the differential capacity of various sectors to absorb or mitigate the risks associated with criminal presence. Consequently, sectors with greater mobility and lower entry barriers might demonstrate more resilience or adaptability in the face of such adversities. The empirical findings thus highlight the critical interplay between criminal activity and economic resilience, emphasizing the necessity for targeted policy interventions that consider sector-specific vulnerabilities and the broader economic implications of DTO presence on local economies.

This paper contributes to understanding the dynamics of DTOs in the real sector of the economy. It contributes exciting elements to discuss their impact on social dynamics, such as economic activities and community political processes.

In the next section, I present the literature review on the link between DTOs' presence and some economic outcomes, such as employment, the theoretical argument, and

associated hypotheses. The following section contains the description of the context of DTOs' presence, violence, and firms' victimization outcomes. Section 3 presents the data, and Section 4 the empirical strategy in more detail. In Section 5, I present the results for all and individual economic sectors. In the last section, I conclude and discussing the findings of this paper in the context of the literature.

## **2. Literature Review**

This article contributes to the literature on the economic impacts of crime, particularly in emerging market economies facing high levels of crime and violence, such as Mexico. While it is well-documented that violence and crime impede long-term economic growth (World Bank, 2021), there is a significant gap in understanding how firms specifically respond to the presence of crime, particularly drug trafficking organizations (DTOs).

It is noteworthy that existing literature predominantly examines the consequences of violence linked to drug trafficking organizations (DTOs), rather than specifically isolating the effects solely attributable to their presence in regions they control. This distinction is critical because DTOs can establish territorial dominance without necessarily instigating overt violence. Consequently, the bulk of scholarly research focuses on understanding the socio-economic and political ramifications of violent conflicts associated with DTO operations, thereby underscoring the need for further investigation into the nuanced impacts of DTO presence in contexts devoid of overt violence.

The literature, in general, points out that the effects of the presence of criminal organizations has had adverse economic effects, particularly in those geographies where crime and the mafia have been persistent, such as in Italy, negatively affecting firm performance (Calamunci and Drago, 2020), preying on healthy business (Mirenda et al., 2022), stifling competition and investment (Slutzky and Zeume, 2019) and ultimately hindering economic growth (Pinotti, 2015).

Following Ballea and Lavezzi (2023), organized crime operates through several microeconomic channels that hinder economic growth: (i) by creating barriers to market entry, (ii) by suppressing small businesses that struggle to expand due to limited access to credit in crime-affected environments, and (iii) by fostering conditions conducive to a poverty trap driven by non-convexity in the cost function. These dynamics illustrate the multifaceted ways in which organized crime can disrupt economic stability and growth.

The practical implications of these dynamics are evident in the impact of extortion on businesses, which is not merely a theoretical concern but a real-life challenge. Extortion fees, anticipated costs for businesses operating in regions controlled by organized crime, act similarly to fixed costs, escalating rapidly for smaller businesses and stabilizing somewhat for larger ones. This additional cost introduces significant distortions in

investment decisions, particularly for smaller enterprises, and acts as a market entry barrier, thus constraining competition. Consequently, the result is the emergence of oligopolistic markets characterized by a limited number of firms setting high prices and offering low-quality products.

Moreover, the findings of Ballea and Lavezzi (2023) have tangible implications for development dynamics. A critical factor for firm growth, both in terms of size and productivity, is the reinvestment of profits. However, organized crime distorts both investment and profit levels, with a significant portion of realized profits being siphoned off by criminal groups, particularly from smaller firms. These combined effects reduce the resources available for reinvestment, thereby impeding potential firm growth.

Access to external funding, such as bank loans, is another significant source of business expansion, and this too is influenced by the presence of organized crime. Evidence from Italy suggests that in areas affected by crime, especially where organized crime extorts businesses, interest rates on bank loans are higher, with smaller companies being particularly affected by increased interest rate spreads. Additionally, firms in these areas are required to provide more collateral and face credit rationing. Consequently, smaller businesses experience lower profitability and restricted capacity to accumulate sufficient collateral for accessing additional credit, leading to higher interest rates on loans and exacerbating the constraints on their growth potential.

In examining the Mexican context, previous research indicates that violence significantly impacts economic outcomes. For example, an increase in homicides leads to a substantial reduction in income and the proportion of business owners. Furthermore, dramatic increases in violence between 2006 and 2010 significantly reduced electricity consumption, a proxy for economic activity in Mexican municipalities (Robles et al., 2015). Violence also negatively affects manufacturing industries, reducing plant output, product scope, employment, and capacity utilization (Utar, 2022). Resilience to violence varies across different types of employment within firms and across firms with different characteristics (Utar, 2022).

Regarding business creation or destruction, evidence indicates that firms tend to reduce their presence following significant increases in violence, with larger firms being more responsive to such changes, as observed in Afghanistan's violent context (Blumenstock et al., 2018). An effective fight against organized crime has demonstrated positive effects on economic activity. For instance, in 1991, the Italian central government intervened in city councils where the mafia had infiltrated, leading to long-term increases in the number of firms, employment, and the price of industrial real estate (Fenizia and Saggio, 2024).

The violence related to crime affects other economic outcomes in the labor market, as well as prices and exports in Mexico. An increase in DTOs' presence in a city increases

the price dispersion by 2.85 MXN by-products in the CPI basket in Mexico (Stolkin Moss, 2023). Firms exposed to the Drug War experienced lower export growth (Gorrín et al., 2021).

Research has demonstrated that crime and drug cartel organizations can significantly impact wages and human capital. For instance, Wysocki (2015) found that while violence in Mexico did not directly affect human capital accumulation, it did lead to the displacement of some students to areas with lower levels of violence, indirectly affecting educational outcomes. Gómez (2021) further corroborated these findings by showing that the capture of cartel leaders in Mexico resulted in a decrease in nominal wages and paid employment in affected regions. These findings align with the human capital approach to crime, which posits that higher levels of education and intelligence can mitigate criminal behavior (Lochner, 2004). Additionally, in the labor market, violence has been found to adversely affect labor participation and increase the proportion of unemployed individuals (Robles et al., 2015; Velázquez, 2020). For example, in El Salvador, the presence of gangs restricts mobility and limits labor market opportunities, preventing individuals from commuting to other parts of the city (Melnikov et al., 2020). Paradoxically, drug cartels themselves are major employers in Mexico, recruiting between 350 and 370 people per week to sustain their operations in the face of losses from conflicts with rival cartels and incarcerations (Prieto-Curiel et al., 2023). This complex interplay between crime, labor markets, and human capital underscores the multifaceted impact of organized crime on economic and social outcomes.

A general framework that helps to understand the effect of crime and violence in firms is the misallocation of resources within and across firms (Hsieh and Klenow, 2014). One source of misallocation may be institutional design, such as lousy contract and law enforcement and poor enforcement of property rights (Restuccia and Rogerson, 2017; Levy, 2018), which may be the case in this analysis where the presence of DTOs may capture local and federal justice administration official, courts, police, and security forces that weaken law enforcement.

The mere presence of cartels, which can produce misallocation of resources, can occur through two channels: an increase in the marginal costs of operating firms and extortion. Dettoto and Otranto (2010) argue that extortion act as a tax, generating significant revenues for crime organizations enabling control of complete territories and local economies and discouraging investments and reducing competitiveness of business.

For the Mexican case, Mascarúa (2022) developed a general equilibrium occupational model in which there is room for drug trafficking, where an increase in crime lowers the aggregate input use, which results in a contraction of wages and distorts the occupation choice, as the additional crime-related costs push a fraction of formal entrepreneurs into informality.

The ineffective protection of property rights creates a huge incentive to invest in sectors and activities that are not the most productive, such as protection against criminal organizations. So, the presence of DTOs creates misallocation of resources (Ornelas, 2018). In that way, Besley and Mueller (2018) estimated the output loss caused by the misallocation of labor across firms, from production to protection. The loss due to protection efforts is substantial, and patterns of state protection at the micro level can profoundly impact aggregate output losses.

Violence from the War on Drugs in Mexico increased the marginal cost of operating firms (Gorrín et al., 2021), obstructing local capacity to attract capital investments. Thus, effects may come from the misallocated resources due to an increase in private security and protection costs restraining export growth, as was mentioned before.

DTOs' presence and their associated violence can profoundly influence the behavior of firms operating within affected regions. Rodríguez Hurtado's (2023) research highlights a significant correlation between the expansion of DTOs and increased homicides in Mexican municipalities, underscoring the disruptive impact of DTO-related violence on local communities. Moreover, Ganson and Hoelscher (2021) argue that Micro, Small, and Medium Enterprises (MSMEs) navigate urban violence contexts differently from larger firms, shedding light on the unique challenges faced by smaller businesses in such environments, such as capacity limitations, embeddedness in violent communities, and dependence on social networks, particularly those with illicit actors. Meanwhile, Miller and Rettberg (2023) demonstrate that the majority of micro, small, and medium-sized enterprises (MSMEs) in Medellín have effectively navigated the multifaceted landscape of legality, illegality, formality, and violence. These enterprises have adopted various strategies such as acquiescence, evasion, and mitigation to respond to violent actors. The study further reveals that certain strategies are more efficacious than others in promoting survival and growth in violent environments, contingent on the firms' experience and risk management capabilities.

The influence of DTOs on firms extends beyond traditional illicit activities, encompassing mechanisms that can significantly impact various sectors. Jaspers (2019) highlights the integration of DTOs into legal networks and legitimate businesses, emphasizing their presence within business cartels, including drug trafficking. Estancona and Tiscornia's (2022) research in Mexico reveals evidence of criminal groups expanding their influence beyond illicit markets to control sectors like the avocado industry.

