Reducing Crime Without the Police?

Evidence from a Place-Based Infrastructure Intervention in Bogotá, Colombia *

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Abstract

States in the developing world face significant challenges in reducing crime, often relying on policing strategies that are ineffective or counterproductive. We investigate whether large-scale urban infrastructure projects can improve public safety without law enforcement. We study the effects of TransMiCable, a gondola lift system inaugurated in 2018 in Bogotá, Colombia, connecting the marginalized locality of Ciudad Bolívar to the city's mass transit network. Using geocoded administrative crime records from the Colombian National Police and a spatial difference-in-differences design comparing locations within 800 meters of cable car stations to nearby areas 800 meters to 2 kilometers away, we find that crime declines sharply in station catchment areas after TransMiCable is built. Quarterly crime falls by approximately 16.5 percent relative to the immediate adjacent areas. Reductions are largest for violent crime; declines in property crime are smaller and less precisely estimated. Effects begin during the construction phase, consistent with changes in activity and informal monitoring rather than post-opening commuter flows alone. Finally, we examine spillovers to connected transit nodes to assess displacement along the transport network. The results imply that large-scale urban infrastructure can generate substantial public safety benefits in high-crime settings and should be incorporated into the welfare evaluation of transport investments.

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1. Introduction

States in the developing world typically struggle to reduce crime, and suffer high costs associated with violence (Jaitman et al. 2017). Solutions that rely primarily on law enforcement, however, have proven ineffective. Police patrols may inefficiently fail to focus on areas that most need them (Mastrobuoni 2020; McMillen et al. 2019). Even when are intentionally deployed to attack crime hotspots, intensive policing interventions do not always reduce criminal activity (Collazos et al. 2021; Blattman et al. 2023), for a number of reasons. The police may be poorly-equipped to confront organized crime, which benefits from superior firepower and logistical capacities relative to the police in the developing world (Blair and Weintraub 2023). Corrupt law enforcement officials may selectively enforce the law, allowing criminal markets to flourish while undermining public trust that could facilitate information-sharing (e.g. Blair et al. 2021; Flom 2022). Militarized policing interventions so common in the developing world may also generate human rights abuses, further undermining the trust and legitimacy crucial to reducing crime (e.g. Magaloni et al. 2022; Abril et al. 2022).

Given the high social costs of crime and the relative ineffectiveness of policing in the developing world, it is important to determine whether alternative strategies, those that do not directly involve law enforcement, could be more effective in improving public safety. One promising path runs through changes to the built environment in urban settings, where violent crime is typically concentrated.[1] While existing evidence shows that environmental changes can have large effects on behavior generally, and on criminal activity in particular (Bertrand et al. 2006; Chalfin et al. 2022), this literature has focused on small-scale interventions such as tree cover, street lighting, and securing abandoned buildings (Branas et al. 2011, 2016; Chalfin et al. 2022; McMillen et al. 2019). Large-scale interventions that inaugurate potentially transformative changes to urban environments have received far less attention (Montolio 2018; Herrmann et al. 2021; Phillips and Sandler 2015).

We study the effects of a gondola lift system in Bogotá, Colombia, a city with more than 8 million residents. TransMiCable was designed to link the peripheral locality of Ciudad Bolívar with the city's mass transit system, which transports more than 1 million passengers daily. Located on the slopes of the Andes mountains and characterized by steep hills, Ciudad Bolívar has traditionally been difficult to

[1] In Colombia, the context for this study, nearly 75% of homicides occur in urban areas.

navigate via public transportation. It is also one of the most dangerous localities in Bogotá, reporting a homicide rate of 42 per 100,000 residents, nearly 1.7 times the national average. TransMiCable, therefore, offered residents the promise of reduced travel times to reach Bogotá's city center and greater state presence that might improve public safety, among other benefits. TransMiCable was inaugurated in late 2018 and runs for more than two miles.

To estimate causal effects, we combine geocoded administrative crime records from the Colombian National Police with high-frequency spatial variation around stations. Our main design is a spatial difference-in-differences specification comparing outcomes within 800 meters of TransMiCable stations to outcomes in nearby locations between 800 meters and 2 kilometers from stations. The identifying assumption is that, absent the project, crime trends would have evolved similarly in treated and comparison areas. We implement the design with flexible time effects and location fixed effects, and we present event-study estimates to assess pre-trends and dynamic responses.

Our results show that TransMiCable led to large and persistent declines in crime near stations. In the post-opening period, quarterly crime in treated station catchment areas falls by approximately 16.5 percent relative to the immediate adjacent areas. Reductions are largest for violent crime; declines in property crime are smaller and less precisely estimated. Event-study estimates show no differential pre-trends and indicate that the effects persist after the system's opening. Reductions are concentrated within an 800-meter radius of stations and dissipate beyond the station catchment, consistent with a localized change in monitoring and activity rather than broad changes across Ciudad Bolívar. The decline is driven primarily by violent crime, with smaller and less precisely estimated reductions in property crime.

The timing and spatial pattern of the effects point toward changes in local activity and monitoring as key mechanisms. Importantly, crime reductions begin during the construction phase—well before the system becomes operational and before travel-time improvements can affect commuting patterns at scale. This temporal signature is consistent with the idea that infrastructure projects can alter public space and informal surveillance through construction activity, increased local presence, and changes in perceived risk, even before riders begin using the system. While we cannot fully rule out alternative mechanisms, the construction-phase response and the strong spatial decay provide evidence that the project affected crime through local environmental changes rather than commuting flows alone.

A central concern in evaluating place-based policies is displacement. If the project merely pushes crime from station areas to other locations, either deeper into Ciudad Bolívar or along the transit network, then local reductions may not represent net gains in public safety. We therefore examine spillovers to connected nodes and corridors. Specifically, we analyze crime patterns around the BRT terminal that serves as TransMiCable's connection point, and around feeder bus stops that expanded and reorganized service in conjunction with the project. Results suggest that displacement is limited in scope: we find localized increases in street theft at feeder stops and in the immediate micro-environment of the terminal, but no comparable increases in violent crime or other property crimes, consistent with a reshuffling of opportunistic offenses rather than a full offset of the station-area reductions.

Our study contributes to multiple literatures in the economics of crime and urban economics. The economics of crime literature has shown that interventions such as hotspots policing reduce crime in developed countries, yet often face hurdles in developing nations where institutional capacity, community relations, and informal power dynamics differ significantly from those of their advanced-economy peers (Collazos et al. 2021; Blattman et al. 2021). By examining whether and how a non-policing intervention reduces crime, we add empirical evidence to broader conversations about how to shape criminals' incentives and how the state can best allocate resources within specific, marginalized urban areas.

We also contribute to the literature on the secondary effects of urban infrastructure projects, which are typically intended to improve connectivity, access to services, or jump-start economic growth. Their indirect impacts on crime and safety are increasingly recognized as critical dimensions of urban policy. Our findings underscore the importance of considering security implications in the planning and evaluation of infrastructure projects, thereby making them more cost-effective than they might initially appear.

Finally, this paper contributes to the literature on place-based interventions in urban development. The literature has studied neighborhood revitalization programs; transit-oriented development programs that encourage mixed-use development around public transit hubs; community land trusts that ensure affordable housing and prevent resident displacement; and enterprise zones that encourage businesses to locate in economically struggling areas by offering tax breaks and other incentives, among others. These interventions all focus on transforming specific geographic areas to improve social outcomes, often by altering the physical and social environments, but few have studied their effects on crime. We believe that establishing a broad set of potential solutions to crime reduction—including those implemented for reasons orthogonal to public safety—may be an intelligent wager to help improve welfare in the world's most violent places.

The remainder of the paper proceeds as follows. Section 2 describes TransMiCable and its institutional context. Section 3 outlines a simple theoretical framework. Section 4 presents the data and empirical strategy. Section 5 reports the main results and dynamic event-study estimates. Section 6 explores mechanisms, including construction-phase effects and heterogeneity. Section 7 evaluates displacement and spillovers along the transit network. Section 8 concludes with implications for infrastructure policy and public safety in high-crime cities.

2. The TransMiCable System and Ciudad Bolívar

Colombia has made substantial progress in combating drug trafficking and organized crime over the past few decades. In the early 2000s, the country veered toward state failure, as state forces—often tacitly aligned with paramilitaries—battled powerful guerrilla armies. Since then, notable achievements include the demobilization of the FARC-EP, the country's largest insurgent group. Despite these advances, Colombia still grapples with high levels of violent crime. In 2023, the national homicide rate was 21.1 per 100,000 residents, underscoring persistent struggles to reduce lethal violence.

We focus on Colombia's capital of Bogotá, which represents approximately 16% of the country's total population and 25% of its economic activity. Bogotá suffers from maladies common to many Latin American cities: high levels of violent crime (especially armed robbery), stark income inequality, and labor market informality. In 2018, the year prior to the inauguration of TransMiCable, Bogotá had an employment rate of 69%, with unemployment exceeding 10% (Departamento Administrativo Nacional de Estadística (DANE) 2018). Disparities in employment opportunities remain particularly pressing challenges for young people and for women.

Bogotá has experienced a rise in organized crime as competition for microtrafficking has intensified clashes between armed groups (Manjarrés 2022). It also consistently faces a shortage of police personnel: despite the United Nations recommending 300 officers per 100,000 residents, the city had only 65% of that rate as of mid-2024 (Infobae 2024). This shortage of active-duty police officers highlights the need for alternatives to law enforcement to address urgent security challenges.

The geographic distribution of economic opportunities in the city poses a further obstacle to prosperity and public safety: many jobs are located in the city center and the north, while lower-income neighborhoods in Bogotá's south feature far fewer opportunities. Unequal access to transportation compounds these effects, given that the city is among the largest capital cities in the world that still lacks a subway system. Wealthy *bogotanos* experience the city's record-breaking commuting times from the relative comfort of their cars, translating into less physical exhaustion, less exposure to harmful pollution (Guzman et al. 2023), and a lower probability of being victimized by crime while in transit when compared to their less economically-advantaged peers.

To improve transportation options for lower-income workers, city officials planned a gondola lift system to connect two historically marginalized areas in the city's southeast—Ciudad Bolívar and San Cristóbal—to the city's central hubs. Figure 9.1 shows the location of Ciudad Bolívar within Bogotá's city limits (panel a), along with the location of the three TransMiCable stations that were built (left side of panel b) and three more due to be built in the coming years in San Cristobal (right side of panel b). Ciudad Bolívar, one of the city's poorest and most violence-affected areas, faced significant challenges related to connectivity and economic opportunity prior to the construction of the gondola. Spanning 3.4 kilometers and comprising three stations, the system links directly to a base station that integrates with Bogotá's extensive Bus Rapid Transit (BRT) system, the largest of its kind globally (Tsivanidis 2019).

Figure 9.2 provides a timeline for the system's construction. Construction of the first station, Juan Pablo II, began in September 2016, concluded in August 2018, and service was officially initiated in December 2018 (Sarmiento et al. 2020a). The second station, Manitas, began construction in late October 2016 and was completed in August 2018. The third station, Mirador del Paraíso, began construction in January 2017 and finished in August 2018. The total cost of TransMiCable is estimated at approximately USD$109 million (Sarmiento et al. 2020b).

The socioeconomic effects of TransMiCable on the more than one million residents of Ciudad Bolívar have been documented by scholars and the media. For example, commuting times to major transportation hubs and thoroughfares of up to an hour were reduced to 15 to 20 minutes following the project's inauguration (Capital 2019).[2] Studies have also found that TransMiCable decreased perceptions of insecurity and reports of victimization (Rubio et al. 2023). Despite these encouraging results, we do not yet know whether TransMiCable reduced crime.

3. Theoretical framework

Urban cable-car systems may reshape the economic and criminogenic environment of marginalized neighborhoods along two main dimensions. First, construction and operation could increase legitimate activity around stations—more workers, supervisors, security personnel, and, once operational, flows of passengers—which raises monitoring and perceived detection risk. Second, by sharply reducing travel frictions, the system could connect previously isolated areas to the broader transit network, enabling offenders to reach higher-value targets and locations where anonymity is greater. The net effect on crime is therefore ambiguous and likely to vary across space.

To organize our empirical analysis, we develop a model of offender location choice that formalizes these mechanisms. Offenders choose among committing crime locally, committing crime downstream in the transit network, pursuing legal work, or doing nothing. Payoffs depend on target values, detection probabilities, travel costs, and legal wage opportunities. TransMiCable affects these parameters in two distinct ways: it increases monitoring and lawful activity near stations and lowers travel costs to downstream transit nodes. The model delivers clear comparative statics that generate the testable implications we take to the data.

Assume a unit mass Λ of potential offenders living in a hillside neighborhood H.[3] In each period $t \in \{0, 1, 2\}$ (pre-construction, construction, and operation, respectively), each offender chooses among three options: (i) committing a crime in one of several locations; (ii) legal work; or (iii) doing nothing. We model this as a discrete choice problem because offenders cannot simultaneously commit crimes in multiple locations within a given period: they must select a single action that maximizes their expected utility.

[2] Reporting specifically mentions Avenida Boyacá and Portal El Tunal.

[3] We treat the pool of potential offenders as fixed across periods for tractability. In principle, construction wages or improved economic opportunities could permanently reduce Λ by drawing some individuals out of the potential offender pool entirely. Our framework captures this indirectly through the legal work option, but does not model permanent exits from the offending population. Such exits would amplify the crime reduction effects we document near stations.

3.1. Locations and payoffs

Locations are denoted by:

$$\mathcal{L} = \{H_0, H_1\} \cup \{T(d) : d \in [0, \bar{D}]\},$$

where H_0 is the immediate area within a tight radius around the cable car station; H_1 is the broader hillside neighborhood; and $T(d)$ denotes bus stops—transit nodes located along the main transit corridor connecting the hillside neighborhood to the broader public transportation network—at distance d from the TransMiCable station. $d = 0$ is the bus stop closest to the TransMiCable station.

Each crime location $\ell \in \mathcal{L}$ is characterized by:

- R_ℓ: expected rent obtained per crime committed,
- p_ℓ^t: probability of detection in period t,
- τ_ℓ^t: travel or time cost from H in period t.

Offenders face a common sanction $F > 0$ if they are caught by law enforcement; this sanction does not vary by location of their arrest. Legal work in H yields a certain wage, w_H^t, in period t, while the outside option (doing nothing) yields zero utility.

We define an offender's detection probability as follows:

$$p_\ell^t \;=\; \bar{p}_\ell + \alpha E_\ell^t - \beta A_\ell^t, \tag{3.1}$$

where E_ℓ^t measures "eyes on the street" at location ℓ in period t, and A_ℓ^t denotes anonymity at the same place and time, with higher values meaning that the offender is less likely to be recognized. $\alpha > 0$ reflects that additional surveillance makes detection more likely, whereas $\beta > 0$ captures how greater anonymity makes detection less likely.

