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Anti-Crime Programs: An Evaluation (and recognition) of the Plan Comuna Segura

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Anti-Crime Programs: An Evaluation (and recognition) of the Plan Comuna Segura¹

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Summary

The aim of this paper is to evaluate the impact that the anti-crime program *Comuna Segura: Compromiso 100* had on the reporting rate of different types of crimes. This program implemented in Chile from 2001 was very much criticized, and therefore was eliminated in the year 2006. This report provides robust statistical evidence, using the impact assessment methodology, which shows that the program was successful in increasing the reporting rate of certain types of crimes in targeted municipalities, and also in decreasing the crimes associated with other crimes, such as rape. All this underlines the importance of carrying out formal impact assessments in order to determine the benefits associated with a particular program.

JEL classification: J18, K14, K42

Key words: crime, program evaluation, matching.

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1. Introduction

Various opinion surveys indicate that crime is one of the principal problems facing Chilean society today. A *Fundación Chile XXI* publication states “...alongside poverty and unemployment, public safety has been one of the most worrying problems voiced by respondents across all opinion surveys”. Meanwhile, in a recently published report, ADIMARK indicates that crime has been a key public concern throughout the 1990’s, remaining among the top five priorities of public interest. Indeed, between 1990 and 1994 it was the number one public concern.

Despite the relevance of the crime issues in the Chilean society, not enough empirical evidence on the area is yet available. The studies carried out in Chile to date have only looked at the problem from a general perspective. No impact studies have been carried out to measure the effect of specially designed crime fighting proposals.

Nevertheless, some studies, using a cross-country database (Loayza et al. 2002), found that crime and inequality rates are positively correlated. They specifically show that the causality relationship goes from inequality to crime rates. Similarly, Villavicencio and Molina (2002) using the Becker-Ehrlich model for a regional analysis for Chile, find that socio-economic and demographic variables are determinants of crime rates. These authors also indicate that economic cycles affect the probabilities of crimes being committed.

There are, however, several specific anti-crime proposals that have not yet been evaluated. Examples of these are the Penal Reform Process and the *Plan Cuadrante* of the police.²

² The *Plan Cuadrante* is a preventative police surveillance strategy, aimed at progressively satisfying the increasing public demand for security. It is a differentiated, equitable and technical way of allocating human and material resources in the population, through close links and communication with the community. It is currently in operation with 251 *Cuadrantes* or quadrants in all the municipalities of the jurisdictions of the six Santiago Operational Prefectures. This plan works by delimiting an urban zone, giving the responsibility for its surveillance to a particular group of police or *Carabineros* which is determined by the specific security needs and characteristics of the sector, so that the same police officers patrol the sector everyday and thus getting to know the people and strengthening the bonds of trust and cooperation. Its ultimate objective is to consolidate the links with the community and to increase the police presence on the streets. Some of the main objectives of this innovative system are to rationalize and optimize the use of institutional funds, to maximize the coverage provided by preventative vigilance, reduce response times for citizens needs and increase the

The former aims to speed up the legal processes and the application of the law in crime cases while the latter aims to reduce crime rates directly.

The program *Comuna Segura: Compromiso 100* was implemented in Chile from 2001. At first it was applied only in 12 municipalities of the country, but with time it went comprising a larger number of them. This program, like others of a similar nature, has not been formally evaluated, and its effects have been looked at only from a judicial perspective. Hence, this paper makes a contribution to the evaluation of the program. However, Beyer y Vergara (2006) suggested a complete reformulation of the program, since it was not striking to the heart of the problem, namely youth's initiation into crime. Considering the background that existed by that moment, the competent authorities of the time chose to close the program in 2006. However, this study provides evidence that favors the program *Comuna Segura*, in terms of that it increased the reporting rate of certain types of crimes, particularly of those with a gap between the crime rate and the reporting rate, and also it reduced other types of crimes. These results are stable and robust to different specifications and methodologies. This finding suggests that the Plan, rather than reducing the actual crime levels, helps the creation of social networks and thus increases the reporting rates.

Finally, Vergara (2009) analyzes the impact of the program *Comuna Segura* and the Plan Cuadrante using a panel data. The results show that only the Plan Cuadrante was successful in terms of reducing the crime rate, while the program *Comuna Segura* is totally innocuous from the point of view of the original objectives.

This paper is structured as follows. After this introduction, Section 2 explains the details of the Safe Community program and provides information concerning its implementation. Section 3 presents the key characteristics of the municipal variables that are considered relevant for this analysis. Section 4 shows the parametric and non-parametric estimates of the program's effects. Finally, the main conclusions may be found in Section 5.

personalized contact with the neighbors and community organizations. In this system, the participation of the local community is fundamental to support the work of the police in its mission of ensuring public security.

2. The Safe Community program

The *Comuna Segura: Compromiso 100* program is a Ministerio del Interior and Fundación Paz Ciudadana joint-program. The two main objectives of this program are: first, to create a crime prevention and control system that promotes citizen participation by means of the citizen security councils. These councils allow the security concerns of the residents to be aired and permits coordinating the various anti-crime initiatives that start up in the municipality. Second, to setup a financing system that allows the existing resources to be coordinated and to deliver new resources to community security projects in this area through open competition for funds. Actually, this program had an investment fund, whose 70% corresponded to competitive funds to finance projects submitted by social organizations. The other 30% was destined for the support of municipal management and was invested in projects submitted by municipalities to work specific issues selected as priorities by the Councils. In 2005 this line of projects of municipal initiative was consolidated, which delineated four strategic issues: domestic violence, neighbor mediation, school coexistence, and children and adolescents at risk.