Furthermore, Farfán-Méndez (2019) delves into the hierarchical structure of DTOs, noting their investment in managerial development and incentivization of long-term involvement, often leading to risk-averse money laundering strategies. Vázquez Valencia (2019, 2023) also employs network analysis to uncover macro-criminal networks in Mexican states, shedding light on the intertwined relationships between political, criminal, and financial

entities. In particular, the number of suspicious reports of bank account management follows the electoral cycles in municipalities with DTOs presence. However, it does not do so in places without such groups, suggesting that, to some extent, suspicious transactions are related to criminal activities in political campaigns (Enriquez, 2023). Similarly, Giraldo and Naranjo (2011) provide insights into economic sectors exploited for money laundering in Colombia's Bajo Cauca Region, including mining, livestock, and wood industries. These findings underscore the multifaceted strategies employed by DTOs to infiltrate and manipulate various sectors for their financial gain.

Amidst these challenges, Yashnar's (2018) analysis delves into the geographical dynamics of DTO activity, emphasizing the complex interplay between physical geographic factors, political considerations, and illicit actors' decision-making processes. However, Rodriguez Hurtado (2023) shows that DTOs select more prosperous and developed areas within Mexico. Together, these insights underscore the multifaceted impact of DTO-related violence on firm behavior and economic activity, prompting a nuanced understanding of the complexities inherent in such environments.

### **3. Context**

The relevance of this article lies in its exploration of the crime and violence associated with drug trafficking in Mexico since the 1990s. According to Trejo and Ley (2022), contemporary Mexican history is closely intertwined with drug trafficking, driven by the demand from the United States. During the period of single-party dominance by the Institutional Revolutionary Party (PRI), drug cartels enjoyed stable protection from police and security forces across all levels of government. However, this protection began to unravel in the 1990s with the rise of competitive elections, leading to significant political changes. The landmark election in Baja California in 1989, where the right-wing National Action Party (PAN) defeated the ruling PRI, marked the beginning of this shift.

As political dynamics evolved, the established protection networks within police and justice administration offices collapsed, with new authorities appointing officials not aligned with the cartels. Consequently, drug trafficking organizations (DTOs) began to face competition from other cartels, necessitating the renegotiation of protection alliances and the formation of private militias. Given the illicit nature of drug trafficking, this competition inevitably escalated into violence.

The proliferation of organized crime groups and cartels in Mexico can be attributed to a combination of factors, including institutional weakness and corruption, which create an environment conducive to criminal activity (Aguirre, 2013; Jones, 2019). Atuesta et al. (2018) emphasizes that the fragmentation and cooperation within criminal organizations can lead to increased violence, a point that will be elaborated upon later. Trejo and Ley

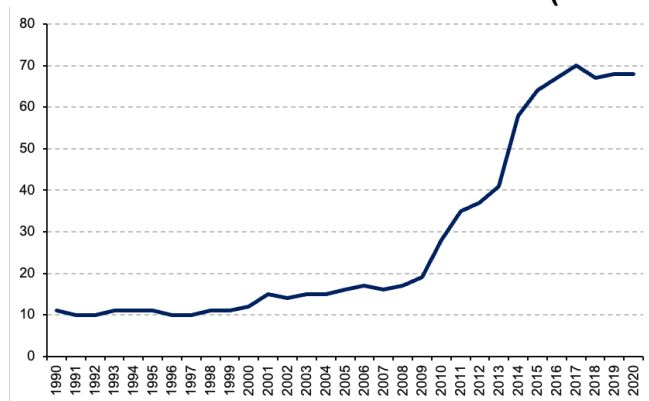
(2022) add a political dimension, arguing that electoral competition and partisan conflict have significantly contributed to the rise in the number of DTOs across Mexico.

Figure 3.1 illustrates the evolution of DTOs active in Mexican municipalities since 1990. Prior to 2000, there were fewer than 15 cartels, coinciding with the transition of federal government parties. This number increased marginally from 2000 to 2008 and surged following the initiation of the “War on Drugs”, stabilizing at 68 different organizations active in the country by 2018.

Criminal groups have increasingly dispersed throughout Mexican territory over time. Figure 3.2 depicts the number of DTOs per municipality in Mexico for the years 1990, 2000, 2010, and 2020, highlighting a significant increase over the years and expanding territorial presence of these groups.

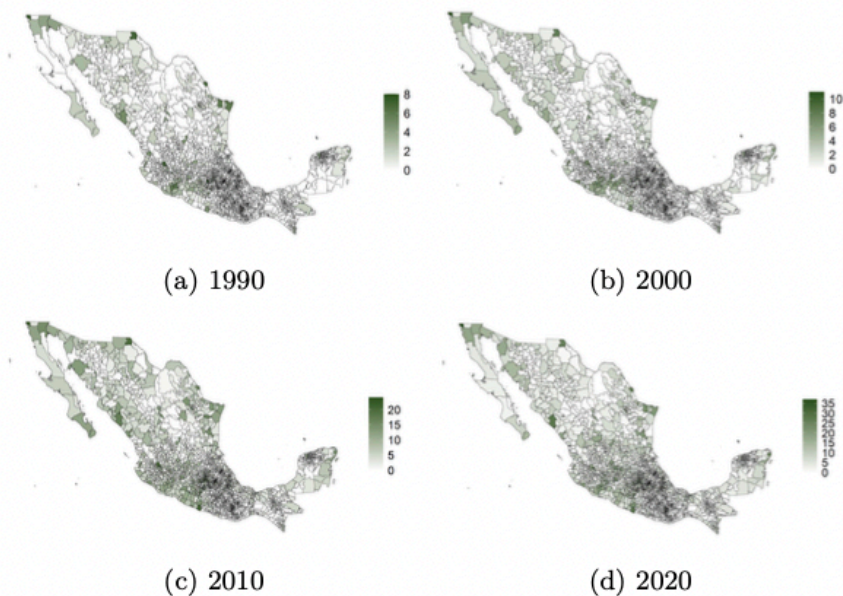
The determination of territorial control by DTOs is contingent upon a multifaceted array of factors. Principal among these are the economic activities prevalent within the targeted region, which provide the necessary infrastructure and opportunities for the illicit operations of DTOs. Furthermore, the negotiation skills of DTO members play a critical role in establishing and maintaining control over these territories. These skills are essential for forging alliances and managing conflicts, both within the organization and with external entities. Another significant factor is the nature of relationships with local authorities. These relationships, often characterized by corruption or coercion, can facilitate the uninterrupted functioning of DTOs by ensuring leniency or complicity from law enforcement and political figures (Dulin and Patiño, 2020). Magaloni et al. (2015) and Cavgias et al. (2021) provide additional insights, with the former linking territorial contestation and control to DTOs’ strategies of extortion and assistance, and the latter examining the impact of DTOs’ territorial control on the enforcement of public policies.

**Figure 3.1. Number of active DTOs in Mexico (1990 – 2020)**



Source: Sobrino (2020)





**Figure 3.2. Number of active DTOs in Mexican municipalities for various years.**  
Source: Sobrino (2020)

The situation became more violent after the Federal Government launched the War on Drugs in December 2006. Political factors also played a significant role in this escalation. As the PAN was the ruling party at the federal level, drug-related violence increased substantially following the close elections of PAN mayors, diverting drug traffic, and increasing violence along alternative routes to the United States (Dell, 2015).

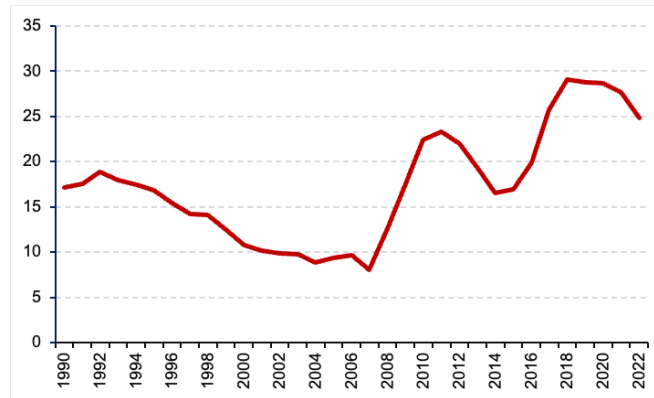
Since 2007, violence has escalated dramatically, with cartels diversifying their activities to increase revenues and mitigate risks. They expanded beyond drug trafficking into extortion, kidnapping, rent-seeking, and the extraction of natural resources (Trejo and Ley, 2022; Alcocer, 2022). The control over natural resources, such as mining and agricultural exports, has been associated with higher levels of violence in Mexican municipalities, as criminal organizations exploit these resources. Consequently, DTOs diversify their activities in response to competition and state repression, seeking territorial control and local hegemony (Herrera and Martinez-Alvarez, 2022).

