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Certainty vs. Severity Revisited:
Evidence for Colombia

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Certainty vs. Severity Revisited: Evidence for Colombia

Camilo Acosta Mejía¹, Daniel Mejía Londoño² & Angela Zorro Medina³

June 2016

Abstract

A recurring debate in the literature on crime control is whether an increase in the probability of punishment is a more effective deterrent than an increase in the severity of the sanction. This paper further explores this issue in the context of crime in Colombia. We use a natural policy experiment (the introduction of the Adversarial System of Criminal Justice) to estimate how changes in the costs associated with criminal activity have affected crime rates in the country. The results show that for the Colombian case, when a reform reduces the probability of punishment it leads to an increase in crime rates across a variety of different types of criminal activity, including both violent crimes and property theft. Moreover, our evidence suggests that changes in the probability of punishment have greater impact in crime rates than changes in its severity. This has important implications for public policy regarding crime rates and the design of judicial mechanisms.

JEL Codes: K42, K14, K41, J18

Keywords: Law and Economics, Crime Economics, Criminal Law, Criminal Procedure, Certainty, Severity, Colombia.

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Certeza vs. Severidad: Repensando el Debate con Evidencia para Colombia

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Junio 2016

Resumen

Un debate recurrente dentro de la literatura del control de crimen ha sido si el efecto de la severidad del castigo tiene un mayor impacto disuasorio que la certeza que enfrenta el criminal de recibir éste castigo. A la luz de esto, este artículo explora este debate dentro del contexto del crimen en Colombia. Para ello usamos la expedición de una nueva legislación penal (Sistema Penal Acusatorio-Ley 906 de 2004) para estimar cómo cambios en los costos asociados a las actividades criminales afectan las tasas de delincuencia en el país. Los resultados muestran que para el caso colombiano, la reducción en la probabilidad de castigo que trajo la reforma conllevó a un incremento en las tasas de criminalidad de diferentes tipos de conductas delictivas, como crímenes violentos y delitos contra la propiedad. Más aún, nuestra evidencia empírica sugiere que cambios en la probabilidad del castigo tienen un mayor impacto en las tasas de crimen frente a cambios en la severidad de la sanción penal. Lo anterior tiene importantes implicaciones para el desarrollo de la política criminal y el diseño de mecanismos judiciales adecuados.

Códigos JEL: K42, K14, K41, J18

Palabras Clave: Análisis Económico del Derecho, Economía del Crimen, Derecho Penal, Procedimiento Penal, Certeza, Severidad, Colombia.

Todas las opiniones, conclusiones y errores corresponden a las de los autores y no a las organizaciones que representan. Agradecemos a Greg Haugan por su excelente trabajo como asistente de investigación y a Camila Uribe por su colaboración en las etapas iniciales de este proyecto. Los comentarios son bienvenidos.

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1. Introduction

Over the past decades the world has witness a trend of more punitive laws and harsher sentencing policies. In many countries, the sentencing policies initiatives have often been enacted with the goal of enhancing the deterrent effect of the criminal justice system. Some of the more common sentencing policies implemented around the world are: “three strikes and out”⁷ policy implemented in countries like Australia and United States; the mandatory minimum⁸ policies implemented in Denmark, United States, Canada, Ireland, Colombia, Cuba, China, among others; and “truth in sentencing policies”⁹ enacted by countries like United States, Australia, Colombia and Canada. All these different policies have been designed to deter crime under a threat of imposing longer prison sentences, which means that utilize a severe sentence in order to deter a person from engaging in criminal activities. Even though, the most common examples of “tough on crime” policies that can be found are related with changes in the severity of punishment, this not the only mechanism through which crime can be deterred. In particular, by increasing the certainty of punishment, potential offenders would face a higher risk of apprehension and conviction, thus creating a disincentive to commit crime.

In light of these two possibilities, a key question for public policy has been whether raising the severity of the punishment has a larger deterrent effect than increases in the probability of being punished, or vice versa. In the literature of crime control, this recurrent debate has important implications for the design of law enforcement mechanisms, particularly in the trade-off between investing additional resources to increase arrests or to toughen punishments.

Previous empirical literature has yielded ambiguous conclusions. From both comparative and local standpoints, the empirical evidence shows that the effect of these policies depends on the risk preferences of the individuals. This implies that criminal justice reforms may

⁷ “Three strikes and out” policies significantly increases the prison sentences of repeat offenders. Under these laws, the imposition of longer prison sentences are mandatory from the judge.

⁸ Minimum mandatory policies reduce judicial discretion and impose minimum mandatory sentences for specific crimes. These policies have been widely used to deter drug crimes around the world.

⁹ “Truth in sentencing” policies have been designed to reduce or abolish alternatives to imprisonment, conditional or suspended sentences.

produce substantially heterogeneous results, depending on the context. Consequently, public authorities should dedicate more resources to investigate the interaction between the severity and the probability of punishment in particular contexts, and to the design of effective deterrence policies, rather than blindly increasing the severity of punishments without any empirical evidence for a deterrent effect.

This article contributes to the literature by answering a specific question: How do changes in the costs and incentives of engaging in criminal activities influence individuals' decisions to commit crimes? Although it seems that this question has been answered several times, our article uses a natural policy experiment that changed both the probability and the severity of the punishment. In particular, we use the introduction of the Adversarial System of Criminal Justice (ASCJ) in Colombia. Specifically, this new system provides more protection to the fundamental rights of the accused, reducing the probability of receiving a condemnatory sentence, but also reduces the duration time of court proceedings, increasing the present value of the punishment.

The gradual and exogenous implementation of the ASCJ across the country, produced variation in “crime costs” over time and across the regions within the country. This variation allows us to empirically estimate the effects of this policy change on crime rates using a difference-in-differences (DID) approach. To this end, this article draws upon a municipal panel dataset of crime rates and other municipal characteristics in Colombia for the period between 2003 and 2008.

Our results present causal evidence showing that crime rates increased after the implementation of ASCJ. More specifically, for some crimes the effect appears to increase over time, suggesting criminals have learned about the reduced probability of being sentenced after repeated exposure to the new criminal justice system, and increased criminal behavior accordingly.

As already mentioned before, the debate about the different incentives agents face when engaging in criminal activities has been going on for a long time. In particular, this debate originated with the treatise of Cesare Beccaria (1767) who believed “that people rationally committed crimes when it was in their best interest to do so, and that they could and should be deterred by expected punishments of appropriate size.” (O’Flaherty and Sethi, 2015). In more recent times, pioneering the field of Crime Economics, Becker (1968) focused on the factors

that determine individuals' decisions to engage in illegal activities, with an approach grounded in the utilitarian perspective of Bentham. In Becker's model, the cost of engaging in crime comes from the imposed sanction and the probability of receiving a punishment. In other words, individuals perceive this cost as the expected value of the punishment: the probability of being punished (p) times the reduction in utility derived from the punishment (s). At the same time, the benefit of the criminal action is associated with the value of the reward (g) obtained. As a result the subject decides to commit a crime if the utility of the reward is higher than the disutility of the expected costs. If we normalize the criminal's outside option to zero, an agent will commit crime if

$$EU_c = p * u(g - s) + (1 - p) * u(g) \geq 0$$

where $u(\cdot)$ is the Bernoulli index of this Von Neumann-Morgenstern representation of the expected utility of committing a crime. It is common to assume that the preferences of the agents are complete, transitive, reflexive and continuous. For a basic dynamic setting, we could write everything in present values, using some discount rate, say r . For a more complete dynamic setting, the reader should refer to O'Flaherty (1998) or McCrary (2010).

A simple analysis of the previous equation can give us very interesting insights. First, by assuming $u'(\cdot) > 0$, this is utility increases with the net reward of the crime, the expected utility of committing a crime decreases when the punishment increases. On the other hand, the effect of the probability of punishment is not as straightforward and it depends on the second derivate of the utility function. In particular, if we assume the person is risk-preferring, an increase in the probability of punishment also decreases the expected utility of committing a crime. A strictly convex utility function is a very common assumption in this literature.

Accordingly, the crime level in society depends negatively on the severity of the punishment and the probability of being detained. However, the relative importance of these two elements depends upon criminals' risk preferences. Becker (1968), as well as Polinsky and Shavell (1979), show that when the subject is risk averse, the negative impact of the severity of the punishment on the expected utility is higher than the impact of the certainty of the punishment. The opposite happens under risk-loving preferences¹⁰.

¹⁰ Beccaria (1767) also proposed celerity as a third dimension. This is, quick punishments have a larger deterrence effect than delayed ones. This is a dimension that modern economic

This contrasts with authors subscribing to the “*Isolation Effect*” Hypothesis, stating that individuals do not take into account the probability of punishment, because they ignore secondary or indirect effects when evaluating their decisions. According to McCaffery and Baron (2006), people tend to isolate the effect of punishment, leaving the probability of detention with no deterrent effect. Similarly, Friesen (2009) finds that increasing the severity of punishment has a larger effect than an equivalent increase in the probability of punishment.

Other articles such that Andvig and Moene (1990), Sah (1991) Schrag and Scotchmer (1994), and Freeman (1996) extend Becker’s model to different settings obtaining similar results. Horvath and Kolomaznikova (2003) provide a nice survey. Levy (2002) also enriched the model by including the social effect of criminal activity. Garoupa (2001) finds that there is a substitution effect between the probability of being imprisoned and the severity of punishment. Furthermore, this effect occurs only if the severity of punishment is similar to the reward of the crime. If not, the relationship is a complementary one.

