Effects of geographic specialization on police effectiveness

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Abstract

This paper provides causal evidence that geographic specialization can significantly enhance police effectiveness. Using rich administrative and survey data from Chile, we examine a major reform that subdivided police operational areas—e.g., municipalities—into smaller zones known as quadrants. On average, each municipality was divided into seven quadrants, with officers permanently assigned to these territories to allow them to develop a deep understanding of their structure, crime patterns, and communities. By exploiting the staggered implementation of the reform across municipalities, we show that this reorganization enhanced police effectiveness along multiple dimensions. Among surveyed households, twelve-month victimization rates declined by 10 percentage points (36%). In line with this result, administrative records from the police reveal a 14% reduction in reported crime. The reform also enhanced public confidence: the share of households reporting high trust in police rose by 12 percentage points (30%), while those perceiving increased criminal activity fell by 15 percentage points (36%). Consequently, the share of households investing in private security measures decreased by 7.7 percentage points (37%). Evidence suggests these improvements stem from geographic specialization, as households in treated municipalities report both greater police presence and better police performance across multiple dimensions associated with a better knowledge of the quadrants and their communities.

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1   Introduction

Crime imposes significant costs on society, straining the criminal justice system and driving up public and private security expenditures. Given these wide-ranging effects, crime consistently ranks as a top public concern and holds a prominent place in the political agenda in many countries (Cafferata and Scartascini, 2021; Gallup, 2023). Police forces play a crucial role in controlling crime and maintaining public safety. While there is vast evidence on the effects of police resources in reducing crime (see for instance Chalfin and McCrary, 2017; Levitt, 1997; Di Tella and Schargrodsky, 2004), relatively little is known about how the organization of these resources influences their effectiveness. Studies on public services indicate that decentralization and local specialization can enhance service delivery (see for instance Besley and Coate, 2003), suggesting that geographic specialization of police forces may likewise improve their effectiveness. While such specialization has been widely adopted by police departments worldwide (Serrano-Molina, 2024; Petersen et al., 2024), there is no rigorous evidence on its effects.

This paper combines rich administrative and survey data from Chile to provide causal evidence that geographic specialization can significantly improve police effectiveness along multiple dimensions. We exploit quasi-random variation generated by the staggered adoption of a large reform—*Plan Cuadrante*—that reorganized existing police operational areas—i.e., municipalities—into smaller zones known as quadrants. On average, municipalities were divided into seven quadrants and specific police units were permanently assigned to each of them to allow them to develop deep knowledge of their assigned territories—including their structures, crime patterns, and communities. Using a difference-in-differences strategy, we show that adopting municipalities experienced significant declines in crime victimization and perceived insecurity, increases in trust in police, and reductions in private investment in security.

Plan Cuadrante aimed to reduce crime victimization and improve security perception in municipalities with at least 70% urban population. These municipalities are typically large, averaging 101,000 inhabitants, with some exceeding 500,000. The exact size and shape of the quadrants was defined by the local police authorities based on characteristics of each municipality such as road network, geographic features, and available resources.

The reform was implemented between 1998 and 2013 in 150 municipalities. To examine its effects, we use household-level data from the National Urban Security Survey (ENUSC), providing information on crime victimization, perceptions, trust in police, and private security

investment for 25,000 urban households across 101 urban municipalities yearly. We complement these data with administrative records on arrests and crime reported to the police. To leverage the staggered adoption, we employ a difference-in-differences strategy comparing early and late adopters using the estimation approach of Callaway and Sant'Anna (2021). Most analyses focus on 46 urban municipalities that adopted the program between 2005 and 2012 and one never-treated municipality, which, altogether, represent over one-third of Chile's population.

We find that households in adopting municipalities become 10 percentage points (36%) less likely to experience crime in the last 12 months, with effects appearing within one year and growing over time. Consistent with this finding, we document 14% decline in crime reported to the police. Note, however, that these analyses may underestimate the reform's true impact since not all crimes are reported to the police, and by bringing the police closer to the communities, the program could have increased reporting rates. Nevertheless, the alignment between analyses relying on survey and administrative data provides reassuring evidence of the effectiveness of the reform.

Beyond reducing crime, the reform increased trust in police and reduced both insecurity perceptions and private investment in security. These results are noteworthy given that actual crime and perceptions can diverge, potentially leading to suboptimal security expenditures. For example, Ajzenman et al. (2023a) shows that rising immigration in Chile between 2000 and 2016 did not increase crime but elevated insecurity perception.

Our analysis investigates what changed in police operations after implementation. Using survey data comparing early and late adopters, we document strong associations between perceived police performance measures and program adoption. Our main specification shows that the share of households reporting increased neighborhood police presence rose significantly once *Plan Cuadrante* was implemented.

While the reform primarily focused on geographic specialization, some municipalities received additional resources. We document increases in officers and patrol vehicles but find that effectiveness improved regardless of resource change magnitude. Moreover, exploiting quasi-random variation in police resources unrelated to program adoption, we show that resource increases alone—without geographic specialization—did not enhance effectiveness. These analyses suggest that while resource changes may have contributed in some areas, geographic specialization played the key role.

Our results contribute to research on police organization and effectiveness. Chalfin and

McCrary (2017) reviews studies on police resources and crime, reporting elasticities from -0.1 to -2, with larger effects in developed settings and for violent crimes. However, these studies provide limited insights on optimal resource organization.

Concentrating resources in crime hotspots has shown mixed results (Di Tella and Schargrodsky, 2004; Blattman et al., 2021; Draca et al., 2011; Weisburd, 2021). While some studies find reductions in crime in targeted areas, others document crime displacement to neighboring zones. Additionally, faster police response times have shown to improve crime clearance rates (Blanes-i-Vidal and Kirchmaier, 2018), suggesting that strategies reducing response times may improve police effectiveness. Community policing approaches have been shown to reduce crime and increase trust in police in developed countries, but have shown limited effects in low- and middle-income settings such as the one we study (Blair et al., 2021; Tobón, 2021).

Our results show that geographic specialization—a policing approach that combines elements of place-based and community-based programs—significantly improved police effectiveness in Chile, a middle-income country. By defining manageable territories and enhancing police officers' knowledge of these areas and their communities, this approach increased community trust and police presence, while reducing victimization and reported cases. By leveraging detailed survey data, we examine a broader range of outcomes than typically studied, including perceived security, an important outcome as misalignments between actual and perceived crime can lead to inefficient expenditures on security.

More broadly, our findings contribute to literature on decentralization and local specialization of public services. Studies suggest that devolving decision-making to local managers improves service quality by aligning operations with local needs (Besley and Coate, 2003; Bardhan, 2002; Bloom et al., 2015; Basurto et al., 2020). Our paper expands this literature by showing that geographic specialization can enhance police service effectiveness.

The rest of the paper is organized as follows. Section 2 presents background information about the program and Chilean police. Section 3 introduces the data and empirical strategy. Section 4 presents the main results. Finally, section 5 concludes.

2 *Plan Cuadrante*: Design and Implementation

Carabineros, the main Chilean law enforcement agency, operates under the Ministry of Interior and Domestic Security and has nationwide jurisdiction. Its core mission is to maintain public

order and enforce the law in Chile.

In 1998, *Carabineros* started piloting a geographic specialization program, *Plan Cuadrante*, to increase police effectiveness, reduce victimization, and enhance security perception in urban areas. Both victimization and insecurity perceptions were growing in that period and the program sought to tackle these trends (Ministerio del Interior y Seguridad Pública, 2014). *Plan Cuadrante* divided existing police operational areas—i.e., municipalities—into smaller, more manageable areas known as quadrants. By permanently assigning police officers to specific quadrants, the program enabled officers to develop deep knowledge of their assigned territories—including local crime patterns, community dynamics, and security challenges—allowing them to better identify and address area-specific problems.

The size and shape of each quadrant were determined by local police authorities based on factors such as road networks, geographic features, and available resources. Municipalities implementing *Plan Cuadrante* were subdivided into seven quadrants on average, with each quadrant typically staffed by 31 officers. Panel (a) of Figure 1 illustrates this division, showing the 29 quadrants created across the four municipalities of the Concepción metropolitan region—Chile's second-largest metropolitan area.

In some municipalities, the reorganization of police forces also required an increase in the number of officers. In Section 4.3, we discuss these changes in detail and show that changes in police resources alone are not driving the effects of *Plan Cuadrante*.

The program roll-out started in Santiago between 1998 and 2000 and was subsequently implemented in Valparaíso in 2002. As illustrated in panel (b) of Figure 1, *Plan Cuadrante* continued to expand in urban municipalities until 2013. By the end of that year, roughly 90% of Chile's population resided in a municipality with the program in place. A detailed account of its implementation and design is provided in Online Appendix C.

3 Data and Empirical Strategy

3.1 Data

We combine administrative and survey data from *Carabineros*, the Undersecretary for Crime Prevention, and the National Institute of Statistics (INE).

Carabineros provided information on *Plan Cuadrante* implementation, which we use to define treatment status across municipalities over time. The National Institute of Statistics granted

access to the National Survey on Security and Crime (ENUSC), a repeated cross-section first conducted in 2003 and administered annually between October and December since 2005. The survey covers more than 25,000 households across 101 urban municipalities, collecting information on crime victimization, perceptions, trust in police, and household prevention measures over the previous 12 months.[1]

Our empirical approach excludes always-treated municipalities (Callaway and Sant'Anna, 2021). Given ENUSC's implementation in 2003 and absence in 2004, our main sample includes households from 46 urban municipalities that adopted *Plan Cuadrante* between 2005 and 2012 plus one never-treated municipality.[2] These areas represent 35% of Chile's population.

The Undersecretary for Crime Prevention provided data on the number of reported crimes and arrests for all municipalities between 2003 and 2018. This comprehensive coverage enables analysis of a larger municipality set, including all post-2003 adopters and never-treated areas. However, the relationship between police effectiveness and these outcomes is theoretically ambiguous: increased effectiveness could simultaneously boost reported crimes and arrests through improved detection and reporting while deterring criminal activity.

3.2 Empirical Strategy

To estimate *Plan Cuadrante*'s effect on police effectiveness, we exploit its staggered adoption across Chilean municipalities between 2004 and 2013. Analyses relying on ENUSC data use variation from 2005-2012 adoptions, while those relying on administrative data use variation from 2004-2013 adoptions.[3]

Treatment exposure is defined at the municipality-year level. ENUSC provides household-level repeated cross-sections with municipality identifiers, enabling household-level analysis for survey data. Police records are available only at the municipality level, requiring aggregated analysis for arrests and cases. We estimate the following difference-in-differences specification:

$$Y_{imt} = \beta_0 + \beta_1 PC_{mt} + \mu_m + \mu_t + \varepsilon_{imt} \tag{1}$$

where Y_{imt} is a police effectiveness measure reported by household i from municipality m in

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[1] The survey is administered to a randomly selected household member who must: a) live in the household, b) be 15 years or older, c) not be a domestic worker, and d) not have any disability preventing survey comprehension.

[2] This sample excludes municipalities adopting *Plan Cuadrante* in 2013 as they are not covered by ENUSC. Also, there is only one never treated municipality covered by ENUSC.

[3] As a robustness check, we estimate effects on administrative data outcomes using only municipalities in the ENUSC sample. Online Appendix Table B1 and Figure B2 show that the results in this restricted sample are very similar to the ones we present in Section 4.

year t or observed in administrative data for municipality m in year t; PC_{mt} indicates whether municipality m had implemented *Plan Cuadrante* by year t; μ_m and μ_t are municipality and year fixed effects; and ε_{imt} is the error term. The parameter β_1 measures the program's effect on police effectiveness.

Given the staggered adoption of the program, standard two-way fixed-effects models could generate negative weights (Goodman-Bacon, 2021). We address this concern using Callaway and Sant'Anna (2021)'s estimation procedure for staggered treatment adoption with multiple periods. Online Appendix Figure B1 shows robustness to alternative estimators, including those developed by Chaisemartin and D'Haultfœuille (2020); Borusyak et al. (2024); Gardner (2022), yielding estimates that closely mirror those from the main specification.

Our empirical approach accounts for time-invariant differences between early- and late-adopting municipalities, as well as time-specific shocks that affect municipalities with and without *Plan Cuadrante* similarly. The key identification assumption is that, in the absence of *Plan Cuadrante*, the outcomes of interest would have followed parallel trends. While we cannot formally test this assumption, we present dynamic specifications that confirm parallel pre-adoption trends across the municipalities in our sample.

An additional threat to the causal interpretation of our estimates is potential crime displacement from treated to control municipalities. This is unlikely given the size of municipalities—which averages 101,000 inhabitants and 2,000 square kilometers (Gobierno de Chile, 2024)—and evidence that criminals typically operate locally (Kirchmaier et al., 2023). Reassuringly, Online Appendix Figure B4 confirms that there is no spillover to nearby untreated municipalities. Online Appendix A presents a variety of additional robustness checks that show that our results are robust to the use of different estimation samples and of different crime perception measures. It also presents results of a placebo exercise that confirms the absence of effects on crimes that we would not expect to respond to *Plan Cuadrante*.

Finally, for statistical inference, we cluster standard errors at the municipality level. Since we work with a relatively small number of large clusters, we compute standard errors using wild bootstrapping (Cameron et al., 2008).

4 Results

This section presents the main results of the paper. First, it shows that *Plan Cuadrante* significantly improved multiple measures of police effectiveness. Second, it shows that these effects were consistent across municipalities with different population densities and with varying socioeconomic levels. Finally, the section studies how police operations changed in municipalities that adopted the program.