The primary objective of military intervention was to eliminate cartel leaders, which led to violent succession conflicts (Ríos, 2013), cartel fragmentation (Phillips, 2015), and fierce competition between DTOs and emerging cartels (Guerrero, 2011). Violence has increased dramatically since 2007, as illustrated in Figure 3.3, which shows a decrease in homicides from 1992 to 2006, followed by an upward trend until 2012. There were

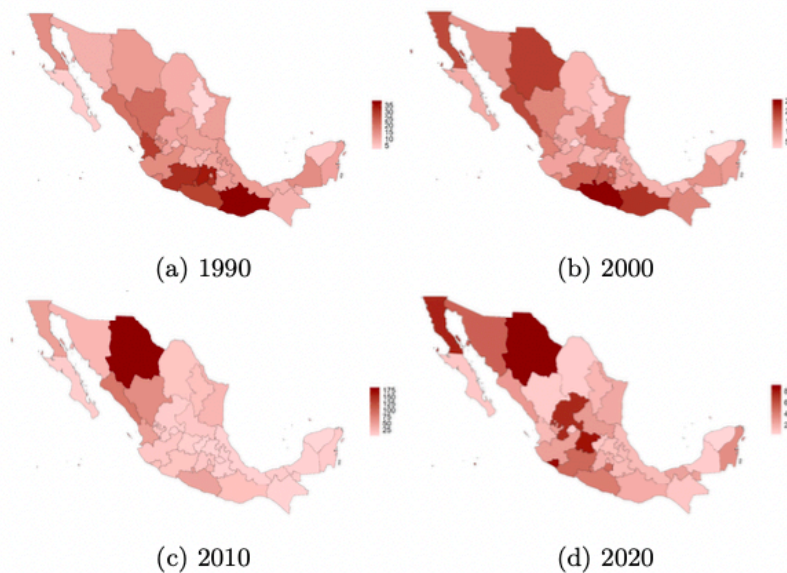
subsequent periods of declining homicides between 2012 and 2016, and again from 2021 to 2022.

The maps in Figure 3.4 indicate that the most violent states in the early 2000s were located in the Bajío and Guerrero regions. By 2010, Chihuahua had become notably violent, while by 2020, violence had spread to Zacatecas, Colima, and Guanajuato.

**Figure 3.3. Homicides per 100,000 habitants in Mexico (1990 – 2022)**



Source: INEGI and CONAPO



**Figure 3.4. Homicides per 100,000 habitants in Mexican states for various years**

Source: INEGI and CONAPO

The presence of organized crime has devastated entire communities in Mexico. Personal accounts highlight the tragic experiences of teenage children and migrants who have been kidnapped, disappeared, tortured, and murdered, as well as the forced conscription of young people into near-slave labor for drug dealing and surveillance, commonly referred to as “*halconeo*” (hawking).

The territorial control exerted by DTOs has led to the extortion of both formal and informal businesses, imposing the notorious “floor charge” (*cobro de piso*) on small entrepreneurs. These charges are often so burdensome that businesses are forced to close, thereby suppressing economic activity in the affected communities. For those who manage to continue operating, the extortion costs are typically passed on to consumers in the form of higher prices.

The detrimental impact of organized crime on business activity has been well documented by the press. The crisis of insecurity and violence has led to a decline in demand for tourist services in cities like Acapulco, resulting in the closure of many micro, small, and medium-sized enterprises (Vanguardia, 2015). Recently, the struggle for territorial control among criminal groups in Mexico City has led to violent attacks on businesses that resist extortion, including instances of establishments being set on fire (Nmas, 2023).

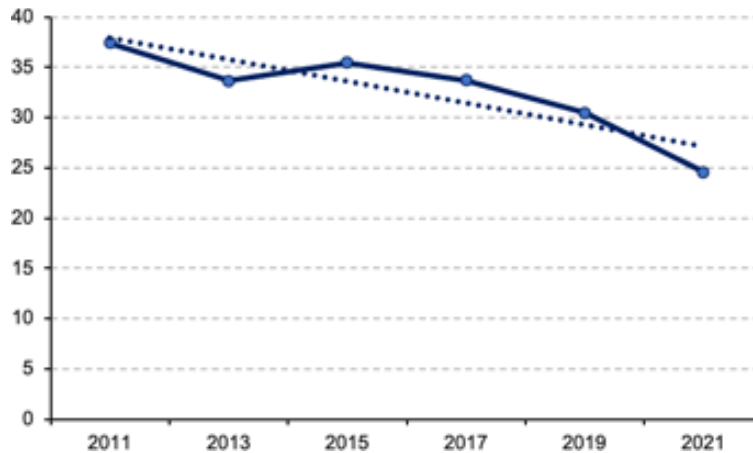
However, extortion by organized crime is not limited to small or medium-sized enterprises; even large gold mining companies in Mexico have reported instances of extortion targeting both managers and workers (Proceso, 2016). More recently, chicken producers, distributors, and retailers in Guerrero have faced extortion, leading to the closure of stalls in public markets (El País, 2024).

The expanding presence and control of organized crime groups have deterred various transnational companies from investing in Mexico, particularly in the context of the relocation of value chains in North America (*nearshoring*), due to concerns over security and extortion (El Sol de México, 2024).

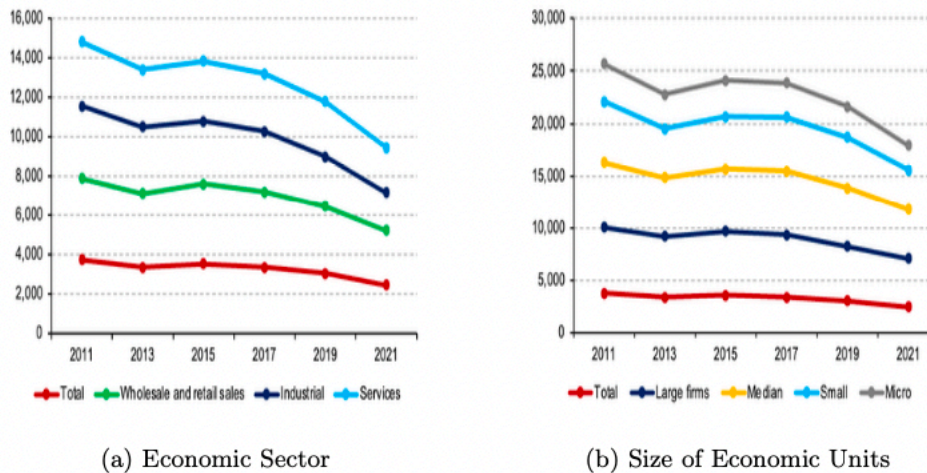
In addition to anecdotal evidence, the *Encuesta Nacional de Victimización de Empresas* provides data on the victimization of businesses (economic units) from 2011 to 2021. Although these statistics do not directly reflect the number of businesses destroyed, they offer insights into the impacts of crime on firms in Mexico.

Figure 3.5 shows that the proportion of economic units victimized by at least one crime has decreased between waves of the business victimization survey, potentially indicating the closure of the most affected businesses due to extortion. In the most recent survey from 2021, 24.6% of economic units reported being victims of at least one crime.

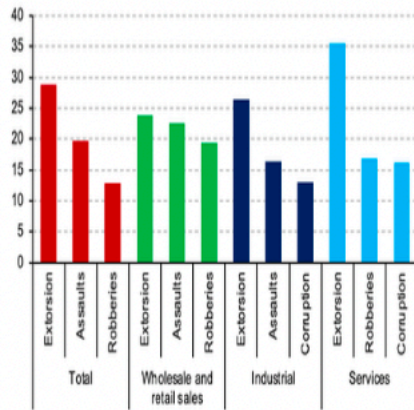
Figure 3.6 shows that economic units in the services sector suffer more crimes than the other sectors and, small and micro-economic units are more affected by crimes compared with large and medium firms. Figure 3.7 highlights that in 2021, the crimes most affecting victimized economic units were extortion (28.9%), assaults (19.7%), and robberies (12.9%). Extortion was the predominant crime across economic sectors and affected firms of all sizes, except for large firms where assaults were more prevalent.



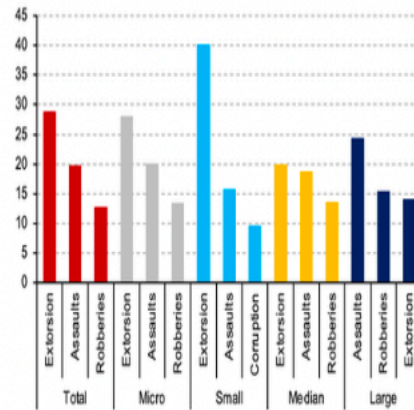
**Figure 3.5. Proportion of economic units' victims of at least one crime (Percentage)**  
Source: INEGI. *Encuesta Nacional de Victimización de Empresas*.



**Figure 3.6. Prevalence of crime in economic units: Victim Economic Units per 100,000**  
Source: INEGI. *Encuesta Nacional de Victimización de Empresas*.



(a) Economic Sector



(b) Size of Economic Units

### Figure 3.7. Three crimes with the highest occurrence in 2021

Source: INEGI. *Encuesta Nacional de Victimización de Empresas*.

## 4. Data

### 4.1 Data Sources

Our analysis data relates to DTOs' presence in Mexican municipalities, firms' creation and destruction data, and their characteristics by year.

#### 4.1.1 Drug Trafficking Organizations' presence data

The presence of Drug Trafficking Organizations (DTOs) was analyzed using the municipal-year panel dataset developed by Sobrino (2020), which tracks 79 distinct criminal organizations across Mexico from 1990 to 2020. This comprehensive dataset records the presence of specific DTOs in various municipalities annually. Sobrino's (2020) meticulous approach, which integrates manually coded data from governmental and expert sources with an automated web-scraping process, ensures the dataset's robustness and reliability. This methodology involved systematic searches of online media outlets to compile relevant data.