By these means, the community will have the necessary resources to satisfactorily implement the initiatives they want in order to more effectively combat the crime problems facing them³. One of the functions of the citizen security council is to promote, through education and training, participation in the development, execution and evaluation of projects, as well as holding expanded community meetings to keep citizens informed on the steps taken and get feedback from the community.

Finally, these councils should have an active role in gathering, processing and disseminating relevant information by carrying out a diagnosis of the local reality in issues related to crime prevention and control. They should also disseminate and promote the

³ The citizen security councils are chaired by the Mayor of the municipality and are made up of the *Carabineros* Police and the Criminal Investigation Department of Chile, counselors and representatives of community organizations as well as representatives of the local business, education and health sectors of the area. As the new penal reform process progresses, the respective district attorney shall be incorporated into these councils and a technical secretary shall provide consultancy.

financing options available, as well as the related projects and develop a communicational strategy to ensure the population is well informed on the security measures being taken.

Based on this analysis, the council is expected to draw-up a plan of action and coordinate the various crime control and prevention initiatives and projects developed in the municipality. These local public security initiatives have two main sources of funding. On the one hand, local crime prevention initiatives receive a global amount from the annual national budget. Said amount is distributed according to previously established technical criteria of the budget law itself. On the other hand, there are resources from funds directed at crime prevention as well as funds from other crime fighting related institutions.

To sum up, the objective of the program is to generate information flows between the community and the respective authorities in order to produce social networks that can help in the fight against crime.

The program started off in twelve municipalities nationwide in march 2001: El Bosque, La Pintana, Lo Espejo, Renca, Santiago, San Bernardo, Copiapó, Coronel, Ovalle, San Pedro, Valdivia y Valparaíso. Table 1 shows the municipalities selected and the total funds allocated to each one. In 2002, and using the same criteria, the program spread out to other twelve municipalities which are: Cerro Navia, Estación Central, Macul, Pudahuel, San Miguel, San Ramón, Melipilla, Calama, Linares, San Antonio, Talca and Talcahuano. Finally, the program had incorporated 70 municipalities nationwide.

The main contribution of the program is through its effect on crime reporting rates, more than directly on actual crime. This rests on the precept that there are a significant series of both monetary and subjective costs for the victims of crime block the reporting of actual crimes committed.⁴

⁴ This will naturally depend on the type of crime. Evidence indicates that crimes such as robbery have a relatively low reporting rate. On the other hand, homicide has a near 100% reporting rate. This could be proof that people have low return expectations in getting back their goods lost in a robbery relative to the cost of following through with a case. The relation is different when it comes to homicide due to the moral duty to know the truth.

Formally, the following relation between crime reported and the level of crime can be proposed (and another set of socio-economic variables). This relation allows us to measure the effects of a program like Safe Community. It is:

$$D = D(P, C(P), X) \quad (1)$$

where D is the crime reported over a defined period and place, P is a dichotomous variable that represents the program, C is the usually not observed level of crime that can also be influenced by the program and X is a vector of various controlled socio-economic characteristics that could affect the municipal crime reporting rates.⁵

We shall assume that all the variables described are continuous.⁶ Thus, a change in the program variable could produce the following effects on the crime reporting rates:

$$\frac{dD}{dP} = \frac{\partial D}{\partial P} + \frac{\partial D}{\partial C} \frac{\partial C}{\partial P} \quad (2)$$

where dD/dP is the change in the crime reporting rates in the community over a given period when the program variable changes (for example, from a zero value, from not belonging to one, to belonging to one). The first term to the right of equality could be interpreted as the change in the “social environment” directly associated to the program. This effect is assumed to be independent of what occurs with the real crime rates. In other words, a large part of what the Comuna Segura program seeks to achieve as previously stated. The program also has a second indirect effect on crime reporting rates through the actual crime rates that is summed up in the second term.

In theory, if the program had a significant effect on crime levels, this last term would be negative. The worst case scenario would perhaps be the non-existence of such a relationship, that is $\partial C/\partial P = 0$. On the other hand, a positive relation between the crime

⁵ Noteworthy among these are inequality, unemployment rate, average schooling of the population, amongst others.

⁶ This assumption does not affect the conclusion objectives of this exercise in any way.

levels and the reporting rates would be expected ($\partial D/\partial C > 0$). Thus, the indirect effect of the program on the reporting rates through the crime rates would be expected to have a negative correlation, or at least a value of zero.

After linking both effects on reporting levels associated to the program, it can be shown that the aggregate effect does not have a predictable sign.⁷ On the one hand, if $\partial D/\partial P$ is greater than zero, the impact through improvement in the “environment” more than compensates the decrease in reporting produced by the crime decrease associated to the program. On the other hand, if $\partial D/\partial P$ is less than zero, the effect of the program would mainly be on actual crime rates and its effect on the “environment” would be comparatively less.

Consequently, as may be expected, the Comuna Segura program would have a positive value derived from the equation (2) if the program had a positive effect.⁸ The rest of this paper examines the latter hypothesis.⁹

Nevertheless, before continuing, it is necessary to make some precisions. In the first place, the most concerning thing from the public policy’s point of view is without a doubt the crime rate, not the crime reporting rate. However, it is also very important to motivate the people to make the respective accusations, since as they do so, the necessary procedure to arrest the criminals can be appropriately established. Moreover, as this procedure is completed successfully, it may deter the future occurrence of crimes. On the other side, it should be noted that the difference between the crime rates and those of crime reporting, called dark figure, varies with the type of crime involved. Thus, while it is likely that the reporting rate of homicide and rape is very high (almost 100%), the dark figure of theft should be significant, either by the cumbersome procedures associated, or the amount involved in the crime. That is why a positive effect of the program on the reporting rate of

⁷ Both directly through the environment and indirectly through number of crimes committed.