4.1 Effects of *Plan Cuadrante* on Police Effectiveness

Panels (a) to (f) in Figure 2 present estimates of the dynamic effects of *Plan Cuadrante* on multiple measures of police effectiveness including victimization, reported crimes, arrests, security perception, and trust in the police. The blue circles and bars represent pre-adoption estimates and their 95% confidence intervals. Very few of these lags are statistically significant and the test of join significance of these coefficients suggests that they are not different from zero.[4] Thus, the outcomes that we study seem to have followed parallel trends before the program's introduction.

The red circles and bars represent post-adoption estimates and illustrate the program's effects.[5]

Panel (a) shows that after adopting *Plan Cuadrante*, there was a significant drop in the share of households reporting crimes in the previous 12 months. This decline in victimization begins in the adoption year and continues over time, falling by ten percentage points (36%) on average. Consistently, panel (b) shows a substantial decrease in reported crimes. Expressed per hundred thousand inhabitants to normalize across municipality sizes, we find an average reduction of 217 reported crimes (14%) following the adoption of the program. Note, however, that analyses based on reported cases may underestimate the reform's true impact since not all crimes are reported to the police, and improved trust in police could increase reporting rates, making any observed reductions in reported crime a conservative estimate of the actual crime decline.[6]

Panel (c) shows that despite the decrease in victimization and reported crime, arrests per

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[4]The p-value for the joint significant test for equal trends before the introduction of *Plan Cuadrante* for the six main outcomes are: 0.833 for victimization, 0.124 for reported crimes, 0.159 for arrests, 0.300 for trust in police, 0.178 for security perception and 0.066 for the adoption of security measures.

[5]The analyses we present in this section come from an unbalanced panel of municipalities. Thus, each lead and lag is identified using a different subset of municipalities. Online Appendix Figure B3 replicates these analyses using only municipalities that implemented *Plan Cuadrante* between 2006 and 2009, allowing us to build for a balanced panel between t-2 and t+3. The estimates remain remarkably similar.

[6]Online Appendix Figure C1 replicates the analyses in panels (a) and (b) by crime type, showing significant reductions in both property and violent crimes. While the definitions of crime categories differ across survey and police databases, the program's effects are consistent in magnitude and statistical significance for violent theft, assault, and home burglary in both crime databases.

hundred thousand inhabitants increased following the adoption of *Plan Cuadrante*. This simultaneous decrease in crimes and increase in arrests suggests improved police effectiveness.

The results above demonstrate that *Plan Cuadrante* improved police effectiveness. But did this change translate into increased trust and security perception? Panel (d) shows that households reporting high or very high trust in police increased by 12 percentage points (30%) in adopting municipalities. Panel (e) reveals that *Plan Cuadrante* decreased crime perception, with households perceiving increased neighborhood crime dropping by 15 percentage points (36%).[7] Following the program adoption, households adopting protective measures—such as buying dogs or weapons, installing alarms or fences, and purchasing insurance or private security—decreased by eight percentage points (37%).[8]

In sum, *Plan Cuadrante* reduced both criminal activity and households' protective behaviors while improving trust in police and security perceptions.

4.2 Heterogeneous Effects of *Plan Cuadrante* by Municipality and House-holds Characteristics

This section examines whether *Plan Cuadrante*'s effects vary by population density, municipal poverty rates, and household socioeconomic status.[9]. These analyses inform both external validity and distributional effects of the program. Figure 3 summarizes these results. We compare municipalities with low versus high population density, municipalities with low versus high poverty rates, and households with low versus high socioeconomic status by splitting the sample in two and estimating specification (1) independently in each subsample. We study the same outcomes as in Figure 2. Left panels illustrate effects for outcomes from the National Survey on Security and Crime (ENUSC), while right panels for outcomes from the administrative data of the Undersecretary for Crime Prevention. Blue and red bars represent β_1 estimates from different subsamples.

While *Plan Cuadrante* was implemented only in urban municipalities, these areas vary substantially in size and structure. Yet panels (a) and (b) show similar effects across population densities. Blue bars illustrate effects in high-density municipalities—top 40% of density distribution—and red bars in low-density municipalities—bottom 40%.[10]

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[7]Online Appendix Figure B5 reports similar declines in crime perception at the municipality and country levels.

[8]Online Appendix Table C1 replicates this analysis by measure type.

[9]Data on population density and municipal poverty rates are available at https://www.sinim.gov.cl/

[10]Average density: 455 inhabitants per square kilometer in high-density municipalities versus 29 in low-density

Panels (c) and (d) present the results of a similar exercise comparing municipalities with different poverty rates. As in the case of population density, effects of *Plan Cuadrante* seem to be similar across municipalities with high- and low-poverty rates. Blue bars show effects in high-poverty municipalities—top 40% of poverty rate distribution—and red bars in low-poverty municipalities—bottom 40%.[11]

Finally, panel (e) indicates that effects on victimization and security perception do not vary across household socioeconomic status (SES), based on ENUSC's household self-reported classification.[12] Blue bars represent high-SES households, red bars low-SES households.

These results indicate that the police geographic specialization induced by *Plan Cuadrante* benefited municipalities and households similarly, regardless of population density or socioeconomic status.

4.3 How Did *Plan Cuadrante* Transform Police Work?

This section examines the changes in police operations introduced by the *Plan Cuadrante* and explores how these changes contributed to the improvements in police effectiveness documented in Section 4.1.

We begin by analyzing whether residents in municipalities that adopted the *Plan Cuadrante* perceived differences in police work after the program's implementation. To this end, we conduct two exercises using ENUSC survey data.

The first exercise relies on questions about perceived police performance that only appear in the 2005 wave of the ENUSC. Since these questions are cross-sectional, we can only compare early adopters—i.e., municipalities that had implemented the *Plan Cuadrante* by 2005—with late adopters—those municipalities that implemented it later. As shown in Panel (a) of Figure 4, households in early-adopting municipalities had a significantly better impression of police work than those in late-adopting municipalities. Specifically, they were 8.1 percentage points (16%) more likely to report that police performance was good or very good, 7.6 percentage points (11%) more likely to describe the police as efficient, 5 percentage points (6%) more likely to find the police helpful, and 4.9 percentage points (7%) more likely to report that the police was well-informed. Additionally, these households were 3.9 percentage points (10%) less likely to perceive the police as corrupt, 7.9 percentage points (21%) less likely to believe that the police

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municipalities.

[11]Average poverty rate: 28% in high-poverty municipalities versus 14% in low-poverty municipalities.

[12]SES classification: Low-SES includes lower-class and lower-middle-class households; high-SES includes upper-middle and upper-class households.

failed to control crime, and 7.6 percentage points (22%) less likely to state that the police did not perform their duties effectively.

The second exercise examines changes in police presence in public spaces also using survey data from the ENUSC. Although questions on police presence are not included in every wave of the survey, they appear frequently enough to allow for an analysis using our main specification. Thus, as in the rest of the paper, we estimate a difference-in-differences specification following Callaway and Sant'Anna (2021). Panel (b) of Figure 4 shows that the adoption of the *Plan Cuadrante* significantly increased police visibility in public spaces. The share of households perceiving an increase in police presence rose by 35 percentage points (156%), while the share of households reporting that police passed by their house daily increased by 22 percentage points (59%). Similarly, the share of households reporting never seeing police patrols near their house fell by 10 percentage points (57%), and complaints about lack of police surveillance decreased by nearly 9 percentage points (20%). In line with the geographic specialization approach encouraged by *Plan Cuadrante*, these findings suggest that *Plan Cuadrante* transformed police work by increasing their presence in the *quadrants*, which resulted in a closer engagement with local communities, which noted and appreciated these changes.

As discussed in Section 2, in some municipalities, the adoption of *Plan Cuadrante* was accompanied by an increase in police resources. Using data on police resources available for the period 2006-2012 for police officers and 2005-2012 for patrol vehicles, Panels (a) and (b) of Figure 5 show significant increases in both the number of police officers and patrol vehicles following the program's adoption. To assess the extent to which these increases in police resources contributed to the improvements in police effectiveness documented throughout the paper, we conduct three complementary exercises. The key results of these exercises are presented below. Online Appendix C.4 provides additional details and extends some of these analyses. All the analyses we conduct suggest that the effects of *Plan Cuadrante* are not driven by changes in police resources alone.

The first exercise examines the heterogeneity of *Plan Cuadrante*'s effects by the magnitude of resource increases in each municipality. Panels (c) and (d) of Figure 5 show that municipalities in the bottom 40% of the resource increase distribution—represented by blue bars—experienced relatively small changes in the number of police officers and patrols once they adopted the program. Indeed, these changes were similar to the ones experienced by the municipalities in our sample before they adopted *Plan Cuadrante* (green bar). In contrast, municipalities in the

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top 40% of the resource increase distribution—represented by red bars—saw much larger gains, with police officers growing by roughly 70% and patrol vehicles multiplying by a factor of seven. To conduct our heterogeneity analysis, we split the sample into municipalities with small and large resource increases and estimate specification (1) separately for each subsample. Panels (e) and (f) of Figure 5 show that the *Plan Cuadrante* was similarly effective in both groups. For outcomes such as 12-month victimization and private investment in security, the estimated coefficients are larger in municipalities that experienced smaller resource increases. The effect on the probability of complaining about police surveillance, a proxy for police presence, was also similar for both groups.[13] More generally, we cannot reject the hypothesis that effects are equal between the two groups in all the examined outcomes. We replicate this analysis in Figure C2 in Appendix C, using predicted rather than actual resource increases, and find consistent results.

The second exercise examines the association between police resources and police effectiveness in municipalities that had already adopted the *Plan Cuadrante*. Using data for the period 2006-2012 from the 41 municipalities in the Santiago Metropolitan Region surveyed in ENUSC, we exploit variations in police resources that are unrelated to the program's adoption—all the municipalities of the Santiago region had adopted the *Plan Cuadrante* by 2000. Figure C3 shows no significant association between police resources—officers or patrols—and any measures of police effectiveness (see Online Appendix C for details).[14]

The third exercise evaluates the impact of *Seguridad Ciudadana*, a program that created local security forces to complement police activities. Although the members of these new security forces cannot carry weapons or apprehend potential criminals, they help the police in patrolling and other deterrence activities. This program was implemented once the roll-out period of the *Plan Cuadrante* had already finished.Using a difference-in-differences specification following Callaway and Sant'Anna (2021), we find that this program had no significant effects on police effectiveness, as shown in Figure C5 (see Online Appendix C for details).

Finally, we re-estimate the main results presented in Figure 2, this time controlling for police resources. Although these resource variables are arguably bad controls and the results should therefore be interpreted with caution, Table C2 in Appendix C shows that including them in the estimations leads to only minor changes in the estimated effects of the program.

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[13]We do not study heterogeneous effects on the other measures of police presence analyzed in Panel (b) of Figure 4 as they are only available in ENUSC rounds 2003, 2005 and 2006 and information on police resources is only available from 2006 onward.

[14]Using ENUSC rounds 2006-2012, Figure C4 shows similar results for the full set of municipalities that implemented the *Plan Cuadrante* before 2006 and the never treated municipalities.

Taken together, the results discussed in this section suggest that while increasing police resources might have facilitated the implementation of *Plan Cuadrante*, resource increases alone do not account for its effects. The geographic specialization introduced by the program, which allowed officers to build localized knowledge of their assigned quadrants and engage more effectively with communities, appears to have been an important driver of its success.

5   Conclusions

Police forces around the world increasingly adopt geographic specialization as a strategy to enhance their effectiveness in addressing crime and maintaining public safety (Serrano-Molina, 2024; Petersen et al., 2024). This approach involves allocating police resources and personnel to specific areas rather than rotating into larger catchment areas, allowing officers to develop a deeper understanding of local issues, crime patterns, and community dynamics. Geographic specialization is particularly common in urban areas, where densely populated regions and diverse neighborhoods require tailored policing strategies. However, despite reforms increasing geographic specialization of the police are common throughout the world, there is no rigorous evidence exploring this question.

Using administrative and survey data from Chile, we show that a reform that reorganized police resources to reduce the catchment area of police units in urban municipalities significantly increased police effectiveness. The positive effects of *Plan Cuadrante* appear to be driven by geographic specialization, consistent with evidence suggesting that decentralization and local specialization can enhance the delivery of public services (Besley and Coate, 2003). Our results highlight that the organization of police resources, not just their quantity, is crucial for their effectiveness.

The results show that increasing geographic specialization reduced both crime incidence and perception. Changes in actual crime rates do not always translate into changes in perceived risk of victimization (Ajzenman et al., 2023b), making this alignment particularly noteworthy. Crime perception, while understudied, has important economic implications as households may overinvest in private security or push for excessive public expenditure when perceived risk exceeds actual risk (Mastrorocco and Minale, 2018; Ajzenman et al., 2023b). Our findings suggest that *Plan Cuadrante*'s reduction in perceived crime led households to decrease their investments in protective measures.

Finally, our results show that geographic specialization can increase trust in the police, a crucial input for police effectiveness that has proven particularly challenging to build in the Global South. While community policing—the flagship strategy to improve trust in recent decades—has shown limited effects in low- and middle-income countries (Blair et al., 2021), our results suggest that geographic specialization could be an effective alternative for building trust in Latin American police forces.

The results of this study highlight a mechanism—geographic specialization of police work—that has the potential to improve police effectiveness, reduce crime, and build trust in law enforcement across different contexts. While the implementation of *Plan Cuadrante* took place in Chile under specific conditions, those conditions help clarify why the program worked and under what circumstances similar reforms might succeed elsewhere.

