Why Remain Illegal? The Deterrent Effect of DTO Control on Legal Cannabis Market Access

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Why do cannabis users remain illegal after cannabis legalization? Is the presence of drug trafficking organizations (DTOs) a deterrent for drug users to access legal markets? In this article, we exploit cannabis legalization in Uruguay as a unique case that offers an empirical setting to address these questions. Using two novel datasets and a matching strategy, we find that users living in neighborhoods with DTO control are 77% less likely to register for legal access than those living in similar neighborhoods with no DTOs. The result is robust to a sensitivity analysis for hidden bias. Our findings are relevant to understanding the broader implications of drug regulation by showing how criminal organizations can influence policy outcomes. DTO territorial control exerts a preventive regulatory effect limiting users' legal market participation.

Keywords: criminal organizations, cannabis legalization, illegal markets, drug policy, DTO control.

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I. Introduction

In recent years, there has been an ongoing debate about the regulation and legalization of illegal drugs. One of the main goals of these strategies is to shift users from illegal to legal markets. However, this debate often overlooks the presence of drug-trafficking organizations (DTOs), their control over territories, and how they adapt to these policies. Furthermore, since DTOs influence varies across regions, legalization strategies may impact different populations differently.

Are users who live in territories with DTOs' control deterred from accessing legal drug markets? We exploit cannabis legalization in Uruguay as a unique case that offers an empirical setting to address this question. Consumers are required to become part of a registry to access drugs legally in Uruguay. In addition, in recent years, the country has witnessed a marked growth in drug trafficking, DTO activity and gang clashes disputing the territory. Using two novel datasets and a matching strategy, we find that DTO presence deters users from registering and becoming part of the legal market. We argue that in DTO-controlled areas, users are inclined to pursue legal access but remain in the illegal market.

Our work is related to the literature that studies the effects of violent gang disputes. Clashes negatively affect educational outcomes (Monteiro and Rocha, 2017), deteriorate employment prospects mainly for women and self-employed workers (Velásquez, 2020), and can make people more risk-averse (Brown et al., 2019). In our study, we document an additional outcome of DTO territorial dynamics: citizens' reluctance to participate in legal markets. Although we only explore the specific mechanisms behind this deterrent effect, which may arise not only from violent disputes, we are sure that the DTOs exercise territorial control over illicit markets. Therefore, our study contributes to research on the long-term effects of organized crime's territorial control.

The literature on the consequences of organized crime that can exert long-term control

over a territory highlights the extractive nature of these criminal organizations. Most of this literature studies the consequences of the mafia presence in Southern Italy: reduced consumption and growth (Pinotti, 2015), diversion of public resource allocation (Cataldo and Mastrorocco, 2021), money laundering practices at the firm level (Mirenda et al., 2022), and adverse effects on educational outcomes (Acemoglu et al., 2020). Recent research also examines how criminal organizations maintain long-term territorial control through a governance logic. Criminal governance, understood as local systems of control that DTOs impose, restricts the behavior of both criminal and non-criminal civilians, affecting social, economic, and political aspects of everyday life (Lessing, 2021). For example, it may dictate voting behavior, restrict neighborhood movement, regulate participation in civil society organizations, and control drug distribution (Trejo and Ley, 2020; Ley, 2017; Magaloni et al., 2020; Arias and Barnes, 2017). Our work shows how such control can also limit consumers' access to legal drug markets, thereby undermining the intended effects of drug market legalization.

Furthermore, our study engages with the ongoing debate on the relationship between drug regulation and crime, which has not reached a consensus. Cannabis is at the center of this debate, as cannabis legalization reforms have been gaining ground in several countries. A recent systematic review (Castillo and Llanes, 2024) indicates that regulating cannabis either has no effect on crime or tends to reduce criminal activity. Our paper looks at the other side of the coin: how crime, in particular DTOs' control, impacts the success of cannabis legalization, a relationship that is currently understudied. Illegal drug sellers and DTOs might play a role in how drug legalization works. They can prevent users from moving to the newly established legal market for fear induced by violence or non-violent social pressure. Designing effective regulation of cannabis markets requires understanding how to attract users but also illegal sellers and growers to the new legal market (Belackova et al., 2023; Adinoff and Reiman, 2019; Kilmer et al., 2021); and yet, we know very little about how dealers and DTOs react to the creation of a legal market.