⁸ A $\partial D/\partial P$ value equal to zero may suggest that or well both effects are perfectly compensated – very improbable – or that the program had no significant effects on crime reporting rates.

⁹ The program *Comuna Segura: Compromiso 100* was structured through different measures to encourage crime reporting. The aim of this paper is then to evaluate this group of measures, and how they altered (if so) the municipal reporting rates.

thefts can be interpreted as a decrease in this dark figure. In contrast, a negative effect of the program on the reporting rate of rapes can be interpreted as a decrease in the crime rate, for its effect on the dark figure would be null (what was happening was already being reported).

3. Data

There are two sources for the data in this study. First, the crime rate information was provided by the Ministerio del Interior, which is measured on the basis of crimes reported per 100,000 inhabitants. This study utilized the information available for the first quarter of the years 2001 and 2002. Second, in order to control for municipal characteristics present in 2001 and 2002, the information available in the CASEN (Encuesta de Caracterización Socioeconómica Nacional) 1998 and 2000 surveys is used.¹⁰ CASEN is a cross-sectional survey with national representation and it is a fundamental tool for social policy in Chile, for it contains valuable information about Chilean households regarding housing, education, health and labor characteristics. Based on this survey, socioeconomic indicators can be established on municipality level, which allows us to complement the information related to reporting rates. These are inputs needed to evaluate the impact of this security program now abolished, which will let us have a more objective view of its effect on delictual indexes of the country.

Table 2 shows descriptive statistics of the municipal variables for the municipalities included in the program (beneficiaries) as well as for those that were not (for control).¹¹ The table shows that the beneficiary municipalities have comparatively lower levels of

¹⁰ Additionally, the 2000-1998 difference of these characteristics is controlled by the fixed effects that exist on a municipal level for the years 2002-2001.

¹¹ The total number of beneficiary municipalities was twelve while there were 82 controls. All had to have over 70,000 inhabitants for inclusion in the program.

inequality, higher school attendance rates, higher unemployment rates, lower per capita income and a higher population density.¹²

The panel b of Table 2 shows the 2002-2001 variations on reporting rates (per 100,000 inhabitants) of five types of crimes: theft, aggravated theft, theft with force, rape and homicide. An increase can be seen on reporting rates of theft and theft with force, both in beneficiary and non beneficiary municipalities. The sharp increase in the rate of theft with force in beneficiary municipalities is particularly remarkable. On the other hand, there was a decrease in those of aggravated theft, rate and homicide. However, in the last type of crime, the variation is practically nil.

Considering the available information, it can be concluded that the two municipality groups (beneficiary versus non beneficiary) are different, and therefore, a simple comparison of reporting rates would not identify the causal effect the program.

4. Program Impact Estimates

This section presents the methodology used in evaluating the effects of the Comuna Segura program has had on the municipal crime reporting rates. The study has focused on the following crimes: theft, aggravated theft, theft with force, homicide and rape.¹³

As mentioned earlier, to analyze the robustness of the results, two alternative evaluation techniques have been implemented. Firstly, parametric estimates are calculated through a difference-in-difference analysis. Second, non-parametric matching-type estimators are applied as described hereunder.

¹² Apart from having populations of over 70,000 inhabitants, the selection criteria for inclusion in the Safe Community program includes the poverty index, theft with force and the aggravated theft rates per 100,000 inhabitants of the municipality.

¹³ See Appendix for definitions.

It is possible to consider the decision to participate in the program Comuna Segura as a latent variable that is influenced by a vector of characteristics (W'), such as:

$$C_i^* = W_i' \gamma + v_i$$

where C_i^* is a latent variable that is not observed by the researcher. One observe whether the municipality participates or not (C) which is a dummy variable.

Let Y_1 be the reporting rate of a beneficiary municipality of the program Comuna Segura, and let Y_0 be that of a non beneficiary of this anticrime program. Then we have the following set of equations that describe the behavior of the variable reporting rate:

$$Y_0 = \mu_0 + U_0$$

$$Y_1 = \mu_1 + U_1$$

Es directo notar que el econometrista puede observar a la comuna en cuestión en un solo estado, es decir, como beneficiaria o bien como no beneficiaria; por lo tanto, solo observa lo siguiente:

$$Y = CY_1 + (1 - C)Y_0$$

Handling the above expression, we can get to:

$$Y = Y_0 + (Y_1 - Y_0)C$$

Assuming the case of homogeneous treatment effect ($U_0 = U_1 = U$) we can get the following:

$$Y = \mu_0 + (\mu_1 - \mu_0)C + U$$

The least squares approach helps us identify the average treatment effect (*ATE*) assuming that there are no differences in non observables. In fact, in this context all of the treatment parameters are equal:

$$ATE = TT = TUT$$

where *TT* is treatment on the treated, and *TUT* is treatment on the untreated.

Given the selectivity of the program Comuna Segura that can be controlled by W' , we can get the impact of the program through OLS; nevertheless, we are assuming a specific functional form on the outcome equations which enables us to run OLS regressions. So, the logical next step would be to relax this assumption enabling a nonparametric version of this impact. That is exactly what matching actually does.