Given the sensitive and illicit nature of the subject, the robustness of Sobrino's (2020) dataset attests to the meticulous approach taken. It integrates hand-coded information from both Mexican government sources and subject matter experts with an automated process that rigorously scrapes data from online media outlets. This process involves systematic searches on platforms such as Google and Google News to identify mentions of municipalities and DTOs, followed by the compilation of all relevant links associated with these searches. This comprehensive approach ensures the accuracy and reliability of the dataset.

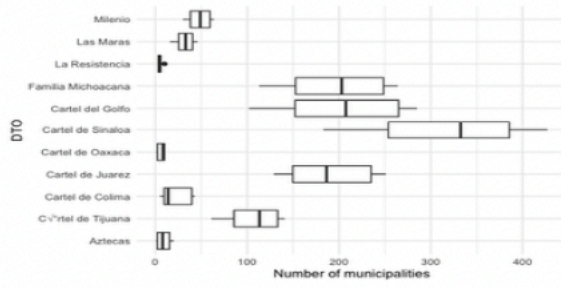
To assemble the dataset, Sobrino employs a web crawler and a neural network, a form of artificial intelligence, for data collection. Enhancing the neural network's efficacy required manual training of a bot, which is tasked with determining whether the content of an article genuinely reflects the presence of DTOs. It is noteworthy that the mere mention of a DTO in an article does not necessarily confirm its presence in a municipality. The bot was tested on a sample of 1,201,483 news articles and demonstrated an accuracy rate of 86% in correctly identifying the presence of DTOs within municipalities.

Figure 4.1 illustrates the distribution of municipalities by DTO presence over three decades. In the 1990s, a pivotal period in the evolution of Mexico's criminal organizations, the most prominent cartels were Sinaloa, del Golfo, Juárez, and La Familia Michoacana. These cartels played a significant role in shaping the landscape of criminal organizations in Mexico.

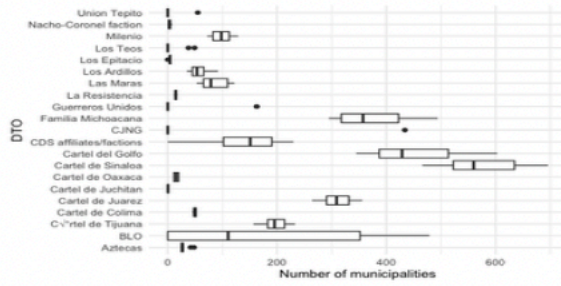
By the 2000s, the number of active organizations had risen to 21, while the previously dominant cartels maintained their influence. During this decade, the Beltrán Leyva organization emerged, a significant development resulting from a split in the Sinaloa Cartel, marking a notable event in the evolution of Mexico's criminal organizations.

Throughout the decade from 2010 to 2020, the landscape of criminal organizations in Mexico underwent significant transformation. The number of DTOs surged to 75, with the Zetas and the Jalisco Nueva Generación Cartel (CJNG) emerging as major players. These organizations, which originated from schisms within the Golfo and Sinaloa cartels respectively, continue to exert substantial influence. This rapid and substantial increase in the number and prominence of criminal organizations highlights the pressing need to understand their dynamics and impact.

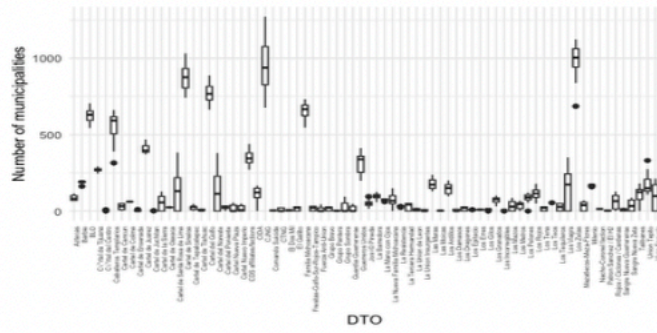
Regarding the presence of DTOs by state, Figure 4.2 shows the proportion of municipalities with DTO presence and the average number of cartels per municipality at the beginning of each decade. Notably, the presence of criminal groups has expanded over time, and since 2010, some states have seen DTO presence in all municipalities. This alarming trend, with 68% of municipalities experiencing DTO presence by 2020, underscores a significant concern at the national level. The average number of cartels per municipality has also increased markedly, from three in 2010 to six in 2020 across the country.



(a) 1990 - 1999



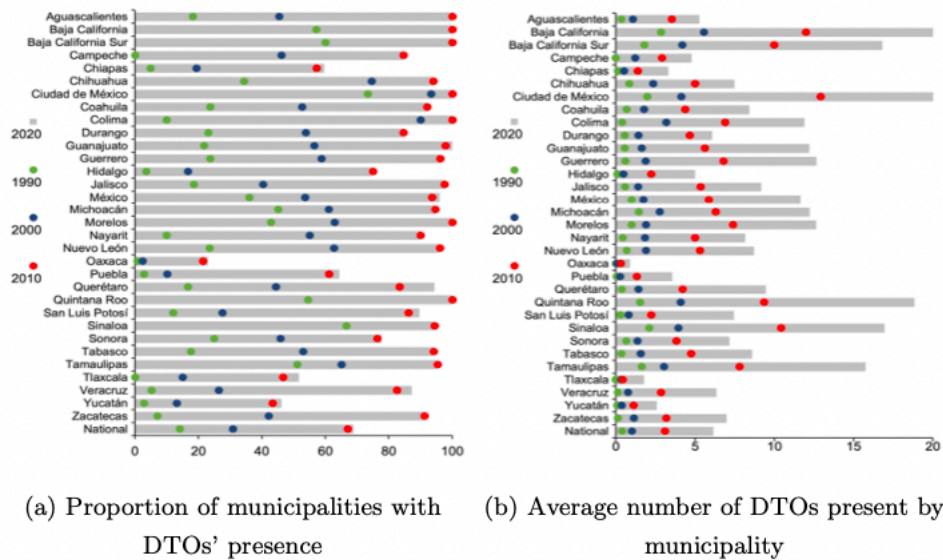
(b) 2000 - 2009



(c) 2010 - 2020

Figure 4.1. Number of municipalities by DTO

Source: Sobrino (2020)



**Figure 4.2. DTOs' presence by municipality for various years**  
 Source: Sobrino (2020)

#### 4.1.2 Outcome Variables: Firms and Banking Data

As the primary data source, I utilized the *Atlas de Complejidad Económica*, which provides annual data on formal employment, wages, and the number of firms by municipality and industry from 2004 to 2014. Additionally, I accessed data from the Mexican Social Security Institution (IMSS) on employer characteristics, such as sector of economic activity, wage bill, and size, available monthly at the municipal level since July 1997.

To examine the impact of DTOs on money laundering activities, I referenced records from Mexico's Comisión Nacional Bancaria y de Valores (CNBV). These records offer detailed insights into the financial landscape, encompassing various financial product transactions at the municipal level from 2010 to 2020. These datasets provide valuable information on contracts and transactions within the financial sector, facilitating analysis of patterns indicative of potential money laundering activities.

## 4.2 Variables

To construct the final dataset, we first identified the periods during which each DTO was present in each municipality, treating these periods as an absorbing state; once a cartel enters a municipality, it is considered to remain there permanently. This approach aligns with the methodological considerations to be discussed in the subsequent section. This identification provides a variable indicating the ever-increasing number of cartels in municipalities, as depicted in the figure below. We then identified the periods during which



the number of DTOs in a municipality increased to analyze the intensive margin. Subsequently, we merged this dataset, which indicates DTO presence, with a dataset containing outcome variables, identified using the unique key assigned by INEGI to each municipality for the relevant periods. To mitigate the impact of extreme values (outliers) in the distribution of outcome variables, we applied winsorizing at the 90 % level.

## 5. Empirical Strategy

To address the research question, I employed the Difference-in-Differences (DiD) approach with the following estimation equation:

$$Y_{m,s,t} = \alpha + \beta_1 DTO_{m,t} + \gamma_m + \delta_t + \nu_s + \epsilon_i \quad (6.1)$$

where,  $Y_{m,s,t}$  represents the number of economic units or firms by municipality (m), economic sector (s), and year (t),  $DTO_{m,t}$  is an indicator variable that takes a value of 1 from the point of entry of a Drug Trafficking Organization (DTO) into the municipality (m);  $\gamma_m$ ,  $\delta_t$ ,  $\nu_s$  denote fixed effects by municipality, year, and economic sector, respectively.

Nevertheless, the standard DiD approach may lead to biased estimates due to heterogeneous treatment effects over time. This heterogeneity stems from the staggered introduction of DTOs into different municipalities, leading to varying initial treatment effects and subsequent dynamic impacts across regions. To address this issue, I adopt the imputation estimator approach proposed by Borusyak et al. (2021), which involves fitting a Two-Way Fixed Effects (TWFE) regression using observations exclusively from units and periods that have not yet been exposed to treatment.

These methodologies produce reliable estimates under the assumption of parallel trends for all groups and periods, and in the absence of anticipation effects (Roth et al., 2021). Additionally, for robustness checks, I utilize the approaches proposed by Callaway and Sant'Anna (2020) and Chaisemartin and D'Haultfoeille (2020), which are robust to staggered treatment adoption and heterogeneous treatment effects. These methods involve considering multiple estimates and various types of parallel-trend assumptions.

A critical assumption underlying these analyses is the parallel trends assumption. This assumption posits that, in the absence of DTO presence, the treated group (municipalities with DTOs) and the control group (municipalities without DTOs) would exhibit similar trends over time. Given the staggered nature of DTO presence and the resulting heterogeneous effects, evaluating event studies that account for dynamic effects becomes essential. To examine the parallel-trend assumption, I construct event-study plots to assess whether the coefficients in periods preceding the treatment are statistically indistinguishable from zero.