This work also contributes to the research that studies users' barriers to moving to the new legal market. The existence of a legal market in and of itself does not eliminate the illegal one, as not all cannabis users switch to the legal market. Recently, academic research started to focus on the barriers and motivations for cannabis users to move to the legal market or stay in the illegal one. The main barriers to explain the failure of the transition to the legal market are restricted availability through legal sources, higher prices, characteristics of the regulations such as quantity limits, fear of stigmatization in the legal sector because it is more public, and loyalty to suppliers in the illegal market (Amlung and MacKillop, 2019; Fischer et al., 2021; Queirolo et al., 2023; Robertson and Thyne, 2021). Several of these barriers are even more important for cannabis users with low socioeconomic levels than for those with higher income.

We use two sources of data in this work: the 2018 National Drug Use Survey and a dataset on DTO control at the neighborhood level in Montevideo. Using a matching strategy, we estimate the impact of DTO control on the registration and propensity to register. We match the observations using detailed individual data: gender, age, distance to a cannabis dealer pharmacy, educational level, and employment status. Our results indicate that residents of DTO-controlled areas are 77% less likely to register. The result is robust to a sensitivity analysis: an unobserved not correlated with the variables used to match the observations should be more powerful than the group fixed effects -constructed with the variables used to match the observations- to be able to disappear the effect of DTO control. We also find evidence suggesting that residents of DTO-controlled areas are more prone to register. Although the main estimates are not statistically significant, propensity may suffer more measurement error than the registry. In addition, we have fewer observations for propensity than for registry, as for already registered users, naturally, there is no data on propensity to register. Thus, propensity estimates may be underpowered.

While this article does not empirically test the mechanisms underlying the observed deterrent effect of DTOs on cannabis users switching to legal markets, it contributes to

the discussion by considering possible explanations. In theory, four mechanisms could account for why users in DTO-controlled areas avoid registering for legal cannabis access: direct violence, anticipatory compliance, loyalty to illegal suppliers, and ease of access to illegal cannabis through DTOs. However, since illegal access to cannabis is widespread and not only available in DTO-controlled territories, the matching design allows us to rule out this mechanism as the primary explanation. Three plausible mechanisms remain, each tied to different dimensions of DTO influence: direct violence, where DTOs explicitly threaten users who attempt to transition; anticipatory compliance, where users adjust their behavior preemptively to avoid potential retaliation; and loyalty, where longstanding social or economic ties to illegal suppliers discourage users from shifting to the legal market. Although disentangling these mechanisms is beyond the scope of this paper, understanding their relative importance is crucial for designing legalization policies that effectively compete with illegal markets in contexts of organized crime.

This work makes theoretical, empirical and policy contributions to the study of drug legalization and organized crime. Theoretically, it extends criminal governance frameworks by showing how drug legalization outcomes vary across territories under DTO control, where fear often deters users from accessing legal markets. Empirically, while most research examines the effects of drug legalization on crime, our study takes the reverse approach, exploring how the presence of DTO impacts the success of legalization policies. We show that when a geographical area is under DTO control, it hinders user registration despite a positive inclination toward legality. The findings also highlight the role of structural inequalities, beyond socioeconomic disparities, in shaping policy effectiveness. From a policy perspective, our findings highlight that legalization policies cannot assume uniform implementation across all territories.

The paper is structured as follows. The next section introduces the Uruguayan case, providing an overview of cannabis regulation, legal access mechanisms, and the dynamics of organized crime and micro-trafficking in Montevideo. We then outline our main

argument, followed by a detailed description of our data and empirical strategy. The subsequent section presents and analyzes the key results of our model. We then discuss potential mechanisms underlying the observed effects. Finally, the paper concludes by discussing the findings and their implications.

II. The Uruguayan Case

Uruguay represents a crucial case in which to test our argument. In 2013, Uruguay passed Law 19.172, becoming the first country to regulate the cannabis market fully, from cultivation to commercialization and consumption. The way regulation was implemented is also unique: it is a stringent, state-centered regulatory framework that made user registration mandatory and established maximum quantities of cannabis that could be purchased legally per month (40 grams) and year (480 grams), the prohibition of selling to tourists, the prohibition of any advertising, and the prohibition of selling oils, edibles, or any other product other than cannabis flowers (Cerdá and Kilmer, 2017). Even though some of these regulations exist in other districts where cannabis has been legalized, such as the prohibition of advertising, the combination of all these regulations makes the Uruguayan model more restrictive (Queirolo et al., 2023, 2024b). All the restrictions impose costs for those users who want to be part of the legal market. Furthermore, legalization took place in the context of an increase in a series of crimes such as homicides, robberies, and assaults, as well as the increased presence of criminal organizations involved in drug dealing in urban areas (Bogliaccini et al., 2024). The restrictiveness of the regulatory framework and the context of the increased presence of criminal organizations and crimes make Uruguay a relevant case to extract lessons about the impact of this kind of regulatory framework.