In particular, two contextual features likely supported the effectiveness of the intervention. First, the absence of significant organized crime during the study period meant that officers could repeatedly operate in a location with less risk of intimidation, or capture, allowing geographic specialization to translate into real gains in responsiveness and trust. Second, the relatively high level of training of the Chilean police provided a solid foundation for implementing such a reform. These are not idiosyncratic traits, but institutional features that are present—or could be developed—in other settings. Thus, findings provide valuable evidence on how structuring police presence and accountability at the local level can strengthen policing outcomes, particularly when supported by institutional capacity and a manageable security environment.

References

Ajzenman, N., P. Dominguez, and R. Undurraga (2023a). Immigration, crime, and crime (mis) perceptions. *American Economic Journal: Applied Economics*.

Ajzenman, N., P. Dominguez, and R. Undurraga (2023b, October). Immigration, crime, and crime (mis)perceptions. *American Economic Journal: Applied Economics 15*(4), 142–76.

Bardhan, P. (2002). Decentralization of governance and development. *Journal of Economic Perspectives 16*(4), 185–205.

Basurto, M. P., P. Dupas, and J. Robinson (2020). Decentralization and efficiency of subsidy targeting: Evidence from chiefs in rural malawi. *Journal of Public Economics 185*, 104047.

Besley, T. and S. Coate (2003). Centralized versus decentralized provision of local public goods: a political economy approach. *Journal of public economics 87*(12), 2611–2637.

Blair, G., J. M. Weinstein, F. Christia, E. Arias, E. Badran, R. A. Blair, A. Cheema, A. Farooqui, T. Fetzer, G. Grossman, et al. (2021). Community policing does not build citizen trust in police or reduce crime in the global south. *Science 374*(6571), eabd3446.

Blanes-i-Vidal, J. and T. Kirchmaier (2018). The effect of police response time on crime clearance rates. *The Review of Economic Studies 85*(2), 855–891.

Blattman, C., D. P. Green, D. Ortega, and S. Tobón (2021, 02). 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.

Bloom, N., R. Lemos, R. Sadun, and J. V. Reenen (2015). Does management matter in schools? *The Economic Journal 125*(584), 647–674.

Borusyak, K., X. Jaravel, and J. Spiess (2024). Revisiting Event-Study Designs: Robust and Efficient Estimation. *The Review of Economic Studies*.

Cafferata, F. and C. Scartascini (2021). Combating crime in latin america and the caribbean: What public policies do citizens want? Inter american development bank.

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

Cameron, A. C., J. B. Gelbach, and D. L. Miller (2008). Bootstrap-based improvements for inference with clustered errors. *The Review of Economics and Statistics 90*(3), 414–427.

Carabineros de Chile (2007). Plan Cuadrante de Seguridad Preventiva. `https://www.carabineros.cl`. Presentación institucional.

Chaisemartin, C. and X. D'Haultfœuille (2020, September). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review 110*(9), 2964–96.

Chalfin, A. and J. McCrary (2017, March). Criminal deterrence: A review of the literature. *Journal of Economic Literature 55*(1), 5–48.

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

Draca, M., S. Machin, and R. Witt (2011, August). Panic on the streets of london: Police, crime, and the july 2005 terror attacks. *American Economic Review 101*(5), 2157–81.

Gallup (2023). Gallup global law and order report 2023.

Gardner, J. (2022, July). Two-stage differences in differences. Papers 2207.05943, arXiv.org.

Gobierno de Chile (2024). Subsecretaria de Desarrollo Regional y Administrativo. Sistema Nacional de información Municipal. `https://datos.sinim.gov.cl`. Consultado el 6 de agosto de 2024.

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

Kirchmaier, T., M. Langella, and A. Manning (2023). Commuting for crime. *The Economic Journal 134*(659), 1173–1198.

Levitt, S. D. (1997). Using electoral cycles in police hiring to estimate the effect of police on crime. *The American Economic Review 87*(3), 270–290.

Mastrorocco, N. and L. Minale (2018). News media and crime perceptions: Evidence from a natural experiment. *Journal of Public Economics 165*, 230–255.

Ministerio del Interior y Seguridad Pública (2014). Evaluación del Programa Plan Cuadrante de Seguridad Preventiva. Technical report.

Petersen, K., D. Weisburd, J. C. Hinkle, C. W. Telep, and S. Fay (2024). Does level of geography influence proactive policing's impact on crime? a synthesis of systematic reviews of three evidence-based policing strategies. *Aggression and Violent Behavior 78*, 101988.

Serrano-Molina, A. (2024). *Policia de proximidad, un enfoque innovador para la seguridad ciudadana.* Ocronos.

Tobón, S. (2021). Community policing in the developing world. *Science 374*(6571), 1046–1047.

Weisburd, S. (2021, 05). Police Presence, Rapid Response Rates, and Crime Prevention. *The Review of Economics and Statistics 103*(2), 280–293.

Figure 1: Implementation of *Plan Cuadrante*
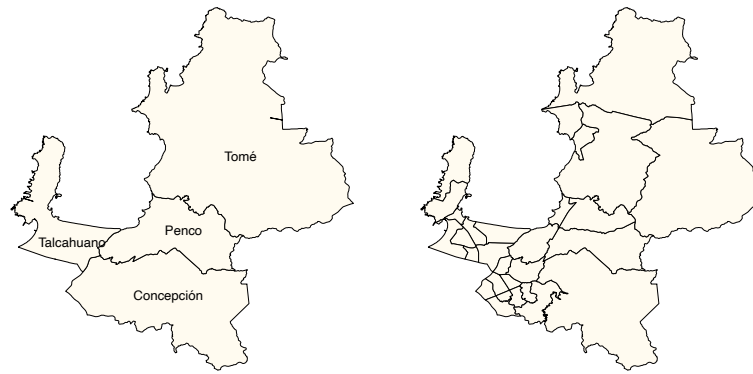
(a) *Plan Cuadrante* in the Concepción area
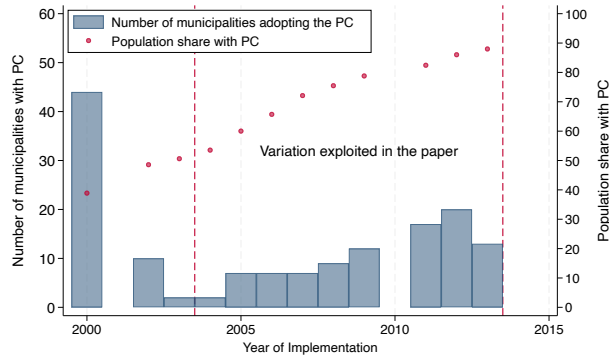
(b) Adoption of *Plan Cuadrante*

Notes: Panel (a) illustrates the division of the police catchment areas into quadrants in the metropolitan area of Concepción, the second largest metropolitan area of Chile. The *Plan Cuadrante* divided the previous catchment areas of the police, which correspond to the territories of a municipality, into smaller quadrants. The bars in panel (b) show the number of municipalities adopting the *Plan Cuadrante* each year, while the diamonds above them illustrate the cumulative share of the Chilean population living in a municipality with the *Plan Cuadrante* already in place.
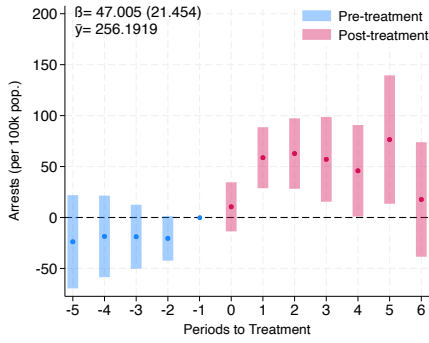
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Figure 2: Effects of *Plan Cuadrante* on Police Effectiveness and Security Perceptions
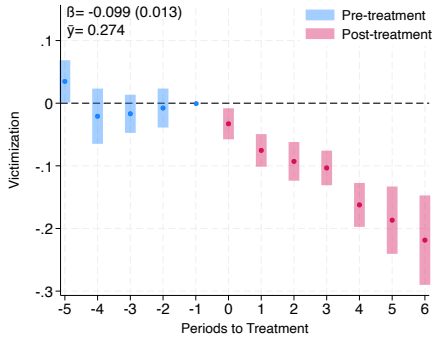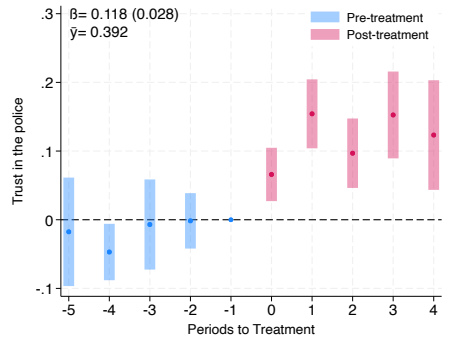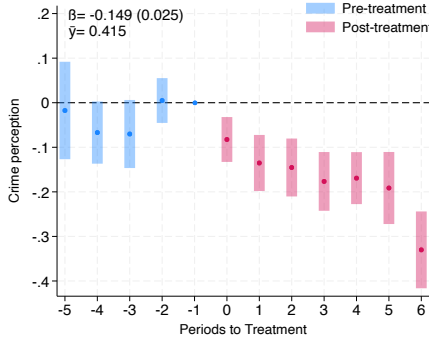
(a) Victimization in last 12 months
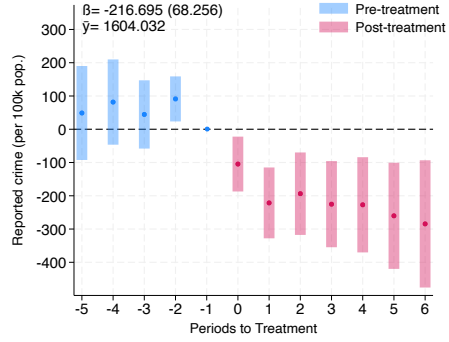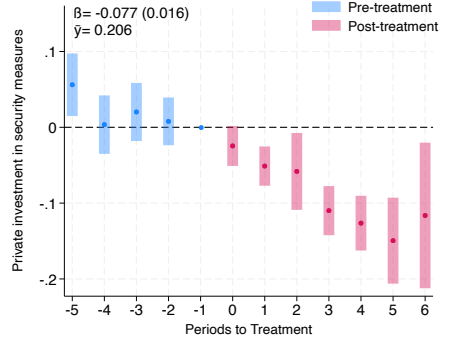
(b) Reported crime per 100k inhabitants

(c) Arrests per 100k inhabitants

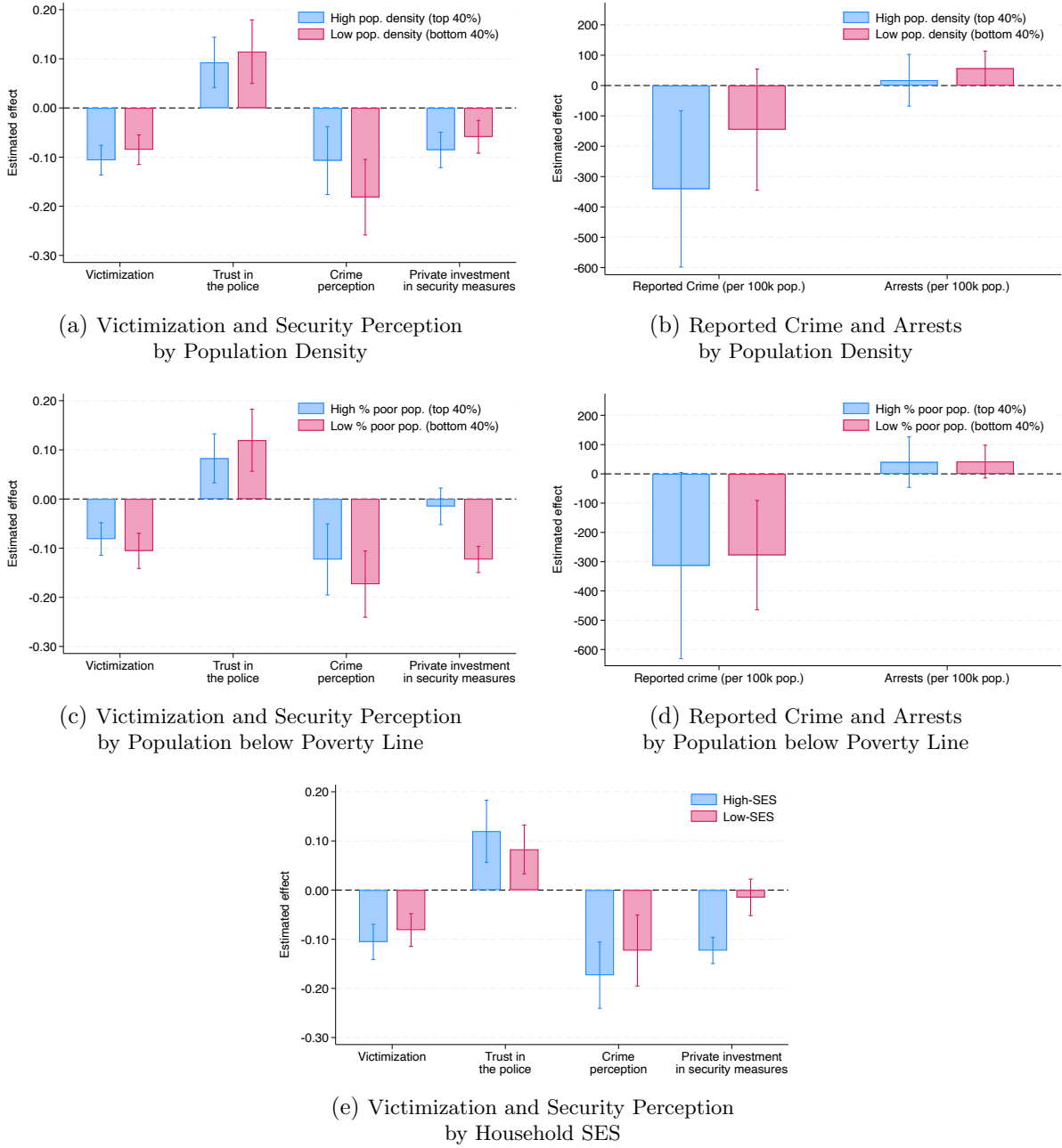(d) Households reporting high trust in the police

(e) Households reporting an increase in crime

(f) Households adopting security measures

Notes: This figure shows the dynamic effects of the *Plan Cuadrante* on different measures of police effectiveness. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The dots in the figure represent the estimated coefficients and the bars behind them 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure. The pooled effect and the mean outcome before the introduction of the treatment is also presented in each panel. Panel (a) reports the effect of *Plan Cuadrante* on the probability of household victimization in the last 12-months using the ENUSC survey. Panel (b) reports the effect on the number of crimes known to the police in the municipality per 100,000 inhabitants using administrative data. Panel (c) reports the effect on the number of arrests in the municipality per 100,000 inhabitants using administrative data. Panel (d) reports the effect on trust in the police using the ENUSC survey. The number of post treatment periods in this estimation is lower because the last survey round with information on trust in the police was implemented in 2009, while for the rest of ENUSC outcomes we use data until 2012. Panel (e) reports the effect on crime perception using the ENUSC survey. Panel (f) reports the results on the probability of purchasing private security measures in the last twelve months using the ENUSC survey. Panel a) includes 93,041 observations; panel b), 4,371; panel c), 3,372; panel d), 60,010; and panels e) and f), 89,578 and 90,696 observations, respectively.