Another assumption inherent in the methods proposed by Borusyak et al. (2021) and Callaway and Sant'Anna (2020) is that the treatment is a binary absorbing state. I have incorporated this consideration when constructing the treatment variable, as different DTOs arrived at different times in the municipalities. Once a DTO is present, it is assumed to remain present.

## **6. Results**

### **6.1 Aggregated Results**

This section examines the impact of the presence of Drug Trafficking Organizations (DTOs) in municipalities on various economic variables related to firm dynamics, such as the number of establishments, levels of formal employment registered with the Instituto Mexicano del Seguro Social (IMSS), average wages, and the wage bill for formal workers. Initially, I present results for economic sectors that account for nearly 80% of employment recorded in the Social Security Institute database: manufacturing (27%), sales (20%), and services (34%).

As discussed in previous sections, the nature of the treatment as an absorbing state implies that once a DTO is present in a municipality, it is considered treated in all subsequent periods. Consequently, my analysis includes 781 municipalities, given that data on firms commence from 2004, while DTO presence may predate this year.

For all variables, following a logarithmic transformation, I present the estimations as per Borusyak et al. (2021), conduct event studies using the aforementioned approach, and implement methodologies from Callaway and Sant'Anna (2020) to verify the parallel trends assumption. Additionally, a summary of the results with various approaches demonstrates the bias inherent in Two-Way Fixed Effects (TWFE) estimators.

The results reveal that the presence of DTOs correlates with a decrease in the number of establishments, formal employment wages, and consequently, the wage bill. Specifically, the entry of DTOs results in a reduction in the number of firms and workers in the formal sector, alongside a decrease in wages and, as a result, a declining wage bill. Thus, the mere presence of DTOs is associated with negative economic outcomes in the formal sector upon their arrival in a municipality. Across the variables of interest, event plots indicate that the observed declines are not immediate but manifest after a certain period of DTO presence.

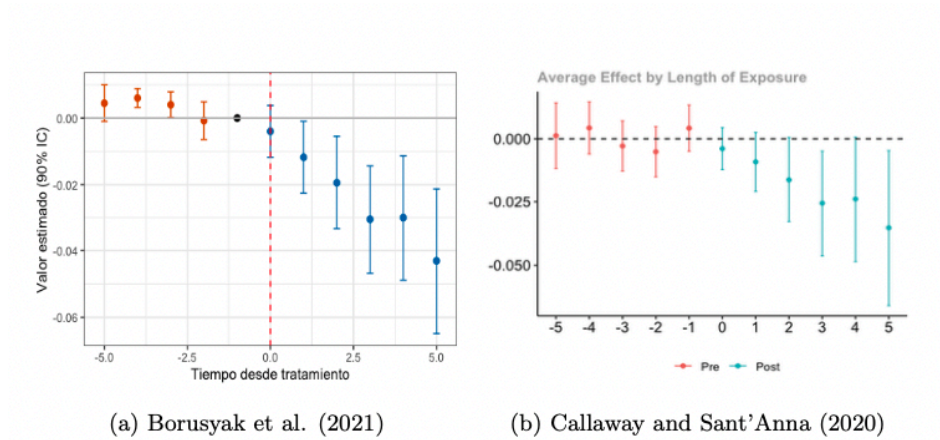
One might expect a decrease in employment to result in an increase in wages due to the scarcity of the labor force. However, this is not the case, possibly because more qualified workers with higher wages tend to leave upon the arrival of DTOs. This aspect warrants further research.

	Dependent variable:	
	Establishments	Employment
DTO presence (Number of DTOs > 0)	-0.024** (0.009)	-0.043*** (0.019)
Observations	77,319	77,319
Municipality-fixed effects	Yes	Yes
Time-fixed effects	Yes	Yes
Economic sector-fixed effects	Yes	Yes
Control for DTO presence (DTO > 0)	No	No

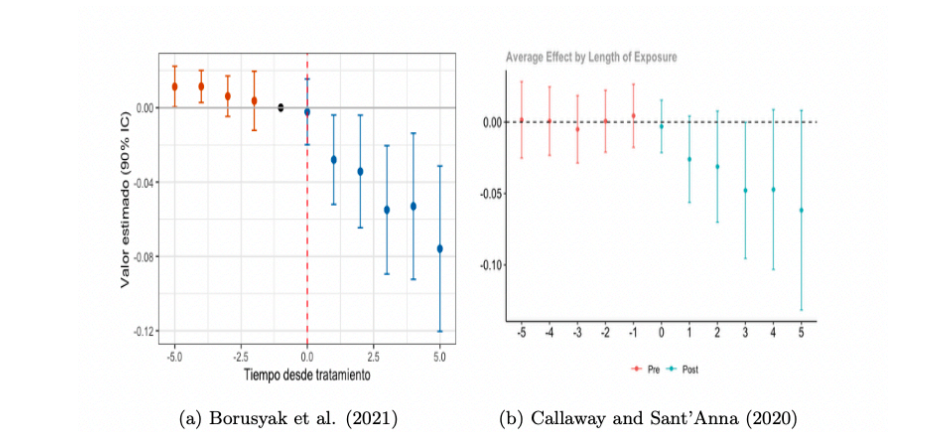
Notes: \*p< 0.1, \*\*p< 0.05, \*\*\*p< 0.01

Estimates derive from implementing Borusyak et al. (2021)

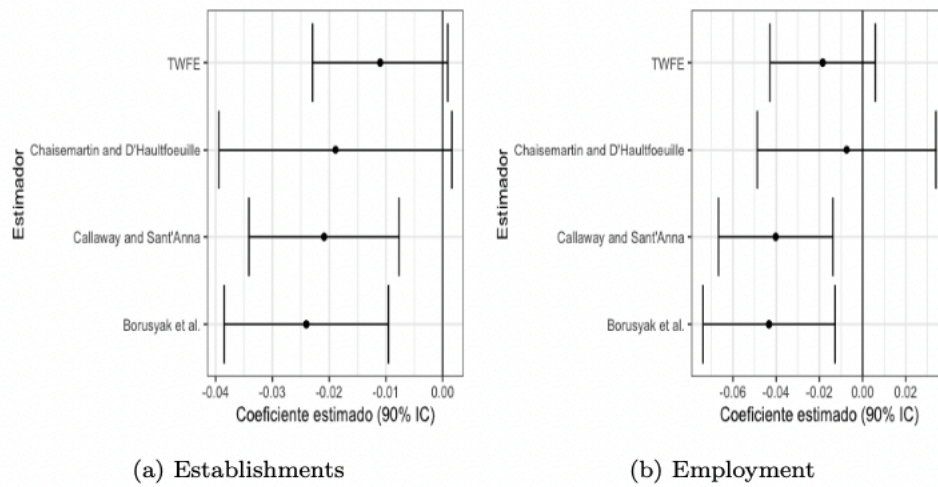
**Table 6.1. Impact of DTOs' presence on Establishments and Employment**



**Figure 6.1. Event Study Plot Establishments - DTOs' Presence**



**Figure 6.2. Event Study Plot Employment - DTOs' Presence**



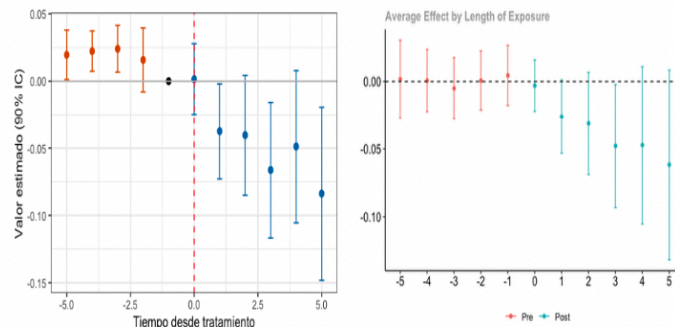
**Figure 6.3. Summary results: Establishments and Employment - DTOs' Presence**

	Dependent variable:	
	Wage	Wage Bill
DTO presence (Number of DTOs > 0)	-0.048** (0.027)	-0.081** (0.045)
Observations	77,319	77,319
Municipality-fixed effects	Yes	Yes
Time-fixed effects	Yes	Yes
Economic sector-fixed effects	Yes	No
Control for DTO presence (DTO > 0)	No	No

Notes: \*p< 0.1, \*\*p< 0.05, \*\*\*p< 0.01

Estimates derive from implementing Borusyak et al. (2021)

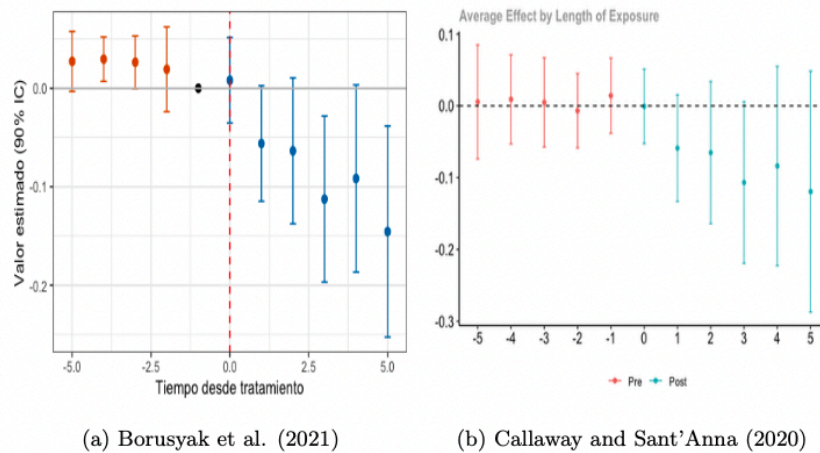
**Table 6.2. Impact of DTOs' presence on Mean Wage and Wage Bill**