Different empirical studies seem to confirm Becker’s prediction of risk-loving criminals. Levitt and Miles (2007) find that recent empirical work confirms that the deterrent effect of policing: more police is associated with an increase in the probability of punishment and a reduction in crime. They also recognize the big simultaneity problems that arise in identifying these effects are a recurring issue in the literature. Di Tella and Schargrotsky (2004) attempt to resolve these simultaneity issues by using an exogenous increase in policing around Jewish institutions in Buenos Aires following a terrorist attack in 1994 to identify the effect of police deterrence on crime, finding a significant negative effect in the immediate local areas that received more policing, without the level of crime rising everywhere else. Durlauf and Nagin (2011) provide a complete review of empirical studies of deterrence. O’Flaherty and Sethi (2015) also provide a very nice survey of some other articles that study this relationship.

Levitt (1998) uses a regression discontinuity approach, exploiting differences between juvenile and adult criminal justice systems to estimate the effect of more severe penalties on crime. The results show a sharp drop in involvement in criminal activity just after individuals

analysis of crime has not followed. Although important in our analysis, we analyze celerity as an element of severity. Specifically, the introduction of the ASCJ, by reducing the duration time of court proceedings, affects the severity by increasing the present value of the punishment, which can actually be thought as affecting the celerity of the punishment.

reach the age of majority, suggesting that the application of harsher penalties acts as a deterrent.

In Colombia there are only a few empirical studies on this subject. These studies have generally focused on juvenile crime, and results have been mixed. In particular, Ibañez, Rodríguez and Zarruk (2013) show that the introduction of the new Criminal Justice System for Adolescents (CJSA) in Colombia, which exempts adolescents from imprisonment, generated an increase in juvenile crime. Consistent with this result, the authors find that the implementation of the CJSA generated an increase in theft rates in urban areas, especially in communities with a higher proportion of teenagers. Moreover, they also show that the effect of the CJSA on the decision to commit crimes is only valid for males. Our article also represents an important contribution by properly studying the effects of this law on the evolution of crime in Colombia.

The remainder of this article paper is organized as follows. Section 2 analyzes the new ASCJ in Colombia and its implications in the cost of crime. Sections 3 and 4 present the data and the empirical strategy, respectively. Section 5 presents the main results, while the results of a series of robustness checks are presented in Section 6. The final section concludes.

2. Law 906 of 2004: Adversarial System of Criminal Justice

The criminal legal systems of the world are influenced by two traditions: the inquisitorial and the adversarial justice systems. Inquisitorial justice is usually described as a system that aims to discover the truth of the facts through an extensive investigation, where the judge is actively involved. On the other hand, the adversarial system aims to get to the truth through a debate between a prosecutor and a defender, with the most compelling argument winning the case, and the judge is an impartial referee between the prosecution and the defense. Historically, inquisitorial justice has strongly influenced the Colombian criminal legal system. Nevertheless, in 2000, Colombia enacted Law 600, which was a legal reform to the criminal procedure with the purpose of approaching an adversarial system. This legal reform was a response to the inherent inequity generated by the definition of roles in the inquisitorial system, owing to the biased role of the judge.

However, this reform proved insufficient. The defense typically did not have the opportunity to dispute the evidence provided by the prosecutor. At the same time, in addition to being responsible for collecting and presenting evidence against the accused, the prosecutor had great discretion in determining the necessity of restricting the rights of the accused during the procedure, such as by applying pre-trial incarceration.

The justice system also remained based on a system of written arguments, creating significant delays in the procedure. The average criminal process lasted more than two years (Torres, 2007). Apart from the high congestion in the judicial system, this process was expensive. To reduce the caseload in Colombia's criminal courts, 250 new positions were created within the criminal jurisdiction, with an annual cost of over USD\$4,798,609 (Colombia Superior Council of the Judiciary, 2004)."

As a consequence, in August 2004 the Colombian Congress approved Law 906 of 2004, through which the country's new Criminal Procedural Code was passed. This new code introduced the criminal accusatory procedure (or ASCJ) into the national legislation. The principal change that this new legislation brought was the change in the role of the prosecutor; hence, it was necessary to reform the Political Constitution.¹¹ The main objective of the ASCJ was to align the national legislation with international human rights treaties. Specifically, Colombia sought to incorporate the rights embodied in Article 14 of the International Covenant on Civil and Political Rights.¹²

Amongst the changes that the ASCJ introduced to ensure the procedural equality of the parties, the most important were the creation of the Supervisory Judge (SJ) (*Juez de Control de Garantías*) and the requirement that the examination of the evidence be done by the Trial Judge (TJ) (*Juez con Función de Conocimiento*) in a public hearing. With the creation of the SJ role, the prosecutor position lost its ability to make decisions regarding restrictions to the fundamental rights of the accused (such as pre-trial detention). The prosecutor now presents the collected evidence to the SJ in a public hearing, and the defense has the ability to dispute this evidence. Moreover, the SJ is in charge of deciding if there is enough evidence to initiate a formal

¹¹ See Legislative Act 003 of 2002.

¹² The Colombian judicial system was already in the process of aligning its legislation with the international treaties through the constitutional jurisprudence, but the international right requirements were not fully guaranteed. See Sentences CConst., C-646/2001, MP: Marco Gerardo Monroy Cabrera; CConst., C-100/2003, MP: Manuel José Cepeda Espinosa.

process, and if the procedure can be conducted in absence of the accused, in order to protect the rights to due process (Article 291, Law 906 of 2004).

The implementation of an adversarial system of criminal justice, in which the judge is an impartial referee between two opposing parties, improves the protection of the presumption of innocence. The TJ decides whether the accused is guilty beyond reasonable doubt without having any previous contact with the case or the facts that are debated in the process, which guarantees the impartiality of the trial. Given that the accused is considered innocent until proven guilty under the new ASCJ, the prosecutor has a greater burden of proof because she now has to validate her decisions and evidence in front of an impartial judge. Furthermore, the adversarial debate over the evidence implies that the prosecutor needs to invest more time in the preparation of her arguments to win the case. On the other hand, the increase in the burden of proof of the prosecutor is actually greater due to the *in dubio pro reo* principle (embodied in article 7 of the Law 906 of 2004), under which any doubt about the guilt must be resolved in favor of the accused.

The changes implemented under the ASCJ were also intended to streamline the structure of the criminal justice system. A primary way of doing this was changing from the old system of written arguments to an oral hearing procedure. According to the Colombian Superior Council of the Judiciary (2011), the new ASCJ generated a reduction of the length of the criminal procedure between a 78% and a 93%. Specifically, the length of the process to determine guilty in robberies decreased by 93%, while the homicides process saw a reduction of 90%. Furthermore, in 2005 judges closed the judicial year with no pending audiences, and the period of time between scheduling did not take more than 30 days (Colombian Superior Council of the Judiciary, 2011).

The ASCJ was implemented gradually to ensure that the judicial districts were adequately trained. The Colombian Congress created four groups within Colombia's judicial districts, in which the adoption of the new system was done over a transitional period, with the first group adopting the new system in January of 2005 and the final group implementing the system in January of 2008. It is necessary to clarify that the implementation of the ASCJ did not eliminate the criminal procedure under the Law 600 of 2000. Right now both systems coexist and are the previous law is still implemented. This means that the inquisitorial system regulates crimes committed before 2005. Even though the two systems continue working

simultaneously between 2005 and 2008, this does not change our analysis, because the ASCJ regulates the crimes committed after its implementation, and the Law 600 of 2000 cannot be applied to these crimes under any circumstances. Consequently, the individual's decision to commit a crime after 2005, depending on the judicial district, incorporates the new ASCJ, not the old inquisitive model.

The implementation of the ASCJ across the country was exogenous for two main reasons. First, the Colombian Constitution only authorizes Congress to modify norms in the criminal court system; meaning local governments did not participate in the ASCJ formulation process. Second, in the Explanatory Memoranda of Law 906 of 2004, the Colombian Congress explains that the principal reasons for the change in the criminal justice procedure were to reduce the high levels of congestion in the courts caused by the written system, and to better protect the accused's fundamental rights, thereby complying with international human rights standards (Congress of the Republic of Colombia, 2003).

In light of the above, the effect of the ASCJ on the cost of committing a crime is (*a priori*) ambiguous. On one hand, the new criminal legal system affects the certainty of punishment in a way that has not been further explore in the crime literature. Usually, changes in the risk of punishment have been addressed as increases in probability of apprehension, which is not totally correct. A person can be arrested but not convicted because of flaws in the criminal justice system, which means that a better way to measure the risk of punishment would be the probability of actual conviction or imprisonment. The ASCJ decreases the probability of conviction or imprisonment by increasing the burden of proof on the prosecutor to demonstrate the existence of legal responsibility with the protection of the accused rights. On the other hand, the ASCJ increases the value of the punishment. Assuming that the criminal considers the present value of the magnitude of the punishment $\left(\sum_{t=1}^T \frac{u(s_j^t)}{(1+r)^{t-1}}\right)$, if the time between the crime and the effective sanction is shorter, the discounted factor will be lower, leading to a greater punishment.

An additional advantage of the evaluation of severity and certainty by using the ASCJ is that it allows us to take into account critics related with to what extent purported policy changes are implemented (Tonry, 2008). In this particular case, the ASCJ implementation has been constantly evaluated and the government and external institutions have determined that this system increases the due process guarantees and reduces the length of the criminal

procedure (Corporación Excelencia en la Justicia, 2014). Moreover, this policy allows us to respond to what extent its adoption is perceived by would-be offenders. It is important to clarify that we do not expect individuals to follow changes in the criminal justice system, and thus they should be unaware of the change without some personal or close exposure and should require repeated exposure to the criminal justice system in order to change the offender's expectations of the cost of committing a crime. In this case, the learning process can happen faster because the ASCJ affects not only severity of legal punishment (sentence after conviction) but also affects the implementation of pre-trial detention (in a strict legal sense pre-trial detention is not punishment, but in practice it is a harm for the offender). Because the pre-trial detention happens in an early stage of the process, the learning process of would-be offenders about it can be perceived in shorter periods of time than sentence length. This means that it is easier for potential offenders to be aware of sanction risk and consequences before they engaged in future criminal behavior. Finally, because the ASCJ introduces two effects at the same time, it clearly allows for a direct comparison between the severity and the certainty of a punishment.