For each crime location ℓ, therefore, the expected net utility from committing a crime in period t is:

$$v_\ell^t = R_\ell - p_\ell^t(R_\ell + F) - \tau_\ell^t, \tag{3.2}$$

whereas legal work yields

$$v_L^t = w_H^t, \tag{3.3}$$

and the outside option yields

$$v_0 = 0. \tag{3.4}$$

3.2. Choice and crime intensity

Offender i chooses the action that maximizes $v_a^t + \varepsilon_{i,a}$, and choice probabilities therefore take the standard multinomial logit form.[4] The share of offenders choosing crime at location ℓ in period t is

$$\pi_\ell^t = \frac{\exp(v_\ell^t)}{\exp(v_L^t) + \exp(v_0) + \sum_{k\in\mathcal{L}} \exp(v_k^t)}. \tag{3.5}$$

Crime intensity at location ℓ is therefore

$$\lambda_\ell^t = \Lambda \pi_\ell^t. \tag{3.6}$$

3.3. The influence of TransMiCable

TransMiCable affects parameters across three moments: $t = 0$ (the pre-construction phase); $t = 1$ (the construction phase, when stations are being built, but before the system begins to function); and $t = 2$ (the operation phase, when stations are open and passengers are using the system). We assume the following:

1. **Local deterrence near stations:**

$$E_{H_0}^1 > E_{H_0}^0, \qquad E_{H_0}^2 > E_{H_0}^1, \tag{3.7}$$

$$\text{so that} \qquad p_{H_0}^1 > p_{H_0}^0, \qquad p_{H_0}^2 > p_{H_0}^1, \tag{3.8}$$

given equation (3.1). This assumption reflects the fact that both construction activities and subsequent passenger flows substantially increase the density of workers, supervisors, security personnel, and bystanders in the area of the gondola station. These changes raise the likeli-

[4] Offender i has idiosyncratic taste shocks $\varepsilon_{i,a}$ over actions $a \in \{L, 0\} \cup \mathcal{L}$, drawn independently from a Type I extreme value distribution. These shocks capture unobserved heterogeneity—individual differences in intrinsic preferences for crime versus legal work, or for traveling a greater distance to offend—that we do not model explicitly. Our framework assumes each offender commits at most one crime per period. If some offenders are particularly prolific and commit multiple crimes, the model should be interpreted as capturing the location choice for a representative criminal act, with the total number of acts scaling with offender productivity. The key comparative statics regarding location choice remain unchanged under this interpretation.

hood that offenders are observed or identified, thereby increasing the perceived probability of detection during both the construction and operational phases.

2. **Local employment:**

$$w_H^1 \geq w_H^0, \quad w_H^2 \geq w_H^1. \tag{3.9}$$

This assumption captures that the construction of the stations generates temporary employment opportunities for local residents, while the operation of the system creates a smaller but lasting set of jobs (e.g., maintenance, cleaning, security, and station services). These additional legal earnings raise the attractiveness of the lawful work option relative to crime during both the construction and operation phases.

3. **Access to trunk bus stops:**

$$\tau_{T(d)}^1 < \tau_{T(d)}^0, \quad \tau_{T(d)}^2 \leq \tau_{T(d)}^1 \tag{3.10}$$

for all $d \in [0, \bar{D}]$. This assumption reflects that both the preparation of access routes during construction and the operation of the gondola system lower the time and effort required to travel from the hillside neighborhood to the broader trunk corridor. Improvements may include temporary construction pathways, increased circulation of workers and equipment, and, once operational, fast and reliable cable car service.

Spatial variation in travel costs. Within each period, travel costs increase monotonically with distance from the cable station:

$$\frac{\partial \tau_{T(d)}^t}{\partial d} > 0, \quad \text{for all } t \in \{0, 1, 2\} \tag{3.11}$$

Reaching bus stops farther downstream along the trunk corridor requires longer trips on the feeder bus system, entailing both greater time investment and higher monetary costs (additional fares and/or multiple bus transfers). This spatial gradient is present in all periods but becomes more salient once the cable car begins to function, reducing access costs to the corridor.

4. **Anonymity gradient along trunk corridor:**

$$\frac{\partial A^t_{T(d)}}{\partial d} > 0 \quad \text{for all } t \in \{0, 1, 2\} \tag{3.12}$$

   More distant bus stops offer greater anonymity because offenders are less likely to be recognized—both by police and bystanders—in neighborhoods farther from their home area. Combined with equation (3.1), this implies that detection probability $p^t_{T(d)}$ decreases with distance d along the trunk corridor, all else equal.

5. **The anonymity-cost trade-off.** These two spatial gradients—increasing anonymity with distance and increasing travel costs with distance—create a fundamental trade-off for potential offenders. Traveling to more distant stops offers the benefit of reduced detection probability through greater anonymity, but imposes higher access costs. In the model, lower travel costs $\tau^t_{T(d)}$ increase the relative attractiveness of committing crime at downstream nodes, particularly for offenders whose expected benefits (greater rents in more affluent neighborhoods) are sufficient to justify the additional travel investment. This trade-off likely generates spatial heterogeneity in crime displacement patterns: offenses with higher expected returns may displace farther along the corridor, while lower-value crimes may concentrate closer to the gondola station where access costs are lowest.

For reference, Table 3.1 summarizes how TransMiCable shifts key parameters over time and the predicted net effect on crime at each location type.

Table 3.1. Summary of parameter shifts induced by TransMiCable

Parameter	Meaning	$t = 0$	$t = 1$	$t = 2$	Interpretation	Predicted net effect on crime
$E^t_{H_0}$	Eyes on the street near station	baseline	↑	↑↑	More workers, supervisors, and passengers near stations	H_0: ↓↓
w^t_H	Local legal wage in hillside neighborhood	baseline	↑	↑ / ↑↑	Construction jobs and persistent station-related employment	All locations: ↓
$\tau^t_{T(d)}$	Travel cost from H to trunk stop at distance d	high	↓	↓↓	Improved access routes and faster travel via cable car	$T(d)$: ↑
$A^t_{T(d)}$	Anonymity at trunk stop $T(d)$	gradient in d	gradient in d	gradient in d	Lower near stations, higher at more distant stops	Enables displacement to distant d
$p^t_{T(d)}$	Detection probability at trunk stop $T(d)$	gradient in d	gradient in d	gradient in d	Higher near stations, lower at more distant, anonymous stops	$T(d)$: ↑ strongest at intermediate d

Note: ↑ denotes an increase, ↑↑ denotes a large increase, and ↓ denotes a decrease. All changes are relative to the pre-construction baseline ($t = 0$).

3.4. Modeling choices

The model as presented below deliberately abstracts away from important details to maintain tractability and focus on the core trade-offs. We briefly note the most important omissions and our rationale for excluding them.

First, we hold target values R_ℓ constant across periods. In principle, the influx of construction workers, supervisors, and passengers could increase the value of targets near stations (e.g., more people carrying cash or valuables). However, we do not focus on this channel because we believe that the deterrence effect—through increased monitoring and detection risk—will likely dominate in the immediate station area, and because we can test for changes in target values empirically by examining the composition of crimes. If target values rise substantially, we would expect to see shifts toward higher-value crimes like robbery rather than uniform reductions across crime types.

Second, the model does not explicitly incorporate how the cable car might increase foot traffic and legitimate economic activity at bus stops themselves, not just at stations. If this spillover effect is large, it could raise detection risk at nearby trunk stops and attenuate any crime displacement. While we expect increases in activity occur at the stations themselves, with more modest effects at adjacent bus stops, any such spillovers would bias our displacement effects to the trunk corridor towards zero. In other words, if we identify such displacement effects, we should think of them as a lower bound on the true effects.

Third, we do not model gang territorial dynamics or strategic enforcement responses by police. Gangs might reallocate members or redraw boundaries in response to new infrastructure, and police might shift patrols toward newly accessible areas. These dynamics could either amplify or dampen the effects that we model. However, incorporating strategic interactions between multiple criminal organizations and the state would require a much richer framework and would complicate the derivation of testable predictions. Our approach captures the net effect of all these forces on offender location choices, the object of primary interest for our empirical analysis.

Finally, we treat travel costs τ_ℓ^t broadly to include not only physical travel time and monetary costs, but also psychological frictions such as fear of traveling on unfamiliar routes, lack of information about distant locations, or social norms against leaving the neighborhood. If these non-pecuniary frictions are substantial for a large share of potential offenders, displacement to downstream nodes may be much smaller in magnitude than the local crime reductions observed at stations. Our comparative statics therefore speak to the *direction* and relative *location* of crime shifts, rather than implying that crimes prevented near stations are fully reallocated elsewhere in the network.

3.5. Local crime near stations

We first show that increasing eyes on the street or local wages reduces crime in the immediate station area.

Proposition 1 (Local crime reduction near stations)**.** *Holding R_{H_0} and $\tau_{H_0}^t$ fixed, and holding all other v_k^t for $k \neq H_0$ fixed, crime near the station strictly decreases when either (i) $E_{H_0}^t$ increases or* *(ii)* w_H^t *increases. More formally, we can say:*

$$\frac{\partial \lambda_{H_0}^t}{\partial E_{H_0}^t} < 0, \qquad \frac{\partial \lambda_{H_0}^t}{\partial w_H^t} < 0.$$

Intuitively, more eyes on the street will raise detection probabilities and thus lower the expected net returns to crime in H_0, while higher local wages will raise the payoff from legal work and shift offenders away from crime.

Under the assumptions above, moving from $t = 0$ to $t = 1$ and then to $t = 2$ increases both $E_{H_0}^t$ and w_H^t. As such, Proposition 1 implies a decline in crime near gondola stations during construction that should continue after the stations open and begin serving passengers.

For the broader hillside neighborhood H_1, we expect qualitatively similar effects to those at H_0, but of smaller magnitude. The increased monitoring and employment effects should extend throughout the neighborhood, though they will be most concentrated near the station itself. Empirically, we test whether crime reductions are larger in the immediate station vicinity compared to the broader neighborhood, consistent with this spatial gradient in treatment intensity.

3.6. Displacement to trunk bus stops and distance gradients

We now consider the change in crime at trunk bus stops induced by TransMiCable. These stops are indexed by their distance d from the gondola stations. To simplify, fix a particular distance d and suppress other crime locations. Consider the binary choice between committing crime at H_0 and at $T(d)$, ignoring legal work and the outside option. The share of offenders who choose $T(d)$ is:

$$\tilde{\pi}_{T(d)}^t = \frac{\exp(v_{T(d)}^t)}{\exp(v_{T(d)}^t) + \exp(v_{H_0}^t)}. \tag{3.13}$$

As such, total crime is defined as $\tilde{\lambda}_{T(d)}^t = \Lambda \tilde{\pi}_{T(d)}^t$.

Proposition 2 (Travel cost and displacement to trunk bus stops)**.** *Holding* $v_{H_0}^t$ *fixed, a reduction in travel cost* $\tau_{T(d)}^t$ *increases crime at* $T(d)$*:*

$$\frac{\partial \tilde{\lambda}_{T(d)}^t}{\partial \tau_{T(d)}^t} < 0.$$

Moreover, for a common change in travel cost $\Delta\tau < 0$ applied at all d, the increase in crime at $T(d)$ is larger where the baseline utility $v^t_{T(d)}$ (and hence baseline share $\tilde{\pi}^t_{T(d)}$) is higher.

The first part of Proposition 2 reflects a simple substitution effect: once access to a bus stop becomes cheaper, its relative attractiveness as a site for crime increases. The second part highlights that this effect is strongest at more distant stops where anonymity is higher and detection risk is lower, which in the model raises $v^t_{T(d)}$.

By assumption, for small d near the station, $E^t_{T(d)}$ is high and anonymity is low, so $p^t_{T(d)}$ is relatively high and $v^t_{T(d)}$ is low. For intermediate d, anonymity rises and $p^t_{T(d)}$ falls, so $v^t_{T(d)}$ is higher. Proposition 2 then implies that a common reduction in travel cost $\tau^t_{T(d)}$ during construction and operation produces stronger crime increases at more distant bus stops when compared to bus stops immediately adjacent to gondola stations, consistent with spatially selective displacement.

3.7. The extensive margin: reallocation versus new entry into crime

An important distinction in interpreting displacement effects concerns whether improved access reallocates existing offenders across locations or induces new entry into criminal activity. The model allows for both channels, and here we make the mechanisms more explicit.

A reduction in $\tau^t_{T(d)}$ can draw new offenders into crime, not simply reallocate existing offenders across locations. Before TransMiCable, some residents of H may have preferred legal work or inactivity because the expected return to crime at any location, including within H, was too low. By reducing the cost of reaching downstream transit nodes where anonymity is higher and potential victims are of higher value (because they come from more affluent environments), the system can raise $v^t_{T(d)}$ above both v^t_L and v_0, thereby inducing crime participation among individuals who would not have offended in the absence of the infrastructure improvement. In the model, this appears as a shift in the extensive margin: a decrease in π^t_L or π^t_0 and a corresponding increase in $\sum_d \pi^t_{T(d)}$.

At the same time, higher local wages w^t_H and increased monitoring $E^t_{H_0}$ can push individuals out of crime entirely, raising π^t_L and π^t_0. The net effect on total crime therefore depends on the relative strength of these opposing forces. Put simply, if the deterrence and wage effects dominate, total crime falls even as some offenses are displaced to the trunk corridor. If the access effect dominates, total crime may rise, with increases concentrated at newly accessible nodes along the bus network.

Importantly, this means the model does not imply a one-for-one relationship between crime reductions near stations and crime increases at bus stops. Changes in detection risk and legal opportunities affect the total volume of criminal activity, while changes in travel costs affect its spatial distribution. Empirically, we assess the net impact on total crime by aggregating across all locations in the network, and we distinguish reallocation from new entry by examining whether increases in trunk-corridor crime fully offset reductions near stations.

3.8. Crime distribution along the transit network

The analysis above focuses on crime at a given trunk stop $T(d)$ relative to the immediate station area H_0. The full model, however, enables us to provide a complete allocation of crime across all locations in the network. At any period t, total crime is

$$\sum_{\ell \in \mathcal{L}} \lambda_\ell^t = \Lambda \sum_{\ell \in \mathcal{L}} \pi_\ell^t = \Lambda \left(1 - \pi_L^t - \pi_0^t\right),$$

such that changes in monitoring, wages, or travel costs affect both the overall volume of crime (through π_L^t and π_0^t) and its spatial distribution across $\mathcal{L}$.