A. Cannabis Regulation and Legal Access in Uruguay

There are three ways in which residents of Uruguay who are over 18 years of age can access cannabis legally: home cultivation, buying cannabis in pharmacies, or being a mem-

ber of a cannabis social club. Users are required to choose one of these ways to access cannabis, and they are also required to become part of a registry. Registered home growers can have up to 6 female plants, with a total yield of up to 480 grams annually. They must dispose of the surplus if they produce more than that amount. The registration of self-growers began in August 2014, and at the time of writing, there were 11,708 registered users. Cannabis Social Clubs (CSCs) are non-profit organizations with between 15 and 45 members, up to 99 plants in the club, and distribute up to 480 grams per year per member. The surplus they generate must be delivered to the IRCCA (Institute for Control and Regulation of Cannabis), which implements and fiscalizes the policy. Registration at CSC began in 2014, and there are currently 410, with 13,687 registered users. Finally, pharmacy sales are the latest access mechanism, implemented in July 2017. The Uruguayan state grants licenses to companies that produce cannabis to be distributed and sold in pharmacies, which is users' preferred mechanism: there are 71,843 registered users and 40 pharmacies that sell cannabis.

One particularity of the Uruguayan cannabis regulation is its mandatory register. For many users, the register is an important barrier to buying cannabis in the legal market. Despite that, cannabis users who switch to the legal market are very similar in their sociodemographic profile and consumption patterns to those that are not registered (Sotto, 2024; Queirolo et al., 2023).

Even though the regulation applies to the entirety of Uruguay, not every Uruguayan city has a pharmacy that sells cannabis or a cannabis social club. As a result, some users must travel if they want to buy cannabis in the legal market. This paper focuses on the city of Montevideo, the country's capital. Montevideo has the largest market, it is the most populous city in the country, and it also concentrates the presence of several criminal organizations.

B. Organized crime and micro-trafficking in Montevideo

Over the past two decades, there has been a notable increase in the presence of criminal organizations involved in drug dealing and trafficking at the local level in the city of Montevideo (Feldmann and Luna, 2023; Fynn et al., 2024). These DTOs vary in size and capacity for violence across different neighborhoods. In a recent study, Tiscornia, Pérez-Bentancur, Fynn, and Diaz (Tiscornia et al., 2023), identified 36 distinct DTOs operating across 24 of Montevideo's 62 neighborhoods in the past decade, a trend corroborated by the Ministry of the Interior. These groups are entrenched in economically marginalized neighborhoods.

As is the case in several other countries, DTOs in Montevideo originated in families involved in criminal activities, who later expanded their illegal business to include local drug dealing and set up operations in their neighborhoods. These families are well-known to neighborhood residents (Fynn, 2025). When multiple groups are present, they tend to be involved in disputes over drug sales in the area. While no evidence exists that these groups have established liberated zones or dominate entire communities, their presence and behavior are often violent, leading to a range of coexistence problems for local populations. Neighborhoods with competing DTOs experience heightened insecurity as conflicts over drug sales frequently escalate into violence, including shootouts and homicides. The Ministry of the Interior's Bi-Annual Homicide Report (Ministerio del Interior, 2019) indicated that in 2018, half of Uruguay's homicides were linked to gang-related violence, contributing to an unprecedented homicide rate of 16.9 per 100,000 inhabitants in Montevideo. Uruguay has experienced a steady rise in homicides over the past decade, from 7.6 per 100,000 in 2013 to 15.2 in 2023, placing it well above countries with similar social structures, such as Argentina (5 per 100,000) and Chile (4.5 per 100,000) (Fynn and Luna, 2024).