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Figure 3: Effects of *Plan Cuadrante* by Population Density and Socioeconomic Status

(a) Victimization and Security Perception
by Population Density

(b) Reported Crime and Arrests
by Population Density

(c) Victimization and Security Perception
by Population below Poverty Line

(d) Reported Crime and Arrests
by Population below Poverty Line

(e) Victimization and Security Perception
by Household SES

Notes: This figure reports the heterogeneous effects of *Plan Cuadrante* by population density, proportion of poor people in the municipality, and household wealth. The estimation is conducted using the difference-in-differences estimator for staggered treatment adoption developed in Callaway and Sant'Anna (2021). The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping procedures. Panel (a) reports the effect of the program on victimization and security perception outcomes separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the population density distribution. Panel (b) reports the effects on reported crime and arrests outcomes separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the population density distribution. The average population density is 462 inhabitants per square kilometer in high-density municipalities and 30 in low-density municipalities. Panel (c) reports the effect of the program on victimization and security perception outcomes separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the poverty distribution. Panel (d) reports the effects on reported crime and arrests outcomes separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the poverty distribution. The average poverty rate is 28% in high-poverty municipalities and 14% in low-poverty municipalities. Panel (e) reports the effects on victimization and security perception outcomes separately for low- and high-SES households. Socioeconomic status is based on self-reported socioeconomic strata in the ENUSC. Low-SES households include lower-class and lower-middle-class households, while high-SES households include medium and high-class households.

Figure 4: Effects of *Plan Cuadrante* on Perceived Police Performance and Police Presence
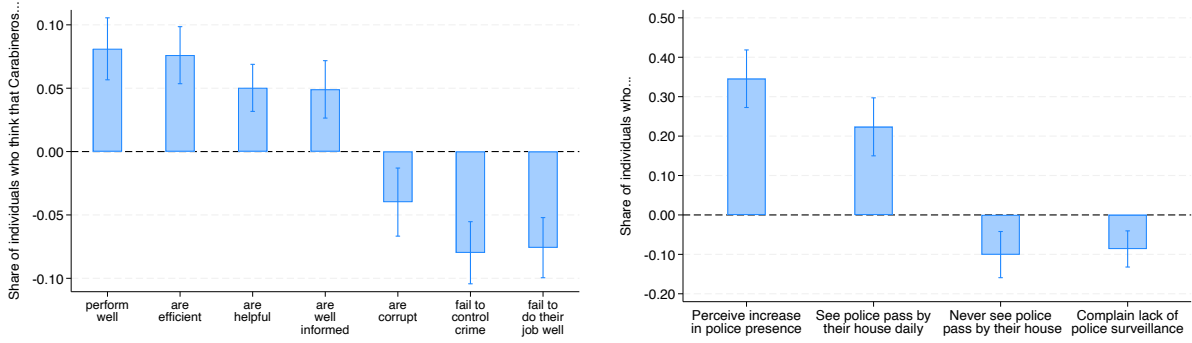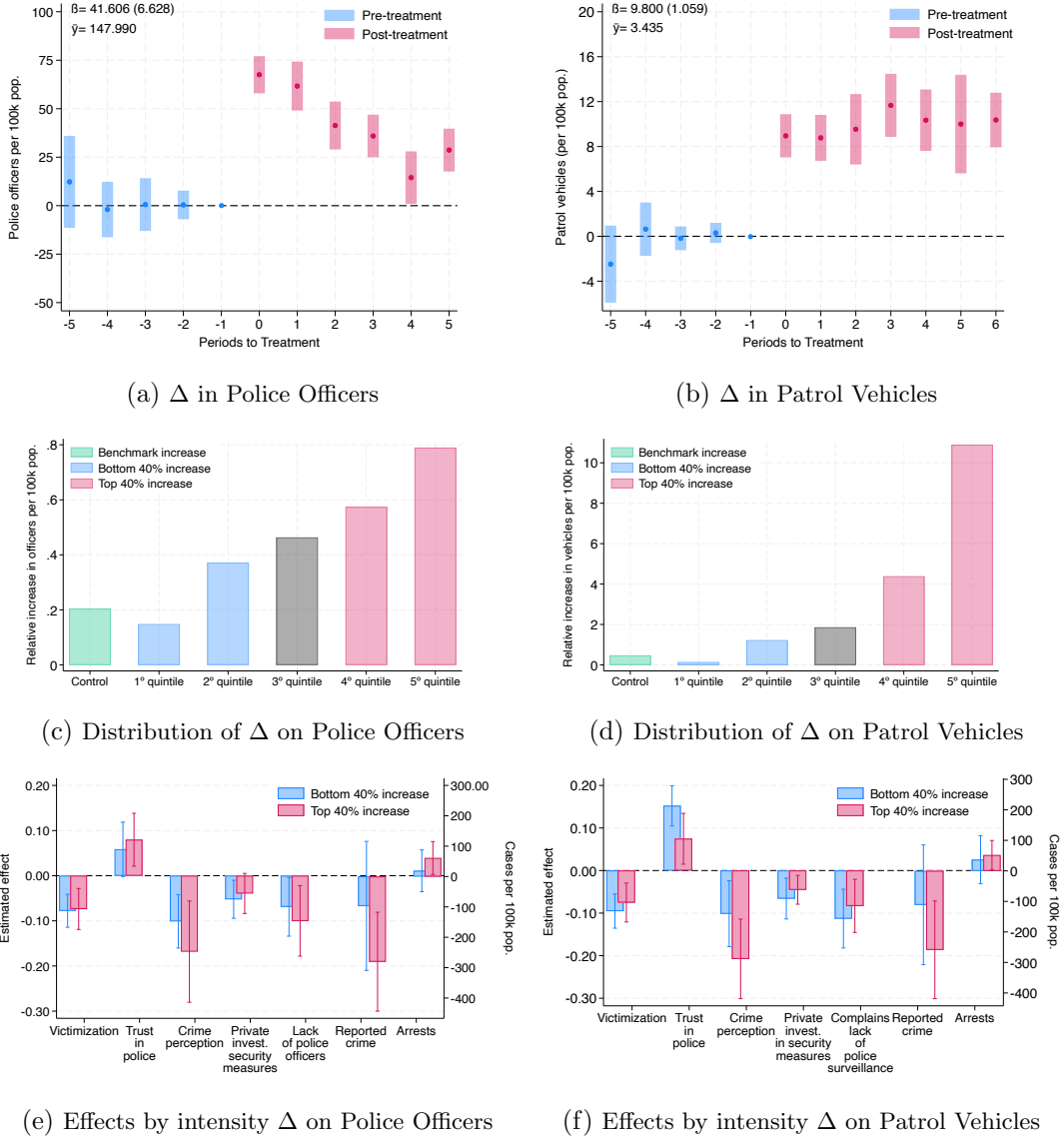

(a) Effects on perceived police performance measures

(b) Effects on police sighting frequency

Notes: Panel (a) reports the association between *Plan Cuadrante* and different measures of subjective police performance available in ENUSC round 2005. These are the share of individuals that believe Carabineros perform well, are helpful, are corrupt, are efficient, failed to control crime, failed to do their job well, and are well informed. We compare these measures in municipalities in the main analytical sample where *Plan Cuadrante* was already implemented before 2006 and in municipalities where the program was implemented after 2005. This panel includes 8,495, 7,975, 8,326, 7,439, 6,621, 7,712, 7,889, respectively, corresponding to each bar from left to right. The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level. Panel (b) reports the effects of *Plan Cuadrante* on different measures of police presence: the probability of perceiving an increase in police presence, seeing police pass by their house daily, never see police pass by their house, and complains about lack of police surveillance. Information on the three first measures is only available for ENUSC rounds 2003, 2005 and 2006, while information on complaints about the lack of police surveillance is available for ENUSC rounds 2003-2012. This panel includes 22,971, 15,151, 15,151, and 120,033 observations, respectively, corresponding to each bar from left to right. The estimation is conducted using the difference-in-differences estimator for staggered treatment adoption developed in Callaway and Sant'Anna (2021). The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure.

Figure 5: Effects of *Plan Cuadrante* and Changes in Police Resources

(a) Δ in Police Officers

(b) Δ in Patrol Vehicles

(c) Distribution of Δ on Police Officers

(d) Distribution of Δ on Patrol Vehicles

(e) Effects by intensity Δ on Police Officers

(f) Effects by intensity Δ on Patrol Vehicles

Notes: Panel (a) shows the effect of *Plan Cuadrante* on the number of police officers per 100,000 inhabitants in the municipality using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. Information on police officers is available for the period 2006-2012. The graph displays the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping. The analysis includes 320 observations. Panel (b) shows the effect of *Plan Cuadrante* on the number of patrol vehicles per 100,000 inhabitants in the municipality using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. Information on patrol vehicles is available for the period 2005-2012. The graph displays the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping. The analysis includes 231 observations Panel (c) shows the mean value of the increase in police officers as part of *Plan Cuadrante* for each quintile of the distribution of the increase in police officers. Panel (d) shows the mean value of the increase in patrol vehicles as part of *Plan Cuadrante* for each quintile of the distribution of the increase in police officers. Panel (e) reports the effect of *Plan Cuadrante* on the main outcomes and on complaints for lack of police surveillance separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the increase in police officers as part of *Plan Cuadrante*. The graph displays the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping. Panel (f) reports the effect of *Plan Cuadrante* on the main outcomes and on complaints for lack of police surveillance separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the increase in patrol vehicles as part of *Plan Cuadrante*. The graph displays the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping.

Effects of Geographic Specialization on Police Effectiveness[†]

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Latest Version

Contents

A   The Implementation of *Plan Cuadrante*

This appendix provides additional information on the nature and implementation of the *Plan Cuadrante* program.

A.1   The Reform

Plan Cuadrante is an initiative by Carabineros de Chile aimed at increasing police effectiveness by dividing larger catchment areas into smaller ones. It emphasizes the importance of direct interaction between citizens and police officers to facilitate the exchange of information relevant to public safety. The reform also seeks to provide police units with the necessary resources for effective implementation of the program.

The permanent assignment of police units to specific quadrants, rather than rotating them through larger catchment areas, is believed to give these units a better understanding of local crime patterns and foster a lasting relationship with the community. This approach arguably also allows for a more efficient use of police resources, such as optimizing patrol placements and improving responsiveness to citizen requests.

A.2   Implementation

Plan Cuadrante was launched in 1998, initially as a pilot program in a few municipalities in the southern part of the city of Santiago. This initial phase aimed to test the plan's implementability. The six-month pilot revealed promising outcomes, which leads to its broader implementation despite the need for additional resources and personnel.

By 2000, the *Plan Cuadrante* had expanded to 44 municipalities in Santiago, covering approximately 96.1% of the city's population. This expansion was based on expert recommendations and the division of urban areas into manageable patrol zones. The plan was then implemented gradually throughout urban municipalities in Chile. The staggered expansion of the Plan Cuadrante beyond Santiago was, in principle, meant to follow a prioritization based on various indicators such as crime rates, demand for police services, and social vulnerability. Official documents referred to composite formulas that incorporated variables such as population size, police-reported crime, and demand for surveillance units. However, in practice, there was no clear or consistently applied rule guiding the selection of municipalities for incorporation into the program, and the allocation appears to have involved a significant degree of discretion.

The plan saw significant growth between 2002 and 2006. In 2002, it extended beyond Santiago into the V and VIII Regions, adding ten new municipalities. The expansion continued from 2003 to 2006, with 18 additional municipalities incorporated into the plan. By 2006, the Plan Cuadrante covered a total of 72 municipalities across Chile. During this period, the plan underwent adjustments to address resource needs.

