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Inequality, Opportunity and Redistribution

Three Essays on Institutions and Development in Latin America

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Contents

List of Figures

List of Tables

Tables Essay 1

Tables Essay 2

Tables Essay 3

General introduction

This dissertation consists of three empirical essays analysing different determinants of socio-economic development in Latin America. All three essays are self-contained and can be read independently of the others, but share a particular emphasis on institutional and social dynamics that are related with the persistently high levels of inequality and poverty in the region. They explore unfairness in access to social mobility opportunities, public attitudes towards redistribution and governmental institutions often permeated by corruption, and the effects of increasing levels of criminal violence on poverty.

Latin American countries have made significant progress on poverty and inequality reduction in the last two decades. In particular, since the early 2000s, poverty in the whole region has fallen by more than 15 percentage points (from 44 per cent) and the Gini coefficient has reduced by one per cent or more per year in most of the countries (ECLAC, 2011). Given the prolonged absence of overall distributive improvement in the past, this is a remarkable achievement. However, it has not been enough to change Latin America's position as the most unequal region in the world, not only in terms of income, but also in terms of development outcomes, such as educational achievement, which has severely limited a better distribution of opportunities and social mobility in the region (OECD, 2009; Lopez-Calva and Lustig 2010, ECLAC 2011, Birdsall et al. 2011).

In addition, unfortunately with few exceptions, Latin American countries are also in high positions in the international rankings of corruption and the region is characterized by having the highest rates of criminal violence. On the one hand, not only the region consistently performs poorly in independent surveys by NGOs that estimate public sector corruption (e.g. Transparency International), but also corruption commonly appears among the most serious problems mentioned by citizens in opinion polls in most countries. On the other hand, according to the United Nations, between 2000 and 2010, the murder rate in the region grew by 11 per cent, whereas it fell or stabilized in most other regions in the world. As a result, Latin America registers more than 100,000 homicides per year and most countries have homicide rates which are considered to be at epidemic levels by the World Health Organization (UNPD 2014). The deterioration of security has not been a uniform phenomenon and countries hit by organised crime, especially drug trafficking, have borne the brunt.

In this context, the purpose of this dissertation is to analyse different determinants of socio-economic development in Latin America, especially linked to the persistence of inequality, from three different perspectives. First, the role of the expansion of higher education in improving equality of opportunity and social mobility is analysed, using Colombia as a case study. Second, individual perceptions of corruption effects on support for redistribution are examined, using survey data for 18 countries. Finally, the impact of drug-related violence on socio-economic development in Mexico is assessed, using municipal level data. The three essays in this dissertation have a microeconometric approach and share an empirical focus on causal analysis.

The first paper analyses the effects of the expansion of higher education supply on the equality of educational opportunities. Expansion of educational access is of great interest not only considering its role in economic growth and development, but also because educational inequality is one of the main channels through which economic inequality persists. Important reforms in educational systems, a dynamic growth of public spending and a higher openness to private sector have led to an important growth of enrolment rates in Latin America[1] and this increase in educational coverage has been identified as an important driver of the observed reduction in earnings inequality in the region (López-Calva and Lustig 2010). However, intergenerational mobility continues to be low and there are significant differences across social classes in the opportunities of accessing high-quality education (Daude, 2014).

Following previous research on the effects of institutional reforms in Italy (Bratti *et al.*, 2008), this approach to the Colombian case contributes to the literature on inequality of educational opportunity in two ways: first, by focusing on the supply side of educational expansion and its effect on intergenerational mobility and, second, by taking advantage of the specific nature of an institutional reform during the 1990s to analyse separately the role of the public and the private sector. The role of supply growth has usually been taken for granted. However, changes in both the amount and quality of higher education supplied by a growing and diverse number of institutions may affect individual schooling decisions and indirectly in intergenerational mobility. Particularly, the cost-reduction effect and a potential increase in the expected returns of a higher schooling allow new entrants from families with lower socioeconomic backgrounds, and then improve equality of opportunity. However, the hierarchical diversification that usually accompanies higher education expansion, boosted by a

[1] Latin America has witnessed an important expansion in educational coverage over the last two decades. On average, enrolment rates in primary (net) and secondary education (gross) increased from 85.9 percent and 49.6 percent in 1980 to around 94.0 percent and 89.7 percent in 2011, respectively. FUENTE

wider range of providers, degrees and quality standards, could limit the benefits of supply expansion in terms of equality of opportunity.

In particular, this paper analyses the effect of increasing higher education supply on inequality due to circumstances in the likelihood of attaining higher education in Colombia, spanning the period 1992–2002. Using a differences-in differences methodology allows estimating the individual's probability of attending and completing higher education and identifying the students who benefited most from the increase in the number of both institutions and undergraduate degrees. The main finding is that expansion of supply had a positive effect on equality of opportunity in higher educational attainment, as it increased the probabilities of enrolling and graduating for individuals of less well-off backgrounds. Nevertheless, there has been also a process of diversion, which means that these students were channelled to educational opportunities considered of lower status by Colombian society. Furthermore, the results signal a trade-off between efficiency and equity in the public education system, as students from the most advantaged backgrounds obtained the highest benefits from the expansion of public sector supply.

The second paper addresses attitudes towards government's role in reducing income inequality in Latin America. As individual preferences are expected to eventually translate into redistributive policies via some mechanism of aggregation, a critical issue is to identify the level of support for redistribution and the factors behind it. Following studies that highlight the close relationship between trust, social norms and formal institutions (e.g. Alesina and Angeletos 2005b, Bénabou and Tirole 2006, Aghion et al. 2010), the central idea of this paper is that beliefs regarding the quality of the institutional framework help to explain differences in popular support for redistribution and, ultimately, cross-country differences in the scope of the welfare systems.