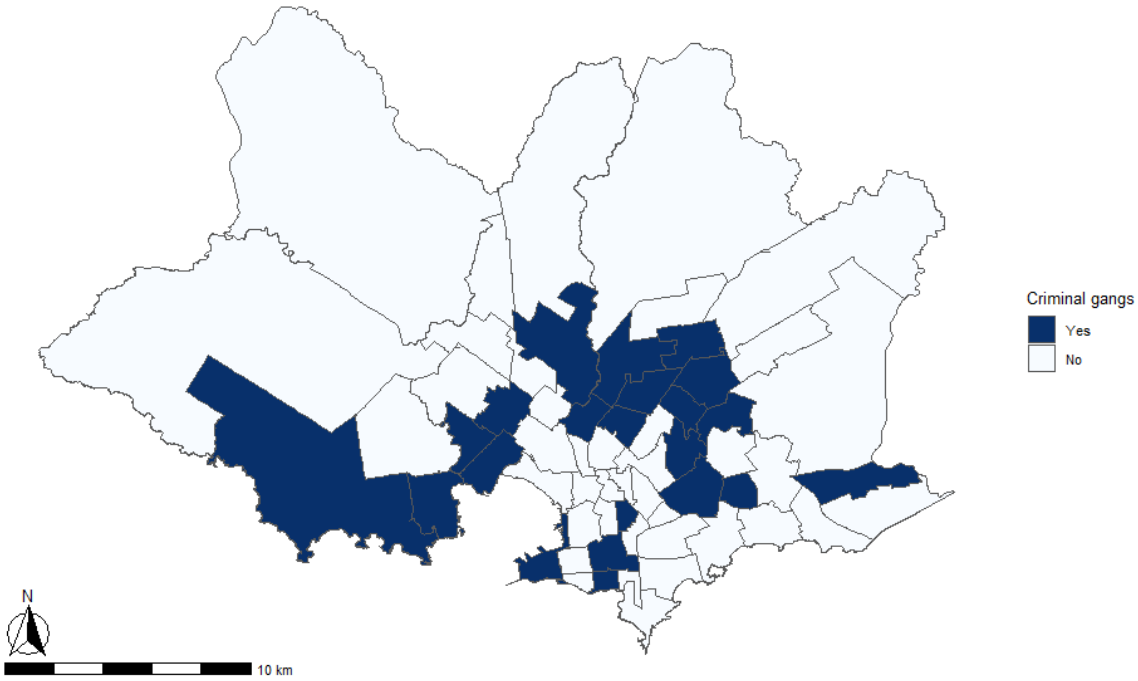

Figure 1: Gangs Presence in Montevideo´s Neighborhoods

Notes: The map shows Montevideo neighbourhoods with criminal gang presence by 2018.

Source: Authors' elaboration based on data collected by Fynn et al. (2024).

DTOs in Montevideo employ different strategies to maintain territorial control, maximize drug trade profits, regulate prices, control who can buy and sell, manage trade volumes, and monitor transaction locations (Fynn et al., 2024). Violence plays a key role in their operations, with tactics like forced evictions and threats used to ensure control and client loyalty. However, some DTOs also use non-violent methods, such as providing material assistance, supporting community initiatives, and offering jobs -particularly to young men- to gain local support and reinforce their influence. In vulnerable neighborhoods, these criminal groups exert significant control over daily life, affecting residents' routines. Many residents adjust their behavior to avoid retaliation or punishment from the DTOs (Fynn, 2025). Beyond regulating the market, DTOs monitor consumers, often using violence to ensure loyalty. This pervasive influence shapes local attitudes toward

drug consumption, leading us to expect that residents may similarly modify their behavior when presented with the option of purchasing drugs through legal means.

III. Argument

We argue that cannabis users who live in territories where DTOs maintain control would be less prone to access cannabis in the legal market. In other words, DTOs can become a significant barrier to legalizing the drug market. We develop a Becker-style crime model that studies the relationship between drug legalization, DTOs' control and consumers' access to legal markets. In this simple model, an agent must choose to consume in the legal or in the illegal market. The city is split into two areas: Area 1 and Area 2. The only difference between the areas is that Area 1 is under DTO control, whereas Area 2 is not.

A rational consumer will opt to buy in the legal market as long as the following inequality holds:

$$L(1-\pi) - \pi S_a - D \geq I \tag{1}$$

where L is the benefit of buying in the legal market; π is the probability of sanction by the DTO faced by the individual; S_a is the sanction the consumer faces if captured buying in the legal market in area a; D is the direct cost of consuming in the legal market; and I is the net benefit of buying in the illegal market.[1] The left-hand side of the inequality represents the net benefit of buying in the legal market; the right-hand side represents the opportunity cost of doing so.[2]

The legal sale of cannabis in pharmacies implies a reduction in D, which, for the sake of simplicity, we assume is homogeneous across the city. Thus, pharmacy sales increase the net benefit of consuming in the legal market while holding the opportunity cost constant. As a result, a rational consumer in any part of the city becomes more likely to buy in the

[1] We can see the benefit of buying in the illegal market as a sense of belonging. Among the costs, we can consider all the risks associated with engaging in an illegal activity.

[2] We assume that the agent is risk-neutral.

legal market.

We assume that the level of sanction, S, is a function of the direct cost of buying in the legal market. Furthermore, we assume, first, that the less expensive it is to buy in the legal market, the higher the sanction imposed by organized crime. The more expensive legal access is, the less DTOs need to punish consumers for defecting. Second, the less expensive to buy in the legal market, the weakest the response to a change in the direct cost. The marginal effect of decreasing D on increasing S diminishes.[3] Since Area 1 is under DTO control and Area 2 is not, it follows that $S_1 > S_2$. Therefore, the sale of cannabis in pharmacies elicits a larger sanction response in Area 1 than in Area 2. As a result, although legalization benefits all consumers equally in theory, the net benefit of purchasing in the legal market increases more in Area 2 than in Area 1. A rational consumer will find buying in the legal market less beneficial in areas under DTO control.