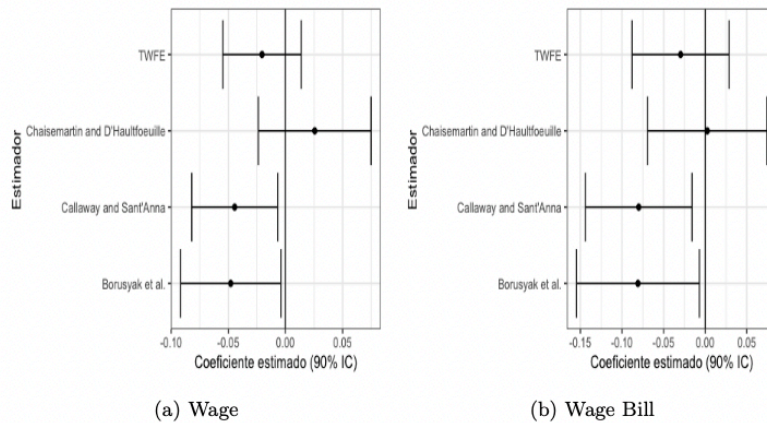
(a) Borusyak et al. (2021)

(b) Callaway and Sant'Anna (2020)

**Figure 6.4. Event Study Plot Wage - DTOs' Presence**



**Figure 6.5. Event Study Plot Wage Bill - DTOs' Presence**



**Figure 6.6. Summary results: Wage and Wage Bill - DTOs' Presence**

## 6.2 Sectoral Analysis

This section explores the results across economic sectors to identify heterogeneous effects. I provide results for the manufacturing, services, and sales sectors, which together represent 80% of the employment registered with the Social Security Institute in Mexico.

### 6.2.1 Establishments

In the aggregated case, the presence of DTOs is associated with a 2.4% average reduction in the number of establishments, caeteris paribus. When disaggregated by sector, the manufacturing and sales sectors exhibit a higher decrease by approximately 2

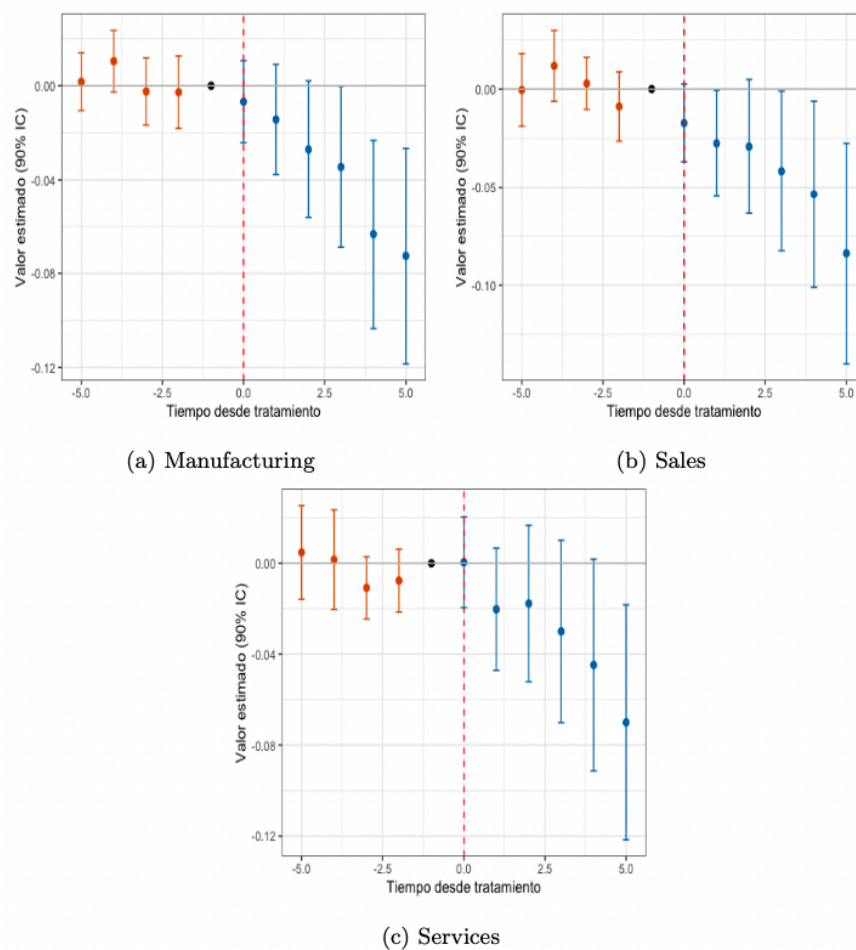
percentage points each, compared to the general case. In the sales sector, however, the presence of DTOs does not appear to significantly impact the number of establishments.

	Economic Sector:		
	Manufacturing	Sales	Services
DTO presence (Number of DTOs > 0)	-0.041*** (0.018)	-0.049*** (0.022)	-0.032 (0.021)
Observations	8,591	8,591	8,591
Municipality-fixed effects	Yes	Yes	Yes
Time-fixed effects	Yes	Yes	Yes
Control for DTO presence (DTO > 0)	No	No	No

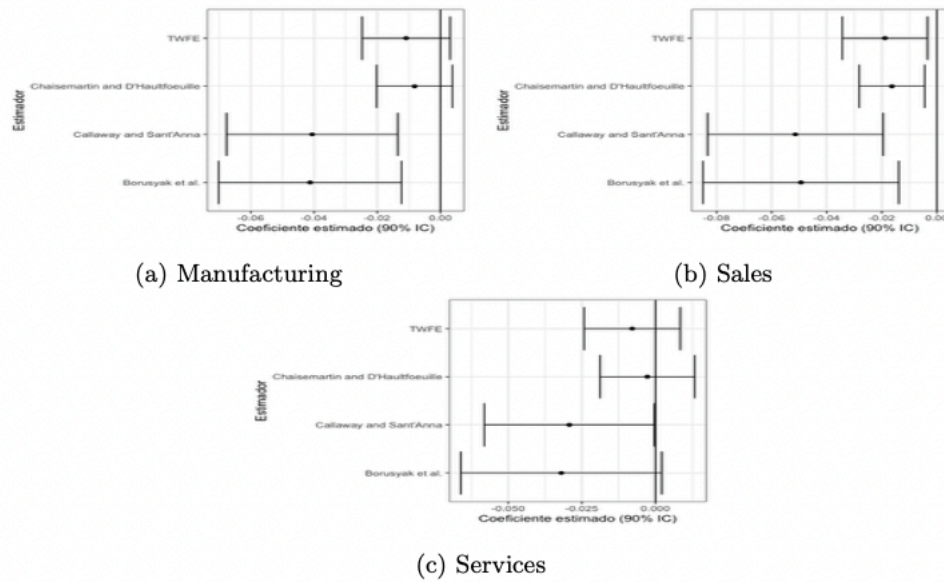
Notes: \*p< 0.1, \*\*p< 0.05,\*\*\*p< 0.01

Estimates derive from implementing Borusyak et al. (2021)

**Table 6.3. Impact of DTOs' presence on Establishments by Economic Sector**



**Figure 6.7. Event Study Plot Establishments - DTOs' Presence by Economic Sector following Borusyak et al. (2021)**



**Figure 6.8. Summary results: Establishments - DTOs' Presence by Economic Sector**

### 6.2.2 Employment

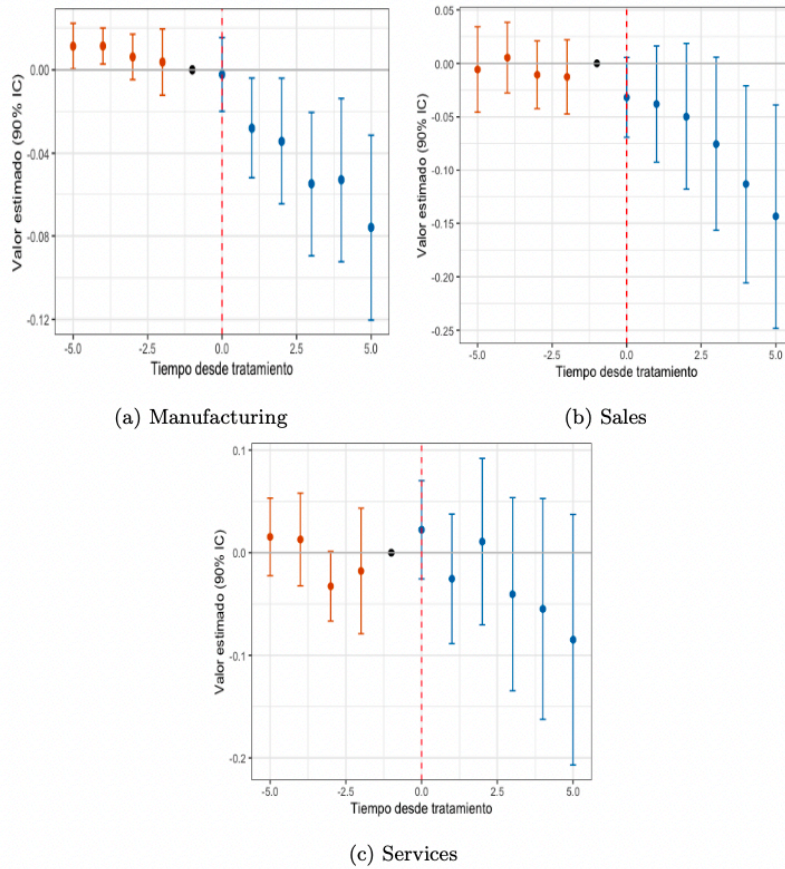
For the general case, the presence of DTOs is associated with an average 4.3% decrease in employment registered with social security, holding other factors constant. Sector-specific analysis reveals that the reduction in formal employment due to DTO presence is more pronounced in the manufacturing and sales sectors, with an additional decrease of nearly 2 percentage points. The services sector, however, shows no significant effect.