Following the arguments presented in the introduction, this work states the hypothesis that the certainty of being punished has a greater impact than commensurate changes in the severity of the sanctions within the criminals' decision of committing a crime. Underlying this hypothesis, the ASCJ would have generated a rise in the crime rates due to the reduction in the probability of receiving punishment.

3. Data

Our data comes from four sources. First, most data on crimes and arrests was provided by Colombia's National Police Department. This data includes several crime categories, but we use only two due to their lower rate of reporting errors: homicides and thefts. Thefts are divided into four categories: (i) muggings, (ii) home burglaries, (iii) business robberies, and (iv) vehicle thefts. The Directorate of Criminal Investigation and Interpol, a Directorate of the Colombian National Police Department, provided additional data on crimes by municipality. The crime variables from this source include aggravated assaults and fights. The data per crime is monthly for each of the municipalities in Colombia from 2003 to 2008. We also use monthly data on police arrests in each municipality.

Third, we use the municipal data panel from the *Centro de Estudios para el Desarrollo Económico* (CEDE; Center for Economic Development Studies, in English) at the *Universidad de Los Andes* in Bogota. This panel provides yearly information on socio-economic variables for each municipality. Relevant data includes income from commercial and industrial activity, per capita educational investments, inequality measures, fiscal organization, a rural population index, and the number of people displaced by the Colombian conflict. Finally, we use the monthly unemployment data for the 13 metropolitan areas in Colombia from the *Life Quality Survey (LQS)* for the period between 2004 and 2008 conducted by the National Statistical Department (NSD).

Using the data on crimes, we also create three indices to measure the aggregate level of all criminal activity in the municipality each month, using the methodology proposed for Colombia by Mejia, Ortega, and Ortiz (2015). This allows us to create separate indices for Aggregate Total Crime, Aggregate Violent Crime, and Aggregate Property Crime, weighting the monthly crime rates in each municipality according to the length of the average sentence for each crime. Specifically:

$$Crime\ Index_{i,t}^c = \sum \left(\frac{p_s}{P_c} * rate_{i,t}^s \right)$$

Where $Crime\ Index_{i,t}^c$ represents crime index c (total, violent, or property) in municipality i , for month t ; p_s is the average sentence length in years for individuals convicted of crime s ; P_c is the sum of the average sentences for all crimes included in the index; and $rate_{i,t}^s$ is the crime rate for crime s , in municipality I , during month t , expressed in terms of crime incidences per 100,000 residents.

Table 1 presents the descriptive statistic for municipal crime rates. All the crime rates are normalized per 100,000 inhabitants. As the table shows, the 13 largest metropolitan areas have higher crime rates than Colombia's other municipalities. In particular, the mean for the aggregate crime index for the period 2003-2008 was 1.57 times higher, violent crime rates were 1.18 times higher, and property crime was more than four times higher for the largest 13 metropolitan areas in the country than all other municipalities.

Table 2 shows the main descriptive statistics for the variables from the LQS, the municipal panel from the CEDE, and the police arrests data obtained from the National Police. The arrests are measured per 100,000 inhabitants to obtain comparable values. As

observed, the arrest rate is also higher in the 13 metropolitan areas than in the rest of the country. As mentioned before, the unemployment information is only available for the 13 metropolitan areas.

**Table 1. Monthly Municipal Crime Rates: All Municipalities,
13 Metropolitan Areas and Other Municipalities**

Variable	All Municipalities		13 Metropolitan Areas		Other	
	Mean	Sd	Mean	Sd	Mean	sd
Muggings	2.919	8.157	9.994	11.718	2.699	7.922
Business Robberies	0.961	3.510	3.036	3.316	0.897	3.497
Home Burglaries	1.628	5.677	3.308	3.829	1.576	5.717
Vehicles Thefts	0.435	2.302	2.140	2.345	0.382	2.281
Homicides	3.780	9.865	3.988	3.517	3.774	9.997
Assaults	5.285	12.572	8.266	9.027	5.193	12.655
Fights	27.32	92.476	39.27	86.224	26.95	92.639
Crime Index	3.122	5.892	4.816	3.013	3.069	5.952
Violent Crime Index	4.054	8.618	4.766	3.405	4.032	8.729
Property Crime Index	1.312	3.351	4.912	4.411	1.200	3.249
Observations	79,092		2,376		76,716	

Source: Author's calculation based on National Police data.

**Table 2. Municipal Controls: All Municipalities,
13 Metropolitan Areas and Other Municipalities**

Variables	All Municipalities			13 Metropolitan Areas			Other		
	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD
Arrests per 100,000 residents	79,092	12.177	21.895	2,376	20.047	15.309	76,716	11.933	22.023
Rural Index	79,092	2.681	3.633	2,376	0.199	0.285	76,716	2.758	3.662
Investment in Education Per Capita	77,844	153.585	3,143.199	2,376	121.393	83.340	75,468	154.598	3,192.256
Tax Revenues from Industry and Business	79,008	0.014	0.038	2,376	0.070	0.087	76,632	0.012	0.033
Population density	79,092	142.841	627.694	2,376	2,126.515	2,849.862	76,716	81.404	170.639
Displaced Population Expelled	79,116	254.338	666.175	2,376	263.697	412.719	76,740	254.048	672.499
Displaced Population Arrival	79,116	249.677	1,311.010	2,376	2,611.601	5,419.525	76,740	176.548	827.571
Fiscal Performance	77,964	58.984	8.582	2,352	67.728	8.131	75,612	58.712	8.452
Unemployment	-	-	-	1,980	14.173	2.305	-	-	-

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

Table 3. Difference in process time between Law 906 and Law 600

Crime	N. of days.	N. of days.	Days reduction	% reduction
	Law 600	Law 906		
Thefts	567	69	498	87%
Homicide	493	116	377	76%

Source: Colombian Superior Council of the Judiciary. *Informe al Congreso de la República 2006-2007*. Page 208.

4. Empirical Strategy

The purpose of this article is to identify whether judicial process reforms affect the decisions to commit crimes through changes in the implicit costs of participating in criminal activities. We use the exogenous variation created by the implementation of Law 906 of 2004 in Colombia (ASCJ) to determine this effect. As discussed earlier, the introduction of this law changed incentives faced by individuals through two channels. First, the legal reform provided new guarantees for the prosecuted: it reinforced the presumption of innocence by increasing the burden of proof on the prosecutor's office. As a result, the prosecution found it harder to obtain a guilty verdict, therefore decreasing the probability of punishment. Second, the ASCJ reduced the length of court proceedings, which resulted in considerably reduced time before a verdict was rendered, hence increasing the present value of the punishment. (See Table 3).

When choosing whether or not to commit a crime, the individual makes a cost-benefit analysis. Hence, as he considers the present value of the expected utility of committing a crime, the date on which he receives the sanction alters the costs of engaging in criminal activity. The relationship between the cost of crime and the time until the penalty is imposed is negative. The longer the judicial process, the lower the costs of illegal behavior.

In order to perform an empirical evaluation of the effect of the ASCJ on crime rates in Colombia, we use a differences-in-differences methodology. The ASCJ was gradually implemented throughout the country, which allows us to exploit the temporal and a geographic variation in the changes to the costs of criminal activity imposed by the law. The ASCJ divided the country's judicial districts into four groups, and implemented the new process in stages, with each new group entering in subsequent years (see Graph 1). The first stage was implemented on January 1st of 2005, the second and third stages began January 1st of 2006 and 2007, respectively, and in the final implemented the ASCJ January 1st, 2008.

Graph 1. Effective Date of ASCJ Implementation, by Group Stages

Stage I	Stage II	Stage III	Stage IV
Armenia	Bucaramanga	Antioquia	Barranquilla
Bogotá	Buga	Florencia	Cartagena
Manizales	Cali	Ibagué	Cúcuta
Pereira	Medellín	Neiva	Montería
	San Gil	Popayán	Quibdó
	Santa Rosa de Viterbo	Pasto	Pamplona
	Tunja	Villavicencio	Riohacha
1-Jan-05	1-Jan-06	1-Jan-07	1-Jan-08

Source: Authors' creation based on Article 530 of Law 906 of 2004.

Now, in order to explain our regressions, consider the following framework, Let D_i be a variable that takes the value of 1 when municipality i implements the ASCJ, and 0 to the contrary, and $Y_{i,t}$ be the outcome of interest, which corresponds to the municipal crime rate in period t . The average crime rate of the municipalities that have implemented the ASCJ by period t is denoted by $Y_{i,t,1}$; and $Y_{i,t,0}$ denotes the crime rate of the municipalities have not yet implemented the ASCJ by period t . Therefore, our variable of interest is described by the following equation:

$$Y_{i,t} = D_i Y_{i,t,1} + (1 - D_i) Y_{i,t,0} \quad (1)$$

As a result, the mean change in the crime rate resulting from the introduction of the ASCJ in municipality i , given municipal characteristics $X_{i,t}$, is defined as follows:

$$E(Y_{i,t,1} - Y_{i,t,0} | D = 1, X_{i,t}) = E(\Delta Y_{i,t} | D = 1, X) \quad (2)$$

The variable $Y_{i,t,0}$ is a non-observable variable for municipalities in which the ASCJ entered in effect. Thus, our strategy allows us to control for systematic differences across time and space under the assumption of parallel tendencies, which we explore later in this section.