In particular, the objective of this paper is to test whether corruption, as perceived by citizens, affects their willingness to support public policy aimed at reducing inequality. Some authors have linked the perception of corruption with public support for left-wing regimes, and more importantly, with inefficient redistribution in the region[2]. Di Tella and MacCulloch (2009), for instance, allude to Latin American examples to argue that demand for a more intrusive government in developing countries stems from perceptions of high levels of corruption. Similarly, Alesina and Angeletos (2005b) suggest that corruption produces more demand for redistribution, and various populist regimes in Latin America may have been

[2] While the extent of inequality resulting from market forces in OECD countries is quite similar to that in Latin America, taxes and transfers reduce income inequality by 19 Gini points in Western Europe while the difference is less than two points in Latin America (see OECD 2009 and Lindert et al 2006).

supported by a paradoxical coalition between the poor, who benefit from redistribution, and rich insiders who can benefit from corruption.

The study of attitudes towards government intervention to reduce inequality in the Latin American context contributes to this literature by providing new empirical evidence on the relevance of perceptions of corruption and trust in governmental institutions. Corruption perceptions may affect support for redistribution at least by three channels: first, by affecting people's trust in public officials; second, by signalling further opportunities to those who are able to benefit from corruption; and third, by generating fairness concerns as corruption may subvert equality of opportunity. Since the first effect reduces support for redistribution but the last two are likely to increase it, the net impact of the perception of corruption on support for redistribution is an empirical question. Additionally, the paper uses a simultaneous equation approach employing data on bribery victimization in order to address the potential endogeneity concern, namely, that the causal link between beliefs and preferences runs in both directions —beliefs not only shape public policies, but are also influenced by policies and institutional environment.

The empirical results using data from the Latin American Public Opinion Project for 18 countries between 2008 and 2012 indicate that perceived corruption enhances support for redistributive policies. Even though perceived corruption undermines trust in government, this effect is not translated to public support for redistribution. In other words, rent seeking motives and fairness concerns seem to outweigh the effect of undermined trust in government and political institutions brought about by increased corruption. These findings suggest that perceived corruption can be interpreted as an expression of a fairness concern rather than a judgment of the government's lack of capacity.

Finally, the third paper tackles the impact of drug trafficking and drug-related violence on economic development in Mexico[3]. Given its proximity to the United States, Mexico has long been a key transit point for narcotics, illegal immigrants and contraband from South and Central America. However, violence involving drug trafficking organizations has notoriously reached unprecedented levels in Mexico since "war on drugs" was intensified since the mid-2000s. Negative consequences of drug-related violence go far beyond the casualties of those directly involved in the criminal activity and its victims. It has created a climate of insecurity that hurts both citizens and businesses. Moreover, local population has become pray to extortions and other thefts in localities where cartels operate. This paper presents empirical evidence on the indirect socio-economic costs of the violence that has been unleashed by drug

[3] This last paper is co-authored with Professor Roxana Gutiérrez-Romero.

trafficking organisations and exacerbated by the current anti-drugs enforcement strategy, as well as their potential long term consequences.

Drug cartels may disrupt economic activity directly as themselves represent an important industry in the economy. The high incidence of drug related homicides suggests that some of the local population is involved in drug trafficking. The job opportunities and extra capital offered by cartels have the potential to benefit the economy, reduce poverty and inequality in the local areas where they work. However, as the literature on violence and crime has stated (Soares, 2009; Miguel and Roland, 2011, violence creates further disruption of economic activity through the general climate of insecurity and fear increasing the riskiness and uncertainty of the business environment, which in turn may hinder the accumulation process and lower the long-run growth rate of the economy and, through this way, increase poverty and affect other development outcomes. Thus, it is not obvious whether poverty and inequality will be affected and how.

This paper contributes to this literature by estimating, for the first time, the impact that drug cartels and separately drug related homicides have had on poverty and inequality. Furthermore, it also explores how drug trafficking and drug violence could have affected these figures. We do so by assessing the changes in internal migration, education drop out, economic activity, and the number of employers, employees, remunerations and investment across various industries before (2000-2005) and after cartels settled in certain areas for the first time (2006 or afterwards), and compare that change to the ones experienced in areas that did not have cartels or drug related homicides over the same periods. In order to do so, a unique dataset was built to identify the areas where cartels have been active with and without related homicides by gathering data from multiple sources: official records on drug related homicides, on line national and international media reports, and specialized blogs.

Using the difference-in-difference kernel matching method, results indicate that, on the one hand, inequality declined to a large extent in areas where cartels were active without incidents of drug related homicides. On the other, poverty increased in areas that had both the lowest and the highest rates of drug related homicides. This increase in poverty might be related to the fact that in the most violent areas the number of employers and remunerations declined in key industries, such as manufacturing. In the least violent areas poverty increased possibly due to people migrating from the more violent places.

As a conclusion, this dissertation provides three pieces of empirical research on three social phenomena that are fundamental to understand development outcomes in Latin America: the consequences of educational expansion on social mobility; the incidence of

corruption on public support for redistribution; and the effects of drug-related violence on poverty and inequality. The empirical work is aimed to show some connections between those phenomena and the persistent social underdevelopment in most countries of the region and to disentangle underlying causal ties in such connections using a rich set of data and well suited microeconometric techniques. Results point that the peculiar balance between persistently high levels of inequality, weak institutional frameworks and inefficient redistributive systems in Latin America are at some extent explained by social dynamics and institutions that have been developed historically in the region.

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Expanding Higher Education… Expanding Opportunities? Evidence from Colombia

Mónica Oviedo

Abstract

This paper analyses the effects of the expansion of higher education supply on the equality of educational opportunity. The central question is whether expanding supply contributes to reduce the impact of family background on individuals' probability of attending and completing higher education. I use a quasi-experimental methodology to analyse the extraordinary expansion of higher education supply in Colombia during the Nineties as case study. The main finding is that expansion of supply had a positive effect on equality of opportunity in higher educational attainment, as it increased the probabilities of enrolling and graduating for individuals of less well-off backgrounds. However, this positive effect was limited in two different ways. First, the positive effect for students from less well-off backgrounds was mainly driven by non-university supply. This suggests a process of diversion, i.e. these students were channelled to educational opportunities considered of lower status by Colombian society. Second, the supply of public institutions mostly benefited individuals from the most advantaged backgrounds and the positive effect of new public degrees tended to be proportional to the parents' educational level, which signals a trade-off between efficiency and equity in the public education system.