Conditional on choosing the crime option, the share of offenses occurring at location ℓ is

$$\Pr(\ell \mid \text{crime}, t) = \frac{\pi_\ell^t}{\sum_{k \in \mathcal{L}} \pi_k^t} = \frac{\exp(v_\ell^t)}{\sum_{k \in \mathcal{L}} \exp(v_k^t)}.$$

Holding the outside options $(L, 0)$ fixed, any change in $\{v_\ell^t\}_{\ell \in \mathcal{L}}$ only reallocates crime across locations without changing the total volume of offenses. In particular, a reduction in $\tau_{T(d)}^t$ shifts crime mass toward trunk stops, with the relative increase at each $T(d)$ proportional to $\exp(v_{T(d)}^t)$.

Combining this with the anonymity gradient on the trunk, $A_{T(d)}^t$ increasing in d and hence $p_{T(d)}^t$ decreasing in d, implies that improved access tilts the distribution of crime toward those downstream stops where $v_{T(d)}^t$ is highest. In our setting, these are the more distant, more anonymous stops along the corridor, rather than the stops adjacent to the stations where monitoring remains high. This is the network-level counterpart to Proposition 2 and motivates our focus on distance gradients in the empirical analysis.

3.9. Crime displacement during construction

Finally, we show that if construction simultaneously raises deterrence near stations and lowers travel costs to bus stops, crime displacement can arise *even during the construction phase*, before operation occurs. This can happen for a few reasons. Construction requires the creation or upgrading of access paths for machinery, materials, and work crews, which effectively lowers the physical barriers that previously made it costly or time-consuming to descend the hillside. These new or improved paths—often graded, cleared, lit, and regularly used by workers—increase the reliability and safety of movement from the neighborhood to the rest of the transportation network. In addition, the continuous flow of construction personnel and vehicles creates informal transportation opportunities and reduces the perceived risk of traveling alone on previously isolated routes. As a result, even before the gondola begins service, the effective travel cost of reaching bus stops elsewhere falls relative to baseline conditions. Finally, new economic opportunities in the immediate surroundings of the TransMiCable construction area could create profitable and licit outside options for criminals.

Proposition 3 formalizes the insight that construction can trigger displacement through the combination of local deterrence increases and travel cost reductions, even before the gondola system begins passenger service.

Proposition 3 (Construction-induced displacement)**.** *Suppose that from $t = 0$ (pre-construction) to $t = 1$ (construction) we have:*

1. $E^1_{H_0} > E^0_{H_0}$ *and* $w^1_H \geq w^0_H$*, so that* $v^1_{H_0} < v^0_{H_0}$ *by Proposition 1,*
2. *for some* d*,* $\tau^1_{T(d)} < \tau^0_{T(d)}$ *while* $p^1_{T(d)} = p^0_{T(d)}$ *and* $R_{T(d)}$ *is unchanged, so that* $v^1_{T(d)} > v^0_{T(d)}$*.*

Then the share of offenders committing crime at $T(d)$ increases between $t = 0$ and $t = 1$, and the share committing crime at H_0 decreases.

In other words, construction can trigger both a reduction in local crime near TransMiCable stations and a reallocation of crime to newly accessible bus stops, even before the gondola system starts operating.

3.10. Implications and testable predictions

The model yields sharp comparative statics that guide our empirical analysis. Higher monitoring or legal earnings around stations lower the relative payoff of committing crime in the immediate station area, reducing local crime during both construction and operation. Lower travel costs to downstream transit nodes raise the relative payoff of committing crime at those nodes, especially where recognition risk is already low. Importantly, because construction activities simultaneously increase monitoring at H_0 and reduce the effective cost of reaching the trunk corridor, these forces operate even before passenger service begins. The spatial structure of anonymity implies that displacement should be weakest at bus stops adjacent to stations and strongest at intermediate distances where anonymity is higher but travel costs are manageable.

These predictions map directly to our empirical strategy. We test whether crime declines near stations during construction and operation (Proposition 1), whether crime rises at trunk bus stops that become more accessible (Proposition 2, first part), whether displacement exhibits the predicted distance gradient along the corridor (Proposition 2, second part), and whether these patterns emerge during construction as well as operation (Proposition 3). By examining total crime across the network, we can also assess whether the net effect represents pure reallocation or whether deterrence and wage effects reduce overall criminal activity.

4. Data and Empirical Strategy

4.1. Crime Data and Spatial Units

We combine data from three sources. First, we use incident-level and geocoded administrative crime records covering January 2011 to December 2020. These data include the date, time, and offense type, and we focus on index crimes that most closely correspond to the FBI's Uniform Crime Reports (UCR).[5] Second, we assemble administrative data for each TransMiCable station, including construction start and end dates and the official opening date. Third, we use block-level census data from the Colombian National Statistics Agency to assess treatment selection by comparing pre-treatment characteristics of blocks with and without stations.

[5] The Colombian National Police uses crime definitions that differ from the FBI's UCR categories.

4.2. Identification strategy and estimation

Our objective is to estimate the causal effect of TransMiCable's construction and inauguration on neighborhood crime rates. We construct a quarterly panel of crime counts at the level of 100-meter grid cells and merge it with precise information on the location and timing of each station's construction and opening. Exploiting the staggered rollout, we compare changes in crime over time between grid cells just inside a station's catchment area and immediately adjacent grid cells just outside it. This spatial difference-in-differences design absorbs time-invariant grid-cell characteristics and accounts for common temporal shocks, leveraging within-area changes over time to estimate the effect of new cable-car access on local crime incidence.

In an ideal setting, we would randomly assign TransMiCable stations to neighborhoods and estimate their causal impact on crime by comparing treated and untreated areas. In practice, however, station placement is determined by planning priorities and is not random. Table 10.1 illustrates this by comparing key characteristics across three areas: Bogotá as a whole, Ciudad Bolívar (where the first TransMiCable line was built), and San Cristóbal (a locality selected for future expansion).

Ciudad Bolívar differs in several dimensions from Bogotá as a whole, including higher baseline crime and lower access to transit infrastructure. As a result, comparing treated grid cells in Ciudad Bolívar to the average Bogotá grid cell would conflate the effect of the intervention with broader structural differences across the city. To address this concern, we restrict the main analysis to within-locality comparisons, adopting a spatial difference-in-differences strategy that contrasts changes in crime over time between grid cells near TransMiCable stations and nearby grid cells farther away, all within Ciudad Bolívar. By restricting comparisons to proximate areas, we mitigate concerns about unobserved confounders that vary across neighborhoods. Following prior work on geographically localized interventions (Donohue et al. 2013; Albouy et al. 2020; Diamond and McQuade 2019; Linden and Rockoff 2008; Di Tella and Schargrodsky 2004), we define control areas as grid cells that are contiguous in any direction and located up to 2 km from a station.

While this within-locality comparison forms the core of our empirical strategy, we also leverage the planned expansion of the cable car system to San Cristóbal. Although Ciudad Bolívar differs from the citywide average, it is remarkably similar to San Cristóbal across most observed pre-treatment characteristics. Both are located on the urban periphery, face limited transit connectivity, and exhibit elevated levels of crime. These similarities allow us to use San Cristóbal as a credible counterfactual for Ciudad Bolívar in a triple-differences framework.

4.3. Spatial Exposure Framework

We begin by empirically characterizing the geographic reach of the TransMiCable intervention. We estimate a flexible spatial difference-in-differences model that traces how the impact of station openings varies with distance, using concentric distance bands around each station. Our identifying assumption is that, absent the intervention, crime would have evolved similarly across grid cells at different distances from a station. Restricting comparisons to geographically proximate areas helps limit bias from unobserved, time-varying confounders. Formally, we estimate:

$$Crime_{g,n,t} = \sum_j \beta_j \, \mathbb{1}\{g \in \mathcal{R}_j\} \times \text{Post}_t \; + \; \alpha_g \; + \; \delta_t \; + \; \varepsilon_{g,n,t}, \tag{4.1}$$

where $Crime_{g,t}$ is the number of violent or property crimes in 100-meter grid cell g in quarter-year t.[6] The term $\mathbb{1}\{g \in \mathcal{R}_j\}$ indicates whether grid cell g lies within distance band j meters of its nearest TransMiCable station, where $j \in \{$0–200, 200–400, 400–600, 600–800, 800–1000$\}$. These indicators are interacted with Post_t, an indicator equal to one for quarters in 2019 and later, corresponding to the beginning of TransMiCable operations. The specification includes grid-cell fixed effects α_g, and quarter-by-year fixed effects δ_t. Grid cells located between 1 km and 2 km from any station serve as the comparison group. The coefficients β_j therefore capture the post-opening change in crime for each distance band relative to this control group.

This specification flexibly traces how treatment effects vary with distance. As shown in Figure 9.4, the estimated effects are largest for grid cells closest to the stations and decline with distance, becoming negligible beyond 800 meters. Guided by this pattern, we define grid cells within 800 meters of a station as exposed in subsequent average treatment effect models, and use grid cells

[6]In our baseline specifications, we model crime using the inverse hyperbolic sine transformation, $\text{asinh}(y) = \ln\Big(y + \sqrt{y^2+1}\Big)$, to accommodate the mass of zeros while remaining in a linear framework that facilitates staggered-adoption difference-in-differences estimators.

located between 800 and 2000 meters as comparisons. This threshold aligns with the observed spatial decay and with commuting patterns in Bogotá, where residents walk on average approximately 800 meters to reach public transit (Munoz-Raskin 2010).

4.4. Estimating Localized Crime Effects of TransMiCable

Guided by the spatial decay patterns documented above, we estimate the average treatment effect of TransMiCable on crime by comparing grid cells within 800 meters of a station to those located between 800 meters and 2 kilometers away. The estimating equation is:

$$Crime_{g,n,t} = \beta \cdot \mathbb{1}[\text{Distance}_g \leq 800] \times \text{Post}_t + \alpha_g + \delta_t + \varepsilon_{g,n,t} \tag{4.2}$$

where the notation follows Equation (4.1). The coefficient β captures the average post-opening change in crime for grid cells near TransMiCable stations relative to more distant comparison areas.[7] As in our spatial exposure analysis, we include grid cell fixed effects α_g, and quarter-year fixed effects δ_t. Standard errors are clustered at the neighborhood level.

4.5. Dynamic Effects and Assessment of Pre-Trends

To examine how the effects of TransMiCable station openings evolve over time and to assess the plausibility of the parallel trends assumption, we estimate an event-study specification aligned to the system's inauguration. Although infrastructure construction was staggered, all stations began operations simultaneously in 2018, resulting in a single-treatment-time setting. The event study, therefore, traces the dynamic response to the availability of the service, rather than to the start of construction.

We estimate the following model:

[7] Because IHS-based estimates can be sensitive to the units of measurement and have interpretation nuances when outcomes have a mass at zero, we keep the crime measure on a fixed scale throughout and report robustness using linear models in levels as well as Poisson pseudo-maximum likelihood and negative binomial specifications (Aihounton and Henningsen 2021; Mullahy and Norton 2024; Wooldridge 2023).

$$Crime_{g,n,t} = \sum_{g=-G}^{G} \beta_q \cdot \mathbb{1}[q = t - T] \cdot \mathbb{1}[\text{Distance}_i \leq 800] + \alpha_i + \delta_t + \varepsilon_{g,n,t} \tag{4.3}$$

where T is the quarter of inauguration, and q indexes event time relative to that quarter. The coefficients β_q capture the evolution of crime in grids located within 800 meters of a station, relative to grids located between 800 and 2000 meters away, with the previous quarter, and the rest follows Equation (4.1).

This specification allows us to evaluate whether the two groups followed similar pre-trends and to assess the timing and persistence of post-inauguration effects. Since the timing of treatment is uniform across units, concerns related to two-way fixed effects under staggered adoption do not apply directly (Sun and Abraham 2021; Goodman-Bacon 2021).

In later sections, we examine the role of station construction as a potential mechanism. Although all stations opened simultaneously, construction proceeded on a staggered schedule and may have affected local crime patterns prior to inauguration. In particular, increased activity around construction sites may have led to greater surveillance, consistent with the "eyes on the street" mechanism, or changes in policing or community presence. By exploiting variation in the timing of construction starts, we isolate this channel separately from the effect of operational transit service.

5. Crime Falls Near Gondola Stations

5.1. Baseline Results

Table 10.2 reports the baseline estimates of the effect of TransMiCable station openings on quarterly crime outcomes. We estimate the specification described in Equation (4.2) using the inverse hyperbolic sine (IHS) transformation of crime counts as our main outcome. The analysis compares grid cells located within 800 meters of a station to grid cells located between 800 meters and 2 kilometers away, before and after the inauguration of the system.

The results indicate statistically significant reductions in crime in areas near the stations following the intervention. Column (1) shows that total crime declined by approximately 6.1 percent. Column

(2) reveals that violent crime experienced a larger reduction of approximately 6.9 percent. The estimated effect on property crime in column (3) is negative but not statistically significant at conventional levels, suggesting that the crime reductions are driven primarily by violent offenses.

Appendix Table A.1 presents estimates from alternative model specifications to assess the sensitivity of our findings. Column (1) reproduces the main IHS results, while columns (2) through (4) report estimates from OLS with untransformed counts, Poisson regression, and negative binomial models, respectively. Although the magnitudes are not directly comparable across estimators due to differences in functional form, the sign and significance patterns provide a useful robustness check. Taken together, these results suggest that the estimated crime reductions—particularly for violent offenses—are not driven by the choice of functional form.

Overall, the evidence indicates that the opening of TransMiCable stations led to meaningful reductions in crime in nearby areas, with the strongest and most robust effects observed for violent crime. We now explore the timing of these effects and test for the presence of anticipatory dynamics prior to the system's inauguration.

5.2. Dynamic Effects around the Station Opening

Figure 9.5 presents event-study estimates of the effect of TransMiCable station openings on crime in nearby areas, using the two-way fixed effects specification described in Equation (4.3). The figure plots quarterly estimates of the difference in crime between blocks located within 800 meters of a station and those located farther away, relative to the quarter preceding the system's inauguration.

Consistent with the baseline DiD results, we observe a clear decrease in crime following the system's opening. The reduction appears shortly after Q3 2018, the date of inauguration, and persists over subsequent quarters. This pattern reinforces our interpretation that the availability of the cable car system contributed to improving public safety in nearby areas.

6. Crime Reductions Begin During Construction

Figure 9.5 shows that crime falls sharply after the system begins operating, but also reveals that reductions begin several quarters earlier, during the construction phase. Construction started in Q3

2016 at Juan Pablo II, followed by Manitas in Q4 2016 and El Paraíso in Q1 2017, with all stations completed by Q3 2018. The fact that crime begins to decline around the onset of these staggered construction start dates suggests that the intervention may have affected local criminal activity before passenger service began.