The years 2007 to 2009 marked a phase of refinement for the *Plan Cuadrante*. In 2007, the plan expanded to include 28 more municipalities, reaching the 100 municipalities covered by the *Plan Cuadrante*. This expansion was accompanied by several improvements, including the establishment of an "Observatory of Good Practices" to monitor and promote effective strategies. This period also saw increased integration of the *Plan Cuadrante* into broader national security

strategies. The commitment to continuous improvement and adaptation was reflected in the plan's ongoing expansion and refinement.

The *Plan Cuadrante* faced significant challenges in 2010 due to the earthquake that struck Chile. The disaster necessitated a reallocation of resources to support recovery efforts, temporarily halting the plan's expansion. Despite this setback, the *Plan Cuadrante* resumed its implementation in 2011. Between 2011 and 2013, the plan was expanded to include an additional 50 municipalities, bringing the total to 150 across Chile. Tables A2 and A3 present summary statistics at the household and at the municipality level of the municipalities implementing *Plan Cuadrante* in the period that we study.

Table A1: Implementation of *Plan Cuadrante* by Year

Year	Municipalities
2000	44 municipalities in Santiago
2002	Chiguayante, Concepción, Hualpén, Quilpué, San Antonio, San Pedro de la Paz, Talcahuano, Valparaíso, Villa Alemana, Viña del Mar
2003	Padre Las Casas, Temuco
2004	Antofagasta, Coapiapó
2005	Alto Hospicio, Arica, Calama, Curicó, Iquique, Linares, Talca
2006	Coquimbo, La Serena, Los Andes, Ovalle, Rancagua, San Felipe, San Fernando
2007	Chillán, Chillán Viejo, Los Ángeles, Osorno, Puerto Montt, Punta Arenas, Valdivia
2008	Ancud, Castro, Constitución, Coronel, Lota, Peñaflor, Quillota, Rengo, Villarrica
2009	Angol, Aysén, Calera, Concón, Coyhaique, La Unión, Padre Hurtado, Parral, Penco, San Carlos, Tomé, Vallenar
2011	Arauco, Cañete, Cartagena, Cauquenes, Curanilahue, La Ligua, Limache, Molina, Nueva Imperial, Pucón, Puerto Varas, Río Bueno, San Clemente, San Javier, San Vicente, Santa Cruz, Victoria
2012	Cabrero, Calbuco, Casablanca, Chimbarongo, Collipulli, Curacaví, El Monte, Graneros, Illapel, Isla de Maipo, Lautaro, Machalí, Mostazal, Mulchén, Nacimiento, Natales, Panguipulli, Quellón, Quintero, Tocopilla
2013	Bulnes, Laja, Las Cabras, Lebu, Llay Llay, Loncoche, Longaví, Los Álamos, Maule, Requínoa, Teno, Vicuña, Yumbel

Note: Data shared by Carabineros de Chile.

Table A2: Summary Statistics - ENUSC sample

	Mean	SD	Min	Max	N
Household					
Socioeconomic status (0-5)	3.57	0.73	1	5	97,847
Victimization (0/1)	0.26	0.44	0	1	97,847
Crime perception (0/1) (neighborhood)	0.38	0.49	0	1	94,210
Crime perception (0/1) (municipality)	0.65	0.48	0	1	95,389
Crime perception (0/1) (country)	0.79	0.41	0	1	97,089
High trust in police (0/1)	0.44	0.50	0	1	50,778
Private investment in security measures (0/1)	0.21	0.40	0	1	97,847
Plan Cuadrante (year)	2,008	1.85	2,005	2,012	97,847
Household member interviewed					
Female	0.55	0.50	0	1	97,847
Age	43.87	17.96	15	99	97,847
Primary school attendance	0.98	0.14	0	1	97,847
Secondary school attendance	0.72	0.45	0	1	97,847
University attendance	0.20	0.40	0	1	97,847

Note: This table presents summary statistics from the ENUSC sample in the 46 municipalities that adopted the Plan Cuadrante between 2005 and 2012, which constitute the source of variation exploited in our analysis. Socioeconomic status is a 1 to 5 measure produced by ENUSC surveys and based on self-reported socioeconomic strata, being 1 the highest ranked and 5 the lowest. Crime perception is equal to 1 if the interviewed person reports that crime has increased in the last 12 months.

Table A3: Summary Statistics - Municipality-level sample

	Mean	SD	Min	Max	N
Reported crime (per 100k pop.)	1,737.91	1033.78	0	11,434	4,362
Arrests (per 100k pop.)	326.36	263.26	0	1,712	3,444
Plan Cuadrante (year)	2010	2.81	2003	2013	1,380
Poverty rate (%)	25.74	9.72	6	58	4,335
Pop. density (pop./km2)	63.51	140.47	0	1,110	4,305
Plan Cuadrante (year)	2010	2.57	2005	2013	1,104
Poverty rate (%)	25.80	9.74	6	58	3,420
Pop. density (pop./km2)	61.53	137.47	0	1,110	3,396

Note: This table presents summary statistics from the Undersecretary for Crime Prevention sample, focusing on the municipalities that adopted the Plan Cuadrante between 2004 and 2016 and those that have not implemented the program and serve as a pure control group (never-treated).

B   Robustness Checks

This appendix presents the results of various empirical analyses that confirm the robustness of our analyses to different specifications, samples, and measures of crime. First, we show that our findings are robust to the use of alternative difference-in-differences estimators for staggered treatment adoption. Second, we show that the effects of the program on arrests and reported crimes from administrative records are not driven by the inclusion of a broader sample of municipalities in this dataset. Third, we show that the estimates presented in the main body of the paper are very similar to the ones we obtain using a balanced panel of municipalities. Fourth, we document that *Plan Cuadrante* has limited effects on neighboring municipalities, making it unlikely that the program's impact on crime victimization is biased due to crime displacement. Fourth, we establish that the effects of the program on crime perception remain consistent when alternative measures of crime perception available in the dataset are used.

B.1   Alternative Estimation Methods

The results reported in Section 4.1 are estimated using the difference-in-differences estimator for staggered treatment introduction developed in Callaway and Sant'Anna (2021). In this subsection, we examine the robustness of the results to the use of alternative difference-in-difference estimators for staggered treatment introduction including those developed in Borusyak et al. (2024), Chaisemartin and D'Haultfœuille (2020), Gardner (2022), and also to the canonical two-way fixed effects (TWFE).

   The results of these analyses are reported in Figure B1 and show similar effects of *Plan Cuadrante* in terms of both magnitude and statistical significance across most specifications. On the other hand, the canonical TWFE shows smaller effects, likely due to the negative weights problem highlighted by Goodman-Bacon (2021) when estimating difference-in-differences with staggered treatment adoption using TWFE.

Figure B1: Effects of *Plan Cuadrante* on Police Effectiveness Using Alternative Estimators
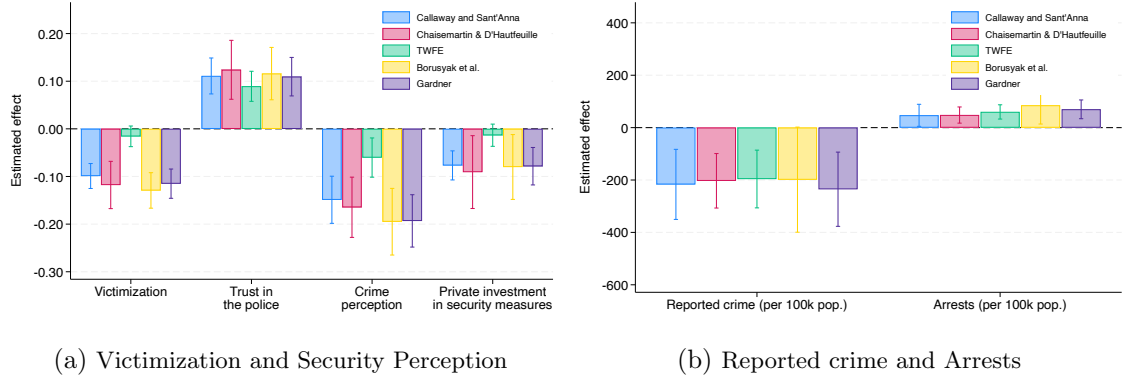
(a) Victimization and Security Perception

(b) Reported crime and Arrests

Notes: The figure reports the effects of *Plan Cuadrante* on different measures of police effectiveness using various difference-in-differences estimators including the methods developed in Callaway and Sant'Anna (2021), Chaisemartin and D'Haultfœuille (2020), Borusyak et al. (2024), Gardner (2022), and the canonical two-way fixed effects (TWFE). The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level. Panel (a) reports the effects of *Plan Cuadrante* on victimization and security perception outcomes constructed using the ENUSC data. Panel (b) reports the effect on arrests and reported crime constructed using administrative records.

B.2 Effects of *Plan Cuadrante* Using Administrative Data and the Sample of Municipalities Included in the ENUSC Survey

The results reported in Panel (b) and (c) of Figure 2 in Section 4.1 show the effects of *Plan Cuadrante* on the number of reported crimes in the municipality and the total number of arrests, which are administrative data provided by the police for all Chilean municipalities. The latter analysis is conducted with all never treated municipalities and municipalities that implemented the program between 2004 and 2013. This is a different analytical sample from the one used in the analysis of ENUSC survey outcomes -victimization, trust in the police, crime perception, and crime prevention measures- since the ENUSC survey was conducted only on a subsample of municipalities and for a different time period.
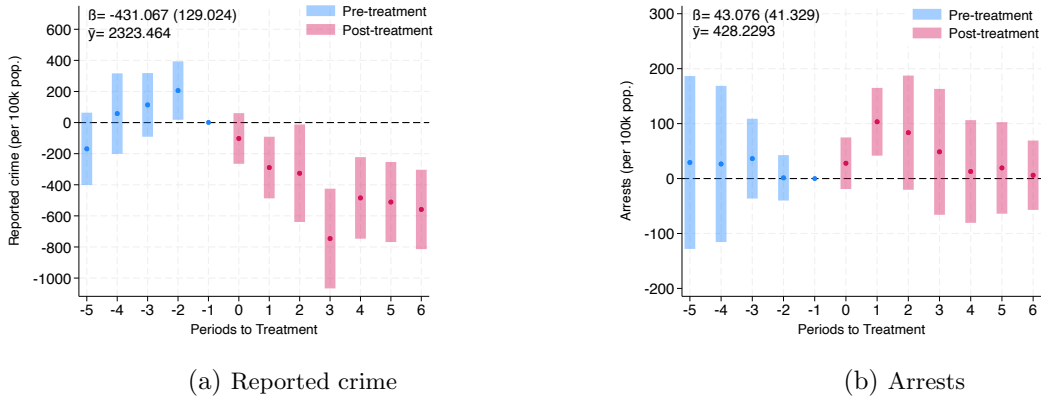
In this appendix, we estimate the effects of *Plan Cuadrante* on the number of crimes reported to the police and on the total number of arrests, using only the subsample of municipalities included in the analysis of the ENUSC outcomes. While the sample size is smaller, the estimates using this restricted analytical sample, reported in Table B1 and Figure B2, show similar patterns to those observed when using the full sample.

Table B1: Effects of *Plan Cuadrante* on Reported crime and Arrests with the Sample of Municipalities Included in the ENUSC

Outcome	(1) Reported crime All	(2) Reported crime Sample ENUSC	(3) Arrests All	(4) Arrests Sample ENUSC
ATT	-216.70***	-431.07***	47.00**	43.08
	(68.26)	(129.02)	(21.45)	(41.33)
N	4,371	702	3,372	480
Municipalities	292	47	281	40

Note: This table shows the effects of *Plan Cuadrante* on the number of crimes known to the police in the municipality per 100,000 inhabitants and on the number of arrests in the municipality per 100,000 inhabitants using administrative data from the Undersecretary for Crime Prevention. The table reports the results for two samples: the full sample of municipalities included in the administrative database that is used for the analysis of these outcomes and the subsample of these municipalities included in the analysis of ENUSC outcomes. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. Standard errors are clustered at the municipality level using the wild bootstrapping procedure.***p<0.01,**p<0.05,*p<0.1.

Figure B2: Effects of *Plan Cuadrante* on the Reported Crimes and Arrests (Sample of Municipalities Included in the ENUSC)


(a) Reported crime

(b) Arrests

Notes: This figure shows the dynamic effects of *Plan Cuadrante* on the number of crimes known to the police per 100,000 inhabitants in the municipality in panel (a) and on the number of arrests per 100,000 inhabitants in the municipality in panel (b) using administrative data from the Undersecretary for Crime Prevention. Unlike in panel (b) and (c) in Figure 2, the analysis is conducted using only the sample of municipalities included in the ENUSC survey. Panel (a) includes 702 observations, while panel (b) includes 480 observations. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The dots in the figure represent the estimated coefficients and the bars behind them 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping. The pooled effect and the mean outcome before the introduction of the treatment is also presented in each panel.

B.3 Effects of *Plan Cuadrante* using a Balanced Panel

Figure B3 shows the effects of *Plan Cuadrante* on the main outcomes, but estimated using a balanced panel of municipalities. This panel includes only municipalities that implemented the *Plan Cuadrante* between 2006 and 2009, allowing the construction of a balanced panel from t-2 to t+3. The resulting estimates are very similar to those presented in the main document.