JEL: I23, I24
KEYWORDS: higher education; intergenerational educational mobility; equality of opportunity.

1. Introduction

The expansion of higher education has been particularly important in the last two decades in all income level countries (Appendix 1). Along with the increasing coverage in secondary education, a growing demand for skilled workers has increased the number of people seeking a higher education degree, putting pressure on the higher education sector to expand. Different strategies and institutional arrangements have been adopted to face the increasing demand for higher education. Some countries have increased the number of places available or have replicated their existing supply across the country, while others have introduced a diversification in the supply by offering a broader variety of degrees or by establishing new types of institutions. Mostly, these reforms have been accompanied by a widening of the private sector, as many states lack the fiscal capacity to support an increasing higher education demand by themselves. In fact, higher education has become in a dynamic industry and a wide variety of for-profit institutions have emerged around the world (The Economist, 2005; Altbach *et al.* 2009).

While the demand side of educational expansion and its effects on inequality have been widely studied (Blossfeld and Shavit, 1991; Araum, Gamoran and Shavit, 2007; Blanden and Machin, 2004; Büchner, van der Velden and Wolbers, 2007; Machin, 2004; Peragine and Serlenga, 2007), the role of supply growth has usually been taken for granted. Indeed, conventional wisdom is that higher education expansion has been mostly a demand-driven phenomenon. However, not only the enrolment expansion in many countries would have not been possible without a dynamic higher education sector, but also higher education has become an attractive market with an increasing openness to the private sector, and the consequences of this phenomenon in terms of inequality has not been sufficiently studied.

Therefore, the purpose of this work is to assess the effects of changes in size and composition of supply in higher education on the equality of educational opportunity. Changes in both the amount and quality of higher education degrees supplied by a growing and diverse number of institutions may affect individual schooling decisions and indirectly in intergenerational mobility. Particularly, expanding supply in higher education is likely to produce at least two different effects: a cost-reduction effect and a potential increase in the expected returns of a higher schooling (Bratti *et al.,* 2008). If these effects allow new entrants from families with lower socioeconomic backgrounds, then the expansion would improve equality of opportunity by definition.

However, it is not so obvious that supply expansion specifically benefits individuals from lower socio-economic backgrounds, given the selection mechanisms used by higher

education institutions –ability and willingness to pay– and the existence of imperfect credit markets for financing this type of education. In addition, the hierarchical diversification that usually accompanies higher education expansion could produce a diversion effect (Blossfeld and Shavit, 1991; Araum, Gamoran, and Shavit, 2007), i.e. that people from the less well-off backgrounds be diverted to the less socially valued opportunities. Therefore, a key question is whether educational supply expansion, and the way it has occurred, reduces inequality of opportunity by providing more opportunities to individuals from disadvantage families, or conversely magnifies inequality by expanding opportunities disproportionately for the advantaged.

Besides the large literature on inequality of opportunity in education, this paper builds on the literature on the effects of expansion of educational infrastructure on educational attainment (Card, 1995; Duflo, 2001), and it is closely related to different studies on the effects of institutional changes in the Italian higher education system (Bratti *et al.*, 2008; Di Pietro and Cutillo, 2008; Oppedisano, 2011). This research seeks to contribute to this literature in two different ways. First, it contributes by presenting additional empirical evidence on the effect of supply expansion on intergenerational mobility, particularly in the tertiary level. Second, it contributes by taking advantage of the specific nature of the Colombian reform during the 1990s to analyse the role of the private sector.

In particular, I use the extraordinary supply expansion in Colombia after 1992 as a case study, when both higher education supply and enrolment increased considerably as a result of a new legislation that gave university autonomy a key role. Unlike the Italian case (and other European countries usually analysed in the literature), where the reform was explicitly designed to balance higher education supply across territories and decongest overcrowded universities, but fundamentally based on publicly provided university education, the Colombian legislation was aimed at strengthening university autonomy, seeking to increase coverage as a secondary outcome, in a process that resulted in a pronounced expansion of the private supply.

I analyse whether or not this expansion, in terms of new institutions and new degree programs, contributed to increase the individual probability of attending higher education and achieving a higher education degree, and which individuals benefited the most according to their family background (parental education). Following the work by Bratti *et al.* (2008), I use a quasi-experimental methodology to compare the educational attainment of individuals with similar characteristics before and after the enactment of the reform. The differential expansion of supply at regional level is the source of variability used to understand the relationship

between the availability of new undergraduate degree programs and new institutions and the probability of attending and/or completing a higher education degree.

The main results of this paper suggest that the expansion of tertiary education supply in Colombia had a positive effect on equality of opportunity in higher education attainment, as it increased the probabilities of enrolment for individuals of less well-off backgrounds, particularly the new private offer. Nevertheless, this effect is limited in two different ways. First, the positive effect was driven mostly by the increasing supply in the non-university system, which suggests a process of *diversion*, in which less advantaged students were channelled to educational opportunities considered of lower status by Colombian society. Second, the supply of public institutions mostly benefited individuals from the most advantaged backgrounds and the positive effect of new public degrees tended to be proportional to the educational attainment of the parents, which signals that there is indeed a trade-off between efficiency and equality, even in the public sector.

The paper is divided into four sections. The first presents a general framework of analysis and the results of some empirical studies about the effects of higher education expansion. In the second section there is an overview of higher education in Colombia and its expansion between 1992 and 2002. The methodological framework, the estimated models and data used are explained in the third section. The fourth section presents the main results and offers an interpretation of the main findings while the fifth shows the results of the robustness checks. The final section summarizes the main conclusions and questions for further research.