To isolate these construction-phase effects, we exploit variation in the timing of construction starts across stations and estimate event-study effects aligned to the quarter in which construction begins. Because treatment timing is staggered and treatment effects may be heterogeneous over event time, conventional two-way fixed effects event studies can yield biased dynamic estimates. We therefore use the regression-based estimator proposed by Gardner (2022), which estimates event-time coefficients by comparing not-yet-treated and already-treated areas while flexibly aggregating across cohorts. This approach is well-suited to our setting because it accommodates high-dimensional fixed effects and allows us to trace the evolution of crime around construction start without relying on the implicit weighting assumptions in standard TWFE designs.

Figure 9.6 reports the resulting construction event-study estimates for total, violent, and property crime in grid cells located within 800 meters of a station, relative to the 800–2,000 meter comparison area. Pre-treatment estimates are close to zero and generally statistically indistinguishable from zero, providing support for the parallel trends assumption, while crime declines sharply beginning shortly after construction starts and remains persistently lower through the remainder of the construction period. The timing of these reductions is consistent with our theoretical model, which proposed that construction could have lowered physical barriers to descending the hillside, even before the system began to function.

These construction-phase effects also raise the possibility that the intervention reshaped the spatial allocation of crime rather than reducing it uniformly. In particular, if construction and subsequent operation increased monitoring near stations while simultaneously improving access to the broader transit network, offenders may have shifted activity toward other locations that became easier to reach or offered greater anonymity. In the next section, we test for spatial displacement by examining whether crime increases at downstream transit nodes and adjacent areas as crime declines near TransMiCable stations.

7. Displacement and Network Spillovers

7.1. Terminal Spillovers: The Tunal Node

The terminal station (Portal Tunal) is a natural place to look for displacement and network spillovers. Unlike the intermediate gondola stations, Tunal functions as a transfer node into the TransMilenio BRT system and concentrates passenger flows, commercial activity, and waiting time. These features may generate different crime responses than those observed near the hillside stations, potentially combining deterrence effects with changes in target density and opportunity.

Table 10.3 uses the Gardner (2022) two-stage estimator to compare crime dynamics near the three intermediate stations (within 800 meters) to a finer distance gradient around Tunal, split into 200-meter bands. As before, we distinguish the construction period from the post-opening period. The results confirm large and persistent reductions in crime near the intermediate stations: during construction, total crime falls by 0.094 IHS points (s.e. 0.026), and after opening the decline reaches 0.208 IHS points (s.e. 0.030), with sizeable reductions in both violent and property crime.

In contrast, the response around Tunal is heterogeneous across distance bands and not monotonic. During construction, crime declines at distances between 200 and 800 meters from the terminal (e.g., total crime falls by 0.104 IHS points at 200–400m and by 0.155 at 400–600m), but the area immediately adjacent to the terminal exhibits a different pattern: within 200 meters, total and property crime *increase* (0.108 and 0.138 IHS points, respectively), even as violent crime declines. After TransMiCable opens, estimated effects remain spatially uneven: total crime falls in the 200–400m band (-0.229 IHS points, s.e. 0.090) and property crime declines in the 400–600m band, while effects within 200 meters are imprecisely estimated but continue to suggest elevated property crime.

This non-monotonic distance pattern is consistent with a shift in the spatial distribution of criminal activity toward the terminal micro-environment. One interpretation is that increased monitoring and activity around the system may deter violence more broadly, while the terminal itself generates concentrated opportunities for non-violent offenses (e.g., theft and pickpocketing) due to crowding, transfers, and short-duration interactions. The fact that increases are concentrated in the closest band, while crime declines in surrounding bands, is also suggestive of localized displacement toward the node rather than uniform spillovers.

In the next subsection, we extend this analysis to test more directly for displacement and network spillovers beyond the terminal, examining whether crime rises in connected transit nodes and feeder corridors as crime falls in the immediate station catchment areas.

7.2. Spillovers to Feeder Bus Stops

A critical question in urban economics and the study of place-based interventions is whether crime reductions near new infrastructure represent an aggregate decrease in criminal activity or a mere spatial displacement to other nodes within the transit network (Phillips and Sandler 2015). To investigate these potential network spillovers, we extend our analysis to the local bus stops of the SITP (*Sistema Integrado de Transporte Público*) that serve as feeders for the TransMiCable system (i.e., Zonal Component). These locations are essential for "last-mile" connectivity and often serve as focal points for pedestrian aggregation in marginalized areas, such as Ciudad Bolívar.

Using the Gardner (2022) estimator to account for the staggered adoption and potential treatment effect heterogeneity, we identify significant spillover effects that are highly specific to the nature of the offense. Our results indicate that while crime decreases in the immediate vicinity of the TransMiCable stations, there is evidence of a diffusion of costs toward the feeder network. Specifically, we find that the reduction in property crime near the gondola stations is accompanied by an increase in reports of thefts from persons and cell phone thefts at nearby bus stops (Figures 10 and 11). This suggests that offenders, deterred by the high visibility and "eyes on the street" at the main stations (Jacobs 1961), strategically relocate to these secondary nodes where surveillance is less consistent.

However, this displacement effect does not generalize to all crime categories. We find no significant effects on other types of property crime, such as burglaries or motor vehicle thefts (Figures 12 and 13). This distinction is theoretically consistent: while increased pedestrian traffic and state presence at transit nodes may deter or shift street crime, they are unlikely to affect crimes that occur in private settings or involve motorized logistics away from the immediate vicinity of the bus stops. These results mirror findings in the transport-crime literature, suggesting that transit improvements primarily affect the safety of the immediate public environment rather than influencing broader residential security dynamics (Herrmann et al. 2021; Montolio 2018).

Furthermore, we do not identify significant changes in violent crimes that typically occur within private domains, such as domestic violence (Figure 14). This stability in domestic violence rates near feeder stops serves as a crucial placebo test for our identification strategy. While place-based interventions can theoretically improve overall quality of life and reduce community-level stress, the immediate "eyes on the street" mechanism is inherently limited to the public sphere. The fact that we observe significant reductions in street-level thefts but a null effect on household violence suggests that our findings are not driven by a generic, locality-wide downward trend in all types of crime. Instead, the results are consistent with a specific deterrent effect tied to the transformation of the built environment and the resulting change in the probability of being observed in public spaces, while leaving the socio-behavioral drivers of violence inside the household untouched.

In sum, the evidence suggests that the TransMiCable system generates a complex spatial reshuffling of criminal activity. Rather than a pure diffusion of benefits, we observe a diffusion of costs where street-level crimes are pushed "downstream" toward the SITP feeder network. This highlights the strategic nature of offenders as documented by Phillips and Sandler (2015) and underscores the importance of considering network-wide security when implementing large-scale urban infrastructure projects (Montolio 2018; Herrmann et al. 2021).

8. Conclusion

This paper provides new evidence on the potential for urban infrastructure to improve public safety. We study the introduction of TransMiCable, a gondola lift system in Bogotá, Colombia, designed to improve transit access for residents in a highly marginalized locality. Using geo-located administrative crime data and a spatial difference-in-differences design, we find that the inauguration of the system led to significant and persistent reductions in crime near stations. These effects are concentrated within 800 meters of gondola stations and hold across multiple crime categories, including violent crime and domestic violence.

The timing and spatial concentration of these effects suggest that increased pedestrian activity—consistent with "eyes on the street" dynamics—likely plays a key role. These results highlight the potential for non-policing, place-based interventions to generate meaningful improvements in public safety.

Our findings carry implications for urban policy in contexts marked by limited law enforcement capacity and deep inequalities in access to infrastructure. While policing remains a central pillar of crime prevention strategies, these results suggest that complementary investments in the built environment can yield substantial co-benefits for security. We highlight the value of integrating urban planning, transport policy, and crime prevention strategies. Rather than treating these areas in isolation, governments could achieve greater impact by designing infrastructure projects with explicit attention to their potential safety spillovers. Importantly, the improvements to public safety from the gondola lift system occurred in one of Bogotá's most underserved areas, suggesting that place-based investments in marginalized neighborhoods can reduce spatial inequality not only in access to services, but also in exposure to violence.

While our study focuses on a single intervention in one urban setting, the results may extend to other cities in the Global South that face similar challenges of inequality, informality, and weak state presence. Future research should examine whether similar transit-oriented infrastructure projects yield comparable benefits in other contexts.

References

Abril, V., Perez-Vincent, S. M., Tobon, S., and Vanegas-Arias, M. (2022). How to measure public trust in the police? a framework with an application for Colombia.

Aihounton, G. B. and Henningsen, A. (2021). Units of measurement and the inverse hyperbolic sine transformation. *The Econometrics Journal*, 24(2):334–351.

Albouy, D., Christensen, P., and Sarmiento-Barbieri, I. (2020). Unlocking amenities: Estimating public good complementarity. *Journal of Public Economics*, 182:104110.

Bertrand, M., Mullainathan, S., and Shafir, E. (2006). Behavioral economics and marketing in aid of decision making among the poor. *Journal of Public Policy & Marketing*, 25(1):8–23.

Blair, G., Weinstein, J. M., Christia, F., Arias, E., Badran, E., Blair, R. A., Cheema, A., Farooqui, A., Fetzer, T., Grossman, G., Haim, D., Hameed, Z., Hanson, R., Hasanain, A., Kronick, D., Morse, B. S., Muggah, R., Nadeem, F., Tsai, L. L., Nanes, M., Slough, T., Ravanilla, N., Shapiro, J. N., Silva, B., Souza, P. C. L., and Wilke, A. M. (2021). Community policing does not build citizen trust in police or reduce crime in the global south. *Science*, 374(6571):eabd3446.

Blair, R. A. and Weintraub, M. (2023). Little evidence that military policing reduces crime or improves human security. *Nature Human Behaviour*, 7(6):861–873.

Blattman, C., Duncan, G., Lessing, B., and Tobon, S. (2023). State-building on the margin: An urban experiment in medellín. Working Paper 29692, National Bureau of Economic Research.

Blattman, C., Green, D., Ortega, D., and Tobón, S. (2021). Place-Based Interventions at Scale: The Direct and Spillover Effects of Policing and City Services on Crime. *Journal of the European Economic Association*, 19(4):2022–2051.

Branas, C. C., Cheney, R. A., MacDonald, J. M., Tam, V. W., Jackson, T. D., and Ten Have, T. R. (2011). A difference-in-differences analysis of health, safety, and greening vacant urban space. *American journal of epidemiology*, 174(11):1296–1306.

Branas, C. C., Kondo, M. C., Murphy, S. M., South, E. C., Polsky, D., and MacDonald, J. M. (2016). Urban blight remediation as a cost-beneficial solution to firearm violence. *American journal of public health*, 106(12):2158–2164.

Callaway, B. and Sant'Anna, P. H. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2):200–230.

Capital, C. (2019). Conozca cómo transmicable le cambió la vida a los habitantes de ciudad bolívar. Accessed: 2024-10-01.

Chalfin, A., Hansen, B., Lerner, J., and Parker, L. (2022). Reducing crime through environmental design: Evidence from a randomized experiment of street lighting in new york city. *Journal of Quantitative Criminology*, 38(1):127–157.

Collazos, D., García, E., Mejía, D., Ortega, D., and Tobón, S. (2021). Hot Spots Policing in a High-Crime Environment: An Experimental Evaluation in Medellin. *Journal of Experimental Criminology*, 17:473–506.

Departamento Administrativo Nacional de Estadística (DANE) (2018). Boletín técnico: Mercado laboral - diciembre 2018. Technical report, DANE.

Di Tella, R. and Schargrodsky, E. (2004). Do police reduce crime? Estimates using the allocation of police forces after a terrorist attack. *The American Economic Review*, 94(1):115–133.

Diamond, R. and McQuade, T. (2019). Who wants affordable housing in their backyard? an equilibrium analysis of low income property development. *Journal of Political Economy*.

Donohue, J., Ho, D., and Leahy, P. (2013). Do police reduce crime? *Empirical Legal Analysis: Assessing the Performance of Legal Institutions*, page 125.

Flom, H. (2022). *The informal regulation of criminal markets in Latin America*. Cambridge University Press.

Gardner, J. (2022). Two-stage differences in differences. *arXiv preprint arXiv:2207.05943*.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, 225(2):254–277.

Guzman, L. A., Beltran, C., Morales, R., and Sarmiento, O. L. (2023). Inequality in personal exposure to air pollution in transport microenvironments for commuters in bogotá. *Case Studies on Transport Policy*, 11:100963.

Herrmann, C. R., Maroko, A. R., and Taniguchi, T. A. (2021). Subway station closures and robbery hot spots in new york city understanding mobility factors and crime reduction. *European Journal on Criminal Policy and Research*, 27(3):415–432.

Infobae (2024). Menos policías en bogotá: alertan por déficit de pie de fuerza para contrarrestar la delincuencia. https://www.infobae.com/colombia/2024/09/25/menos-policias-en-bogota-alertan-por-deficit-de-pie-de-fuerza-para-contrarrestar-la-delincuencia/. Accessed: October 1, 2024.

Jacobs, J. (1961). *The Death and Life of Great American Cities*. Random House, New York.

Jaitman, L., Caprirolo, D., Ochoa, R. G., Keefer, P., Leggett, T., Lewis, J. A., Mejía-Guerra, J. A., Mello, M., Sutton, H., and Torre, I. (2017). *The costs of crime and violence: New evidence and insights in Latin America and the Caribbean*, volume 87. Inter-American Development Bank Washington, DC USA.

Linden, L. and Rockoff, J. E. (2008). Estimates of the impact of crime risk on property values from megan's laws. *American Economic Review*, 98(3):1103–27.

Magaloni, B., Melo, V., and Robles, G. (2022). Warriors and vigilantes as police officers: Evidence from a field experiment with body-cameras in rio de janeiro. *Available at SSRN 4005710*.

Manjarrés, J. (2022). Bogotá, epicentro de guerra entre bandas del microtráfico en colombia.

Mastrobuoni, G. (2020). Crime is terribly revealing: Information technology and police productivity. *The Review of Economic Studies*, 87(6):2727–2753.

McMillen, D., Sarmiento-Barbieri, I., and Singh, R. (2019). Do more eyes on the street reduce crime? evidence from chicago's safe passage program. *Journal of urban economics*, 110:1–25.

Montolio, D. (2018). The effects of local infrastructure investment on crime. *Labour Economics*, 52(C):210–230.

Mullahy, J. and Norton, E. C. (2024). Why transform y? the pitfalls of transformed regressions with a mass at zero. *Oxford Bulletin of Economics and Statistics*, 86(2):417–447.

Munoz-Raskin, R. (2010). Walking accessibility to bus rapid transit: Does it affect property values? the case of bogotá, colombia. *Transport policy*, 17(2):72–84.