4.1. Parametric Estimates

Considering the above-mentioned the simplest empirical specification for evaluating the effects of the program is as follows:

$$Y_{ij} = \alpha + \beta C_{ij} + u_{ij} \quad (3)$$

where Y_{ij} represents the difference (2002-2001) of the crime reporting frequency of municipality i for the crime j per 100,000 inhabitants and C_{ij} is a dummy variable with a value of 1 when the municipality participates in the Safe Community program, and 0 if it does not. Therefore, the OLS parameter β provides a measure of the program's effect. If this parameter is positive, it would indicate that crime reporting frequency rates of municipality i for the crime j are higher conditional on its participation in the program. For those crimes whose dark figure is high, that is, whose reporting rate is significantly lower than the real crime rate, this positive value will be the proof that the program is achieving the stated objective, in terms of encouraging the citizen to report crimes. As it was discussed above (see Equation 1), if the program does not have a positive effect on the criminality rate, then this program's positive impact on the reporting rate represents a

decrease in the dark figure. This situation can be seen in crimes such as theft, aggravated theft and theft with force, where the dark figure was significant. Now, in crimes such as homicide and rape, where the dark figure is close to zero, the impact of the program on the reporting is not to reduce the dark figure, but to lower the criminality rate. Therefore, in that context, the negative impact of the program on the reporting rate reflects a decrease in crimes.

Table 3 shows the estimates obtained from the model specification in (3). The program positively affects several crime types.¹⁴ We can particularly note a positive and significant impact on theft and theft with force. On the other hand, in rape, the program affected negatively the reporting rate.

Nevertheless, the previous specification does not consider some factors that could affect the crime reporting frequency rates beyond the effects of the program. Therefore, the following specifications controls for potentially relevant characteristics when evaluating the impact of the program:

$$Y_{ij} = \alpha + \beta C_{ij} + x'_{ij} + u_{ij} \quad (4)$$

where x'_{ij} represents a vector of socio-economic characteristics on a municipal level. The CASEN 2000 survey has been used as an information source for those controls. The covariates are: quintile ratios, percentage of non-attendance to educational institutions, unemployment rate, per capita income (standardized by its median), Penal Reform Process dummy variable, and population density. The quintile ratio variable, an income inequality indicator, shows the possible effects of an unequal distribution of income on the crimes observed. This rests on the premise that worse income distributions would increase social tensions and thus promote crime. The percentage of non-attendance to educational institutions attempts to capture school drop-out rates caused by the opportunity cost connected to the profitability of illegal activities. The unemployment rate attempts to measure the economic environment and the lack of opportunities in the formal markets to

¹⁴ In the case of “theft” participation in the Safe Community program leads to an almost 400% increase in the crime reporting rates per 100,000 inhabitants.

get a legal job. The per capita income captures the municipal poverty indices and how these affect the crime rate. The Penal Reform Process dummy variable controls for the possible effects of the penal reform process that has already been implemented in some regions of the country.¹⁵ Finally, the population density variable measures the municipal housing and the possible effects of this on the crime indices as population concentrations increase.

Table 4 shows the results when estimating the equation (4) by traditional parametric methods but controlling for potentially relevant characteristics which might affect the crime reporting rates. The results remain stable at least for theft and rape. In other words, there are effects (similar to the previous ones) associated with the program that remain after control variables are included.

Given that we have worked with the dependant variable in difference, we believe it is pertinent to evaluate the same specification (4) but now using the controls in differences, which allows us to control for fixed effects on a municipal level.¹⁶ We have used the CASEN 1998 for this and obtained the 2000-1998 difference for the control variables: quintile ratios, percentage of non-attendance to educational institutions, unemployment rate, per capita income (standardized by its median), Penal reform process dummy variable, and population density.

Table 5 shows the results of this specification. The estimated effects are robust to this new model again for theft and rape. This provides us with clear signs of the positive and

¹⁵ These regions are Antofagasta, Atacama, Coquimbo, Del Maule and De la Araucanía.

¹⁶ Consider the existence of a fixed effect influencing the municipal crime reporting rates in the period t :

$$D_{ijt} = \alpha + \beta C_{ijt} + x'_{ijt}\gamma + \delta h_{ij} + u_{ijt}$$

where D represents the crime reporting rates in the period t and h_{ij} is the fixed effect. The same non-observable fixed factor would be present in the time t' :

$$D_{ijt'} = \alpha + \beta C_{ijt'} + x'_{ijt'}\gamma + \delta h_{ij} + u_{ijt'}$$

Thus, taking away both specifications, we remove said fixed effect:

$$\Delta D_{ij} = Y_{ij} = \Delta C_{ij} + \Delta x'_{ij}\gamma + \delta h_{ij} + u_{ij}$$

which is the model that we finally estimate.

significant effects of the program on the municipal crime reporting rates for theft. On the other hand, the program affected negatively on the rape reporting rate, which can be understood as a decrease in the effective rate of this type of the crime.

As can be seen throughout these three specifications, the variable that identifies those municipalities with the penal reform process has a significant and positive effect on the crime-reporting rate (aggravated theft and theft with force), which is interesting in terms of the signaling role that the reform seems to have played. This is interpreted as an increase in trust by the community in reporting crimes, since the reform has a facilitating role in judicial processes. In addition, we don't found any effect of unemployment on crime reporting rates.¹⁷

4.2 Non-parametric Estimates

The OLS estimates identify the impact of participating in the program Comuna Segura, assuming a homogeneous treatment effect, that selectivity to the program is based on observables (which is, in this case, entirely reasonable), and that the outcome equations are well specified. This estimation identifies the average treatment effect, the treatment on the untreated (*TUT*), the treatment on the treated (*TT*) and all of them are equal. Now we developed a matching version of this impact, which is a nonparametric way to estimate the effect of the program Comuna Segura. Therefore, we don't impose a functional form and we select the most comparable municipalities through the propensity score. However, here again the treatment parameters are all the same.