2. Higher education expansion and inequality of opportunity

John Roemer (1998) suggested that one should separate the determinants of a person's advantage (i.e. any desirable outcome, such as income or status) into *circumstances* and *efforts*. Circumstances are factors which are economically exogenous to the person, such as gender, race, family background or place of birth. They may affect a person's outcomes, but cannot be influenced by the individual himself. Efforts, on the other hand, are outcome determinants which can be affected by an individual's choice. Inequalities which are originated by circumstances are considered as ethically unacceptable while inequalities from individuals' effort are ethically accepted[4]. So, although there are alternative definitions of equality of opportunity, it is widely accepted that increasing equality of opportunity is associated with a

[4] A consequence of this approach in terms of public policy is that inequality due to circumstances must be compensated by public intervention while inequality due to effort factors must not be rectified. It is important to note that by *effort* Roemer means not only the extent to which a person exerts himself, but all the other background traits of the individual that might affect his success, but which are excluded from the list of circumstances. This entails several problems from a methodological point of view, but the distinction between circumstances and effort is basically a political matter.

reduction in the influence of circumstances on individual achievements. Thus, accordingly with this notion, any action capable of reducing the impact of one or some of these circumstances on individual educational choices can be regarded as reducing inequality of educational opportunity (Bratti *et al*., 2008).

Empirical and theoretical literature suggests several factors affecting the educational attainment of children, but family characteristics appear to be the most important determinant in terms of persistent educational inequality[5]. In particular, educational choices are typically correlated with family attributes, including income and inherited wealth, parental education, cultural resources, residential choices, and so on. Children with better conditions (abler, richer and with comparatively more educated parents, for instance) tend to attain higher levels of education. Moreover, empirical evidence suggests that less able but wealthier children have benefited most from education expansion whereas poorer children, even the abler ones, face problems to obtain similar educational achievements.

According to the economic literature, these inequalities are originated by two kinds of heterogeneity known as *elitist* and *egalitarian* (Becker, 1993). The former implies that more talented children (the elite) obtain greater human capital because abler individuals stay longer at the educational system and avail its advantages; while the latter implies that, even though all individuals have more an less the same capacity to benefit from human capital investments, differences in the environment (family income and imperfect financial markets, for instance) may cause that underprivileged receive less education. Whatever the reason is, either persistence in unobserved ability or imperfect financial markets, both heterogeneities can be intergenerationally transmitted (that is, educational achievements are correlated across generations), and reducing inequality of educational opportunity means reducing such correlation (Checchi, 2006: 50).

Expansion of education supply and inequality of opportunity

Most of the empirical research on the effect of educational expansion on inequalities in educational attainment has been done in terms of enrolment expansion, more precisely, in terms of the increase across birth cohorts in the proportion who have attended a particular level (Shavit and Blossfeld, 1993; Araum *et al*, 2007; Machin, 2004; Blanden and Machin, 2004; Büchner *et al*, 2007). In general, these studies have investigated the extent to which enrolment expansion was equally or unequally distributed across the parental income and family

[5] See Haveman and Wolfe (1995) for a review of empirical research on the link between investments in children and children attainments. Piketty (1998) and Black and Devereux (2010) give excellent surveys of the literature on persistent inequality across generations. Wößmann (2004) provides and analysis of the effects of family-background characteristics on student performance in the US and 17 Western European school systems.

backgrounds distribution and whether there were differential shifts in participation rates and qualification attainment across different income or social groups. These works characterise rising enrolment and stable odd ratios for educational transitions as "persistent inequality" and have found mixed results across countries[6]. Most of them, however, tend to question the idea of education expansion as a 'great leveller' which promotes intergenerational mobility. For instance, by analysing cohort data from Britain, Machin (2004) shows that there has been an increase in immobility across generations and that it has occurred at the same time as the rapid expansion of post-compulsory education.

A different approach is to analyse the effect of expansion from the supply side. The studies mentioned in the previous paragraph usually take the role of supply for granted, but enrolment expansion would not have been possible without a significant growth of supply. Furthermore, characteristics of supply expansion may have consequences in terms of achieving greater participation of students from different socioeconomic groups. Then, from this approach, the relevant question is whether educational supply expansion, and the way it has occurred, reduces inequality by providing more opportunities to individuals from disadvantage families, or conversely whether it magnifies inequality by expanding opportunities disproportionately for those who are already privileged.

Expansion of supply in higher education has occurred through different mechanisms in different countries. Some of them have established non-university tertiary education (technical schools), while others have retained a university-based organization of tertiary education but have increased the number of places available, or have introduced a diversification in the supply by offering a broader variety of degrees, replicating their existing supply across the country, or just by opening subsidiary centres, which in many cases are better adapted to the local labour market needs. In some countries, these reforms have been accompanied by widening the private sector share. In particular, the failure of the public non-profit institutions to serve the demand and to provide access for more low-income students, along with the released of programmes of public subsidies in the form, for instance, of publicly financed student aid has created a market for the private (for-profit) higher education sector in many countries, in which student selection process is clearly based on their willingness to pay.

Following Bratti *et al.* (2008), changing and expanding supply in higher education is likely to produce at least two effects: a *cost-reduction effect* associated with "proximity" benefits from the increased supply, i.e. the possibility of enrolling in higher education without moving

[6] According to Shavit and Blossfeld (1993), in only two of the thirteen countries studied —the Netherlands and Sweden—equalization did occur, but it could not be attributed to educational reforms but other factors. Subsequent analyses have clearly shown equalization in the case of Germany, France, Italy, and probably Norway, while the results for Sweden and the Netherlands have been corroborated. Equalization typically has occurred at lower transition points. See Breen and Jonsson (2005).

to a different city; and a *potential increase in labour market returns* associated *with* "variety" benefits, provided there is an increased possibility of courses selection that is better suited to the local employers' preferences. Then, if the new entrants are children from less privileged families, the effect of expansion may be the one of inclusion and increasing equality of opportunity by definition.