Phillips, D. C. and Sandler, D. (2015). Does public transit spread crime? evidence from temporary rail station closures. *Regional Science and Urban Economics*, 52:13–26.

Rubio, M. A., Sarmiento, O. L., Guevara, T., O'Donovan, G., Muñoz, A., Guzman, L. A., Arellana, J., Molano, L., Huertas, B., Indvik, K., et al. (2023). The impacts of an urban cable car system on liveability: a mixed methods study in bogotá, colombia. In *The Empathic City: An Urban Health and Wellbeing Perspective*, pages 311–345. Springer.

Sarmiento, O., Higuera-Mendieta, D., Wilches-Mogollon, M. A., Guzmán, L. A., Rodriguez, D., Morales, R., Méndez, D., Bedoya, C. D., Linares-Vásquez, M., Arevalo, M., Martínez-Herrera, E., Montes, F., Meisel, J. D., Useche, A. F., García, E., Triana, C. A., Medaglia, A., Hessel, P., Arellana, J., Moncada, C., King, A., and Roux, A. D. D. (2020a). Urban transformations and health: Methods for trust-a natural experiment evaluating the impacts of a mass transit cable car in Bogotá, Colombia. *Frontiers in Public Health*, 8.

Sarmiento, O. L., Higuera-Mendieta, D., Wilches-Mogollon, M. A., Guzman, L. A., Rodríguez, D. A., Morales, R., Méndez, D., Bedoya, C., Linares-Vásquez, M., Arévalo, M. I., et al. (2020b). Urban transformations and health: methods for trust—a natural experiment evaluating the impacts of a mass transit cable car in bogotá, colombia. *Frontiers in public health*, 8:64.

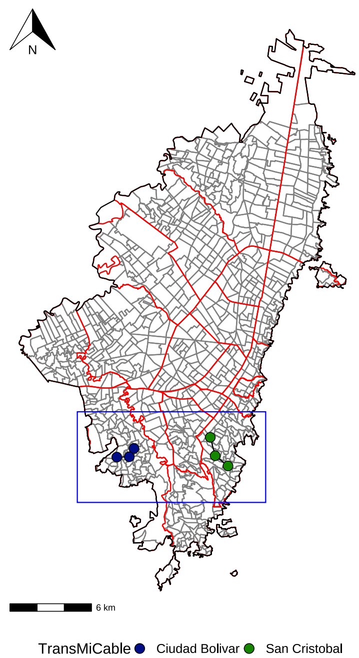
Sun, L. and Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2):175–199.

Tsivanidis, N. (2019). Evaluating the impact of urban transit infrastructure: Evidence from Bogotá's transmilenio. Technical report, mime.

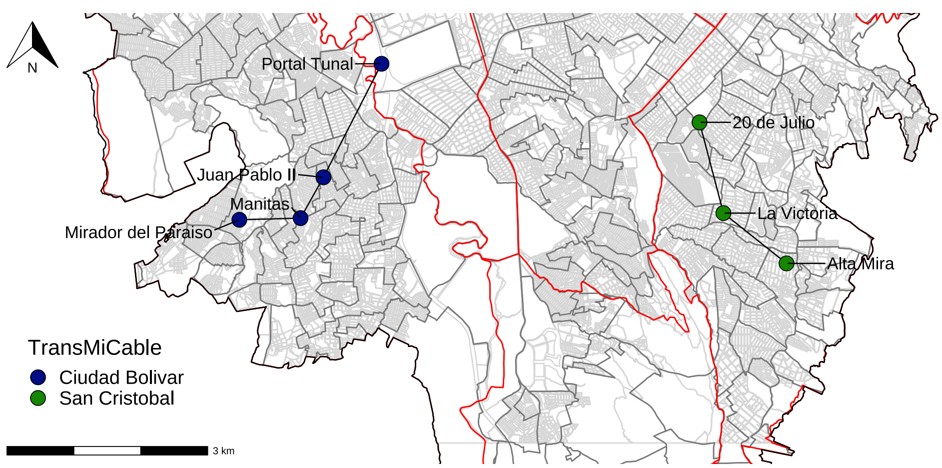
Wooldridge, J. M. (2023). Simple approaches to nonlinear difference-in-differences with panel data. *The Econometrics Journal*, 26(3):C31–C66.

9. Figures

Figure 9.1. TransMiCable Stations in Bogotá



(a) Bogota's Urban Area



(b) Ciudad Bolívar and San Cristobal Localities

Figure 9.2. Timeline of TransMiCable station construction and inauguration

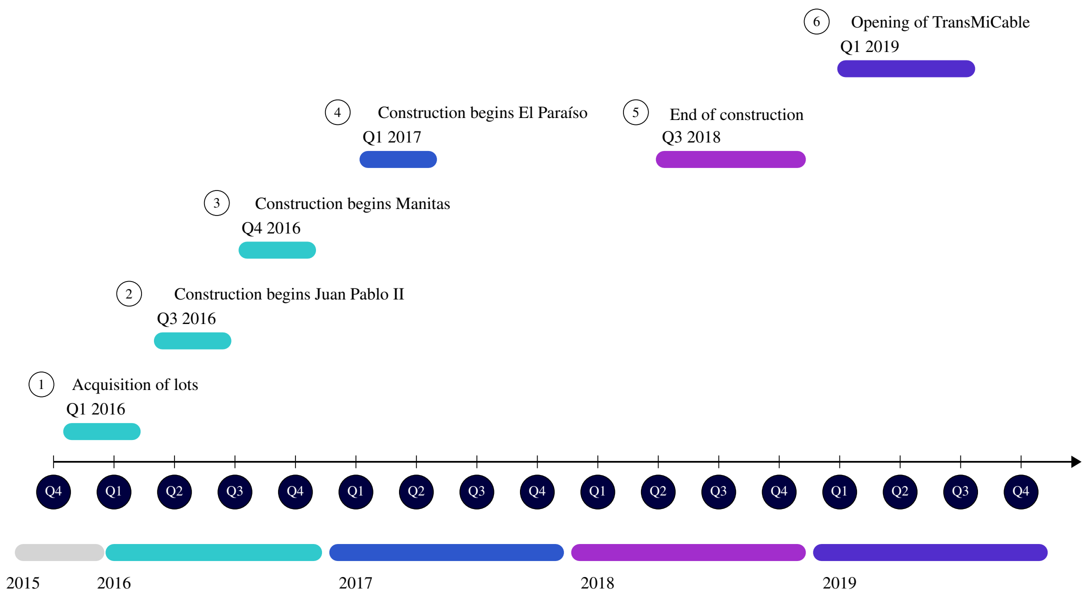
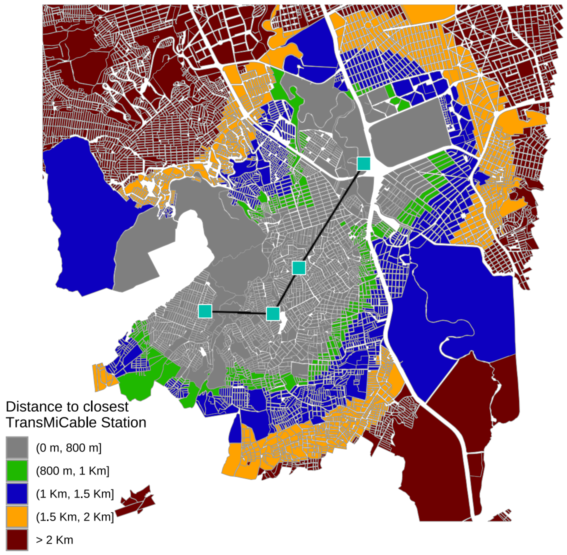
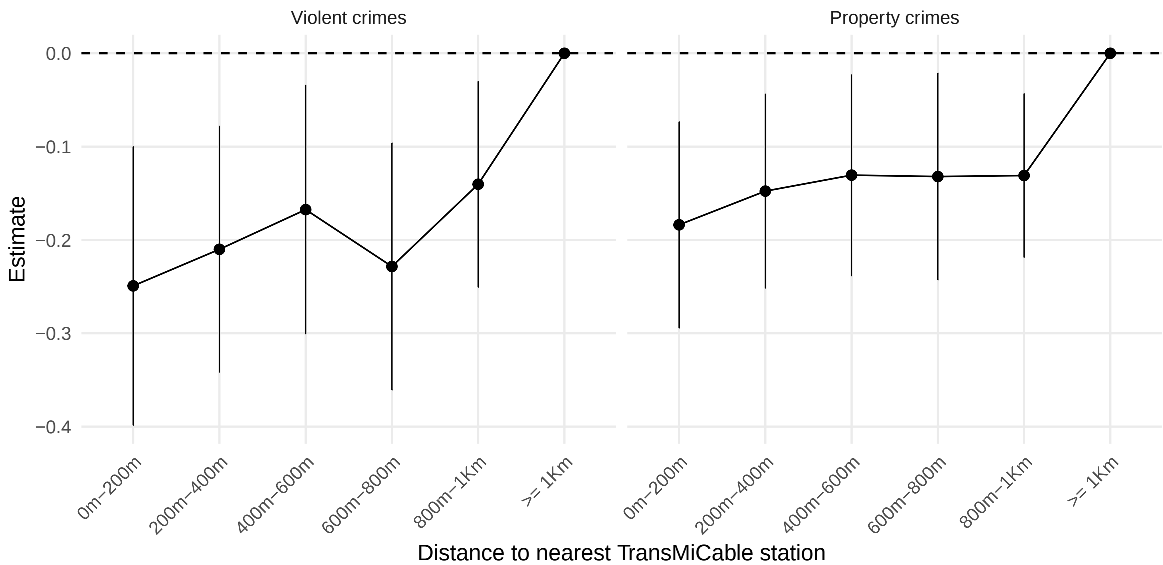


Figure 9.3. Identification Strategy- Difference in Differences



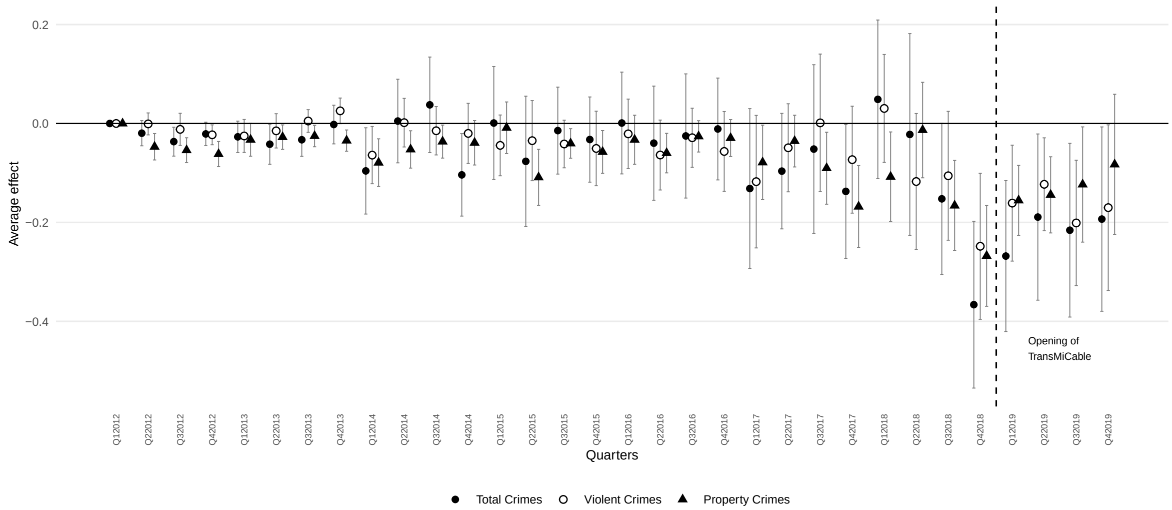
Note: The figure shows blocks within 900 meters (treated) and 1–2 km (control) of TransMiCable stations in Ciudad Bolívar. Block boundaries are shown for reference.

Figure 9.4. Spatial Decay – Difference-in-Differences Estimates by Distance to TransMiCable Station



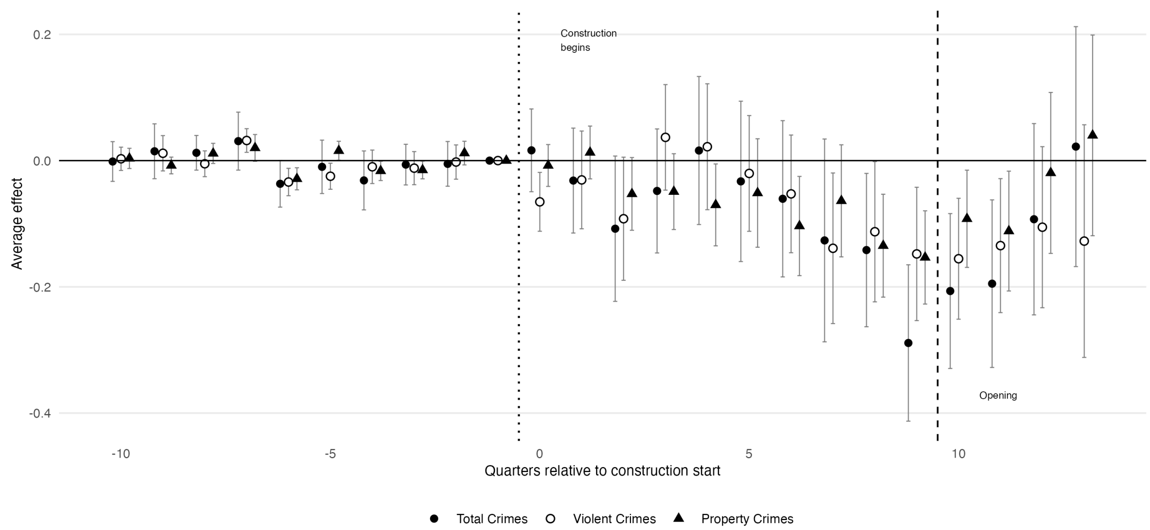
Notes: Estimates correspond to Equation (4.1), which models crime as a function of distance to the nearest station interacted with a post-inauguration indicator. Coefficients represent the change in crime relative to blocks located 1–2 km from a station. Crime is measured using the inverse hyperbolic sine transformation. Vertical bars denote 95% confidence intervals. Treated blocks are those within each specified ring; the control group comprises blocks 1–2 km from a station.