IV. Data and Empirical Strategy

We construct our dataset by combining two unique sources. First, the 2018 National Drug Use Survey, conducted by the Uruguayan Observatory on Drugs, provides detailed individual data on drug use and a broad range of demographic and socioeconomic characteristics such as age, gender, education, and employment status. The sample size is 4,720, and the interviews were collected from September to December 2018. This survey includes questions about respondents' registration status for legal cannabis access and, if not registered, their propensity to register. Using this information, we develop two primary outcome variables: an indicator of registration status and a Likert-scale type measure of propensity to register that ranges between 1 and 4, where 1 means the respondent is unlikely to register, and 4 means the respondent is likely to register. The survey data also includes respondents' geographic block of residence, which is instrumental to our empirical strategy. This information makes it possible to know if the respondent lives in

[3] That is to say, $S'(D) < 0$ and $S''(D) > 0$.

an area under DTO control. The survey is representative of the whole country, but for this article, we only use cases from Montevideo.

Our second data source is a dataset on DTO control at the neighborhood level in Montevideo from Fynn et al. (2024). These data provide a spatial dimension to DTO presence, enabling us to assess its impact within specific areas.

Our final sample comprises 364 cannabis users with 18 years old or older, that live in Montevideo, and have used cannabis in the last twelve months. Among the 364 respondents, 142 live in areas under DTO control and 222 in areas without DTO control.

Table 1: Descriptive Statistics

	Mean	S.D.	Min.	Max.	N
DTO	0.39	0.49	0	1	364
Registered	0.15	0.36	0	1	364
Propensity	3.31	1.40	1	5	308
Age	31.38	10.06	18	65	364
Female	0.46	0.50	0	1	364
Distance	2.63	2.42	0	12	364
Education	2.90	0.82	1	4	364
Employed	0.81	0.39	0	1	364

Notes: DTO takes the value 1 if the respondent lives in a neighborhood under DTO control and 0 otherwise. Registered is an indicator variable that takes the value 1 if the respondent is registered. Propensity takes the value 1 if the respondent is propense to register. Female is an indicator variable for female. Education takes three values: 1 for persons with uncomplete secondary education or less, 2 for persons with complete secondary education, and three for persons with tertiary education or more. Employed takes the value one if the person is employed and 0 otherwise.

We estimate the impact of DTOs on the registration and propensity to register using a matching strategy. We match the observations based on age, gender, distance between the block where they live and a pharmacy selling cannabis, education, and employment status.[4] Then, we regress the outcome variables on a DTO indicator variable and pair fixed effects. Our identification strategy relies on the assumption that conditional on the variables used to match the observations, DTO control is as good as random.

[4]We use the Euclidean distance to match the observations. In addition, we impose that matched observations must be of the same educational level, and the difference in distance to a pharmacy cannot be above 5 kilometres.

We believe our assumption holds for two reasons. First, the broad set of personal characteristics used in the matching. Second, the surge in DTO control in Montevideo is relatively recent. Although the first records of DTO presence in Montevideo date back to the early 2000s, most emerged from 2015 onwards.[5] Thus, it is unlikely that gentrification processes of a relevant magnitude are simultaneously in place.

Table 2 shows descriptive statistics for the control and treatment groups, for both the complete and the matched sample. We allow a non-DTO-controlled neighborhood user to be the counterfactual for more than one treated user. We construct 123 groups of observations: two groups have five observations, three groups have four observations, and twenty six groups have three observations; all the remaining are one-to-one pairs. The matched sample consists of 284 observations.

Table 2: Descriptive Statistics

	All Sample		Matched Sample	
	Control	Treatment	Control	Treatment
Age	32	30,37	30.51	30.37
Female	0.44	0.49	0.46	0.49
Distance	2.8	2.37	2.14	2.37
Education	2.02	1.78	2.90	2.75
Employed	0.81	0.80	0.80	0.80
Observations	222	142	142	142

Notes: Female is an indicator variable for female. Education takes three values: one for persons with primary education or less, two for persons with incomplete secondary education, three for persons with complete secondary education, and four for persons with tertiary education or more. Employed takes the value one if the person is employed and zero otherwise.