Nevertheless, expansion of supply in higher education could have limited benefits for children from worse family backgrounds. First, the expansion of supply creates a more competitive environment in tertiary education. Higher education institutions have incentives to attract the best students because it not only improves the quality of their teaching but also attracts more resources. Typically there are two alternative ways of sorting out the best students, either through submitting all applicants to specific exams, or by selecting them in accordance with their willingness to pay[7]. Consequently, expansion can increase the probabilities of attending higher education for both low and high ability students from favourable economic backgrounds, as well for those from less favourable backgrounds but entitled with high ability or less credit constraints, improving participation rates. However, since credit markets for education financing usually either do not exist or are heavily subsidized by the state, meritocratic selection is in general a market-dominated mechanism (tuition fees) to allocate better students to better educational institutions. This implies that there is indeed a trade-off between efficiency and equality in higher education, since it would be efficient to focus resources on those students who are already advantaged. In this sense, the effect of expanding higher education in the achievement of more equality of opportunity will depend on the extent in which the cost-reduction effect of the increasing supply overcomes the restrictions of less-advantaged families in terms of access to credit resources.

Second, expansion of supply generally comes with a diversification in terms of degrees and quality standards, which may have a positive effect, provided it increases potential labour market returns of higher education. However, the mechanisms for assorting students –either meritocracy or willingness to pay– could also create a hierarchically differentiated system with a stratification of students, which could imply other inequality problems. Some authors (Blossfeld and Shavit, 1991; Araum, Gamoran, and Shavit, 2007) suggest that higher education expansion is a process of *diversion*, whereby members of the working class are diverted from elite opportunities and are channelled to positions of lower status. Thus, at the same time the

[7] The efficiency and results of each mechanism depends on the information about individual abilities. Under perfect capital markets both mechanisms of allocation yield efficient outcomes in terms of matching efficiency. However, the market allocation mechanism works properly only when financial markets operate perfectly, that is when families do not face credit constrains. Otherwise, if markets for education financing do not exist, poor parents of high ability children will be outspent by rich parents of lower ability children. About this issue, see Checchi (2006), chapter 4.

members of less well-off backgrounds find new opportunities to enrol in higher education, the differentiation may cause these new opportunities to have a diminished value.

In sum, the expansion of higher education supply may improve equality of opportunity through two mechanisms: a cost-reduction effect and a potential increase in labour market returns. Both mechanisms increase the probability of enrolling in higher education without moving to a different place for all students, and particularly for those of less well-off backgrounds. However, this effect would be limited if the cost-reduction is not enough to overcome credit market restrictions or if there is a process of diversion, by which students from less privileged backgrounds are channelled to a new supply which may be characterised by lower costs but also lower standards and social and labour market recognition.

Empirical evidence of the effect of supply expansion on equality of education has been provided by a branch of research inspired on classical studies of the effects of changes in local availability of schooling infrastructure on educational attainment (Card, 1993; Duflo, 2001). This line of research analyses the effects of changes in the amount and composition of educational supply at different stages on different educational outcomes (Berlinski and Galiani, 2007; Peragine and Serlenga, 2007, Bratti *et al.*, 2008; Di Pietro and Cutillo, 2008; Oppedisano, 2011).

Within this literature, the paper by Bratti *et al.* (2008) is particularly relevant to this research. They study the effects of the expansion of universities in Italy during the Nineties and establish that this expansion might have had only limited effects in terms of reducing existing individual inequality in higher education achievement. They estimate the probability for an individual with a given family background to achieve a university degree and assess whether this probability has changed because of the expansion of higher education supply in Italy between 1990 and 2000. They find that higher education expansion might have had only limited effects in terms of reducing existing individual inequality: the expansion of university courses has effectively increased the likelihood of university enrolment for students from middle-class and/or less educated parents, but the expansion in enrolment has not translated into an increased probability of attaining a degree.

In a related paper, Oppedisano (2011) finds that the Italian reform did not achieve its objective of reducing the gap in educational attainment between the North and South of the country. She analyses the partial ineffectiveness found by Bratti *et al.* (2008) in terms of graduation rates by measuring the effect of the change in the composition of enrolled students and the impact of the type of faculties instituted. Her results show that the higher education supply expansion increased university enrolment, especially among individuals with middle

schooling ability and less favourable family backgrounds, but due to the composition effect, academic performance worsened, especially in Southern regions, where only new scientific faculties were set up.

3. Higher education in Colombia (1992-2002)

I focus on the changes in supply of higher education in Colombia between 1992 and 2002. I have chosen this period because it is between two important reforms that affected higher education provision. First, the introduction of a new Constitution in 1991 and the enactment of a new higher education law in 1992 (hereon Law 30), which established the legal and political framework for the higher education system still in force. Second, in 2002, the new government implemented a comprehensive reform that affected the role played by the institutions responsible of regulating and evaluating the educational system[8], which among other changes caused a variation in the methodology for gathering information from higher education institutions. In addition, the same year another law (Law 749) brought more flexibility in the flow of students between institutions and type of programs (i.e. university and non-university degrees), which most likely had an additional effect on the supply and demand for tertiary education.

Both the Constitution and Law 30 advocated the autonomy of higher education institutions seeking to increase supply and coverage at this level. Article 69 of the Constitution guaranteed university autonomy and granted them the freedom to conduct academic activities and training. Law 30 further specified the rights enjoyed by higher education institutions, such as the right to create, organize and develop academic programs, grant the appropriate degrees, manage their own financial resources, and select professors and admit students according to the parameters freely established by these institutions. In particular, development of the university autonomy meant the possibility of establishing new sites and offering programs in locations different from the institution's origin.

Law 30 also defined four distinct types of higher education institutions: *Universities, University Institutions, Technological Institutions* and *Technical Training Institutions*. Universities and University Institutions serve as teaching institutions by offering academic programs for professions or disciplines; universities also provide basic scientific research and master and doctoral degree programs. Non-university institutions provide operative and instrumental training programs for occupations and usually have lower costs per student.