Figure B3: Effects of *Plan Cuadrante* Using a Balanced Panel of Municipalities
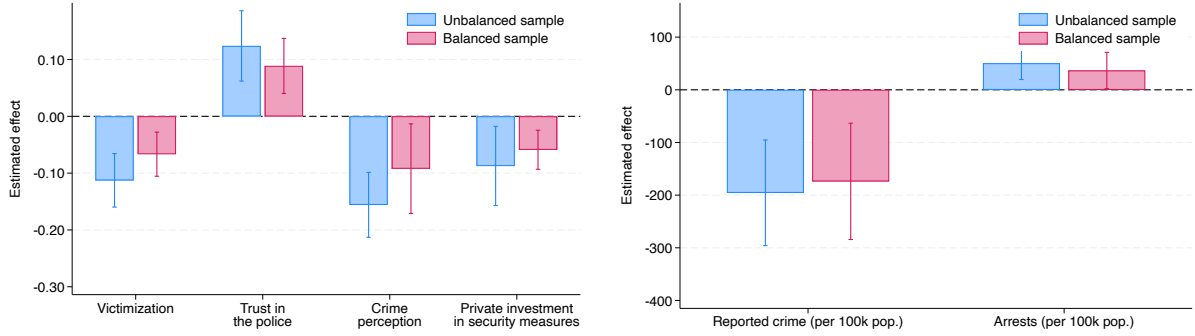
Notes: The figure reports the effects of *Plan Cuadrante* on different measures of police effectiveness using the main analytical sample, and also a balanced panel restricting the sample to the 31 municipalities, for the ENUSC sample, and 91 municipalities, for the administrative municipality-level sample, that implemented the Plan Cuadrante in 2006, 2007, 2008 and 2009. The graph presents the pooled coefficients of the effect for both samples using the estimator developed in Chaisemartin and D'Haultfœuille (2020), which facilitates the estimation of the balanced-sample analysis. The dots in the figure represent the estimated coefficients and the bars behind them 95% confidence intervals. Standard errors are clustered at the municipality level. Panel (a) reports the effect of *Plan Cuadrante* on victimization and security perception outcome variables constructed using the ENUSC survey. Panel (b) reports the effect on the arrests and crime known to the police variables constructed using the administrative information provided by the Undersecretary for Crime Prevention.

B.4 Spillover Effects of *Plan Cuadrante*

A few studies have documented that some programs that increase the presence of the police in some areas can displace crime, eventually limiting the total effects on crime reduction (Blattman et al., 2021). In our context, crime displacement from treatment municipalities to neighboring control municipalities would bias upwards the estimated effects of the program. In this subsection we assess whether *Plan Cuadrante* displaced crime to neighboring untreated municipalities. We examine this hypothesis by estimating the effect of the program on neighbor untreated municipalities:

$$Crime_{mt} = \delta_1 Police\ reform\ near\ municip._{mt} + Municipality_m + Year_t + u_{mt} \qquad (2)$$

where δ_1 measures the effect of the program *Plan Cuadrante* on crime in neighbor municipalities. The estimation sample is restricted to neighboring municipalities that do not implement *Plan Cuadrante* and their treatment date is assigned based on the year of assignment of the neighbor that implemented it earlier. The results of this analysis are reported in Figure B4. The effect of *Plan Cuadrante* on reported crimes in neighboring municipalities is small and largely insignificant at conventional confidence levels. The magnitude of the coefficient is less than one-third of the effect in the treated municipalities, which is reassuring, as it suggests that crime has effectively dropped rather than simply being displaced to nearby municipalities.

The results of the effects are reported in Figure B4 and show no spillover effects of the program on crime and arrests.[15]

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[15]We could not assess the spillover effects using survey data —crime victimization, trust in the police, adoption of crime prevention measures, and crime perception— because there are not enough neighboring, not-yet-treated municipalities surveyed in ENUSC.

Figure B4: Geographic Spillovers of *Plan Cuadrante*

(a) Spillovers on Reported crime

(b) Spillovers on Arrests
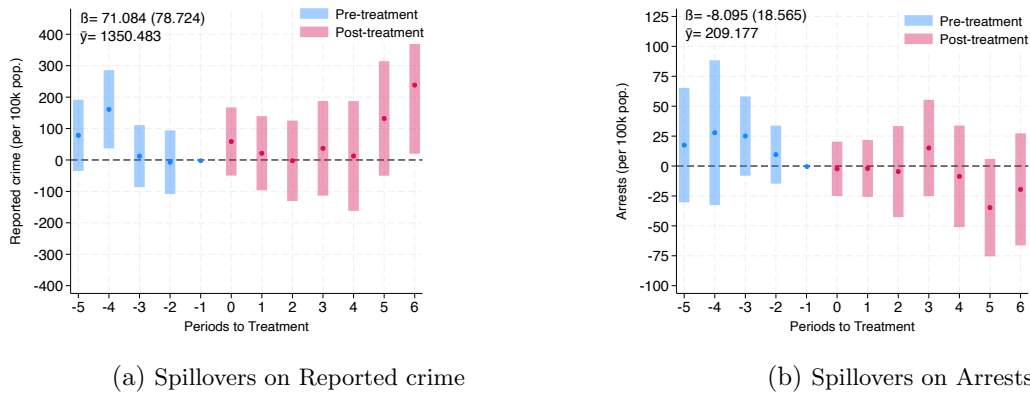
Notes: This figure reports the spillover effects of *Plan Cuadrante* on the number of crimes known to the police in the municipality per 100,000 inhabitants (panel a) and on the number of arrests in the municipality per 100,000 inhabitants (panel b). Panel (a) includes 2,859 observations, while panel (b) includes 2,166 observations. Specifically, the figure shows the dynamic effects of the *Plan Cuadrante* for neighbor municipalities which never introduced the program. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption, using as the treatment introduction date the earliest date of a neighboring municipality. The dots in the figure represent the estimated coefficients and the bars behind them 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure. The pooled effect and the mean outcome before the introduction of the treatment for every outcome is also presented in each panel.

B.5 The Effects of *Plan Cuadrante* on Other Measures of Crime Perception

The results reported in panel (e) of Figure 2 showed that *Plan Cuadrante* decreased household's perception of crime in the neighborhood. However, ENUSC survey not only ask about individual's crime perception in the neighborhood, but also in the municipality and in the country. Figure B5 reports the results of *Plan Cuadrante* on the perception of crime in the municipality and in the country. While the effect is consistently negative and statistically significant also for these measures of crime perception, the effect is much smaller for insecurity in the country, indicating that the effects of the program on crime perception are larger at the local level.

Figure B5: Effects of *Plan Cuadrante* on Crime Perception in the Municipality and in the Country


(a) In the municipality

(b) In the country
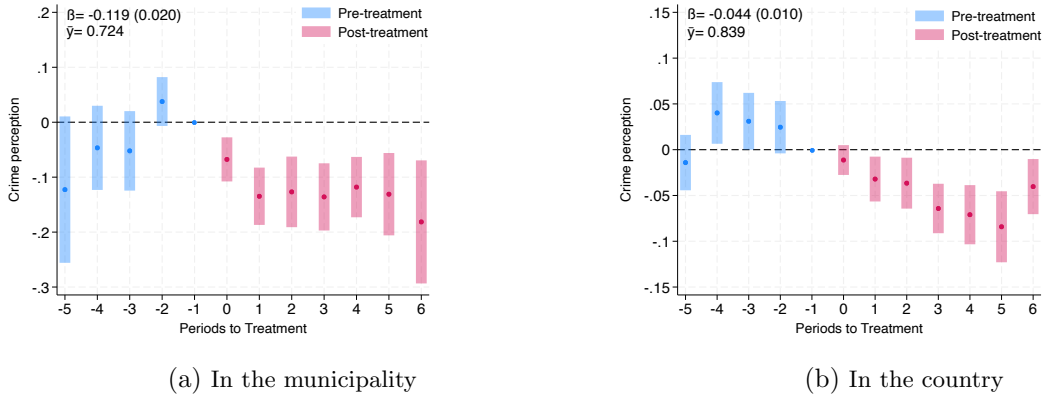
Notes: This figure shows the dynamic effects of the *Plan Cuadrante* on the proportion of individuals that perceive an increase in crime in the municipality in the last 12 months (panel a), and on the proportion of individuals that perceive an increase in crime in the country in the last 12 months (panel b). Panel (a) includes 90,696 observations, while panel (b) includes 92,305 observations. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The dots in the figure represent the estimated coefficients and the bars behind them 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure. The pooled effect and the mean outcome before the introduction of the treatment for every outcome is also presented in each panel.

B.6 Placebo Test Using Non-neighborhood Crime

To assess whether the observed decline in crime is driven by broader temporal trends rather than increased police presence, we conduct a placebo test using a type of crime unlikely to be affected by neighborhood policing—namely, non-neighborhood crime such as sexual abuse. These crimes typically occur outside the scope of routine neighborhood patrols and are therefore not expected to respond directly to changes in local police deployment. We use annual municipal-level data on reported sexual abuse and related arrests from 2005 to 2016, obtained from the Undersecretariat for Crime Prevention.

Figure B6 shows that the implementation of *Plan Cuadrante* is, as expected, not significantly associated with changes in sexual abuse crime.

Figure B6: The Effects of *Plan Cuadrante* on Sexual Abuse

(a) Reported crime	(b) Arrests
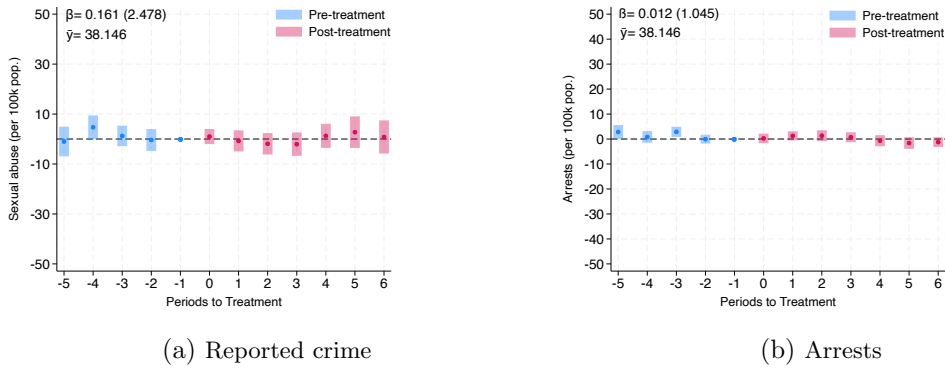
Notes: This figure shows the dynamic effects of the *Plan Cuadrante* on sexual abuse per 100,000 inhabitants. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure.

C Additional Results

This appendix expands on some of the analyses presented in the main body of the paper. First, it shows the effects of *Plan Cuadrante* on different types of crime. Second, it documents some differences in results associated to private investment in security depending on household SES. Third, it presents two new analyses that suggest that changes in police resources associated to the adoption of the *Plan Cuadrante* are not enough to explain its results. Finally, it presents the results of a new exercise that shows that increases in police resources unrelated to *Plan Cuadrante* do not generate major gains in police effectiveness.

C.1 Effects of *Plan Cuadrante* on Different Types of Crime

Figure C1 displays the effects of *Plan Cuadrante* on victimization by type of crime, showing beneficial effects for both violent and property crimes.

Figure C1: The Effects of *Plan Cuadrante* on Victimization and Reported Crime by Type of Crime

(a) Effects on Victimization and Security Perception by Type of Crime

(b) Effects on Reported crime by Type of Crime
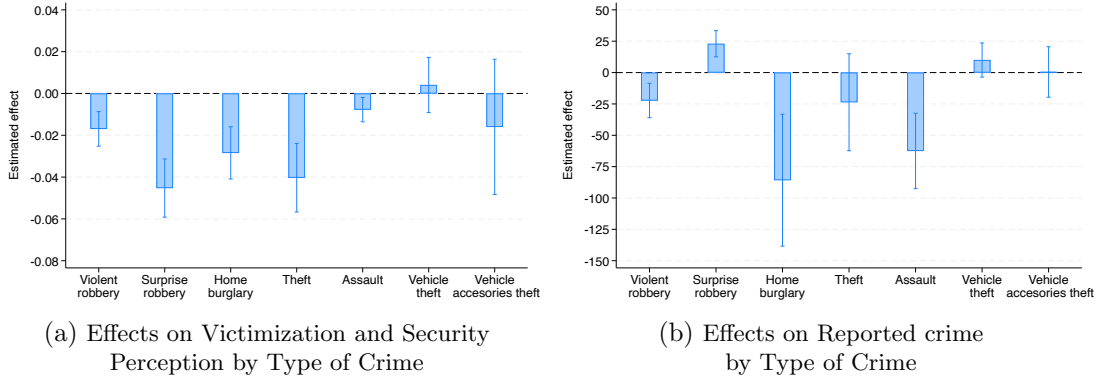
Notes: This figure shows the dynamic effects of the *Plan Cuadrante* on victimization and number of crimes known to the police per 100,000 inhabitants by type of crime. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure. Panel (a) presents the results using victimization data from ENUSC surveys while Panel (b) presents the results using municipality-level administrative data on crime known to the police provided by the Undersecretary for Crime Prevention.

C.2 Effects of *Plan Cuadrante* on Crime Preventing Measures by Type of Measure and Household SES

Finally, Table C1 presents the effect of *Plan Cuadrante* on different types of crime prevention measures by the socioeconomic status of households. The results indicate that *Plan Cuadrante* reduces household investments in crime prevention measures across all socioeconomic groups, particularly investments in more affordable measures such as grilles and dogs.