To demonstrate the appropriateness of this strategy, it is worth highlighting certain details of the exogeneity in the ASCJ implementation. First, the law's expedition was not related to the crime rates within the country. It was proclaimed to protect the rights of the prosecuted individuals, putting Colombia in line with international norms, as well as to reduce the court case backlogs under the inquisitorial system. Second the gradual implementation was exogenous to the crime rates in different areas of the country. Article 529 of Law 906 of 2004 determines the factors used to determine the timeframe for introducing the law in each judicial district. It does not mention any crime-related reasons¹³. Additionally, the reform was proposed at the national level and therefore was created by the national government, ensuring that no regional factors influenced the design. Taking this into account, we estimate the following equation:

$$\begin{aligned} \text{Log}(1 + \text{Crime}_{i,t}^s) &= \beta_0 + \beta_1 * \text{ASCJ}_{i,t} + \beta_2 * \text{ExposureTime}_{i,t} + \beta_3 * \\ \text{Log}(1 + X_{i,t}) + \delta_i + \mu_t + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where the dependent variable, $\text{Log}(1 + \text{Crime}_{i,t}^s)$, is the natural logarithm of one plus the crime rate per 100,000 habitants for crime s , in municipality i at period t . The addition of one to this logarithm prevents us from losing observations of municipalities where the crime rate is zero. Variable $\text{ASCJ}_{i,t}$ is a *dummy* that takes the value of 1 if the ASCJ has been implemented in municipality i at period t , and 0 otherwise.

The specified model includes a vector of municipal control variables represented by $X_{i,t}$. The variables considered are: (i) economic development, using industrial and commerce tax revenues as a proxy for municipalities' GDP, (ii) educational services, as measured by per capita educational investments in the municipality, (iii) quality of institutions, determined by land owning inequality and an index of fiscal management, (iv) conflict dynamics, measured by the number of displaced people, (v) police arrests, (vi) population density, (vii) unemployment for the 13 metropolitan areas. With the exception of unemployment, each of these variables has annual variation. In order to control for national tendencies in the crime rate and non-observable characteristics among the municipalities, we include fixed effects for

¹³ According with the Law 906 all the reasons for the gradual implementation are related with the capacity of the judicial system in each place to adopt the new system. For example, the levels of congestion, the number of judges and prosecutors available in the area, the number of public servers with training to applied the new system, among others.

municipality (δ_i) and time (μ_t). μ_t includes three components: a fixed effect for month (i.e. January), year (i.e. 2007), and month-year (i.e. January 2007).

We estimate several variations of equation (3), and present the results in tables 4 and 5. First, we estimate the regression on the pooled data sample for 2003-2008, including the 2003-2004 pre-treatment period, and the gradual implementation of the new system between 2005 and 2008. Because of the parallel effects between crime and the ongoing internal conflict in Colombia, we separate the 13 main metropolitan areas of the country (with significantly reduced exposure to the conflict) from all other municipalities (where exposure to the conflict is greater). We run the regression again for using only the 13 metropolitan areas sub-sample.

As a result of the gradual implementation, the dummy has time and municipality variation, which provides a causal estimation of the effect, under the assumption of parallel tendencies. This is, while the pre-treatment levels of crime do not necessarily need to be equal between the treatment and control groups, the model requires equality in the period-over-period variation for the control group to serve as a valid counterfactual. While this assumption cannot be verified once the ASCJ has been implemented, one way to test the assumption is to observe the growth path of the pre-treatment crime rates in each group. If the difference between both rates is statistically equal to zero, we fail to reject the null hypothesis that the growth paths are equal and hence we can use the proposed control group as a valid counterfactual.

We graph the difference in the mean growth of crime rates between treatment and control municipalities during the pre-treatment period, 2003-2004. The graphs also show the 99% confidence intervals for the t-test of the hypothesis that the difference in each period is statistically different from zero. With few exceptions, zero is consistently found within the interval. Although only the graphs for the muggings are shown (Graph 2), the pattern is similar for other crimes (the other graphs can be found in the appendix).¹⁴ It is worth

¹⁴ The growth rates in the different graphs corresponds to the growth rate proposed by Davis, Haltiwanger & Schuh (1996):

$$g_{it}^{DHS} = \frac{X_{i,t} - X_{i,t-1}}{0.5 * (X_{i,t} + X_{i,t-1})}$$

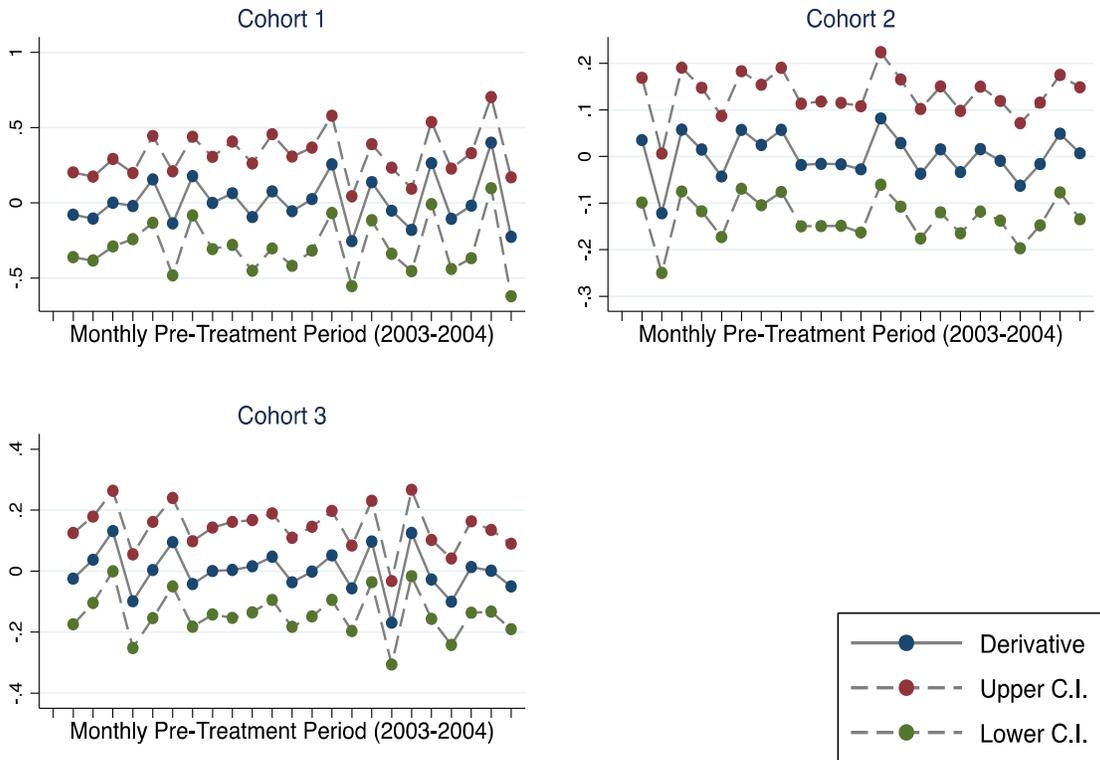
remembering that Cohort 1 in these graphs includes the municipalities listed in Stage I of Graph 1 as the treatment group, Cohort 2 includes municipalities from Stages I and II as the treatment group, and Cohort 3 includes those from Stages I, II, and III as the treatment.

Finally, it is worth mentioning that our dependent variable is potentially serially correlated across time and space, while the independent variable shows high serial correlation (once the ASCJ is implemented, treatment status in period $t+1$ can be perfectly predicted from t). Methods that fail to account for this problem will underestimate the standard error of the treatment coefficient, as described by Bertrand, Duflo, and Mullainathan (2004), potentially leading to a type I error. After running the regressions with robust standard errors, as well as errors clustered at the municipal, judicial district, and cohort level, we find that clustering at the judicial district level provided the most conservative standard error estimates.¹⁵ This also allows us to account for the correlation in crime across municipalities located in the same judicial district, as well as serial correlation within the same judicial district across time. Hence, all standard errors reported here are clustered at the judicial district level.

This growth rate was proposed in the context of analyzing job creation and job destruction when there was entry and exiting of firms; otherwise, these observations would ended up being out of the statistical analysis. We consider this specification is useful here because we have municipalities that don't have some types of crime in different quarters. By using this specification, we are accounting for these observations. Also, Davis, Haltiwanger & Schuh (DHS) show that this growth rate specification shares useful properties of the log differences.

¹⁵ We also considered clustering at the judicial district and state level; however, we realized that that there is not any judicial district containing municipalities from two different states.

Graph 2. Parallel Tendencies of Muggings



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Tables 4 and 5 present the general effect of the implementation of the ASCJ on crime rates for Colombia using monthly data from 2003-2008. The results are shown for seven different types of crimes: muggings, business robberies, home burglaries, vehicle thefts, homicides, assaults, and fights, as well as for the aggregate crime indices. For each dependent variable, we estimated equation (3) for all municipalities and for the 13 main metropolitan areas. Although we do not present the coefficients for the control variables in the tables, all regressions include the control variables and fixed effects described in the previous section. In particular, we present two panels in Table 4. Panel A shows the regression when we use the current value of (log) arrests, while Panel B includes the lagged value instead. This is done in order to alleviate possible endogeneity concerns surrounding the arrests variable.