[8] In particular, some of the functions previously carried out by the Instituto Colombiano para el Fomento de la Educacion Superior (ICFES) were then assigned to the new Viceministry of Higher Education.

Although public universities were the biggest institutions in the 1980s, the increasing demand for higher education congested the supply of educational opportunities available in the public sector. In response to the increased demand, which was related to the improvements in basic and secondary education and a growing recognition of the increased returns to a tertiary education,[9] private institutions emerged as an alternative to the public university education. As a result, and thanks to the new autonomy recognised by the Law 30, the expansion of the private sector flourished rapidly and the percentage of institutions and student enrolment in private institutions soon outgrew those in public universities. The explosion of private higher education supply and enrolment continued throughout the late 1990s and early 2000s, and as a result, Colombia has one of the largest percentages of private higher education in the world nowadays [10].

In particular, between 1993 and 2002, 64 new higher education institutions were founded; a 25 per cent increase with most of them being private (38). From 1993 to 2002, universities increased from 87 to 105, with 12 new institutions only in 1993, and university institutions increased from 61 to 97. The number of technological institutions went up from 55 in 1993 to 65 in 2002, but their growth was already important between 1989 and 1993, when 10 new institutions were created. In contrast, the number of technical and professional institutions was reduced from 60 to 53 during the period of 1993-2002 (See Appendix 2).

The expansion of higher education in Colombia is quite different from the case of Italy, as the latter was carried out mainly by a transformation of the already existing institutions rather than the creation of new ones. As a consequence of Law 30, higher education institutions could change their academic character by making consecutive transitions in order to achieve a "gradual development" into universities as these had traditionally received more recognition than other institutions offering non-university degrees, which have been undervalued both socially and in the labour market. Therefore, all the universities that appeared during that period were not necessarily new institutions, but they were already existing institutions that changed their character. This transformation explains the "disappearing" of some technological institutions.

[9] In 1985, workers with higher education earned 3.31 times more than the wage of a worker with no education. Fourteen years later, this ratio rose to 3.64 times. While the difference between the returns to primary and secondary education went down, their difference with returns to higher education increased. In 1999, pass from having incomplete higher education to complete higher education meant, in average, duplicate the earnings. In 2003, the World Bank estimated that tertiary education graduates earned 2.75 times more than average workers and 6.5 times more than those with no education (Word Bank, 2003). In addition, the unemployment rate of people with higher education has being much lower than the national rate of unemployment (Sarmiento, 2000).

[10] While 41 per cent of students were enrolled in private schools in the 1960s, about 63.9 per cent were enrolled in private higher education programs in 2003 according to the ICFES data. In the 1960s, more than 55 per cent of higher education institutions were official while in 2002 this percentage fell to 32 per cent. At the beginning of the 1990s private programs accounted for 54 per cent of the total while in 2002 they accounted for 66 per cent.

With regard to undergraduate degree programs, these increased from 2,089 in 1993 to 4,201 in 2002, an increase of 101 per cent. The major growth was in private offer, which accounted for 66 per cent of the programs at this level. The expansion was made through a diversification in the fields of knowledge, a strong level of specialization and an increase in the number of evening or distance learning programs (which represented 24 and 9 per cent in 2002, respectively).

Between 1985 and 2002 student enrolment in higher education degree programs increased dramatically, with a yearly average increase of 8.5 per cent. Despite this growth in enrolment, the coverage of population eligible for higher education (traditionally 18 to 24 years old) remained around 20 per cent in 2002[11], compared with a Latin American average of 25 per cent and an OECD country average of 54 per cent.

At regional level, there have been some remarkable differences. The public sector has traditionally focused on provision of education in low-enrolment regions and has put a lot of effort to locate tertiary institutions throughout the country to make higher education accessible, even in remote areas, but in general, the large urban areas are the best served. In average, the coverage has been above 30 per cent in Bogotá, the capital of the country, followed by the departments of Atlántico and Antioquia, with coverage of around 19 per cent. Valle and other departments at the Central region have had average coverage rates around 10 and 15 per cent, while in the rest of the regions they are less than 10 per cent[12].

Between 1993 and 2002, as observed in Figure 1 and Appendix 2, the absolute growth in supply was higher in Bogotá, followed by Antioquia, Atlántico and the Oriental region. The geographical concentration of providers has been very marked, although the expansion in the Nineties improved slightly the distribution of higher education institutions and undergraduate degree programs. In 1992, 35 per cent of higher education institutions were in Bogotá whilst in 2002 this figure fell to 28 per cent. Another remarkable change was the reduction in the participation of Bogotá in the number of undergraduate programs, from 38.1 per cent to 30.6 per cent (and from 36.1 per cent to 26.7 per cent in the case of university degrees), while the Oriental and Central regions increased their participation from 11.3 per cent and 8.8 per cent to 15.0 per cent and 10.3 per cent, respectively.

Diversification and differentiation produced by higher education expansion in the Nineties have had several positive implications. The impressive growth in higher education

[11] Net coverage of the 18–24 year old cohort increased from 9 per cent to 15 per cent between 1990 and 1999.

[12] The region of Amazonas and Orinoquia, which groups the more remote departments, has an average coverage very close to zero, and changes in supply has been modest. For these reasons, I exclude these departments from the analysis, as well as San Andres, an island in the Caribbean Sea.

enrolment and coverage could not have occurred if it had relied solely on the existing, primarily public, higher education institutions. Diversification of supply has been crucial to the regions' continuous efforts to increase higher education enrolment. However, some analysts suggest that diversification and increased coverage have come at a price. For instance, a World Bank report argues that diversity of institutional ownership, autonomy, and funding have contributed to a fragmented system in which "many institutions often lack a clear educational policy and strategy, raising many questions about the quality and relevance of the learning offered" (Holm-Nielsen *et al.,* 2002). Although some private institutions have provided adequate educational opportunities and experience as well as academic prestige, it is true that many of them earned a public reputation of being mostly motivated by profit and providing a low-quality, insufficient education out of touch with the true needs of the labour market and the conditions of a country like Colombia[13].