	Economic Sector:		
	Manufacturing	Sales	Services
DTO presence (Number of DTOs > 0)	-0.081** (0.046)	-0.080** (0.042)	-0.026 (0.048)
Observations	8,591	8,591	8,591
Municipality-fixed effects	Yes	Yes	Yes
Time-fixed effects	Yes	Yes	Yes
Control for DTO presence (DTO > 0)	No	No	No

Notes: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01

Estimates derive from implementing Borusyak et al. (2021)

**Table 6.4. Impact of DTOs' presence on Employment by Economic Sector**



**Figure 6.9. Event Study Plot Employment - DTOs' Presence by Economic Sector following Borusyak et al. (2021)**



**Figure 6.10. Summary results: Employment - DTOs' Presence by Economic Sector**



### 6.2.3 Wages

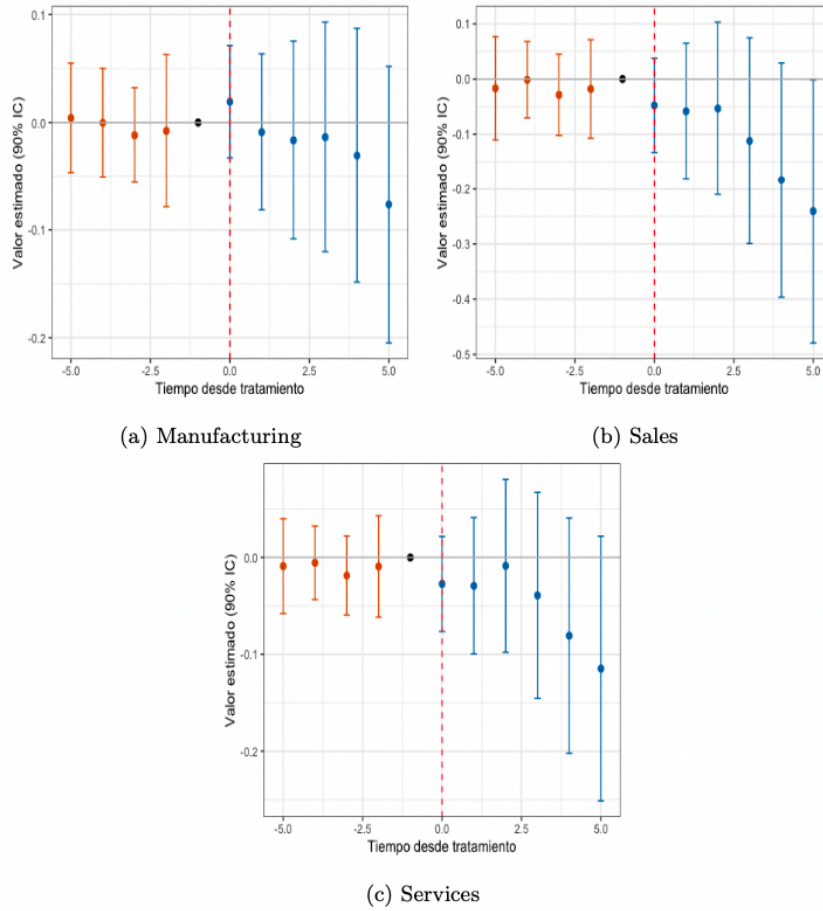
In the general case, DTO presence is associated with an average 4.8% decrease in the mean wage of workers registered with social security, all else being equal. Sector-specific analysis indicates no significant effects on wages or the wage bill within the manufacturing, sales, and services sectors, suggesting that the observed impact may be concentrated in other sectors not examined in this study.

	Economic Sector:		
	Manufacturing	Sales	Services
DTO presence (Number of DTOs > 0)	-0.029 (0.053)	-0.062 (0.055)	0.025 (0.072)
Observations	8,591	8,591	8,591
Municipality-fixed effects	Yes	Yes	Yes
Time-fixed effects	Yes	Yes	Yes
Control for DTO presence (DTO > 0)	No	No	No

Notes: \*p< 0.1, \*\*p< 0.05,\*\*\*p< 0.01

Estimates derive from implementing Borusyak et al. (2021)

**Table 6.5. Impact of DTOs' presence on Wage by Economic Sector**



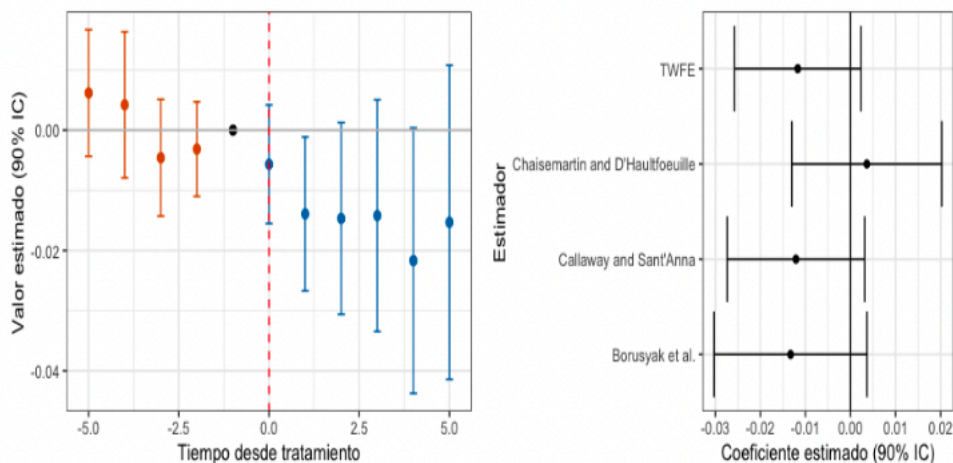
**Figure 6.11. Event Study Plot Wage - DTOs' Presence by Economic Sector following Borusyak et al. (2021)**



**Figure 6.12. Summary results: Wage - DTOs' Presence by Economic Sector**

### 6.3 Increasing DTOs: Intensive Margin

As previously mentioned, the presence of two or more cartels is linked to an increase in violence, which could negatively impact real sector variables such as the number of companies or establishments and employment. To investigate this, I identified municipalities that transitioned from no DTO presence to the presence of one or more, as well as those that saw an increase from one to two or more DTOs. I then analyzed whether this increase in DTO presence is associated with negative outcomes in terms of establishments, employment, and wages. However, no significant results were found to warrant detailed discussion. Figure 6.13 illustrates the impact of increasing DTO presence on establishments, while Annex A provides additional results.



(a) Event Study Plot from Borusyak et al. (2021) approach (b) Summary Results: Establishments - DTO Increasing Presence

**Figure 6.13. DTOs' increasing presence impact on establishments.**

My findings underscore the severe and far-reaching impact of organized crime on various economic dimensions. The detrimental effects on the number of establishments, employment, salaries, and wage bills are both significant and stark. Mechanisms such as extortion and intimidation, along with the resultant uncertainty, not only directly affect demand for products and services but also escalate production costs. These influences significantly shape investment decisions, personnel hiring, and even drive shifts toward informality due to DTO infiltration in these municipalities.

Contrary to expectations, the arrival of additional DTOs does not significantly affect the variables of interest. This suggests that the influence of cartels is more pronounced when a single cartel seeks to monopolize the illicit business of rent-seeking. The complexities

of these dynamics highlight the need for further research and analysis to inform policymakers, researchers, and analysts.

At the outset of this study, I considered the possibility that the substantial cash flows managed by organized crime in Mexico could lead to money laundering, potentially resulting in an increase in formal establishments and employment. The Mexican authorities have identified high cash flow management as a red flag for money laundering activities. Many Mexican DTOs, which are pivotal in organized crime, possess hierarchical structures that involve investing time and resources in developing managers and incentivizing long-term participation. These organizations prefer risk-averse methods for laundering money (Farfán-Méndez, 2019). The sales and services sectors, characterized by significant cash flows, include some risk-averse activities. To test this hypothesis, I conducted an analysis to verify whether DTO presence is associated with an increase in the number of contracts in banking or in point-of-sale (POS) transactions and terminals. However, no significant results were found in any case. Annex B presents the estimates and event study plots.

The limitations of this work, particularly the lack of detailed data on company sizes and employee characteristics, underscore the need for future research. Understanding whether businesses opt to remain or reduce their size (as measured by the number of employees) following the arrival of DTOs, and the impact on salaries, is crucial. Further research is essential to analyze changes in labor and business informality rates and to explore the economic consequences of extortion, including variations in credit amounts and interest rates upon DTO arrival in various Mexican municipalities.