We shall implement the cross-section matching estimators that compare the results (crime reporting rate difference) of the treatment and control groups at some moment after the implementation of the program. Specifically, the following two estimators shall be applied: (1) the cross-section matching estimator of the nearest neighbor, (2) the cross-section matching estimator kernel.

¹⁷ Additionally, the same estimates were then carried out using the per capita amount of resources assigned to the Comuna Segura program as explicative variables considering the positive and significant effect of the program.

In order to matching works we must establish the following standard assumptions:

$$(Y_0, Y_1) \perp C \mid W$$

$$0 < P(C = 1 \mid W = w) < 1$$

The first condition randomizes C with respect to outcomes (unconfoundedness assumption), and second assures comparing comparable municipalities. The common support condition is also necessary.

The first step is to estimate the propensity score or conditional probability of participating in the program.¹⁸ This estimate allows us to reduce the dimensionality of the determinants to carry out the matching; therefore $E(Y \mid P = 0, P(W = w))$ is estimated instead of $E(Y \mid P = 0, W = w)$. To estimate the propensity score, it is necessary to select a set of W characteristics as explanatory variables. It is crucial to restrict the selection of W to the variable not influenced by the program; otherwise the program itself shall bias the estimates. This potential problem is eliminated when considering the municipal characteristics of 1998 and 2000.

We can consider participating in the program as a latent variable that is influenced by a vector of characteristics:

$$C_i^* = w_i' \delta + \varepsilon_i \quad (6)$$

Where C_i^* is a non-observed latent variable. What can certainly be observed is whether the municipality participates or not in the program C_i .

Table 6 shows the probit estimated for the probability of being selected for the Safe Community program. The same controls used in the original model are used as the determinants of the probability of being selected in the program. As may be observed, the only significant variables are unemployment rate and aggravated theft reporting rate. This

¹⁸ Rosenbaum and Rubin (1983).

should not worry given that the goal of the estimate is the construction of the propensity score, which allows us to obtain the matching estimators. However, the other variables are not statistically significant partly due to the fact that the variables incorporated had a high degree of multicollinearity, which would affect the efficiency of the estimation. Moreover, the model presents a great degree of adjustment, since the coefficient of determination (R^2) gets to 22%, which is positive for the pairing process in the matching implementation. As mentioned above, two matching estimators will be employed; that of the nearest neighbor, and the Kernel method.

The nearest neighbor is the simplest estimator to implement. It is first necessary to determine how many neighbors shall be utilized. The neighbors are subsequently selected in accordance with their proximity to the treatment group (propensity score) in terms of Euclidian distance.

One of the problems of the above method is that all the clones receive the same weighting. For instance if there are five neighbors near to the experimental individual, then the second and third and neighbor shall receive exactly the same weighting. A kernel regression estimator chooses the weights so that the observations nearest the individual treatment group, receive the greatest weighting. The implementation of the kernel function requires the choice of a bandwidth h_n , which is analogous to the choice problem of the number of neighbors in the nearest neighbor estimator.¹⁹

Table 7 shows the effect of the program through the matching estimators. The results are interesting for various reasons. Firstly, the program does not appear to have a positive impact on the theft reporting rate. However, now we see a positive and significant impact on theft with force. On the other hand, a decrease in the rape reporting rate is seen again as the result of the implementation of the program, which can be interpreted as a decrease of this type of crimes. For the other crimes, the effects are not statistically significant. It is worth mentioning that although the results for the Kernel estimator gives a bandwidth of

¹⁹ With regard to the bandwidth choice, it is advisable to carry out a sensibility analysis for the different values of h_n .

0.06, a sensibility analysis was conducted, using its different values. The results were robust for the different values of bandwidth used.

An essential aspect when matching stimulators are implemented is related to the balancing property of propensity score. That is, the propensity score should construct a control group that exhibits similar characteristics to the group of beneficiary municipalities. This validates the comparison to be done between the two groups, since it ensures that comparable municipalities are being compared, and that the clones to be used are of good quality. Table 8 presents the test of mean differences for beneficiary and non beneficiary municipalities for each of the variables incorporated in the probit model. One can see that for each variable, it is not rejected for the beneficiary and non beneficiary municipalities to have the same average value.

The estimations carried out so far show two things clearly. Firstly, that the reporting increased in those municipalities that participated in the program, specifically in the theft category. This indicates a positive citizen propensity to report crimes. The latter is in line with the spirit of the program Comuna Segura, which can be summed up as the creation (or utilization) of information networks that promote among the inhabitants of a municipality an atmosphere that is conducive to crime reporting. People feel protected and trust the public mechanisms. Secondly, there is a negative effect in the rape reporting, which can be interpreted as a decrease in the occurrence of this type of the crime. This impact may be due to the dissuasive effect that this anticrime program had.

The estimations presented so far may be biased due to the violation of unconfoundedness assumption (Knutsson and Tilley, 2009). Indeed, the benefits associated with participating in the program could be affecting contiguous municipalities that were not selected to take part in it. In other words, the effects of the program might have been projected toward other non beneficiary municipalities, which would bias the results presented so far. On one hand, effects of spatial displacement are held because, if the transport expenses are not prohibitive (which were not at least until 2002), the criminals could move from one place to another, biasing the estimate of this program's effects. On the other hand, the benefits

associated with the crime control may be dispersed to other municipalities, for the contiguous municipalities could be positively affected because the program is implemented in the neighboring municipality.

In order to analyze the robustness of our results facing those potential problems, two complementary exercises were carried out. First, the effects of the program were estimated again, but without taking into account those non beneficiary municipalities that were contiguous to the beneficiaries. In other words, they were not considered in the search of the clone municipality. Second, a fictitious program was made, which assumed that the beneficiary municipalities were actually not the selected ones, but the contiguous non beneficiaries were those (Imbens and Wooldridge, 2009).