When considering the matched sample, the differences between control and treatment groups are smaller than in the complete sample for all the covariates used to match the observations. In Table 3 we present the balance test for the covariates used to match the observations. We regress the covariates on DTO control and cluster the observations at the neighborhood level. The treatment variable coefficient is not statistically significant

[5]In our sample, among users who live in a neighborhood with gang presence, 60 % live in a neighborhood with gang presence from 2015 or afterwards.

for any of the covariates used to match the sample.

Table 3: Balance Test - Matched Sample

	Age	Female	Distance	Education	Employed
Drug Trafficking Organization	-0.148	0.028	0.237	-0.148	0.000
	(1.086)	(0.062)	(0.598)	(0.166)	(0.045)
Observations			284		

Notes: Female is an indicator variable for female. Education takes three values: one for persons with primary education or less, two for persons with incomplete secondary education, three for persons with complete secondary education, and four for persons with tertiary education or more. Employed takes the value one if the person is employed and zero otherwise. Standard errors clustered at the neighborhood level. Fifty-four clusters used. *** Significant at the 1%, ** significant at the 5%, * significant at the 10%.

V. Results

A. Main Results

We present the main results in Table 4.[6] The incidence of gangs' presence on users' registration is large and statistically significant. In column (1), the value of -0.115 corresponding to the treatment coefficient represents 77 % of the share of registered users in our sample which reaches 15 %. Users living in DTO-controlled areas are less likely to be registered in the legal market. In the Propensity to register model of column (3), DTO presents a positive coefficient. The 0.259 coefficient represents the 11 % of the mean propensity to register in our sample, 2.31. The magnitude of the effect on propensity to register, albeit in absolute value smaller than the incidence on registration, is considerable. However, the dispersion of the estimates does not allow us to reject the null hypothesis.

Montevideo has witnessed a surge in DTO control in the last two decades with important consequences, most notably an increase in violence. The possibility that gang

[6] All estimates are clustered at the neighborhood level. In Registered, 54 clusters are used and in Propensity, 49.

Table 4: The Effect on Legal Markets

	Registered		Propensity	
	(1)	(2)	(3)	(4)
Drug Trafficking Organization	-0.115***	-0.14***	0.259	0.097
	(0.042)	(0.052)	(0.213)	(0.269)
Drug Trafficking Organization*Multiple Gangs		0.06		0.372
		(0.077)		(0.34)
Observations	284		240	

Notes: The dependent variables are Registered and Propensity to Register. Matched pairs based on educational level, age, gender, distance to a cannabis dealer pharmacy, and employment. Standard errors clustered at the neighborhood level. *** Significant at the 1%, ** significant at the 5%, * significant at the 10%.

competition over territory may drive the results is critical. To explore this point, we assess the incidence of the number of gangs on access to legal markets. We regress the outcomes against the treatment variable and the treatment variable interacted with an indicator variable for more than one gang in a neighborhood. In our sample, 12 neighborhoods (80 respondents) have one gang, and 8 (62 respondents) have more than one.

The effect of DTOs on registration and propensity to register is similar to the results presented in columns (1) and (3). Notably, the coefficient of the interaction -in columns (2) and (4)- with multiple gangs is not statistically significant. Multiple gangs in an area do not imply a more significant consumer behavioral response.[7] The results are consistent with a scenario in which gang competition does not explain our main findings.

In studying the relationship between DTO control, registry, and propensity to register, omitted variables may pose a challenge to inference if correlated with both local criminal activity and users' behavior. To guard against this problem, we use a set of control variables to match the observations in groups. Our identification assumption for our effect of interest is that conditional on the variables used to match the observations, assignment to

[7]While DTO competition often leads to violence, a higher number of DTOs does not necessarily indicate rivalry, as they may sometimes cooperate instead (Lessing, 2017; Trejo and Ley, 2020).

DTO presence is as good as random.

As we do not have a truly random treatment assignment, it is worth asking how likely our results are to result from spurious correlation. If we face unobservable variables that bias our results, how strong would their capacity to explain registry and propensity to register have to be for the effect of DTO control to disappear? Cinelli and Hazlett (2020) propose a methodology to answer this question, which we follow. The methodology compares the residual variation of both the treatment and the outcome which must be explained by an unobservable variable or set of variables, orthogonal to those used to match the observations, and compares it with the explanatory power of a benchmark variable or set of variables.