As shown in Table 4, the coefficient associated with the implementation of the ASCJ for all municipalities is positive and significant for assaults and homicides, as well as for the

aggregate crime and violent crime indices. The effect is also positive and significant for thefts to business and residences, though the estimate is less precise. While the implementation dummy appears significant for violent crime, for crimes related to property theft the exposure time to the ASCJ shows the most consistent evidence for significant effects. Of the different property theft categories, the effect is largest for street muggings, perhaps because it is the least risky and requires the least amount of planning, while each additional month of exposure to the ASCJ increases business and home thefts to a lesser extent, though remaining significant. The significant findings for exposure time may indicate that criminals learn about the implications of the ASCJ for reducing their risk of conviction after repeated exposure to the new system. Finally, it is worth noting that the results from Panel B do not differ significantly from those in Panel A.

Table 5 includes results for the 13 metropolitan areas. As the table shows, the ASCJ continues to show evidence of having increased crime rates in this sub-sample. The main difference between these results and the pooled regression is that the ASCJ shows more consistent evidence of having increased property crimes in the main urban areas, while the effect for the pooled sample also shows evidence of increasing violent crime. The effects for these metropolitan areas still hold when we control by municipal unemployment.

Table 4. Dependent Variable: Logarithm of Crime Rates in Municipality *i* and Time *t* - All Municipalities

PANEL A – Controlling for current level of (log) Arrests									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Muggings	Business Robberies	Home Burglaries	Vehicle Thefts	Homicides	Assaults	Crime Index	Violent Crime Index	Property Crime Index
ASCJ	0.093 (0.084)	0.051* (0.030)	0.070* (0.042)	0.019 (0.015)	0.052** (0.022)	0.278*** (0.091)	0.141*** (0.044)	0.169*** (0.045)	0.073 (0.057)
Exposure Time	0.014*** (0.005)	0.005*** (0.002)	0.006** (0.003)	-0.001 (0.001)	-0.000 (0.002)	0.008 (0.005)	0.005* (0.003)	0.003 (0.003)	0.009** (0.003)
Observations	77,268	77,268	77,268	77,268	77,268	77,268	77,268	77,268	77,268
R-squared	0.408	0.301	0.305	0.235	0.275	0.320	0.336	0.298	0.396
PANEL B – Controlling for lagged level of (log) Arrests									
ASCJ	0.056 (0.085)	0.033 (0.029)	0.047 (0.041)	0.016 (0.014)	0.035 (0.022)	0.202** (0.084)	0.097** (0.041)	0.125*** (0.040)	0.048 (0.057)
Exposure Time	0.014** (0.005)	0.005*** (0.002)	0.006** (0.003)	-0.001 (0.001)	-0.000 (0.002)	0.007 (0.006)	0.005 (0.003)	0.002 (0.003)	0.008** (0.003)
Observations	76,189	76,189	76,189	76,189	76,189	76,189	76,189	76,189	76,189
R-squared	0.384	0.288	0.290	0.235	0.274	0.269	0.306	0.277	0.375

Controls: Per capita Industry and Business tax collection, per capita investment in education, fiscal performance, density of population, rural index, displaced population, police arrests, and time of exposure to the ASCJ. All the regressions also include municipality fixed effects, and year, month and year*month fixed effects. Robust Standard errors clustered at the judicial district level in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

Table 5. Dependent Variable: Logarithm of Crime Rates in Municipality i and Time t - 13 Metropolitan Areas

PANEL A – Without municipal unemployment									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Muggings	Business Robberies	Home Burglaries	Vehicle Thefts	Homicides	Assaults	Crime Index	Violent Crime Index	Property Crime Index
ASCJ	0.325** (0.122)	0.214** (0.076)	0.138 (0.099)	0.010 (0.078)	0.022 (0.074)	-0.034 (0.114)	0.061 (0.063)	0.001 (0.063)	0.211** (0.085)
Exposure Time	0.012* (0.006)	0.012** (0.004)	0.007 (0.006)	0.001 (0.004)	-0.002 (0.004)	0.018** (0.007)	0.003 (0.005)	0.003 (0.004)	0.006 (0.006)
Observations	2,352	2,352	2,352	2,352	2,352	2,352	2,352	2,352	2,352
PANEL B – With municipal unemployment									
ASCJ	0.327*** (0.034)	0.234*** (0.024)	0.143* (0.059)	0.062 (0.045)	-0.020 (0.053)	-0.050 (0.024)	0.037 (0.025)	-0.036 (0.018)	0.229** (0.045)
Exposure Time	0.009 (0.006)	0.012** (0.003)	0.005 (0.003)	0.003 (0.004)	-0.005 (0.003)	0.015** (0.003)	-0.000 (0.002)	-0.000 (0.001)	0.005 (0.007)
Observations	1,956	1,956	1,956	1,956	1,956	1,956	1,956	1,956	1,956

Controls: Per capita Industry and Business tax collection, per capita investment in education, fiscal performance, density of population, rural index, displaced population, police arrests, and time of exposure to the ASCJ. All the regressions also include municipality fixed effects, and year, month and year*month fixed effects. Robust Standard errors clustered at the judicial district level in brackets, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

Our two variables to evaluate the impact of the ASCJ show different effects in the crime rates. In first place, the immediate effect of the ASCJ shows the learning process of the individuals based on the early stages of the criminal process, while the exposure time reveals the effect of the learning process of offenders in long run (sentencing stage and post-conviction stage). Our results are consistent with our hypothesis about the learning process of offenders, under which the most serious offenses provide learning in the early stages of the criminal process. Under our assumptions, the offenders learn about the changes in severity and certainty in early stages through the pre-trial detention implementation, which can only be imposed for exceptional cases for severe crimes, among other circumstances. The results exposed in table 4 provide evidence that the ASCJ has immediate effect on the most severe crimes (homicides and assaults).¹⁶ Comparing violent crimes with property crimes we find that violent crimes have an immediate increase in the short run while property crimes do not, and these results are consistent with the fact that pre-trial detention is more frequently imposed to violent crimes than to property crimes, because of the different nature and gravity of the conducts.

The results in table 5 show that for the metropolitan areas the ASCJ has an impact in property crimes. The different type of muggings that happened in the cities and rural areas can explain these results. According with the Colombian Penal Code, the snatching constitutes an aggravated mugging that increases the sentence between a 50% to a 75%; this conduct is common in urban areas in Colombia. The difference between table 4 and 5 can be explained because this aggravated mugging is characteristic of urban zones and it is not that frequent in rural areas, which means that muggings in the cities can be more serious offences according to the Colombian Penal Code than muggings in rural areas.

On the other hand, the exposure time of the ASCJ has a consistent effect on property crimes, which reveals that the more exposure to this new system offenders have, the more they learn about the changes in the cost of crime and the result is the prevalence of the reduction in the risk of punishment. The results in assaults and homicides are not consistent, which confirms what different authors have exposed before about a moderate deterrent impact of severity or certainty of punishment in these types of crimes. The decision making process of a homicide or assault is a more complex and unpredictable

¹⁶ We define severity as highest imprisonment sentence.

process, and it is harder to find a complete rational decision based only in cost and benefits. In contrast, a rational choice perspective better explains the property crimes where the would-be offender approaches the decision by considering the risk and benefits of engaging in crime.

Another explanation of the low effect of exposure time to the ASCJ in severe crimes (severe muggings, homicides and assaults) can be explained by the incapacitation effect of the sentence. If the person is actually convicted then in the most severe cases the imprisonment punishment prevents that person of re-offend, and in that case the offender is not able to “apply” what he has learnt into a new criminal action for a longer period of time.

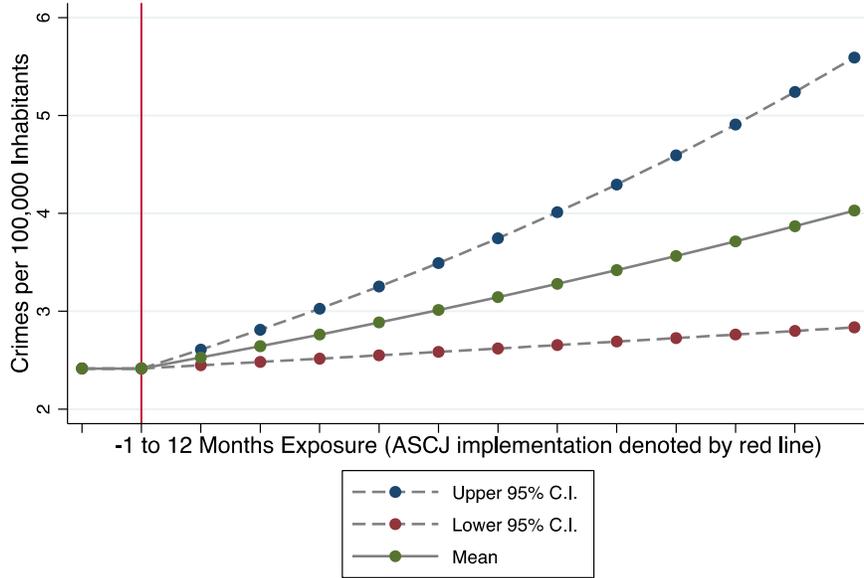
Graphs 3-6 show the implications of the effect of exposure time to the ASCJ on muggings, business robberies, and home burglaries. In each case, we use the average crime rate for all municipalities before ASCJ implementation as the baseline, and then calculate the treatment and exposure time effects implied by the results in Table 4.

As previously noted, the ASCJ increased the present value of punishments, but reduced the probability of being sentenced, thus resulting in a total effect that is ambiguous *a priori*. Our results therefore suggest that, in the case of Colombia’s ASCJ implementation, the effect of reducing the probability of a guilty verdict has been greater than the effect of a larger present value of the punishment. Consistent with Shawness (1965), Radzinowicz (1948) and Becker (1968), the results also confirm the sensitivity of criminals’ decisions to commit crimes to their perceptions of the probability that they will be caught and punished.