Figure 9.5. Effects of TransMiCable Opening on Crime



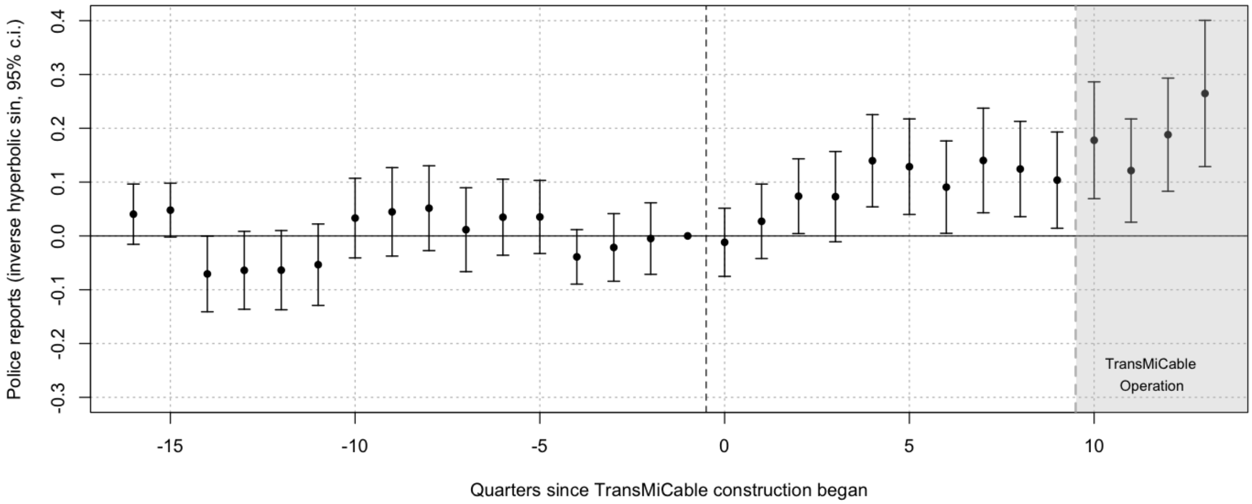
Notes: Figures plot event-study estimates centered on the start of opening of the system for each station, using grids within 800 meters as the “exposed” group. Vertical dashed lines indicate the quarter of the opening of the system start. All estimates include grid and time fixed effects, neighborhood-specific trends, and cluster standard errors at the neighborhood level.

Figure 9.6. Effects of TransMiCable Construction on Crime



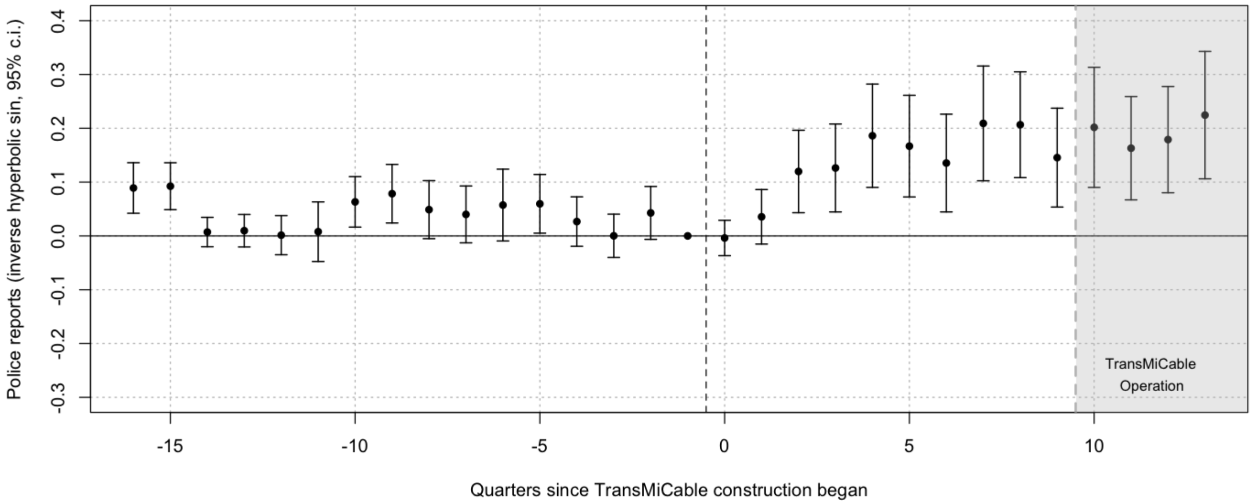
Notes: The figure plots event-study coefficients from a regression-based staggered-adoption estimator (Gardner, 2022), where event time is measured in quarters relative to the start of construction at the nearest TransMiCable station ($t = 0$). The sample consists of 100-meter grid cells within 800 meters of a station, with grid cells located 800-2,000 meters away serving as the comparison group. Markers report estimates for total, violent, and property crimes (inverse hyperbolic sine transformed), with 95% confidence intervals based on standard errors clustered at the neighborhood level. Vertical lines indicate the quarter construction begins and the quarter the system begins operations.

Figure 9.7. Impact on Reported *Thefts from Persons* at Local Bus Stops



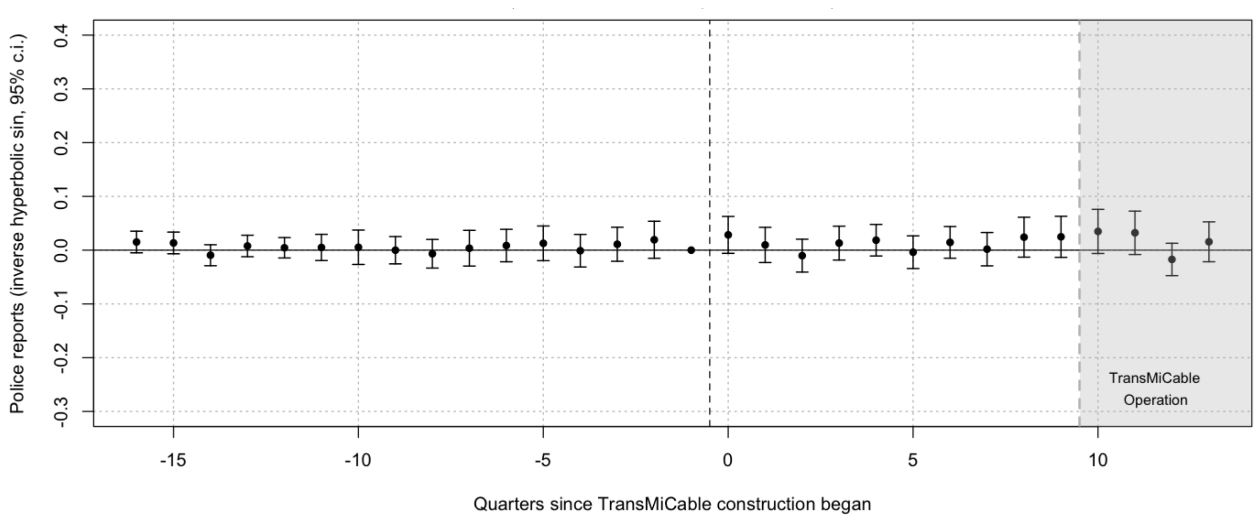
Notes: This figure plots the estimated group-time average treatment effects on the IHS of reported thefts from persons, using the Gardner (2022) estimator. Each point represents the differential change in crime at 100-meter grid cells containing local SITP bus stops (feeder network) within the TransMiCable catchment area in Ciudad Bolívar relative to control units. The vertical dashed line indicates the start of construction ($t = 0$), and the shaded area denotes the beginning of the system's operation (approx. $t = 9.5$). Vertical bars indicate 95% confidence intervals. Estimates include block and time fixed effects. Standard errors are clustered at the neighborhood level.

Figure 9.8. Impact on Reported *Cell Phone Thefts* at Local Bus Stops



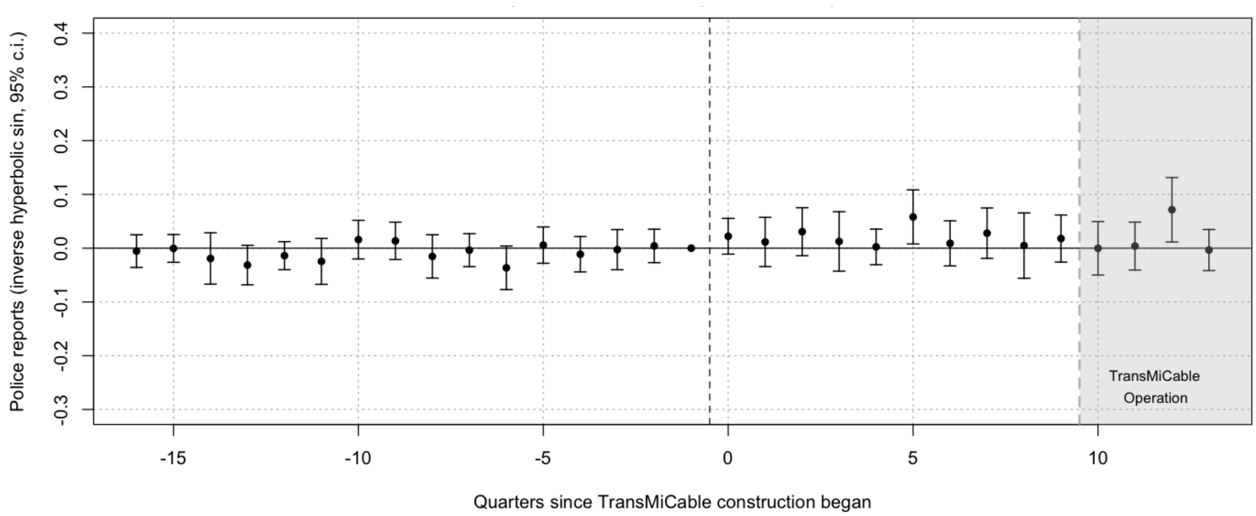
Notes: This figure plots the estimated group-time average treatment effects on the IHS of reported cell phone thefts, using the Gardner (2022) estimator. Each point represents the differential change in crime at 100-meter grid cells containing local SITP bus stops (feeder network) within the TransMiCable catchment area in Ciudad Bolívar relative to control units. The vertical dashed line indicates the start of construction ($t = 0$), and the shaded area denotes the beginning of the system's operation (approx. $t = 9.5$). Vertical bars indicate 95% confidence intervals. Estimates include block and time fixed effects. Standard errors are clustered at the neighborhood level.

Figure 9.9. Impact on Reported *Motor Vehicle Thefts* at Local Bus Stops



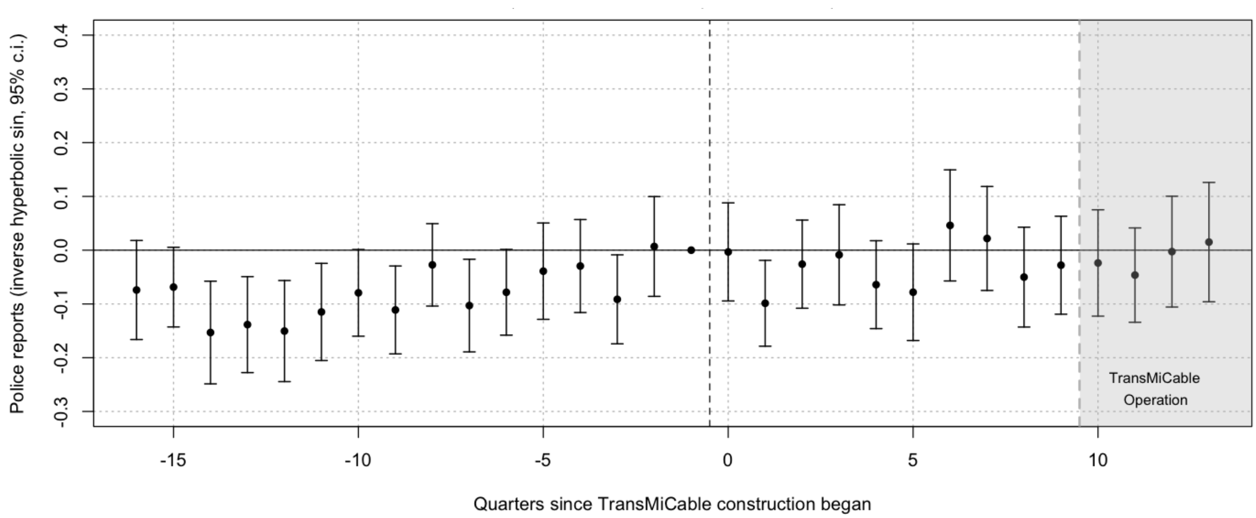
Notes: This figure plots the estimated group-time average treatment effects on the IHS of reported motor vehicle thefts, using the Gardner (2022) estimator. Each point represents the differential change in crime at 100-meter grid cells containing local SITP bus stops (feeder network) within the TransMiCable catchment area in Ciudad Bolívar relative to control units. The vertical dashed line indicates the start of construction ($t = 0$), and the shaded area denotes the beginning of the system's operation (approx. $t = 9.5$). Vertical bars indicate 95% confidence intervals. Estimates include block and time fixed effects. Standard errors are clustered at the neighborhood level.

Figure 9.10. Impact on Reported *Burglaries* near Local Bus Stops



Notes: This figure plots the estimated group-time average treatment effects on the IHS of reported burglaries, using the Gardner (2022) estimator. Each point represents the differential change in crime at 100-meter grid cells containing local SITP bus stops (feeder network) within the TransMiCable catchment area in Ciudad Bolívar relative to control units. The vertical dashed line indicates the start of construction ($t = 0$), and the shaded area denotes the beginning of the system's operation (approx. $t = 9.5$). Vertical bars indicate 95% confidence intervals. Estimates include block and time fixed effects. Standard errors are clustered at the neighborhood level.

Figure 9.11. Impact on Reported *Domestic Violence* near Local Bus Stops



Notes: This figure plots the estimated group-time average treatment effects on the IHS of reported burglaries, using the Gardner (2022) estimator. Each point represents the differential change in crime at 100-meter grid cells containing local SITP bus stops (feeder network) within the TransMiCable catchment area in Ciudad Bolívar relative to control units. The vertical dashed line indicates the start of construction ($t = 0$), and the shaded area denotes the beginning of the system's operation (approx. $t = 9.5$). Vertical bars indicate 95% confidence intervals. Estimates include block and time fixed effects. Standard errors are clustered at the neighborhood level.