Table C1: The Effects of *Plan Cuadrante* on Crime Prevention Measures by Affordability of the Measure and Household Socioeconomic Status

	Low-cost	High-cost	Low-cost		High-cost	
	All	All	High SES	Low SES	High SES	Low SES
	(1)	(2)	(3)	(4)	(5)	(6)
ATT	-0.072***	-0.007*	-0.090***	-0.058***	-0.028***	-0.004
	(0.015)	(0.004)	(0.018)	(0.018)	(0.010)	(0.005)
N	93,041	93,041	40,377	52,664	40,377	52,664
Municipalities	47	47	47	47	47	47

Note: The table reports the effects of *Plan Cuadrante* on security measures adopted in the last 12 months by type of measures and for both high- and low-SES households using information from the ENUSC. Low-cost measures include dogs and grilles for security while high-cost measures include weapons, alarms, insurance, and guards. High SES stands for high and medium-class households, low SES stands for vulnerable and poor households.The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. Standard errors are clustered at the municipality level using the wild bootstrapping procedure.***p<0.01;**p<0.05,*p<0.1.

C.3 Effects of *Plan Cuadrante* and Changes in Police Resources

To make the implementation of *Plan Cuadrante* possible, police resources were augmented in some municipalities. To examine the extent to which the observed results might be driven by the increase in police resources rather than by the geographic specialization component of the reform, we conduct the following three empirical exercises.

Firstly, we examine the heterogeneity of the *Plan Cuadrante*'s effects by the magnitude of resource increases in each municipality. Panels (c) and (d) of Figure 5 show that municipalities in the bottom 40% of the resource increase distribution—represented by blue bars—experienced relatively small changes in the number of police officers and patrols once they adopted the program. Indeed, these changes were similar to the ones experienced by the municipalities in our sample before they adopted *Plan Cuadrante* (green bar). In contrast, municipalities in the top 40% of the resource increase distribution—represented by red bars—saw much larger gains, with police officers growing by roughly 70% and patrol vehicles multiplying by seven. To conduct our heterogeneity analysis, we split the sample into municipalities with small and large resource increases and estimate specification (1) separately for each subsample. Panels (e) and (f) of Figure 5 show that the *Plan Cuadrante* was similarly effective in both groups. For outcomes such as 12-month victimization and private investment in security, the estimated

coefficients are larger in municipalities that experienced smaller resource increases. The effect on the probability of complaining about police surveillance, arguably a proxy for police presence, was also similar for both groups.[16] More generally, we cannot reject the hypothesis that effects are equal between the two groups in all the examined outcomes.

Secondly, we examine the heterogeneity of the *Plan Cuadrante*'s effects based on the predicted magnitude of resource increases, rather than on the actual resource increases themselves. While the fact that the program is effective even in municipalities with limited resource increases—similar to those in the control group—rule out concerns about the relevance of the geographic specialization component, it is also possible that the increase in police resources following program adoption is, to some extent, driven by the expected impact of the program. In this context, we re-estimate the effects using the predicted value of the resource increase rather than the observed increase. To do so, we first regress the observed changes in resources—both in the number of police officers and patrol vehicles—on the initial level of police resources, the victimization rate, and crime perception, which are variables used by *Carabineros* for the allocation of resources across municipalities (Carabineros de Chile, 2007).[17]

$$\Delta \text{PoliceResources}_m = \omega_1 \, PoliceOfficers_{m,\tau_m-1} + \omega_2 \, PatrolVehicles_{m,\tau_m-1}$$
$$+ \, \omega_3 \, Victimization_{m,\tau_m-1} + \omega_4 \, CrimePerception_{m,\tau_m-1} + u_m \quad (4)$$
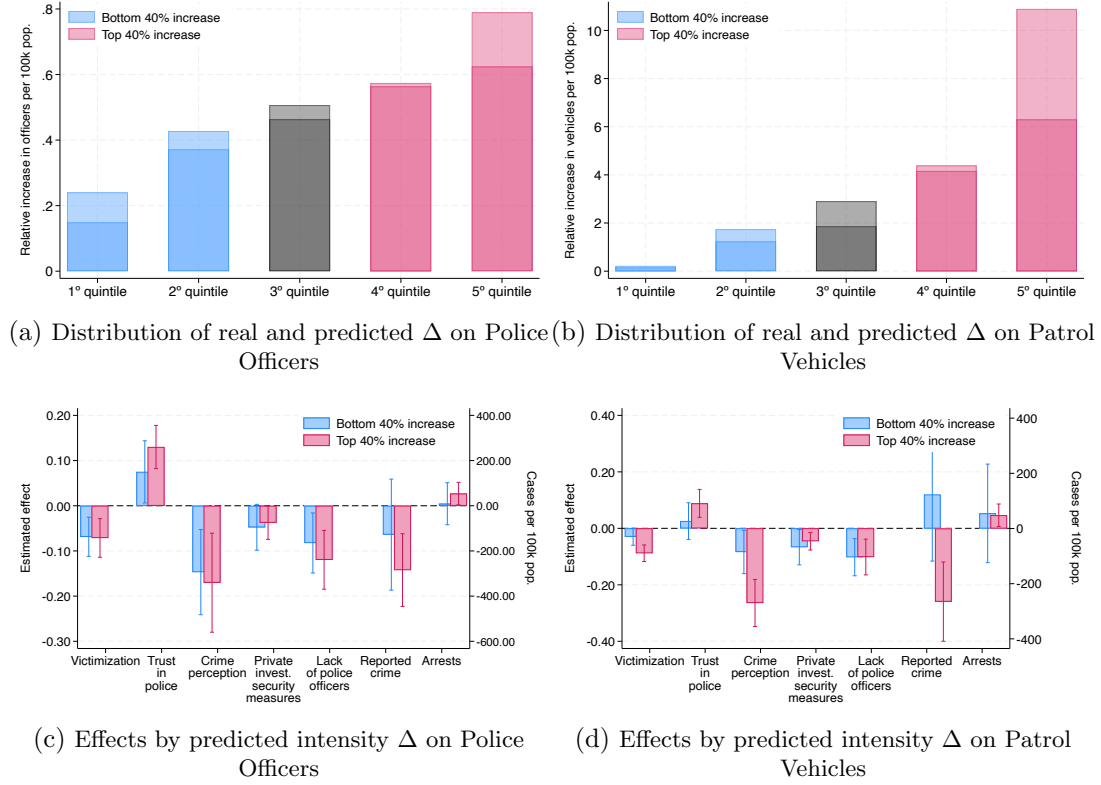
All included variables are statistically significant at conventional confidence levels, with an R^2 of 38% and 30% for police officers and patrol vehicles. We then use the estimated coefficients to calculate the predicted changes in police resources for each municipality, and identify those in the bottom 40% and top 40% of the predicted resource increase distribution. We estimate specification (1) separately for the subsamples of municipalities with small and large predicted resource increases. Overall, panels (a) and (b) of Figure C2 show that differences across quintiles in predicted resource increases (depicted in darker colors) are less pronounced than those observed for actual predicted resource increases. The corresponding results by quintiles of predicted resource increaes are presented in panels (c) and (d). Although the differences are less stark, the patterns broadly resemble those in Figure 5, further reinforcing the notion that geographic specialization plays a key role in shaping the impact of the *Plan Cuadrante* reform.

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[16]We provide the heterogeneous effects of *Plan Cuadrante* on complaints about lack of police surveillance because information on this variable is available for the period 2003-2012. However, Information on the share of households perceiving an increase in police presence, reporting that police passed by their house daily and never seeing police patrols near their house is only available in ENUSC rounds 2003, 2005 and 2006, and therefore there is not sufficient overlap with information on resources, available from 2005 for patrol vehicles and from 2006 for police officers.

[17]Because information on victimization and crime perception is only available for municipalities surveyed in the ENUSC—and therefore unavailable for most municipalities included in the analysis based on administrative data—we calculate the predictions of resource increases for the analysis of administrative data using a slight variation of equation 3 without crime perception and victimization:

$$\Delta \text{PoliceResources}_m = \omega_1 \, PoliceOfficers_{m,\tau_m-1} + \omega_2 \, PatrolVehicles_{m,\tau_m-1} + u_m \quad (3)$$

Figure C2: Effects of *Plan Cuadrante* and Predicted Changes in Police Resources

(a) Distribution of real and predicted Δ on Police Officers

(b) Distribution of real and predicted Δ on Patrol Vehicles

(c) Effects by predicted intensity Δ on Police Officers

(d) Effects by predicted intensity Δ on Patrol Vehicles

Notes: Panel (a) shows the distribution in quintiles of predicted police officers increases in dark colors, and the distribution in quintiles of observed police officers increases in light colors. Panel (b) shows the distribution in quintiles of predicted patrol vehicles increases in dark colors, and the distribution in quintiles of observed patrol vehicles increases in light colors. Panel (c) reports the effect of *Plan Cuadrante* on the main outcomes separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the predicted increase in police officers as part of *Plan Cuadrante*. The graph displays the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping. Panel (d) reports the effect of *Plan Cuadrante* on the main outcomes separately for municipalities in the two bottom quintiles, and in the two upper quintiles of the increase in patrol vehicles as part of *Plan Cuadrante*. The graph displays the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping.

Finally, in the third exercise, we re-estimate the main results of the study reported in Figure 2, controlling for the number of police officers and the number of patrol vehicles in the municipality.

The results of this analysis are reported in Table C2. These resource variables are bad controls as they are affected by the adoption of *Plan Cuadrante*, and therefore the results should be interpreted with caution. Nevertheless, it is reassuring to observe that the findings remain broadly consistent across specifications with and without these bad controls.

C.4 Police Resources and Police Effectiveness

This appendix presents two additional empirical analyses examining the link between police resources and crime in Chile, outside the scope of *Plan Cuadrante*.

First, we use yearly information on the number of policemen and patrol vehicles at the municipality level facilitated by *Carabineros* for the period 2006-2012 to examine the statistical association between police resources and crime, controlling for year and municipality fixed effects. Specifically, we estimate the following regression:

Table C2: Effects of *Plan Cuadrante* controlling by Police Resources

	(1)	(2)	(3)	(4)
ATT on Victimization	-0.099***	-0.077***	-0.086*	-0.091*
	(0.013)	(0.012)	(0.047)	(0.051)
Sample	All years	Years with police resources information	Years with police resources information	Years with police resources information
Controls			Police officers	Patrol vehicles
Observations	93,041	53,973	53,553	53,553
ATT on Trust in the Police	0.111***	0.089***	0.075***	0.125**
	(0.019)	(0.026)	(0.028)	(0.061)
Sample	All years	Years with police resources information	Years with police resources information	Years with police resources information
Controls			Police officers	Patrol vehicles
Observations	45,679	18,582	18,582	18,582
ATT on Crime Percepion	-0.149***	-0.140***	-0.112*	-0.113**
	(0.025)	(0.033)	(0.057)	(0.057)
Sample	All years	Years with police resources information	Years with police resources information	Years with police resources information
Controls			Police officers	Patrol vehicles
Observations	89,578	52,160	51,746	51,746
ATT on Private Investment in Security in security measures	-0.077***	-0.066***	-0.109**	-0.093**
	(0.016)	(0.019)	(0.042)	(0.042)
Sample	All years	Years with police resources information	Years with police resources information	Years with police resources information
Controls			Police officers	Patrol vehicles
Observations	93,041	53,973	53,553	53,553
ATT on Reported Crime	-216.695***	-178.357***	42.387	-572.538***
	(68.256)	(67.196)	(141.124)	(200.575)
Sample	All years	Years with police resources information	Years with police resources information	Years with police resources information
Controls			Police officers	Patrol vehicles
Observations	4,371	2,184	2,184	2,184
ATT on Arrests	47.005	31.003**	98.470**	-11.749
	(21.454)	(14.147)	(46.686)	(69.808)
Sample	All years	Years with police resources information	Years with police resources information	Years with police resources information
Resource Controls	None	None	Police officers	Patrol vehicles
Observations	3,372	2,184	2,184	2,184

Note: This table reports the main results of the paper controlling for police resources, specifically the number of police officers and patrol vehicles per 100,000 inhabitants. Column (1) replicates the estimates from Figure 2. Columns (2), (3), and (4) restrict the analytical sample to years for which police resource data is available (post-2005). Column (2) replicates the main analysis using only this restricted sample. Column (3) reports the estimates using the number of police officers as a control variable, and Column (4) reports the estimates using the number of patrol vehicles as a control variable. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The graphs display the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure.