Finally, it is important to mention that the extraordinary expansion does not seem to have been the result of a long run, coordinated and planned strategy, but the result of the individual initiatives of institutions. This is evident from the fact that the places offered by such institutions overcame the effective demand for higher education in a significant proportion, according to official statistics. Starting from a supply of 180,000 places in 1990, the system expanded considerably and offered 492,000 places in 2000, a 173 per cent increase. Expansion was driven primarily by private institutions that increased supply from 119,000 places to 352,000 places (a 296 per cent increase). While at the beginning of the Nineties the proportion of non-assigned places was less than 13 per cent of the total places offered, during the analysed period this proportion increased to 53 per cent in total.

As observed in Figure 2, in 2002 the vacant places were more than 300,000. It is important to note that the oversupply occurred primarily in the private sector. During this decade, public institutions had only a small number of vacant places, an average of only one out of every ten vacancies, whereas private providers offered significant increases in the number of vacant places.

The fact that such number of non-assigned places existed could seem incomprehensible and paradoxical given the low coverage rate in higher education, which means that there was a non-satisfied demand. Among possible explanations of this wide demand-supply gap are the incapacity of the institutions to anticipate the effective demand, the saturation of overly-

[13] One of the main problems is the inadequate qualified teaching staff. By the beginning of the 2000's, only nearly 20 per cent of professors instructed full-time while others maintained employment in other sectors or institutions. The scarcity of available professors has been exacerbated by Colombia's inability to produce many graduate students. Few university professors in the country held doctoral degrees by then, less than 4 per cent. This average education level was below the Latin American average–about 6 per cent– and much lower when it is compared to Brazil, the regional leader (about 30 per cent), or European countries. See Holm-Nielsen *et al* (2002: 9), and Ayala (2004: 82).

specialized programs, a limited relationship between the degrees supplied and the local economic system and, in general, a poor education planning. On the demand side, other reasons include the lack of information available to potential students, inadequate funding, and the applicants' preference for university education over non-university higher education. In any case, this oversupply can be interpreted as a kind of independence between supply and demand, which will be a key factor for the purpose of this study in its purpose to disentangle the causal effects of the supply expansion on the demand for higher education and equality of opportunity at this level.

4. Empirical strategy and data

The central question of this paper is to what extent did the extraordinary expansion of higher education supply in Colombia during the 1990s helped to reduce inequality of opportunity, that is, whether it contributed to reduce the impact of family background (in particular, parental education) on the individual probability of attending higher education institutions and achieving a higher education degree. Specifically, this analysis attempts to answer two questions: i) did supply expansion improve probabilities of enrolment and holding a higher education degree? and ii) which students benefited the most from higher education supply expansion?

In order to answer these questions, I estimate the probability for an individual with a given family background of enrolling in higher education (and achieving a higher education degree) and assess whether or not this probability (which depends on family background and other individual and regional level features) has changed due to the expansion of higher education supply. The differential expansion of supply at department level is the source of variability used to understand the relationship between the availability of new undergraduate degree programs and new institutions and the probability of attending and/or completing a higher education degree.

For a proper identification of the effects of supply expansion, the ideal situation would be to compare individuals exposed to the increase in higher education supply during the Nineties with fully unexposed ones and those considered as controls for any other possible determinant of tertiary education. However, the available data does not allow achieving both objectives at once because the relevant information about the external circumstances when the individuals took the decision about higher education enrolment is not available. Following Bratti *et al* (2008), this work attempts to overcome these deficiencies by taking into account different outcome variables and by resorting to a 'quasi-experimental' design for data analysis.

I use two different indicators of educational attainment as outcome variables: (1) the probability of holding a higher education degree; and (2) the probability of enrolment in higher education. The former measure takes into account not only the enrolment but also the effectiveness of the educational process, i.e. whether a degree is obtained or not. The latter includes in addition individuals who attended higher education at or before the time of the survey, but had not completed their studies. If the expansion of higher education supply raises the enrolment probability of less motivated or average students, who typically have longer graduation times or high dropout rates, the outcomes would not be captured by the first measure. In addition, both indicators are considered again only for the university level, given its weight in the higher education enrolment and its social and economic role as the "ideal" state of higher education.

To assess the effects of the expansion of higher education supply on these individual educational outcomes, I compare the educational attainment of individuals with similar characteristics before and after the reform introduced by Law 30 of 1992 using two cross-sectional data sets with individual level information, which are linked with data on the differences in intensities of "treatment" across the country (i.e. higher education supply expansion). The date and the region of birth determine an individual's exposure to the expansion and its intensity. The date of birth defines the fact that an individual attended university after the enactment of Law 30, while the intensity of the treatment depends on the size of the higher education supply expansion in the department of birth.

4.1 Individual level data

The cross sectional data used in this study comes from two living standards surveys (*Encuesta Nacional de Calidad de Vida,* ECV hereafter) carried out by the National Department of Statistics (DANE) in 1997 and 2003. These surveys gathered information about school level, parental schooling, and migration history for all the individuals older than eighteen. This data represents the population as a whole as well as the main regions[14].

As I explained before, the date and department of birth determine an individual's exposure to the expansion and its intensity. In order to compare the exposed individuals with unexposed ones, the relevant cohorts from both ECV waves must be selected carefully given that one of the major restrictions is that ECV does not provide individuals' entry or graduation date.

[14] In the context of ECV, a region refers to a geographical grouping which includes several departments. The ECVs define 9 regions: Bogotá, Antioquia, Valle, Atlántica, Oriental, Central, Pacífica, Orinoquía-Amazonía and San Andrés.