Table 9 presents the parametric estimates using level controls. For this group of estimates too, the negative and significant impact of the program on rape reporting stands out. Moreover, it shows that the program had a positive impact on the reporting of theft with force. However, there is no other significant impact observed, even when signs of impact are expected for those crimes such as theft and aggravated thefts; that is, the reporting rate increases as the dark figure decreases. Just as in the previous estimations, we should take into account the efficiency problems related to the small amount of the sample, which could be affecting the statistic significance of the impacts on each crime.

Table 10 confirms the previous estimation using controls in differences, with the aim of controlling for the existence of fixed effects. As it may be seen, the program increases significantly the theft reporting rate. It again shows a decrease in rape reporting, which has been very robust throughout all the estimations.

On the other hand, table 11 presents the impact estimates of the program using the matching estimator; theft and rape exhibit the same effects found previously. Now it also shows a positive and significant effect on aggravated theft.

Since the benefits related to the crime control in some municipalities can affect (positively) those that are geographically near but have not been selected for the program, it is pertinent to carry out the exercise suggested by Imbens and Wooldridge (2009). Thus we proceeded to reestimate all the impacts, but now considering the beneficiary municipalities to be the contiguous to the ones that were actually selected to participate in the program. The impact that this false program should have is null, and that is precisely what the estimates reveal in Table 12. The evidence indicates that the benefits of the program were not significantly propagated into the neighboring municipalities, and therefore, the estimation strategy used is not biased and allows us to identify the impact of the program.

Yet there is still an exercise that can be carried out. As it was said, the program started off in twelve municipalities nationwide in March 2001: El Bosque, La Pintana, Lo Espejo, Renca, Santiago, San Bernardo, Copiapó, Coronel, Ovalle, San Pedro, Valdivia y Valparaíso. However in 2002, using the same criteria of selection, the program was expanded to other twelve municipalities: Cerro Navia, Estación Central, Macul, Pudahuel, San Miguel, San Ramón, Melipilla, Calama, Linares, San Antonio, Talca y Talcahuano. Therefore, the best municipality control of those that were beneficiary of the program during the first trimester of the year 2002 is of those that had just started that year with posteriority. That is why the decision was taken to reestimate the impact of the program, in a parametric way, using only this reduced group of municipalities. Table 13 presents the results. There is no doubt that we have a serious problem of efficiency, because we have few observations, however, the associated signs are again the expected for those crimes with high dark figure. Moreover, in the case of rape a negative and significant effect is seen, which is consistent with all the estimations previously carried out. Incorporating covariates the results remain robust, but as there are very little degrees of freedom, it was chosen not to present these estimates.

As it was mentioned above, the program Comuna Segura started out in 2001, but in 2006 it was decided to eliminate it. Therefore, we have six years of information, when the program was valid. In this context, the natural exercise would be to evaluate the effect of the program on a long term, that is, taking as the impact variable the trajectory of the reportings

from the year 2003. What has been identified so far is a species of impact on a short term, that has to do with the immediate effect of the program on the municipal reporting rates. However, it should be analyzed if this apparent positive effect persisted over time. Now, when the variation is used on the reporting rate, for example during the period of 2003-2001, the beneficial effects that had been identified disappear. This attests that the program, that had a positive effect in the beginning, was not capable of altering significantly the trajectory of the reporting rates in the long term.

5. Conclusions

The present article provides evidence about the effect of the program Comuna Segura program on municipal crime reporting rates. The estimates show clear and significant results for theft and rape. Indeed, the beneficiary municipalities of the program exhibit an increase in the reporting rates of the crimes related with theft. This is consistent with the fact that in those crimes the dark figure are elevated, because the victims do not always report them respectively, either by the cumbersome procedures, or the amount involved in the crime. On the other hand, the estimates show that the program had a negative effect on the rape reporting. As the dark figures of this type of crime are low, the negative impact of the program may be related to a decrease in this type of the crime, which would be due to the dissuasive effect of the program.

Furthermore, the results also suggest that crime-reporting rates have increased significantly in the regions where the Penal Reform Process (PRP) has been implemented. Given that the goal of the PRP is to expedite the legal processes, the population can naturally be expected to increase its reporting rates. However, it should be clarified that this is a possible interpretation for the coefficient that accompanies that dummy variable Penal Reform Process.

The results that have been presented allow us to have a more objective vision on which was the real impact of the program Comuna Segura, where positive effects related to the

implementation could be seen. This reveals the importance of conducting rigorous procedures to evaluate public policies, in a context of few resources, and of an urgent need to combat crimes effectively.

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Appendix

Definition of crimes

Homicide and Parricide: A person, who in full knowledge of the relationship that ties them kills a father, mother or child, be they legitimate or illegitimate, any other ascendant or descendant or their spouse, shall be tried with the crime of parricide. A person, who kills another in any other circumstance, shall be tried for homicide.

Rape: Defined as having sexual contact with a woman in the following circumstances: (i) when force or intimidation is used, (ii) when the woman is deprived of her reason or senses by any cause, (iii) when she is less than twelve years of age, even when none of the above applies.

Theft: Aggravated theft occurs when a person takes another's property with violence or intimidation against people or property without the consent of the owner and with the goal of personal gain; when violence, intimidation and force is absent, it is considered simply theft. Violence or intimidation against people exists when there are damages, threats to handover or provide things, either to block resistance or opposition to the removal of objects, or any other act that may intimidate or force a person to provide or handover an object. It is also considered violence when a person claims to possess orders from an authority, or purports to be a judge or public official.