In the Registered model of column (1), an unobservable variable or set of variables without any correlation with the included controls would have to explain at least 18.61% of the residual variation of the outcome -Registered- and of the treatment -DTO- to bring the point estimate of the effect of DTO control to 0. In addition, to make the DTO coefficient not significant at the 5% or 10% level, the unobservables would need to explain at least 4.84% or 7.23%, respectively, of the residual variation of both the outcome and the treatment. To assess the plausibility of the presence of unobservables that could change our results, we use the set of group fixed effects for the benchmark. The binary variables representing group effects explain 5.68% of the residual variation of the outcome. Thus, only an unobservable or set of unobservables more than three times (18.61/5.68) more powerful than the set of group fixed effects could bring the DTO coefficient to 0. To make the DTO coefficient not significant at the 5%, an unobservable or set of unobservables orthogonal to the variables used to match the observations should have at least the 85% of the group fixed effects explanatory power and to make the DTO coefficient not significant at the 10%, the set of unobservables should be almost 50 % more potent than the set of group fixed effects. Considering the information used to construct the group fixed effects - gender, age, distance to a cannabis dealer pharmacy, educational level, and employment

- it seems unlikely that such a set of unobservables could be present.

The results in 4 indicate that DTO control does not impact the Propensity to register. However, both in column (3) and in column (4), the DTO coefficient is positive. In the model of column (3), the set of unobservable variables should explain at least 12.07% of the residual variation of the outcome and treatment to bring the DTO coefficient to 0. The group fixed effects explain 26.2% of the residual variation of the outcome in the Propensity model. Although the treatment coefficient is not significant, it is remarkable that to bring down the point estimate of the DTO coefficient to 0 an unobservable should be as relevant as more than the 45% of the group fixed effects. Whilst Registered measures an action, Propensity measures an intention. It is reasonable to expect more measurement error for Propensity than for Registered. In addition, our estimates have fewer observations for Propensity: 284 against 240 in the Registered models. Thus, with the information available, the question of to which extent the propensity models are not underpowered remains open.

VI. Discussion

While this research does not primarily seek to explain why consumers in DTO-controlled neighborhoods avoid legal cannabis markets, this section explores potential mechanisms that may help illuminate the observed effect. We identify four possible explanations: direct violence, anticipatory compliance, loyalty to DTOs, and ease of access to illicit cannabis. Each of these mechanisms affects the theoretical equation by altering the perceived or actual costs and benefits of participating in the legal market (see Table 5).

First, users may avoid legal markets due to the threat of DTO violence against those attempting to transition to legal access. DTOs often employ violence to deter behaviors that could undermine their dominance, making this a plausible adaptive strategy to counteract market regulation. This mechanism increases the *sanction term* (penalty) in the equation of our argument, as the risk of physical harm adds a substantial cost to legal market par-

ticipation. The relevance of this factor is underscored by the rising levels of DTO-related violence in Uruguay, as reflected in the steady increase in the homicide rate, which peaked in 2018—the year our survey data was collected. However, available data are insufficient to assess this hypothesis fully. Homicide statistics do not distinguish between killings within the drug trade and those targeting consumers. Moreover, direct violence may manifest in underreported forms, such as non-lethal attacks (e.g., gunshot wounds to the leg, amputations, burns, and severe beatings), which victims may choose not to disclose.

Beyond explicit violence, DTOs exert control through territorial governance, enforcing both formal and informal rules (Lessing, 2021). Residents in these areas engage in anticipatory compliance, modifying their behavior to avoid potential retaliation (Bell-Martin and Marston, 2023; Córdova, 2019; Ley, 2018; Moncada, 2019, 2020). This mechanism increases the *perceived probability of sanctions*, as individuals preemptively avoid legal cannabis out of fear that such actions may be interpreted as disloyal to DTOs, even in the absence of direct violence. The plausibility of this mechanism is supported by prior studies in Uruguay, which indicate that residents in DTO-controlled neighborhoods adjust their behavior not only in response to direct threats but also to mitigate the risk of punitive consequences (Fynn, 2025).

Importantly, deterrence mechanisms may operate even in the absence of direct violence. In some cases, DTOs maintain control through non-violent means, fostering loyalty rather than fear. Residents may avoid legal markets not due to coercion but because DTOs provide tangible benefits, such as subsidized services, employment, or donations. This mechanism raises the *opportunity cost* of legal market participation, as consumers may perceive illicit purchases as acts of reciprocity that sustain their access to these benefits. Recent research in Uruguay suggests that these non-violent forms of control foster reciprocity and gratitude, reinforcing community loyalty (Fynn et al., 2024; Fynn, 2025). In these contexts, avoiding the legal market may be less about avoiding punishment and more about maintaining a mutually beneficial relationship with DTOs.