## **7. Conclusions**

This work examines the profound economic impact of Drug Trafficking Organizations (DTOs) on municipalities, specifically in terms of establishments, formal employment, wages, and wage bills. The findings illustrate that DTO presence exerts a deleterious effect on economic growth and development. In particular, the presence of a DTO within a municipality is associated with significant reductions in formal employment, the number of establishments, mean wages, and the overall wage bill. These effects underscore that DTOs function as an implicit tax on both capital and profits, manifesting through mechanisms such as extortion, a preference among businesses to remain small-scale to avoid attention, and the general climate of uncertainty they foster. Such conditions deter future employment and investment, further stifling economic growth.

The analysis reveals that the economic repercussions of DTO presence are not uniform across sectors. The manufacturing and sales sectors, which are vital to economic activity, experience the most pronounced negative impacts. This sectoral disparity may be attributed to various factors. For manufacturing, limited access to capital markets, coupled

with the threat of extortion, hampers growth and investment. The demand-side effects in the sales sector, including diminished consumer confidence and reduced spending, further exacerbate these challenges. Conversely, the service sector appears less affected, possibly due to its susceptibility to money laundering activities which may buffer it from the more direct impacts of DTO presence.

The implications of this research are substantial, particularly for policy areas related to rule of law, economic informality, and overall development. Effective law enforcement efforts to combat organized crime could catalyze a transition of labor and businesses from the informal to the formal sector, enhancing productivity and economic stability. Such a transition would enable a more efficient allocation of resources within the formal sector, driving significant gains in production. The most profound impact, however, would stem from a reduction in economic informality. This shift promises a more secure and robust economic environment, fostering sustainable growth and development.

Given the limitations of this study, particularly regarding the lack of detailed data on firm size and employee characteristics, future research should aim to delve deeper into these aspects to better understand how businesses respond to the presence of DTOs. It is crucial to explore whether firms prefer to downsize or shift to informality upon the arrival of DTOs, and how this affects salaries and overall economic activity. Further research should also investigate the impact of DTO presence on financial variables such as credit availability and interest rates, to provide a more comprehensive understanding of the economic consequences of organized crime.

In conclusion, the results of this study align with existing literature that underscores the adverse economic impacts of organized crime, particularly the presence of DTOs. This thesis highlights the significant and far-reaching impacts of DTOs on economic activity in Mexican municipalities. By shedding light on the mechanisms through which DTOs influence economic outcomes and emphasizing the critical need for effective law enforcement, this research contributes to the broader discourse on the economic costs of organized crime and the importance of robust institutional frameworks for fostering economic growth and development.

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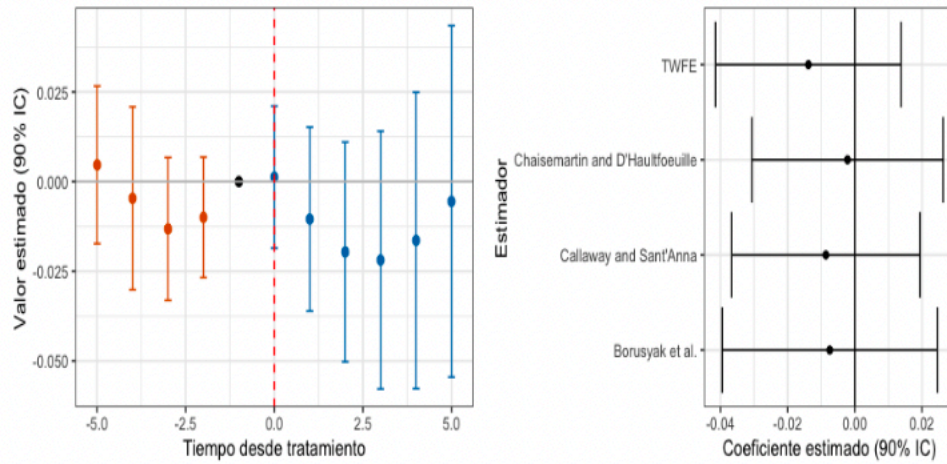
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Wysocki, Maciej and Cezary Wójcik (2015). “The (Non-) Effect of Violence on Education: Evidence from the ‘War on Drugs’ in Mexico.” *RAND Corporation Law*.

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## Annex A. Intensive Margin Analysis

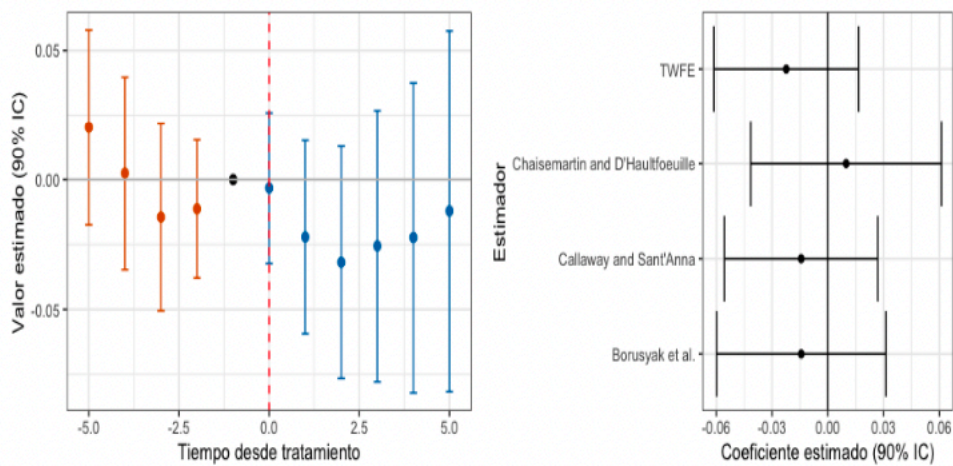
This section shows the results of an increase in the presence of DTOs from two cartels onwards on employment, wages, and wage bill. All results are non-significant.



(a) Event Study Plot from Borusyak et al. (2021) approach

(b) Summary Results: Establishments - DTO Increasing Presence

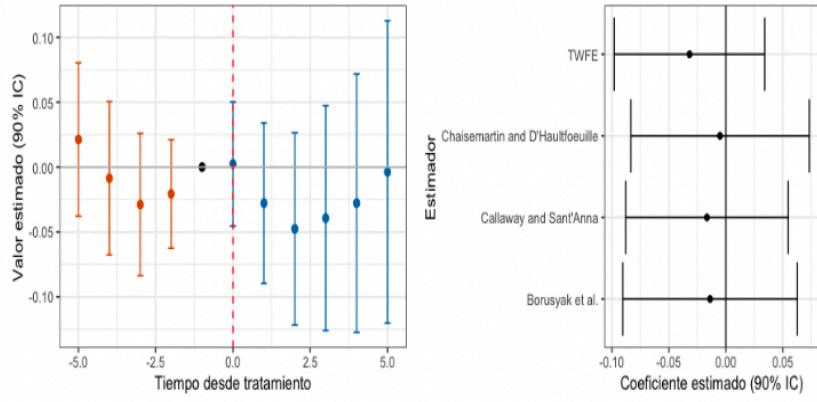
**Figure 7.1. DTOs' increasing presence impact on employment.**



(a) Event Study Plot from Borusyak et al. (2021) approach

(b) Summary Results: Establishments - DTO Increasing Presence

**Figure 7.2. DTOs' increasing presence impact on wage.**



(a) Event Study Plot from Borusyak et al. (2021) approach (b) Summary Results: Establishments - DTO Increasing Presence

**Figure 7.3. DTOs' increasing presence impact on wage bill.**

## Annex B. Banking Data Analysis

I conducted, as before, the effect of DTOs' presence in municipalities on some variables related to banking contracts and transactions. These banking data come from *Encuesta Nacional de Inclusión Financiera*, which has a quarterly periodicity from the first quarter of 2010 to the last quarter of 2020. For each municipality and by quarter, I have obtained for banking, both multiple and development, the number of savings account contracts, time deposits, cards credit and debit, mortgage and group credit, the number of POS, and the transactions carried out at POS and ATMs. Similarly, for the EACP (*Entidades de Ahorro y Crédito Popular*), data was obtained for savings account contracts, demand deposits, term deposits, credit cards, and mortgage and consumer loans.

I obtained non-significant estimates for all variables; that is, DTOs do not affect the banking variables mentioned previously. Below are the results for POS transactions per 10,000 adults.

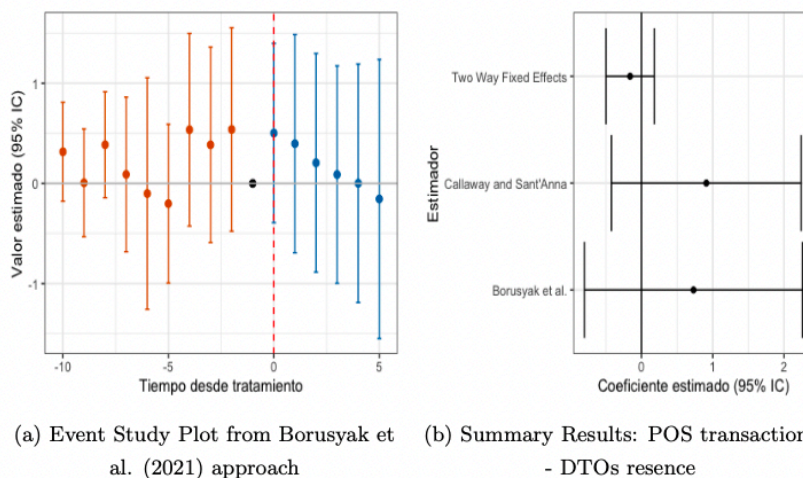


Figure 7.4. DTOs' presence impact on POS transactions per 10,000 adults.