Additionally, the trade-off between the probability and the severity of the punishment can explain some of the mixed results, such as in the case of theft to vehicles. According to Garoupa (2001), the probability and severity of crime are complementary in presence of substantial under-deterrence caused by costly detection and punishment. For instance, the deterrent value of monetary sanctions depends on the economic resources of the offender (e.g. if a criminal is poor, the deterrent value is low). In other cases, evidence suggests that when the punishment cost is close to the benefit of committing a crime, the probability of detention, and fines or imprisonment are substitutes (Garoupa, 2001). This might be the case for vehicle thefts, which would have yielded the insignificant results. These mixed results are not new in the literature, as inconclusive results have been a persistent issue in order to

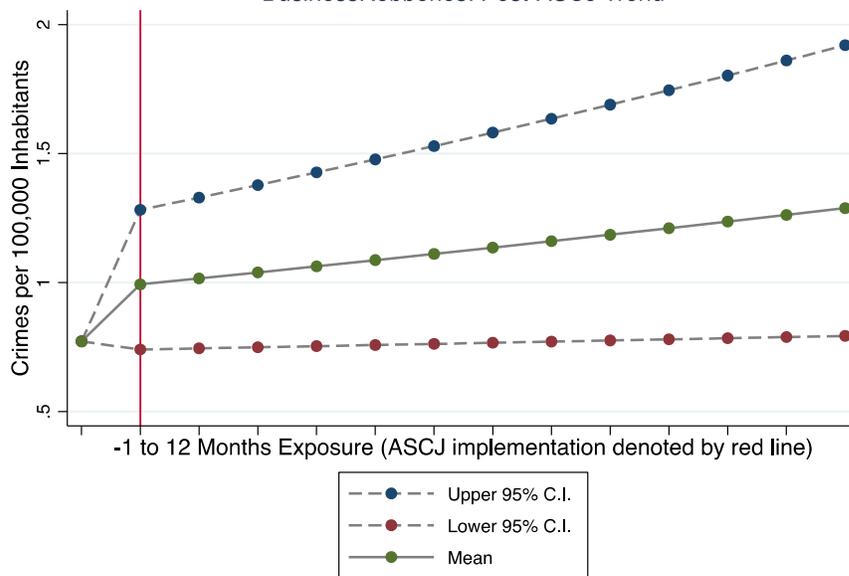
develop a generalized theory on crime, with studies by Andenaes (1975), Eide (1999) and Levy serving as clear examples.

Graph 3. ASCJ Exposure time and Muggings



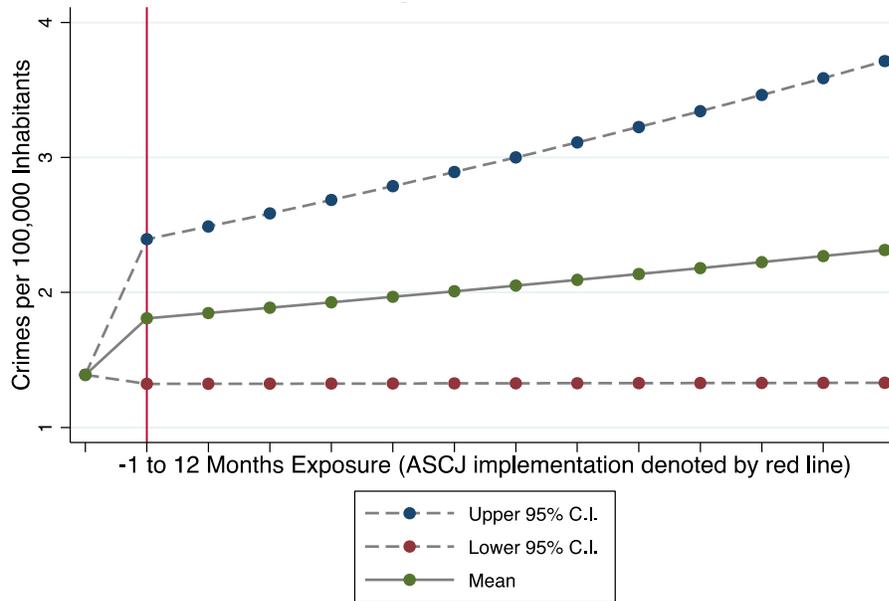
Source: Authors' calculations from National Police Data.

Graph 4. ASCJ Exposure time and Business Robberies



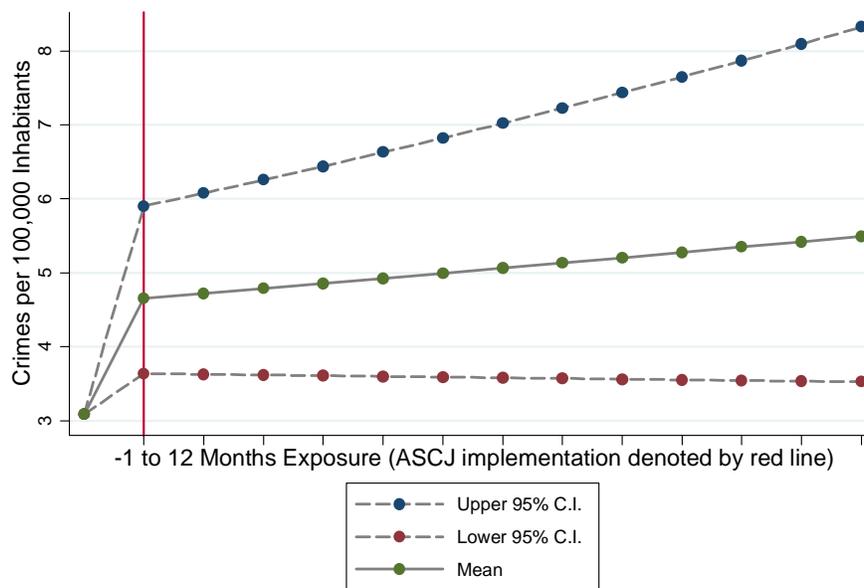
Source: Authors' calculations from National Police Data.

Graph 5. ASCJ Exposure time and Home Burglaries



Source: Authors' calculations from National Police Data.

Graph 6. ASCJ Exposure time and Aggregate Crime Index



Source: Authors' calculations from National Police Data.

6. Robustness Checks

To provide further evidence that these effects are indeed the result of the ASCJ implementation, we run placebo regressions on the crime rates of interest. Specifically, we randomly assign each judicial district to a new ASCJ-entry cohort. The results are presented in Table 6. As expected, the placebo ASCJ does not appear to have had a significant impact on municipal crime rates.

We run an additional regression using the true order of entry into the ASCJ, but including as the dependent variable deaths caused by transit accidents. The logic behind the deterrence theories is based on a rational choice, in which the individual has the intention of engage in a criminal behavior, which means that this balance of cost and benefits can only happened in intentional crimes, not in non-intentional offenses like the manslaughter.. To the extent that the decision to commit a crime follows is rational, these crimes should also show deliberate behavior. These results are presented in Table 7. As expected, the ASCJ reform does not appear to have had any impact on these placebo variables, either from its direct implementation or from a municipality's exposure time to the reform.

Table 6. Placebo Regressions: Randomly Assigned Placebo ASCJ Entry and Logarithm of Crime Rates – All

Municipalities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Muggings	Business Robberies	Home Burglaries	Vehicle Thefts	Homicides	Assaults	Crime Index	Violent Crime Index	Property Crime Index
Placebo ASCJ	-0.042 (0.052)	0.000 (0.029)	0.040 (0.052)	-0.004 (0.013)	-0.020 (0.024)	0.020 (0.100)	-0.009 (0.047)	0.002 (0.051)	-0.028 (0.036)
Placebo Exposure									
Time	-0.007 (0.005)	-0.004* (0.002)	-0.005 (0.004)	-0.001 (0.001)	0.002 (0.002)	-0.002 (0.005)	-0.000 (0.003)	0.001 (0.003)	-0.004 (0.003)
Obs	77,268	77,268	77,268	77,268	77,268	77,268	77,268	77,268	77,268
R-squared	0.38	0.288	0.288	0.235	0.274	0.268	0.305	0.277	0.371

Controls: Per capita Industry and Business tax collection, per capita investment in education, fiscal performance, density of population, rural index, displaced population, police arrests, and time of exposure to the ASCJ. All the regressions also include municipality fixed effects, and year, month and year*month fixed effects. Robust Standard errors clustered at the judicial district level in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

Table 7. Crimes Unaffected by the ASCJ Reform – All Municipalities

VARIABLES	Transit Deaths
ASCJ	-0.025 (0.076)
Exposure Time	0.002 (0.003)
Obs	7,512

Controls: Per capita Industry and Business tax collection, per capita investment in education, fiscal performance, density of population, rural index, displaced population, police arrests, and time of exposure to the ASCJ. All the regressions also include municipality fixed effects, and year, month and year*month fixed effects. Robust Standard errors clustered at the judicial district level in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

7. Concluding Remarks

Our results suggest that the ASCJ increased crime rates across Colombia, a finding that is consistent with different model specifications and that holds up to robustness checks. In particular, the results show that the ASCJ mostly impacted property crime in the largest urban areas of the country, and increased both property and violent crime throughout the entire country. These results can be explained by the changes the ASCJ imposed on the cost of engaging in criminal activities. As previously mentioned, the ASCJ increased the cost of committing crimes by reducing the time of the criminal procedure, so the temporal distance between the felony and the punishment was reduced, increasing the present value of the punishment. On the other hand, the reform lowered the probability of receiving a conviction, which lowers the cost of crime. Thus, our results suggest that the effect of the reduced probability of punishment has been stronger than the increased costs imposed by shortened criminal justice proceedings.