Finally, ease of access to cannabis within DTO-controlled neighborhoods might also play a role in discouraging legal market participation. DTOs ensure a steady supply of cannabis, offering a level of convenience that reduces transaction costs compared to the bureaucratic and logistical hurdles associated with legal access Queirolo et al. (2024a). In particular, in 2018, when this data was collected, the provision of cannabis through the pharmacies system was still experiencing problems with its implementation, which clearly makes the legal access more cumbersome. This mechanism reduces the *practical cost* of illicit purchases relative to legal markets, making illegal cannabis the more convenient option. While this factor likely contributes to overall illicit market reliance, it alone does not explain our findings. Illegal cannabis is widely available citywide, both in DTO-controlled areas and in locations where DTOs operate sales points ("bocas"), but do not exert territorial control. Our study's matching design accounts for this factor, suggesting that ease of access is not the primary driver of legal market avoidance in DTO-controlled areas. Although this factor may be particularly relevant for lower-income users, other mechanisms—such as violence, compliance, and loyalty—likely continue to shape cannabis consumption choices in these neighborhoods, even when legal access is facilitated.

Rather than operating in isolation, these mechanisms likely reinforce one another. The threat of violence may heighten anticipatory compliance, while loyalty and convenience further entrench reliance on illicit markets. In high-violence areas, compliance driven by fear may be the dominant factor, whereas in neighborhoods where DTOs provide community benefits, loyalty may play a greater role. These mechanisms likely vary across and within different areas and may evolve in response to shifts in DTO strategies or state policies. Still, collectively, these dynamics could discourage legal market participation.

These findings challenge the notion that facilitating access to legal cannabis alone will shift users away from illicit markets. While ease of access may be a significant barrier for some consumers, particularly those with lower incomes, our analysis suggests

Table 5: Mechanisms and their Effects.

Mechanism	**Effect**	**Explanation**
Direct Violence	Increases the *sanction term* (penalty)	DTOs directly penalize consumers who shift to legal markets, raising the perceived costs of legal access.
Anticipatory Compliance	Increases the *perceived probability of sanctions*	Fear of potential DTO retaliation fosters a preemptive adjustment of behavior, even without visible direct violence.
Loyalty to DTOs	Raises the *opportunity cost* of legal market participation	Illegal purchases are framed as acts of loyalty or reciprocity, strengthening ties with DTOs and discouraging legal access.
Ease of Access	Reduces the *practical cost* of illicit purchases relative to legal markets	DTOs offer readily available and competitively priced cannabis, making illicit purchases more convenient and attractive.

that other factors—such as coercion, social embeddedness, and perceived benefits from DTOs—continue to discourage legal market participation in DTO-controlled territories.

Understanding these mechanisms is crucial for designing effective legalization policies. If avoidance is primarily driven by direct violence, policy interventions should focus on enhancing security and reducing DTO coercion. If anticipatory compliance or loyalty plays a greater role, strategies should weaken the social and economic ties reinforcing DTO influence. Disentangling these factors is essential, as each mechanism demands a distinct policy response to reduce reliance on illicit markets. Moreover, the potential variation across territories and over time and the likely dynamic nature of these mechanisms suggest that policies must be adaptable to different contexts and flexible enough to respond to evolving conditions.

VII. Conclusions

Following cannabis regulation in Uruguay, not all users transitioned to the legal market. This article shows that, despite a general preference for legal access, cannabis users in DTO-controlled neighborhoods avoid legal channels. In Uruguay, where DTO influence is concentrated in specific urban areas, regulatory policies such as cannabis legalization face significant limitations in these territories. From a policy perspective, our findings highlight the need for legalization strategies to account for local structural conditions, including crime rates and DTO control, which shape the reach and effectiveness of regulatory efforts.

This study underscores that policy implementation not only affects criminal behavior but is also shaped by the actions of criminal organizations. As legal markets emerge, DTOs may play an active role in shaping their evolution, reinforcing the need to consider their influence when designing and implementing regulatory frameworks.

While the precise mechanisms preventing users in DTO-controlled neighborhoods from transitioning to the legal market remain unclear, our design allows us to rule out accessibility as a primary explanation. Future research should focus on empirically identifying the mechanisms that outweigh the perceived benefits of legal market participation, whether through direct violence, anticipatory compliance, or loyalty to DTOs.

Understanding the multifaceted nature of DTO influence is critical for effective public policy design. If direct violence and anticipatory compliance dominate, policies might focus on reducing DTO control and enhancing security. Alternatively, if loyalty is more important, interventions may prioritize building trust in legal institutions and addressing the structural conditions that make illegal markets more accessible and socially embedded. Future research should disentangle the relative contributions of these mechanisms and explore their implications for policy effectiveness in promoting legal market participation in areas under DTO influence.

VIII. Acknowledgements

The authors thank Joaquín Alonso for his work as research assistant for this project. Many thanks for Jake Bowers for helping us to revise and improve the matching design.

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