Theft: Aggravated theft occurs when a person takes another's property with violence or intimidation against people or property and with the goal of personal gain; it is considered simply theft when the violence, intimidation and force are absent.

Tables

Table 1: Resources per Municipality

Municipality	Resources assigned (chilean pesos)	% of total
Copiapó	93,771,354	7.8
Ovalle	89,713,829	7.5
Valparaíso	123,876,275	10.3
Coronel	100,046,039	8.3
San Pedro de la Paz	88,073,372	7.3
Valdivia	94,373,501	7.9
El Bosque	121,199,932	10.1
La Pintana	139,454,554	11.6
San Bernardo	108,368,267	9.0
Lo Espejo	94,287,480	7.9
Renca	84,397,490	7.0
Santiago	62,437,907	5.2
Total	1,200.000,000	100

Source: Seguridad Ciudadana (Ministerio del Interior)

Table 2: Socioeconomic indicators

	Non beneficiary municipalities	Beneficiary municipalities
Quintil ratio	12.77	12.58
% of non attendance at school (5-18 years old)	7.83	8.14
Unemployment rate	10.22	13.33
Per capita income/median	1.62	1.52
% municipalities with Reforma Procesal Penal	13.41	16.66
Population density (Pop./km ²)	2,907.65	5,113.61
2002-2001 variations on crime reporting rates		
Theft	6.14	27.86
Aggravated theft	-7.33	-3.07
Theft with force	20.27	42.85
Rape	-0.41	-2.07
Homicide	-0.08	-0.16

Source: CASEN survey and Seguridad Ciudadana (Ministerio del Interior).

Table 3: Impact evaluation, parametric (without controls)*(Dependant variable: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
Dummy program	21.72** (10.59)	4.25 (5.17)	22.57* (12.58)	-1.65** (0.70)	-0.086 (0.79)
Constant	6.14* (3.62)	-7.33*** (2.14)	20.27 (7.58)	-0.41 (0.33)	-0.08 (0.11)
<i>N</i>	94	94	94	94	94
<i>R</i> ²	0.04	0.005	0.01	0.03	0.0008

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.

Table 4: Impact evaluation, parametric (with covariates)*(Dependant variable: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
Dummy program	23.58* (13.90)	2.90 (4.15)	22.11 (18.74)	-2.06** (0.86)	0.21 (0.33)
Quintil ratio	0.69 (2.14)	-0.59 (0.79)	-0.02 (2.23)	0.042 (0.11)	-0.06 (0.04)
% of non attendance at school (5-18 years old)	-1.10 (1.28)	0.17 (0.72)	-4.62** (2.11)	0.09 (0.09)	0.04 (0.03)
Unemployment rate	31.77 (103.03)	78.33 (61.06)	134.85 (172.18)	5.20 (9.46)	-3.94 (3.28)
Per capita income/median	-10.28 (37.45)	13.81 (13.69)	2.06 (39.03)	-0.97 (2.04)	0.99 (0.81)
Municipality with Reforma Procesal Penal	1.11 (15.06)	8.92** (3.50)	48.65** (18.68)	0.60 (0.80)	0.11 (0.21)
Population density	19.26 (0.0006)	-0.001*** (0.0004)	-0.0003 (0.001)	0.00002 (0.00005)	-0.0000 (0.00002)
Constant	19.26 (30.02)	-27.89* (15.79)	30.18 (39.08)	-0.75 (1.95)	-0.89 (0.78)
<i>N</i>	87	87	87	87	87
<i>R</i> ²	0.06	0.27	0.18	0.07	0.05

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.

Table 5: Impact evaluation, parametric (with covariates in difference)*(Dependant variable: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
Dummy program	24.38** (12.30)	5.35 (3.90)	19.09 (17.65)	-1.42* (0.84)	0.084 (0.35)
Quintil ratio	-0.62 (1.36)	0.58 (0.48)	-0.78 (2.13)	-0.04 (0.09)	-0.05 (0.03)
% of non attendance at school (5-18 years old)	-0.24 (1.44)	0.39 (0.54)	-2.57 (2.14)	0.08 (0.08)	-0.007 (0.02)
Unemployment rate	-46.39 (110.87)	41.15 (50.65)	-25.26 (221.97)	15.18** (6.69)	2.23 (3.77)
Per capita income/median	5.22 (21.17)	-10.93 (7.69)	-4.79 (36.08)	1.34 (1.69)	0.68 (0.44)
Municipality with Reforma Procesal Penal	2.92 (15.51)	9.81*** (3.07)	54.69*** (19.12)	0.61 (0.71)	0.07 (0.21)
Population density	-0.00005 (0.00005)	-0.001*** (0.0004)	0.00007 (0.0009)	0.00003 (0.00004)	-0.00001 (0.00002)
<i>N</i>	86	86	86	86	86
<i>R</i> ²	0.06	0.25	0.17	0.13	0.03

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.

Table 6: Probability of participate in the program (*propensity score*)

	Coefficient
Quintil ratio	0.08 (0.09)
% of non attendance at school (5-18 years old)	0.03 (0.08)
Unemployment rate	14.23*** (5.49)
Per capita income/median	-1.21 (1.62)
Municipality with Reforma Procesal Penal	0.75 (0.56)
Population density	-0.00004 (0.00006)
Theft reporting rate in 2001 (per 100,000 inhabitants)	0.003 (0.004)
Aggravated theft reporting rate in 2001 (per 100,000 inhabitants)	0.01* (0.007)
Theft with force reporting rate in 2001 (per 100,000 inhabitants)	-0.003 (0.004)
Constant	-2.60 (1.89)
<i>Pseudo R</i> ²	0.22
<i>N</i>	87

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.