10. Tables

Table 10.1. Demographic characteristics of control and treatment areas

	Demographic characteristics			
	Bogotá	Ciudad Bolívar	San Cristóbal	Difference
	(1)	(2)	(3)	(4) = (2) - (3)
Perception of household conditions	0.3009	2.1213	2.1078	0.0135
	(1.9819)	(0.2905)	(0.2273)	[0.4318]
Perception of household poverty	0.1829	0.1924	0.1800	0.0124
	(0.1454)	(0.1908)	(0.1836)	[0.3197]
Subsidies	0.1019	0.0859	0.0900	-0.0040
	(0.0515)	(0.1203)	(0.1196)	[0.6135]
Home computer	0.2819	0.4022	0.4637	-0.0615
	(0.6091)	(0.2491)	(0.2477)	[0.0002]
Own home	0.242	0.4796	0.5040	-0.0243
	(0.5185)	(0.2277)	(0.2301)	[0.1122]
People living in the household	0.77	3.1466	3.1158	0.0307
	(2.8905)	(0.7811)	(0.5870)	[0.4994]
Age	8.0801	35.7350	38.7673	-3.0323
	(40.1463)	(6.9243)	(7.6136)	[0.0000]
Proportion male	0.1133	0.4736	0.4864	-0.0128
	(0.4679)	(0.1109)	(0.1065)	[0.0779]
Years of education	1.4934	6.9088	6.9594	-0.0506
	(6.2567)	(1.2199)	(1.2031)	[0.5316]
Proportion of illiterate households	0.0274	0.9920	0.9941	-0.0022
	(0.9954)	(0.0363)	(0.0287)	[0.3159]
Hours of sleep (per week)	6.3576	35.5170	34.6153	0.9018
	(35.7171)	(5.6337)	(10.6405)	[0.1239]
Hours practicing a sport (per week)	1.5506	1.3121	1.3439	-0.0318
	(1.9273)	(1.1011)	(1.4117)	[0.7109]
Proportion of households with smartphone	0.172	0.7978	0.7903	0.0076
	(0.8606)	(0.1909)	(0.2115)	[0.5766]
Life satisfaction	0.6287	8.3465	8.3340	0.0124
	(8.4807)	(0.6745)	(0.6305)	[0.7749]
Work hours (per week)	6.2626	46.3396	46.1458	0.1939
	(45.4081)	(5.4281)	(5.4755)	[0.5969]
Number of blocks		5.415	2.963	

Note: This table reports descriptive statistics for demographic and socioeconomic characteristics across Bogotá as a whole, Ciudad Bolívar (the treated area), and San Cristóbal (a neighboring locality selected for future expansion of the TransMiCable system). Column (4) reports the difference in means between Ciudad Bolívar and San Cristóbal. Standard deviations are in parentheses; p-values for the difference in means are in brackets.

Table 10.2. Baseline Results: Effect of TransMiCable on Crime (IHS)

	Crimes (IHS)		
	Total	Violent	Property
	(1)	(2)	(3)
$\mathbb{1}[\text{Distance}_i \leq 800] \times \text{Post Opening}_t$	-0.1649***	-0.1222***	-0.0629*
	(0.0476)	(0.0411)	(0.0363)
Fixed-effects			
Grid cell	Yes	Yes	Yes
Quarter-Year	Yes	Yes	Yes
Observations	333,072	333,072	333,072

Notes: This table reports estimates from a difference-in-differences specification examining the effect of TransMiCable's opening on crime outcomes within 800 meters of gondola stations. The dependent variable is the inverse hyperbolic sine (IHS) of reported crimes per grid cell per quarter. Each column corresponds to a separate regression with a distinct outcome: total crimes (column 1), violent crimes (column 2), and property crimes (column 3). The key independent variable is an indicator for being within 800 meters of a station, interacted with a post-opening period dummy. All models include grid cell, quarter-year, and neighborhood fixed effects, as well as neighborhood-specific linear time trends. Standard errors clustered at the neighborhood level are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 10.3. Distance Gradient at Tunal Terminal

	Crimes (IHS)		
	Total (1)	Violent (2)	Property (3)
$\mathbb{1}[\text{Dist. Stations}_i \leq 800] \times \text{During Construction}_t$	-0.0935*** (0.0259)	-0.0775*** (0.0177)	-0.0741*** (0.0115)
$\mathbb{1}[\text{Dist. Stations}_i \leq 800] \times \text{Post Opening}_t$	-0.2083*** (0.0304)	-0.1780*** (0.0143)	-0.1056*** (0.0139)
$\mathbb{1}[\text{Dist. Tunal}_i \leq 200] \times \text{During Construction}_t$	0.1077*** (0.0338)	-0.0954*** (0.0163)	0.1381*** (0.0244)
$\mathbb{1}[200 < \text{Dist. Tunal}_i \leq 400] \times \text{During Construction}_t$	-0.1039** (0.0443)	-0.0959*** (0.0287)	-0.0252 (0.0290)
$\mathbb{1}[400 < \text{Dist. Tunal}_i \leq 600] \times \text{During Construction}_t$	-0.1548*** (0.0544)	-0.0650 (0.0433)	-0.0176 (0.0255)
$\mathbb{1}[600 < \text{Dist. Tunal}_i \leq 800] \times \text{During Construction}_t$	-0.0383 (0.0461)	-0.0631** (0.0300)	0.0056 (0.0199)
$\mathbb{1}[\text{Dist. Tunal}_i \leq 200] \times \text{Post Opening}_t$	0.0645 (0.1804)	-0.1455* (0.0822)	0.1776 (0.1286)
$\mathbb{1}[200 < \text{Dist. Tunal}_i \leq 400] \times \text{Post Opening}_t$	-0.2286** (0.0904)	-0.0755 (0.0582)	-0.1117 (0.0766)
$\mathbb{1}[400 < \text{Dist. Tunal}_i \leq 600] \times \text{Post Opening}_t$	-0.1243 (0.0931)	-0.0120 (0.0712)	-0.0606* (0.0336)
$\mathbb{1}[600 < \text{Dist. Tunal}_i \leq 800] \times \text{Post Opening}_t$	0.0624 (0.1122)	0.0227 (0.0526)	0.0621 (0.0538)
Fixed-effects			
Grid cell	Yes	Yes	Yes
Quarter-Year	Yes	Yes	Yes
Observations	400,704	400,704	400,704

Notes: This table reports estimates using the Gardner (2022) two-stage estimator examining distance gradients at the Tunal terminal station. The dependent variable is the inverse hyperbolic sine (IHS) of reported crimes per grid cell per quarter. Panel A shows effects at the three intermediate gondola stations (within 800m). Panels B and C decompose effects at Tunal into 200-meter distance bands to examine spatial decay. "During Construction" captures the period between construction start (Q2 2016 for Tunal) and system opening. "Post Opening" captures the period after inauguration (Q1 2019). The first stage estimates grid cell and time fixed effects using only never-treated observations; the second stage regresses residualized outcomes on treatment indicators. Standard errors clustered at the neighborhood level are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A. Tables

Table A.1. Robustness: Impact of TransMiCable Opening on Crime, by Estimator

	Inverse Hyperbolic Sine (Main) (1)	OLS (Linear) (2)	Poisson (3)	Negative Binomial (4)
Panel A: Total Crime				
$\mathbb{1}[\text{Distance}_i \leq 800] \times \text{Post Opening}_t$	-0.1649***	-0.4697***	-0.2957***	-0.3038***
	(0.0476)	(0.1548)	(0.0736)	(0.0417)
Panel B: Violent Crime				
$\mathbb{1}[\text{Distance}_i \leq 800] \times \text{Post Opening}_t$	-0.1222***	-0.2358***	-0.4902***	-0.4652***
	(0.0411)	(0.0851)	(0.1137)	(0.0994)
Panel C: Property Crime				
$\mathbb{1}[\text{Distance}_i \leq 800] \times \text{Post Opening}_t$	-0.0629*	-0.1117*	-0.1865*	-0.1940*
	(0.0363)	(0.0615)	(0.1089)	(0.1007)
Fixed Effects				
Grid cell	Yes	Yes	Yes	Yes
Quarter-Year	Yes	Yes	Yes	Yes
Observations	296,064	296,064	288,160	288,160

Notes: This table reports the estimated impact of TransMiCable's opening on crime outcomes using four different estimators: inverse hyperbolic sine transformation (column 1, main specification), OLS with untransformed counts (column 2), Poisson regression (column 3), and Negative Binomial regression (column 4). Each panel corresponds to a different outcome: total crime (Panel A), violent crime (Panel B), and property crime (Panel C). The treatment variable is an interaction between an indicator for grid cells located within 800 meters of a TransMiCable station and a post-opening period dummy. All specifications include grid cell, quarter-year, and neighborhood fixed effects, as well as neighborhood-specific linear time trends. Standard errors clustered at the neighborhood level are reported in parentheses.
Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

B. Heterogeneity

B.1. Heterogeneity Across Stations

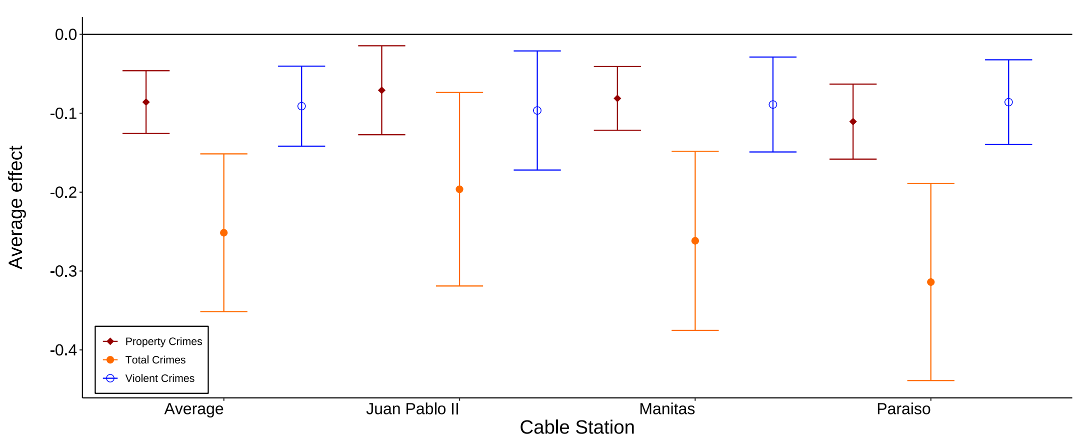
The previous section documented that crime reductions began with the onset of TransMiCable construction and persisted beyond its inauguration. A natural question is whether these reductions are localized—driven by conditions unique to a particular station—or instead reflect broader effects of the intervention that generalize across space.

To explore this, we estimate group-time average treatment effects by station using the estimator developed by Callaway and Sant'Anna (2021), which accommodates staggered implementation and allows treatment effects to vary flexibly across groups and periods. Each group corresponds to the catchment area of one of the three stations: Juan Pablo II, Manitas, and El Paraíso.

Figure B.1 presents both the overall treatment effect and for each station. Despite differences in physical surroundings, and local socioeconomic conditions, we observe a consistent decline in crime following the start of construction and continuing through inauguration.

The consistency of effects across all three sites strengthens the interpretation that the intervention's impact is not driven by idiosyncratic neighborhood characteristics, but instead reflects common features of the infrastructure rollout—such as increased state presence, altered urban form, and changes in perceived security. These results are in line with the "eyes on the street" mechanism discussed previously, and underscore the potential for place-based investments to generate spatially broad and robust improvements in public safety.

Figure B.1. Station heterogeneity using Callaway and Sant'Anna (2021)



Note: Figure plots Callaway and Sant'Anna (2021) estimates by station

B.2. Triple Differences with a Future Expansion Site: San Cristóbal

The evidence presented so far shows that crime reductions began during the construction of TransMiCable and persisted after its inauguration. But what mechanisms underpin these reductions? One possibility is the deterrence effect from increased public presence and activity. Another is a shift in opportunity cost or spatial redistribution of crime. To further probe these channels, we exploit a unique feature of our setting: the planned expansion of TransMiCable to a second locality, San Cristóbal.

San Cristóbal serves as a valuable placebo comparison. Like Ciudad Bolívar, it is a peripheral urban area of Bogotá marked by high crime, socioeconomically disadvantaged populations, and historically limited access to formal public transit. Importantly, while San Cristóbal was designated for future TransMiCable construction, no work had begun during our study period. This allows us to compare areas similarly selected for intervention, but where only one (Ciudad Bolívar) experienced actual implementation. As such, San Cristóbal provides a credible control locality that helps net out spurious time trends or shocks that may have disproportionately affected peripheral neighborhoods across Bogotá.

To exploit this variation, we estimate a triple-differences specification using a standard two-way fixed effects (TWFE) model. While recent difference-in-differences estimators address potential biases from treatment effect heterogeneity, they are not readily adaptable to triple-differences settings. Moreover, the fact that all estimators produced similar results in our main analysis lends confidence to the internal validity of our approach. The TWFE framework offers an intuitive and transparent way to incorporate variation across space (Ciudad Bolívar vs. San Cristóbal), time (pre vs. post construction, and pre vs. post inauguration), and proximity (near vs. far from station areas).

$$\begin{aligned} Crime_{i,t} = {} & \tau \cdot \mathbb{1}[\text{Distance}_i \leq 800] \times \text{CiudadBolívar}_i \times \text{Post Event}_t \\ & + \theta_1 \cdot \mathbb{1}[\text{Distance}_i \leq 800] \times \text{Post Event}_t \\ & + \theta_2 \cdot \text{CiudadBolívar}_i \times \text{Post Event}_t \\ & + \alpha_i + \delta_t + \varepsilon_{i,t} \end{aligned} \tag{B.1}$$

In this specification, $Crime_{i,t}$ is the count of crimes in block i and quarter t. The indicator $\mathbb{1}[\text{Distance}_i \leq 800]$ identifies blocks located within 800 meters of a (current or planned) TransMiCable station. CiudadBolívar_i indicates blocks in Ciudad Bolívar, and Post Event_t denotes the quarters following the start of construction or the opening of stations. The coefficient τ captures the triple-difference estimate: the differential change in crime in station-adjacent blocks of Ciudad Bolívar relative to similarly exposed blocks in San Cristóbal, before and after the designated event.