$$Crime_{imt} = \delta_1 Police\ resources_{mt} + Municipality_m + Year_t + u_{imt} \tag{5}$$

where *Police resources* indicates either the number of police officers per 100,000 inhabitants in municipality m during year t or the number of patrol vehicles per 100,000 inhabitants in municipality m during year t. We focus on the 41 municipalities of Santiago surveyed in ENUSC for the period 2006-2012. The study period is delimited by the availability of data on police resources. We focus on the municipalities of Santiago because *Plan Cuadrante* was implemented in all of these municipalities by 2000. Expanding the analysis to other municipalities may lead to
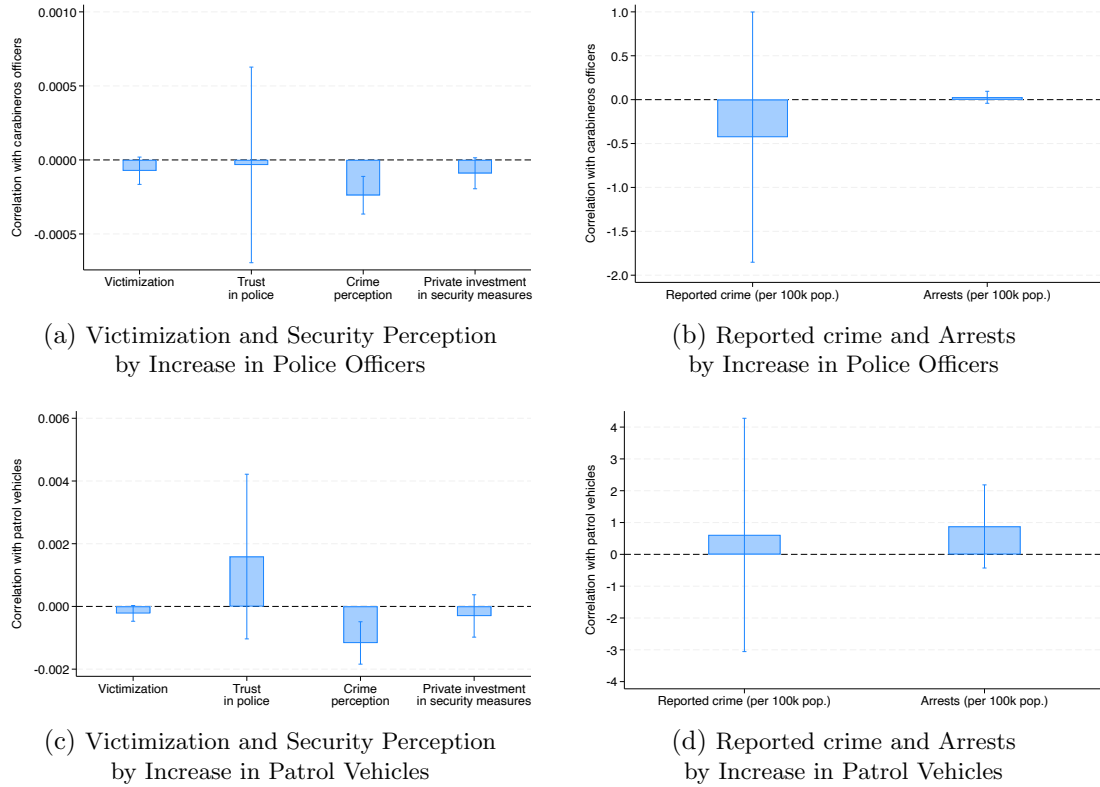
confound the dynamic effects of *Plan Cuadrante* with the potential effects of subsequent increases in police resources. Between 2006 and 2012, these municipalities saw an average increase of 26% in policemen and 83% in patrol vehicles.

The results of the analyses are reported in Figure C3. While the set of fixed effects account for time-invariant unobservable characteristics of the municipalities and the time shocks that affects all municipalities at the same time, the coefficients should be interpreted with caution due to potential endogeneity concerns. Overall, the results show little statistical association between police resources and the different outcomes examined, except for perceived crime. The lack of statistical association between police resources and the main outcomes is consistent with the increase of resources playing a limited role in explaining the effects of *Plan Cuadrante*. We repeat the same exercise for the full set of 62 Chilean municipalities that implemented *Plan Cuadrante* before 2006 and the never treated municipalities that are surveyed in ENUSC. The results are reported in Figure C4 and find similar results.

Secondly, we assess the effects of *Seguridad Ciudadana*, a program that creates a security force that, while they do not have the competence to apprehend or carry weapons, assist Carabineros in their work, effectively increasing their human resources for tasks such as patrolling and other deterrence activities. Like *Plan Cuadrante*, the creation of these municipal security forces was staggered and started after 2012 in nearly all municipalities.[18] Using administrative and ENUSC data available until 2017, the estimated effects of *Seguridad Ciudadana* program are presented in Figure C5. We estimate the effects for all the outcomes examined in the *Plan Cuadrante* analysis except for trust in the police, since information on the latter variable is rarely collected in ENUSC rounds conducted after 2012. The results show that this program had little effects on every dimension of police effectiveness considered. This result is also consistent with the hypothesis that the large effects of *Plan Cuadrante* on police effectiveness are unlikely driven entirely by the change in police resources brought by the program.
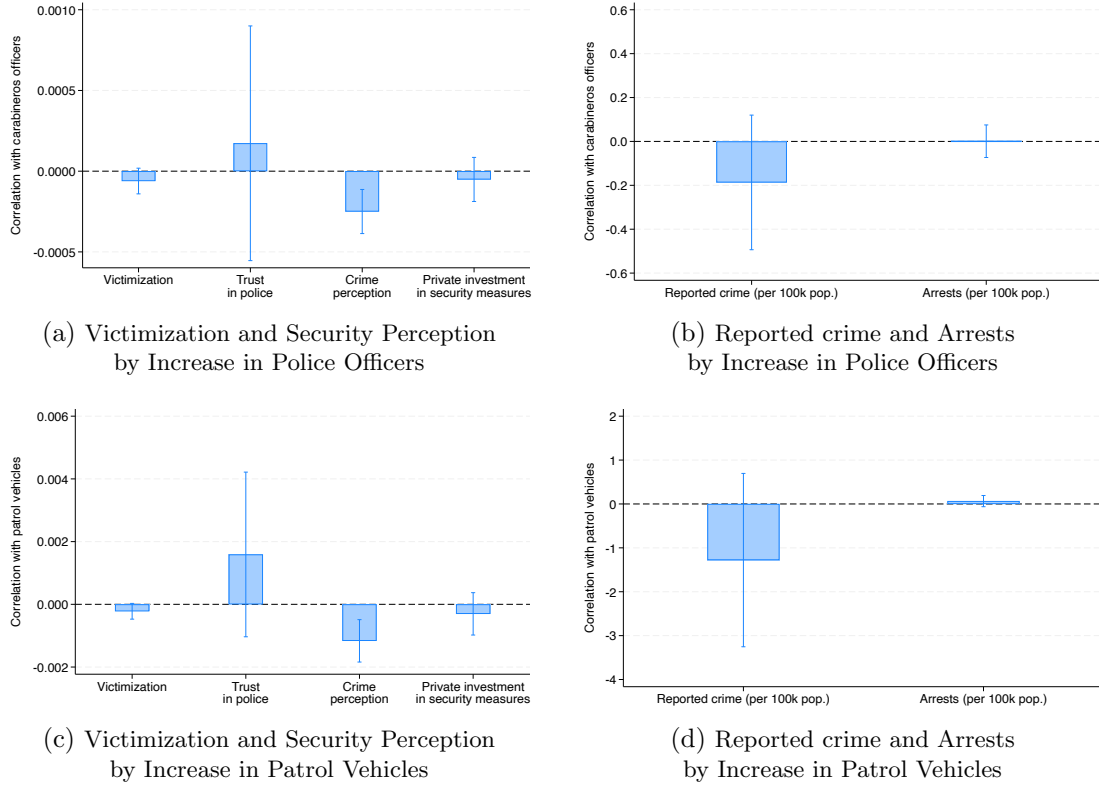
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[18]Among the municipalities in the ENUSC survey, only Curicó introduced the *Seguridad Ciudadana* program before 2013, being 2012 the last year in which *Plan Cuadrante* was implemented for the first time in a municipality surveyed in ENUSC. Among the full set of 345 municipalities, only 10 of them introduced the program *Seguridad Ciudadana* before 2013, all of them except Curicó being small municipalities.

Figure C3: Association between Police Resources and Police Effectiveness in Santiago de Chile (Post-Plan Cuadrante Period)

(a) Victimization and Security Perception by Increase in Police Officers

(b) Reported crime and Arrests by Increase in Police Officers

(c) Victimization and Security Perception by Increase in Patrol Vehicles

(d) Reported crime and Arrests by Increase in Patrol Vehicles

Notes: The figure shows the statistical association between police resources (per 100,000 inhabitants) and the main outcomes. The analysis is conducted for the 41 municipalities of the capital city of Santiago surveyed in ENUSC for the period 2006-2012, for which information on resources is available. *Plan Cuadrante* was introduced in these municipalities in 2000. The estimation is conducted using OLS with municipality and year fixed effects. The graphs show the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure. Panel (a) reports the association between the number of police officers and the victimization and security perception outcomes included in the ENUSC survey. Panel (b) reports the association between the number of police officers and the outcomes constructed using the administrative information on arrests and crimes known to the police provided by the Undersecretary for Crime Prevention. Panel (c) reports the association between the number of patrol vehicles and the victimization and security perception outcomes included in the ENUSC survey. Panel (d) reports the association between the number of patrol vehicles and the number of police officers and the outcomes constructed using the administrative information on arrests and crimes known to the police provided by the Undersecretary for Crime Prevention.

Figure C4: Association between Police Resources and Police Effectiveness in Municipalities implementing Plan Cuadrante before 2006 and never treated municipalities (Post-Plan Cuadrante Period)

(a) Victimization and Security Perception by Increase in Police Officers

(b) Reported crime and Arrests by Increase in Police Officers

(c) Victimization and Security Perception by Increase in Patrol Vehicles

(d) Reported crime and Arrests by Increase in Patrol Vehicles

Notes: The figure shows the statistical association between police resources and the main outcomes. The analysis is conducted for the 62 municipalities that introduced *Plan Cuadrante* before 2006 and the never treated municipalities surveyed in ENUSC for the period 2006-2012. The estimation is conducted using OLS with municipality and year fixed effects. The graphs show the estimated coefficients and 95% confidence intervals. Standard errors are clustered at the municipality level using the wild bootstrapping procedure. Panel (a) reports the association between the number of police officers and the victimization and security perception outcomes included in the ENUSC survey. Panel (b) reports the association between the number of police officers and the outcomes constructed using the administrative information on arrests and crimes known to the police provided by the Undersecretary for Crime Prevention. Panel (c) reports the association between the number of patrol vehicles and the victimization and security perception outcomes included in the ENUSC survey. Panel (d) reports the association between the number of patrol vehicles and the number of police officers and the outcomes constructed using the administrative information on arrests and crimes known to the police provided by the Undersecretary for Crime Prevention.
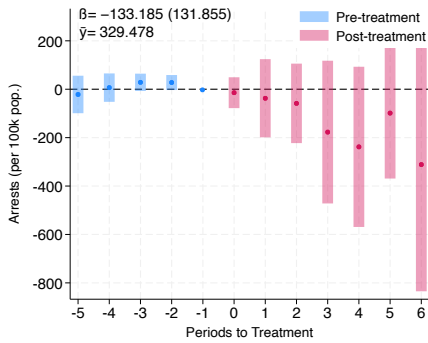
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Figure C5: Effects of *Seguridad Ciudadana* on Police Effectiveness
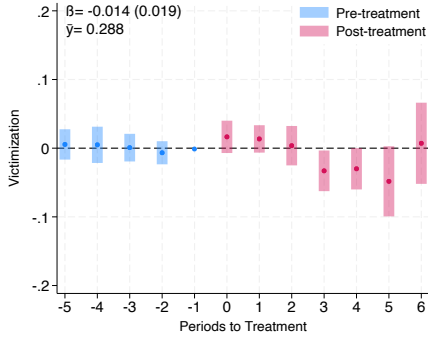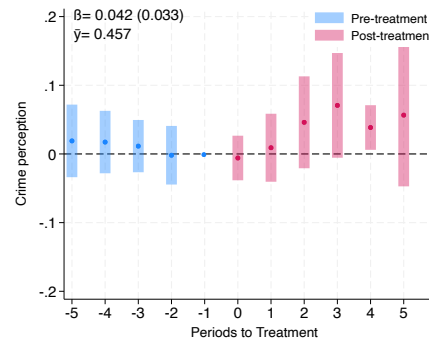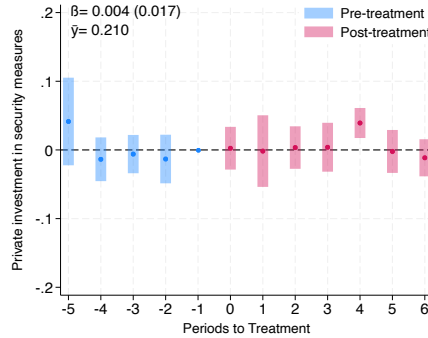

(a) Victimization in last 12 months
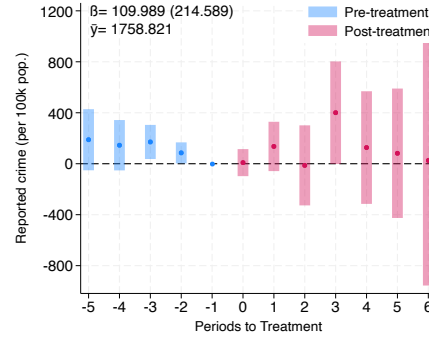
(b) Reported crime per 100k inhabitants

(c) Arrests per 100k inhabitants

(d) Households reporting an increase in crime

(e) Households adopting security measures

Notes: This figure shows the dynamic effects of the *Seguridad Ciudadana* program on different measures of police effectiveness. The estimation is conducted using the procedure developed in Callaway and Sant'Anna (2021) for difference-in-differences with staggered treatment adoption. The dots in the figure represent the estimated coefficients and the bars behind them 95% confidence intervals. Standard errors are clustered at the municipality level using wild bootstrapping. The pooled effect and the mean outcome before the introduction of the treatment for the outcome is also presented in each panel. Panel (a) reports the effect of *Seguridad Ciudadana* on the probability of household victimization in the last 12-months using the ENUSC survey, panel (b) reports the effect on the number of crimes known to the police in the municipality using administrative data, panel (c) reports the effect on the number of arrests in the municipality using administrative data, panel (d) reports the effect on crime perception using the ENUSC survey, and panel (e) reports the results on the number of private investment in security measures in the last twelve months using ENUSC survey. Panel a) includes 210,102 observations; panel b), 2,234 ; panel c), 1,908; panel d), 203,078; and panel e), 74,316.