Additionally, our results may suggest that offenders are marginally risk-loving. The positive impact of the ASCJ on crime rates suggests that the elasticity of the change in the probability of punishment is greater than the elasticity of the reactions produced by the sanctions. The effect of reducing the probability of receiving a punishment is greater than the rise in the value or length of the sanction. These results confirm the conclusions found

by Shawness (1965), Radzinowicz (1948), Becker (1968), and Polinsky and Shavell (1979; 2000).

Our evidence also suggests that the effect of the exposure time to the law varies with the criminal activity. In particular, the effect is largest for street muggings, perhaps because it is the least risky and requires the least amount of planning, while each additional month of exposure to the ASCJ increases business and home thefts to a lesser extent, though remaining significant. The significant findings for exposure time may indicate that criminals learn about the implications of the ASCJ for reducing their risk of conviction after repeated exposure to the new system.

The results found in this work are in line with previous studies that show that mechanisms that change the cost of engaging in illegal activities influence an individual's decision to commit a crime. The evidence that the ASCJ was indeed a significant factor for increasing the crime rates suggests that policy makers must take into account the negative unintended consequences of changing the judicial system. Furthermore, this work warns against the adverse effects of current Colombian legislation, which had never been analyzed until now.

Finally, this article has implications for crime policy in Colombia. As the results show, individuals are more sensitive to changes in the probability of receiving a punishment (or the time between the capture and the sentence) than the severity. Consequently, rather than drawing almost exclusively on increases in imprisonment periods as a mean to reduce crime rates (which has been the course of action of the Colombian Congress and Ministry of Justice in recent years), our results suggest public authorities should focus resources on investigating how to increase the certainty of the sanction without generating unintended negative consequences. We consider that the design and implementation of these mechanisms, together with the study of their effects can be a fruitful way for future research.

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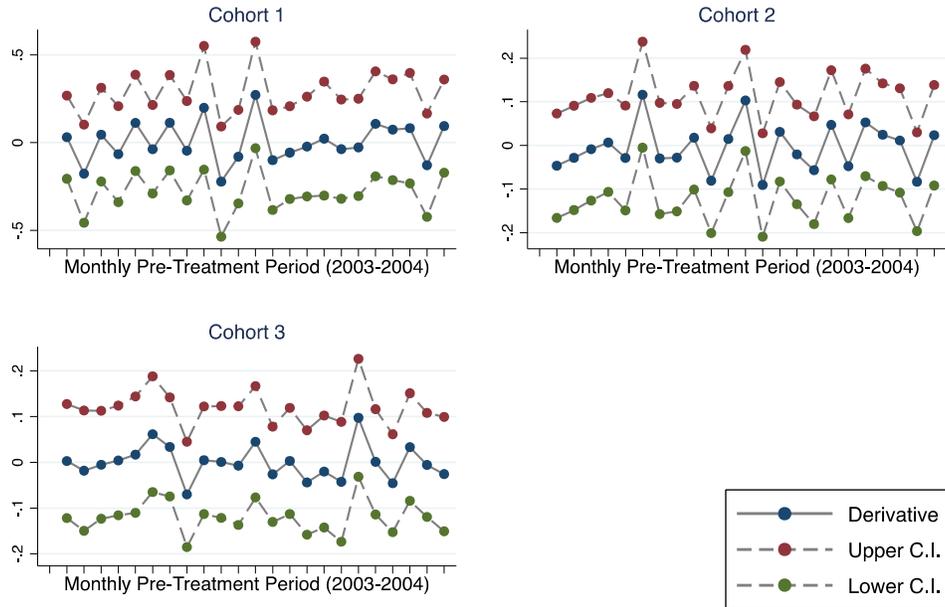
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Appendix

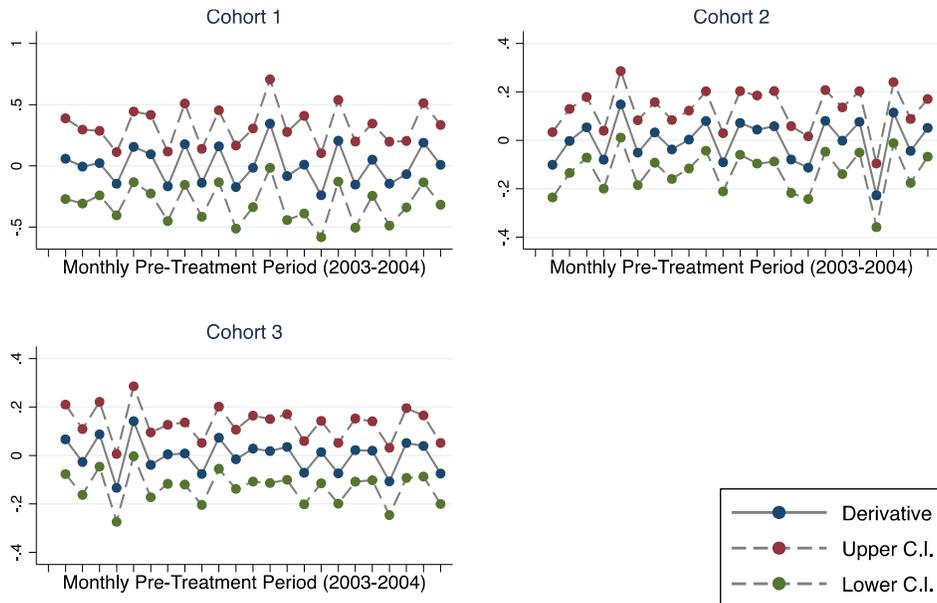
Graph A1. Parallel Tendencies of Business Robberies



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

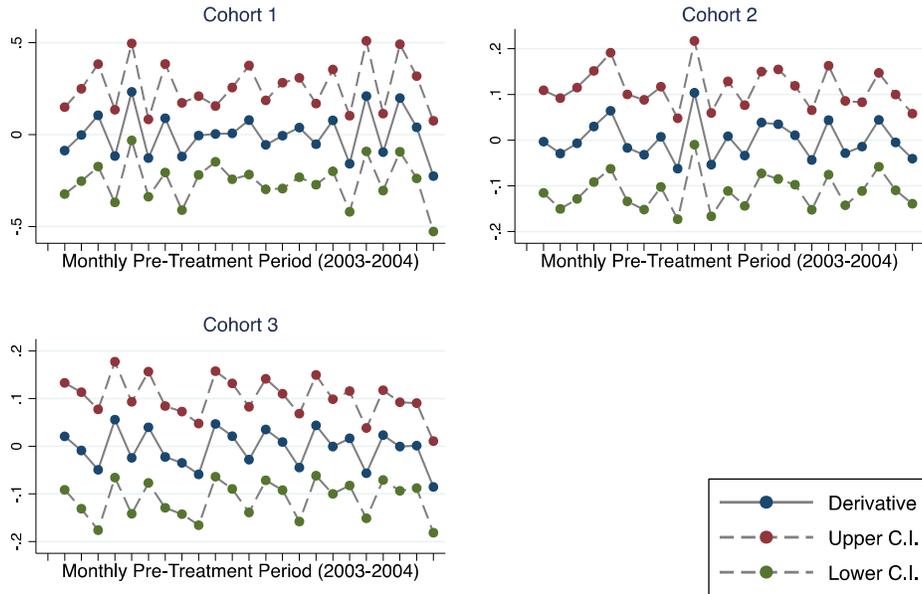
Graph A2. Parallel Tendencies of Home Burglaries



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

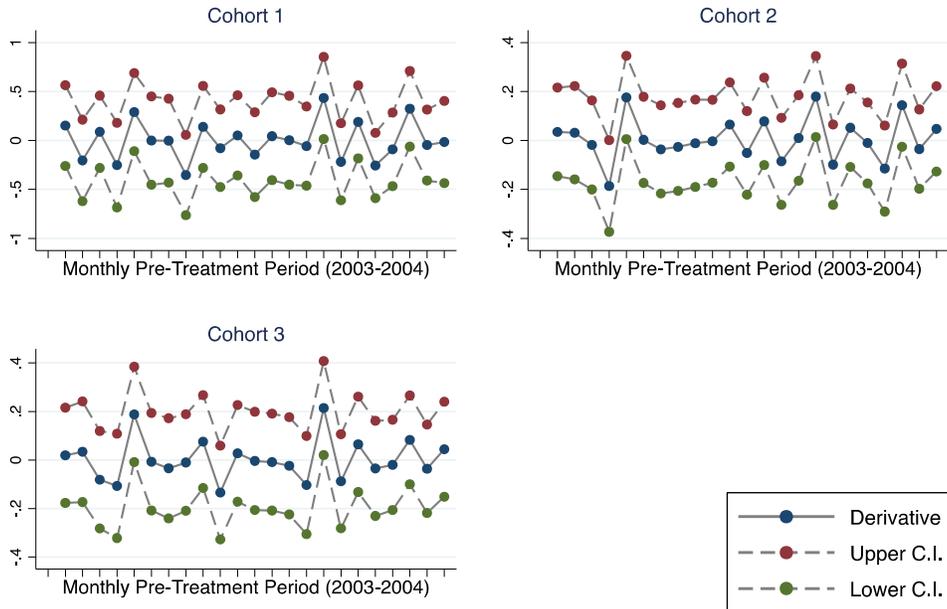
Graph A3. Parallel Tendencies of Vehicle Thefts