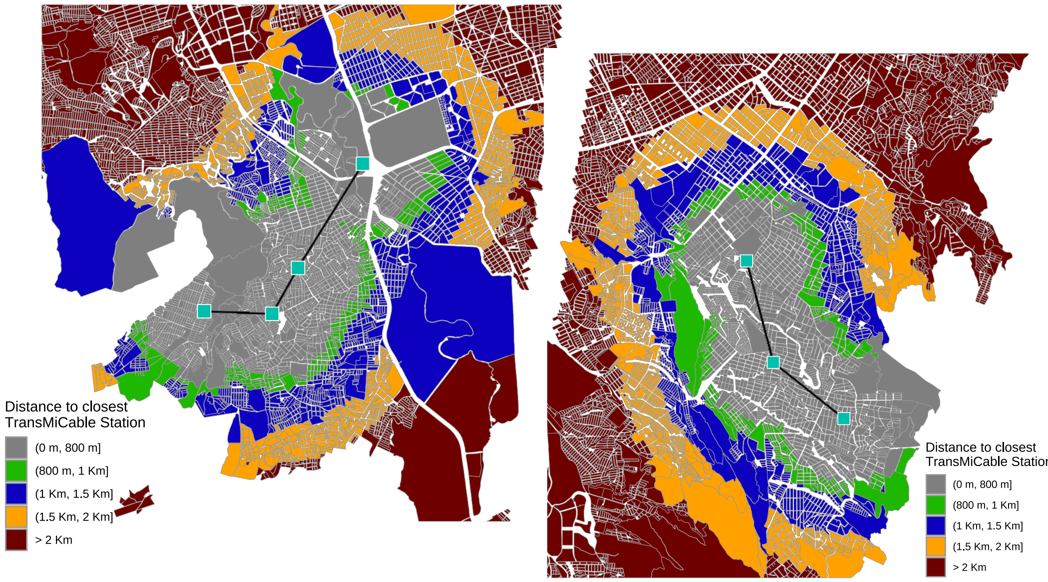
This strategy allows us to more rigorously isolate the causal impact of TransMiCable construction and operation by accounting for locality-specific dynamics and shared exposure to citywide shocks. If crime also declined in San Cristóbal after the same date, our estimates would overstate the true crime-reducing effects of TransMiCable. However, if the reductions are concentrated in Ciudad Bolívar and absent in San Cristóbal, this supports the interpretation that crime declines are related to the intervention itself.

Figure B.3 reports the estimated triple-difference effects from equation Equation (B.1) by crime type. The results show declines in total and violent crime, as well as domestic violence, in Ciudad Bolívar after the inauguration of the system relative to San Cristóbal, where no infrastructure had yet been implemented.

Notably, we find no corresponding effects post-construction, which suggests that the observed reductions are primarily linked to the operational phase of TransMiCable, once the stations opened, rather than merely to the presence of construction activity. This pattern reinforces the idea that increased connectivity, enhanced street presence, and improved perceived safety may be key mechanisms behind the identified effects.

These results strengthen our interpretation of TransMiCable's causal impact. San Cristóbal, a locality slated for future expansion, serves as a credible placebo, showing no comparable crime trends. The triple-differences framework thus offers a more stringent test of our identification strategy, further ruling out spurious locality-specific dynamics.

Figure B.2. Identification Strategy- Triple Difference in Differences

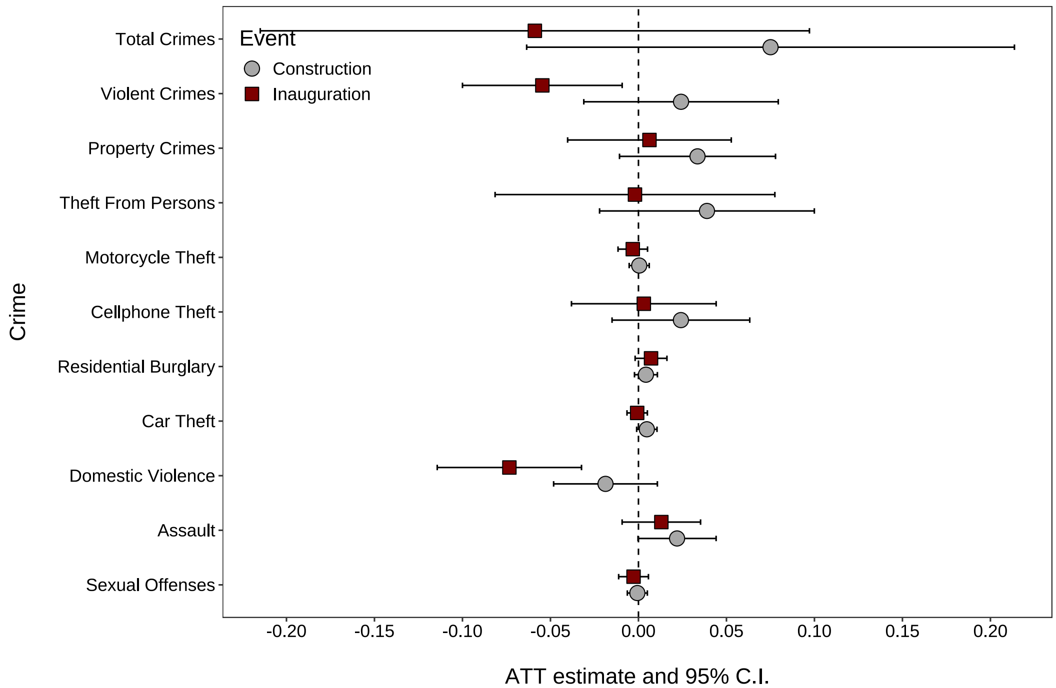


(a) Ciudad Bolívar

(b) San Cristóbal (not yet built)

Note: Panel (a) shows blocks within 800 meters (treated) and 1–2 km (control) of TransMiCable stations in Ciudad Bolívar. Panel (b) shows the analogous exposure zones for San Cristóbal, where no stations were opened during the study period but where a future line is planned. Block boundaries are shown for reference. Shading corresponds to the spatial bands used in the DiD and triple-differences analyses.

Figure B.3. Triple-Differences Estimates: Ciudad Bolívar vs. San Cristóbal



Notes: This figure plots the estimated triple-differences effects of TransMiCable construction by crime type. Each point reflects the differential change in crime in blocks within 800 meters of TransMiCable stations in Ciudad Bolívar relative to similarly exposed blocks in San Cristóbal. Estimates correspond to Equation (B.1) and include block and time fixed effects. Standard errors are clustered at the neighborhood level.

C. Proofs

Proof of Proposition 1

We prove the result for each comparative static in turn.

Part (i): Effect of increased monitoring ($E^t_{H_0}$). From equation (3.1), we have

$$p^t_\ell = \bar{p}_\ell + \alpha E^t_\ell - \beta A^t_\ell.$$

Taking the derivative with respect to $E^t_{H_0}$ yields

$$\frac{\partial p^t_{H_0}}{\partial E^t_{H_0}} = \alpha > 0.$$

More informally, this means that increased monitoring raises the detection probability at H_0.

The expected net utility from committing crime at H_0 is

$$v^t_{H_0} = R_{H_0} - p^t_{H_0}(R_{H_0} + F) - \tau^t_{H_0}.$$

Differentiating with respect to $p^t_{H_0}$, we obtain

$$\frac{\partial v^t_{H_0}}{\partial p^t_{H_0}} = -(R_{H_0} + F) < 0,$$

since both the expected rent R_{H_0} and the sanction F are strictly positive. By the chain rule,

$$\frac{\partial v^t_{H_0}}{\partial E^t_{H_0}} = \frac{\partial v^t_{H_0}}{\partial p^t_{H_0}} \cdot \frac{\partial p^t_{H_0}}{\partial E^t_{H_0}} = -(R_{H_0} + F) \cdot \alpha < 0.$$

We can therefore state that increased monitoring lowers the expected utility from committing crime at H_0.

The share of offenders choosing to commit crime at H_0 in period t is

$$\pi^t_{H_0} = \frac{\exp(v^t_{H_0})}{\exp(v^t_L) + \exp(v_0) + \sum_{k\in\mathcal{L}} \exp(v^t_k)}.$$

Taking the derivative with respect to $v^t_{H_0}$, we have

$$\frac{\partial \pi^t_{H_0}}{\partial v^t_{H_0}} = \pi^t_{H_0}\left(1 - \pi^t_{H_0}\right) > 0,$$

which is strictly positive since $\pi^t_{H_0} \in (0, 1)$. Applying the chain rule again, we have

$$\frac{\partial \pi^t_{H_0}}{\partial E^t_{H_0}} = \frac{\partial \pi^t_{H_0}}{\partial v^t_{H_0}} \cdot \frac{\partial v^t_{H_0}}{\partial E^t_{H_0}} < 0.$$

Finally, since crime intensity at H_0 is $\lambda^t_{H_0} = \Lambda \pi^t_{H_0}$, where $\Lambda > 0$ is the mass of potential offenders, we have

$$\frac{\partial \lambda^t_{H_0}}{\partial E^t_{H_0}} = \Lambda \cdot \frac{\partial \pi^t_{H_0}}{\partial E^t_{H_0}} < 0.$$

This statement establishes that increased monitoring reduces crime intensity near the station.

Part (ii): Effect of higher local wages (w^t_H). The utility from legal work is $v^t_L = w^t_H$. Note that v^t_L enters the denominator of $\pi^t_{H_0}$ but does not appear in the numerator:

$$\pi^t_{H_0} = \frac{\exp(v^t_{H_0})}{\exp(w^t_H) + \exp(v_0) + \sum_{k \in \mathcal{L}} \exp(v^t_k)}.$$

To find the effect of a wage increase, we differentiate $\pi^t_{H_0}$ with respect to w^t_H. Let D^t denote the denominator:

$$D^t \equiv \exp(w^t_H) + \exp(v_0) + \sum_{k \in \mathcal{L}} \exp(v^t_k).$$

Then

$$\pi^t_{H_0} = \frac{\exp(v^t_{H_0})}{D^t},$$

and

$$\frac{\partial \pi^t_{H_0}}{\partial w^t_H} = -\frac{\exp(v^t_{H_0})}{(D^t)^2} \cdot \frac{\partial D^t}{\partial w^t_H} = -\frac{\exp(v^t_{H_0}) \cdot \exp(w^t_H)}{(D^t)^2}.$$

Rewriting in terms of choice probabilities, we have

$$\frac{\partial \pi^t_{H_0}}{\partial w^t_H} = -\pi^t_{H_0} \cdot \pi^t_L < 0,$$

since both $\pi^t_{H_0} > 0$ and $\pi^t_L > 0$. This shows that higher local wages reduce the share of offenders choosing to commit crime at H_0 by increasing the attractiveness of the legal work option.

Again, since $\lambda^t_{H_0} = \Lambda \pi^t_{H_0}$, we obtain

$$\frac{\partial \lambda^t_{H_0}}{\partial w^t_H} = \Lambda \cdot \frac{\partial \pi^t_{H_0}}{\partial w^t_H} < 0.$$

This shows that higher local wages reduce crime intensity near the station.

Proof of Proposition 2

Note that

$$\frac{\partial v^t_{T(d)}}{\partial \tau^t_{T(d)}} = -1.$$

In the binary logit,

$$\frac{\partial \tilde{\pi}^t_{T(d)}}{\partial v^t_{T(d)}} = \tilde{\pi}^t_{T(d)} \left(1 - \tilde{\pi}^t_{T(d)}\right) > 0,$$

so

$$\frac{\partial \tilde{\pi}^t_{T(d)}}{\partial \tau^t_{T(d)}} = \frac{\partial \tilde{\pi}^t_{T(d)}}{\partial v^t_{T(d)}} \frac{\partial v^t_{T(d)}}{\partial \tau^t_{T(d)}} = -\tilde{\pi}^t_{T(d)} \left(1 - \tilde{\pi}^t_{T(d)}\right) < 0.$$

Since $\tilde{\lambda}^t_{T(d)} = \Lambda \tilde{\pi}^t_{T(d)}$, it follows that $\partial \tilde{\lambda}^t_{T(d)} / \partial \tau^t_{T(d)} < 0$.

For the second statement, note that the marginal effect of a change in travel cost on crime intensity is as follows:

$$\left| \frac{\partial \tilde{\lambda}^t_{T(d)}}{\partial \tau^t_{T(d)}} \right| = \Lambda \tilde{\pi}^t_{T(d)} (1 - \tilde{\pi}^t_{T(d)}).$$

The function $\pi(1-\pi)$ is strictly increasing in π for $\pi \in (0, 1/2)$ and strictly decreasing for $\pi \in (1/2, 1)$. Consider two distances $d_1 < d_2$ such that higher anonymity at d_2 implies $v^t_{T(d_2)} > v^t_{T(d_1)}$, and hence $\tilde{\pi}^t_{T(d_2)} > \tilde{\pi}^t_{T(d_1)}$.

Given that crime shares at individual bus stops are empirically small—that is, $\tilde{\pi}^t_{T(d)} \ll 1/2$ for all relevant d—both $\tilde{\pi}^t_{T(d_1)}$ and $\tilde{\pi}^t_{T(d_2)}$ lie in the region where $\pi(1-\pi)$ is increasing in π. Therefore, a common reduction $\Delta\tau < 0$ produces a larger absolute increase in crime at d_2 than at d_1:

$$\left| \Delta \tilde{\lambda}^t_{T(d_2)} \right| > \left| \Delta \tilde{\lambda}^t_{T(d_1)} \right|.$$

Since more distant stops have higher $v^t_{T(d)}$ due to greater anonymity (lower $p^t_{T(d)}$), the displacement effect is strongest at intermediate distances where anonymity gains are substantial but travel costs still remain manageable.

Proof of Proposition 3

We show that the share of offenders choosing $T(d)$ is strictly increasing in the utility difference between $T(d)$ and H_0.

To isolate the substitution between local and displaced crime, consider an offender who will commit a crime and must choose between H_0 and $T(d)$. Conditional on this binary choice, the difference in utilities is:

$$\Delta v^t \equiv v^t_{T(d)} - v^t_{H_0}.$$

The share choosing $T(d)$ is

$$\tilde{\pi}^t_{T(d)} = \frac{\exp(v^t_{T(d)})}{\exp(v^t_{T(d)}) + \exp(v^t_{H_0})} = \frac{1}{1 + \exp(-\Delta v^t)}.$$

This is strictly increasing in Δv^t. By assumption, $v^1_{T(d)} > v^0_{T(d)}$ (due to lower travel costs) and $v^1_{H_0} < v^0_{H_0}$ (due to increased monitoring and wages), such that

$$\Delta v^1 = v^1_{T(d)} - v^1_{H_0} > v^0_{T(d)} - v^0_{H_0} = \Delta v^0.$$

Hence $\tilde{\pi}^1_{T(d)} > \tilde{\pi}^0_{T(d)}$ and $\tilde{\pi}^1_{H_0} < \tilde{\pi}^0_{H_0}$. Since $\tilde{\lambda}^t_\ell = \Lambda \tilde{\pi}^t_\ell$ for $\ell \in \{H_0, T(d)\}$, scaling by Λ gives the same inequalities for crime intensity: $\tilde{\lambda}^1_{T(d)} > \tilde{\lambda}^0_{T(d)}$ and $\tilde{\lambda}^1_{H_0} < \tilde{\lambda}^0_{H_0}$.

This establishes the proposition's claim: construction activities simultaneously reduce crime near the station (where monitoring increases) and increase crime at trunk bus stops (where improved access lowers travel costs). Importantly, this displacement occurs during the construction phase itself, before the gondola system begins passenger service, because the infrastructure improvements affect both detection risk and accessibility.