Table 7: Impact evaluation, non parametric*(Outcome: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
	Nearest neighbor				
Impact	13.63 (14.41)	4.99 (9.03)	38.97 (18.36)	-2.08 (0.91)	0.02 (0.38)
	Kernel				
Impact	16.69 (15.18)	7.29 (7.35)	29.04 (21.65)	-3.00 (1.04)	-0.28 (0.46)

Notes: Standard error in parenthesis. Bandwidth for kernel is 0.06.

Table 8: Balancing property (Propensity score)

Variable	Mean		t-test (p-value)
	Treated	Control	
Quintil ratio	12.23	17.59	0.4
% of non attendance at school (5-18 years old)	8.16	7.62	0.54
Unemployment rate	0.13	0.12	0.61
Per capita income/median	1.52	1.89	0.31
Municipality with Reforma Procesal Penal	0.18	0.18	1.00
Population density	5113.6	8088.3	0.28
Theft reporting rate in 2001 (per 100,000 inhabitants)	90.50	87.00	0.93
Aggravated theft reporting rate in 2001 (per 100,000 inhabitants)	74.54	109.99	0.27
Theft with force reporting rate in 2001 (per 100,000 inhabitants)	151.67	187.73	0.52

Table 9: Impact evaluation, parametric (with covariates)*(Dependant variable: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
Dummy program	21.73 (15.65)	2.56 (3.84)	14.38 (23.27)	-2.46*** (0.87)	0.24 (0.32)
Quintil ratio	0.06 (2.23)	-1.19 (0.76)	-0.98 (2.40)	0.08 (0.10)	-0.05 (0.05)
% of non attendance at school (5-18 years old)	-0.20 (1.42)	0.49 (0.69)	-4.53* (2.39)	0.04 (0.10)	0.02 (0.03)
Unemployment rate	26.76 (166.74)	1.54 (44.62)	165.00 (274.49)	12.77 (8.19)	-3.93 (4.12)
Per capita income/median	2.51 (39.61)	24.34* (13.26)	19.86 (41.71)	-1.87 (1.96)	0.89 (0.89)
Municipality with Reforma Procesal Penal	1.66 (15.23)	8.41** (3.71)	48.27** (19.12)	0.46 (0.80)	0.001 (0.22)
Population density	0.0003 (0.0008)	-0.0009*** (0.0003)	0.001 (0.001)	0.00001 (0.00005)	-0.00002 (0.00003)
Constant	-0.31 (32.24)	-31.12* (16.63)	10.50 (47.86)	-0.05 (1.68)	-0.45 (0.96)
<i>N</i>	72	72	72	72	72
<i>R</i> ²	0.06	0.29	0.19	0.10	0.05

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.

Table 10: Impact evaluation, parametric (with covariates in difference)*(Dependant variable: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
Dummy program	23.63** (11.85)	2.88 (3.42)	13.49 (18.05)	-1.64* (0.86)	0.08 (0.36)
Quintil ratio	-0.18 (1.27)	0.50 (0.45)	-0.06 (2.08)	-0.04 (0.09)	-0.06* (0.03)
% of non attendance at school (5-18 years old)	0.52 (1.59)	0.61 (0.42)	-2.33 (2.36)	0.05 (0.08)	-0.008 (0.031)
Unemployment rate	-49.02 (127.90)	37.30 (56.42)	-20.70 (262.7)	12.75 (7.01)	0.31 (4.28)
Per capita income/median	3.70 (21.26)	-7.45 (7.56)	-10.24 (37.47)	1.39 (1.76)	0.78* (0.46)
Municipality with Reforma Procesal Penal	3.10 (15.37)	8.89*** (2.88)	55.31*** (19.36)	0.58 (0.73)	-0.03 (0.22)
Population density	0.0002 (0.0007)	-0.001 (0.0003)	0.001 (0.001)	0.00005 (0.00005)	-0.00003 (0.0000)
<i>N</i>	71	71	71	71	71
<i>R</i> ²	0.06	0.25	0.16	0.12	0.05

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.

Table 11: Impact evaluation, non parametric*(Outcome: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
	Nearest neighbor				
Impact	2.72 (18.91)	0.56 (7.32)	2.76 (55.69)	-2.65 (1.23)	0.03 (0.44)
	Kernel				
Impact	33.98 (12.19)	16.36 (4.99)	37.49 (21.69)	-1.75 (1.29)	0.21 (0.19)

Notes: Standard error in parenthesis. Bandwidth for kernel is 0.06.

Table 12: Impact evaluation of the fake program, non parametric*(Outcome: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
	Nearest neighbor				
Impact	-3.46 (13.64)	5.18 (13.26)	-9.09 (30.25)	-0.95 (1.24)	-0.26 (0.55)
	Kernel				
Impact	1.40 (20.67)	4.77 (12.92)	8.86 (27.07)	0.95 (1.55)	0.08 (0.51)

Notes: Standard error in parenthesis. Bandwidth for kernel is 0.06.

Table 13: Impact evaluation, parametric (without controls)*(Dependant variable: difference in crime reporting rates per 100,000 inhabitants, 2002-2001)*

	Theft	Aggravated theft	Theft with force	Rape	Homicide
Dummy program	13.40 (15.70)	13.42 (9.11)	36.75* (20.99)	-2.26** (1.01)	0.005 (0.37)
Constant	12.59 (12.87)	-14.81 (7.85)	2.59 (18.68)	0.63 (0.73)	-0.25 (0.26)
<i>N</i>	24	24	24	24	24
<i>R</i> ²	0.03	0.08	0.12	0.18	0.00

Notes: Standard error in parenthesis. *: significant at 10%, **: significant at 5%, ***: significant at 1%.