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

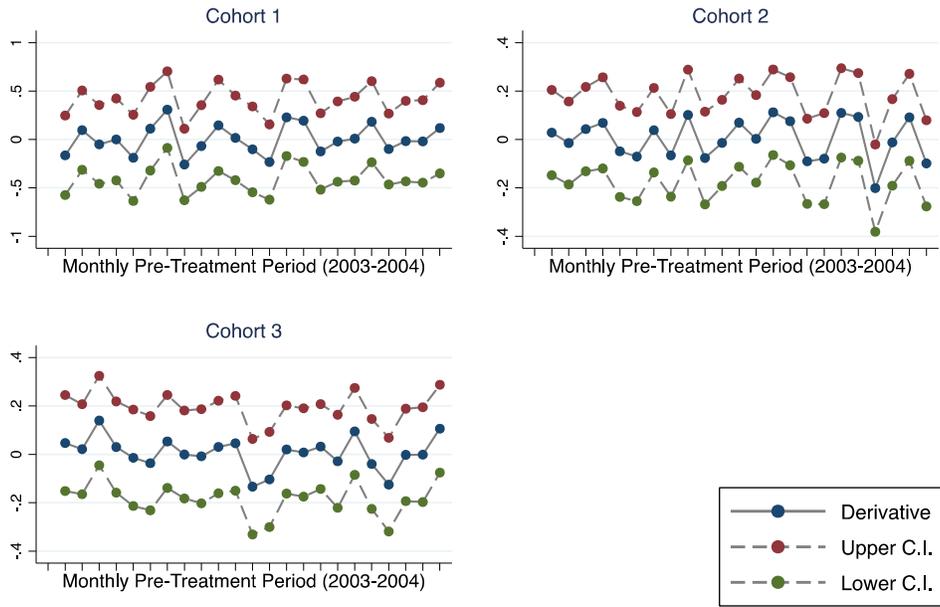
Graph A4. Parallel Tendencies of Homicides



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

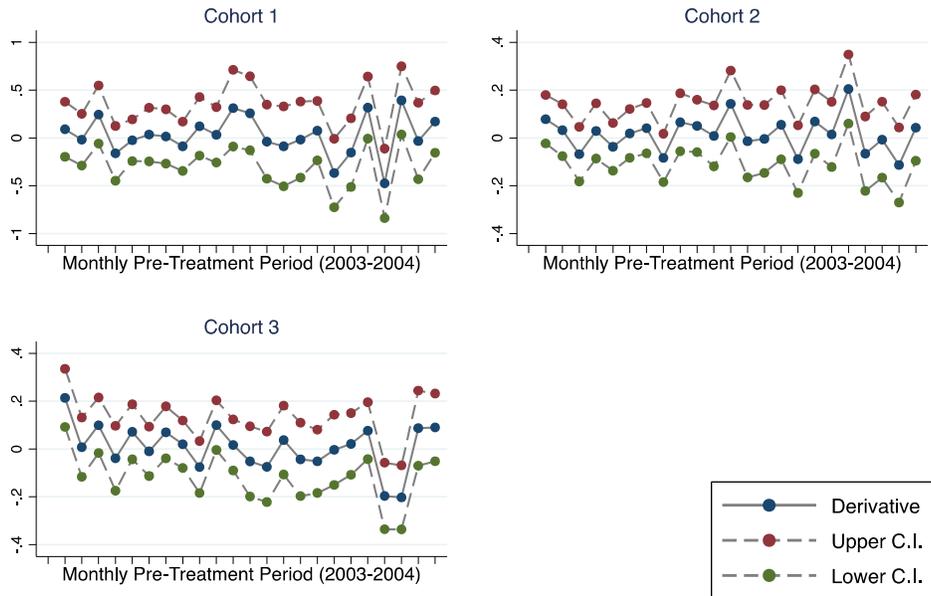
Graph A5. Parallel Tendencies of Aggravated Assaults



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

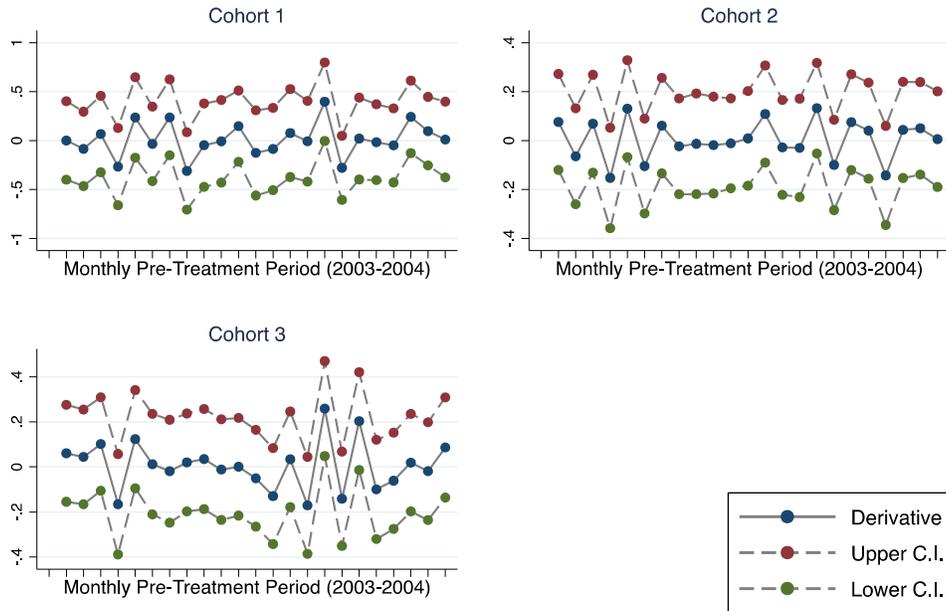
Graph A6. Parallel Tendencies of Fights



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

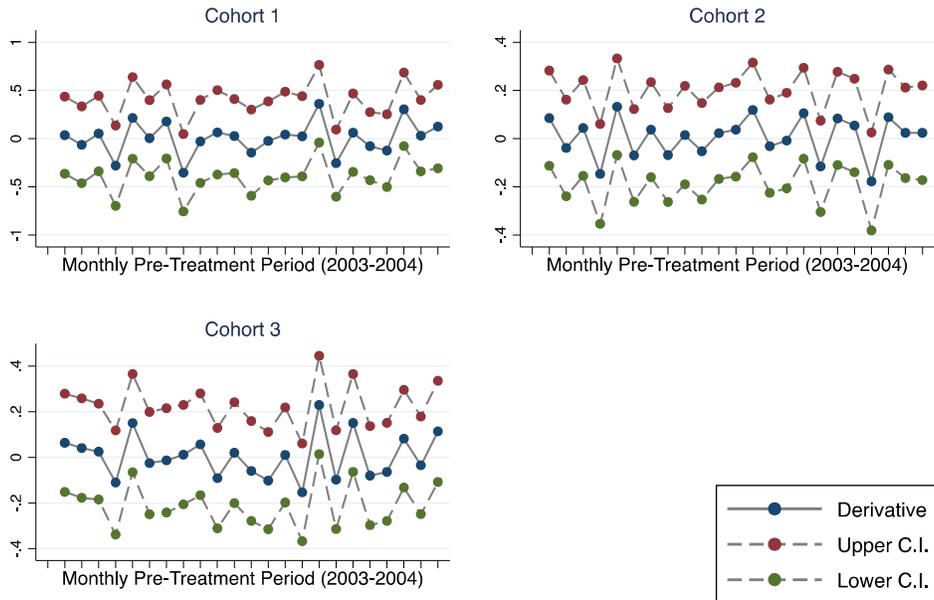
Graph A7. Parallel Tendencies of the Aggregate Crime Index



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

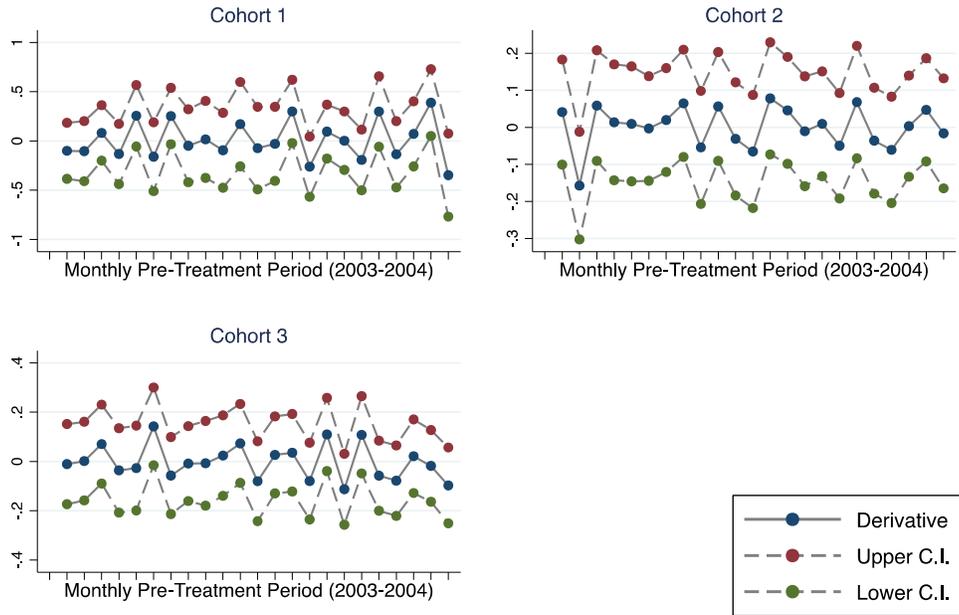
Graph A8. Parallel Tendencies of the Violent Crime Index



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.

Graph A9. Parallel Tendencies of the Property Crime Index



Note: Figure corresponds to the difference between the (DHS) growth rates in the dependent variable between control and treatment groups

Source: Authors' calculations based on National Police Department, CEDE municipal panel and LQS.