Since the regular entry age into higher education in Colombia is 18 years, the sample was selected for individuals aged 23 to 28 years in both cross sections, the range of age in which they may already hold a higher education degree or were enrolled at higher education by the time the survey was carried out. All individuals from 23 to 28 years of age in 1997 must have been enrolled in higher education before the expansion took off after 1992[15]. These individuals are considered to be untreated. I selected individuals among the same age group from the ECV-2003. All individuals in this age range held a degree or attended higher education in 2003 and must have enrolled at higher education in 1992 or later, i.e. during the years of supply expansion. Even though the ECV provides information about both the region of birth and the current region of residence, one constraint of the ECV data is that it is impossible to identify the region of residence at the moment when enrolling decisions are usually made. Therefore, in the baseline specification it is assumed that the region of birth was also the region of residence at the age of 18 years or whenever an individual took the decision to enrol in higher education or not. Nevertheless, this assumption is not taken for granted and the implications of its failure are examined. The main concern is the possibility of endogenous migration, which is discussed in section 5.1.

Colombia is a highly centralized country with almost 20 per cent of the population living in its capital, Bogotá. As this implies important contextual and historical differences in higher education supply and enrolment between Bogotá and other regions, the observations from Bogotá have been excluded from the sample in order to maximise comparability between regions.

The number of observations in the relevant age range and in the regions under analysis is 7,987. Due to missing data in some variables, the final sample size is 7,659 individuals (96% of the original data), 2,942 from the ECV-1997 and 4,717 from the ECV-2003. Sample descriptive statistics are reported in Appendix 3. It can be observed some changes in the distribution of educational achievement between both cohorts. Overall, there has been an improvement in enrolment and graduation levels at tertiary level. By parental education background, it is observed a transition to a distribution in which more people come from families with parents with high and intermediate levels of education, as a natural consequence of the increase in the general level of education and the previous expansion of tertiary education.

[15] Individuals aged 23 to 28 years in 1997 were 18 to 23 years old in 1992, when they should have been higher education students or already would have done their higher education studies in 1992. Those aged 23 to 28 years in 2003 were 18 years or younger in 1993, and in this case they should have attended higher education after 1993, the year in which the reform started to be implemented.

4.2 Supply side variables

I use data on the magnitude of the increase in higher education supply at the department level between 1992 and 2002. As it was explained in section 2, this period was chosen because in 2002 there were important institutional changes, which caused a variation in the methodology for gathering information from the higher education institutions and, as a consequence, the statistical series are no longer comparable. In addition, in 2002 were introduced more flexibility in the flow of students between institutions and type of programs (i.e. university and non-university degrees), which most likely had an additional effect on the supply and demand for tertiary education, making more difficult disentangle the effect of increasing supply.

Following Bratti *et al.* (2008), the proxy to measure the expansion of higher education supply is the territorial distribution of the increase in the number of *degree programs* and *institutions*, normalized by the population aged 18 years in 1994 in order to account for differences in population size across departments. Specifically, I use the annual growth rate of undergraduate degree programs[16]. This variable reflects both the opening of new degrees in sites already served by higher education infrastructures and new degrees in sites not previously endowed with higher education infrastructures. The impact of this variable can therefore reflect both "variety" benefits (due to the availability of programs with up-to-date contents and curriculums that respond better to local labour market needs) and "proximity" benefits, which materialize if the local availability of infrastructures reduces attendance costs. In an attempt to disentangle these two potential sources of benefits, I analyse the effect of the annual growth rate in the number of higher education institutions. This second indicator should reflect more accurately the role of the increased availability of higher education infrastructures throughout the country (Bratti *et al.,* 2008, 58-61).

Figures 3 shows the evolution of the number of degree programs per 1000 inhabitants of 18 years old in 1994 by department and by the origin of the supply (public or private). We observe the supply remain practically unchanged before the reform introduced in 1992. There is also a significant variability in the evolution across departments during the period, both in the rate of growth and the origin of the supply growth. Figure 4 shows the same but focusing on the university level only. Finally, Figure 5 shows the evolution of supply in Bogota, which is excluded for the sample, to remark the differences between the capital city and the rest of the regions.

[16] I use the average annual growth rate calculated with the midpoint formula to account for the initial zero values in some cases.

4.3 Identification strategy and potential endogeneity

The aim of this empirical work is to investigate whether larger higher education supply created larger higher education demand, that is, whether causation run from supply to demand or not. The identification strategy relies on the fact that the expansion of supply of higher education in Colombia after the reform in 1992 showed certain "independence" of potential demand for tertiary education, given the extraordinary oversupply of places offered by higher education institutions, particularly the private ones, as it was discussed in section 2 and it was shown in Figure 2.

However, we must be sure that supply was not affected by potential demand or by factors influencing both supply and demand. In addition, it is important to rule out that the accumulation of human capital has simply grown due to the increase in the general level of education or because of the increase in the number of university-educated parents following an upward trend, regardless of existing supply conditions. As a consequence, time-varying and region specific effects are included in the analysis to control for potential omitted variables that might be simultaneously correlated with both the demand and the supply of higher education. In particular, all the specifications include the change in the number of individuals aged 18 years old as an approach to potential demand, the absolute variation in unemployment rates and the growth rate in per capita real income[17].

First, the rates of expansion of secondary education and demographic trends that vary across regions could explain a substantial proportion of the increase in the demand for higher education. In fact, the increase in the number of individuals who are in the age of completing secondary education, and probably intend to continue with their education, means a direct increase in the demand for higher education and has similar effects as those of income on the institutions' expectations. Therefore, it could be argued that higher education institutions tend to open in regions where resident's education is already increasing or is expected to increase, and therefore they are not a cause but an effect of increasing education. If the expansion of supply simply follows the rise in the number of individuals in the age of completing upper secondary school and starting higher education then the estimated effect could hardly be considered to be supply driven.

Second, increases in both unemployment rates and real income per capita at regional level may increase the demand for tertiary education. Higher unemployment reduces the

[17] Given the availability of the data, the per capita real income at 1994 prices is measured between 1993 and 2002, and unemployment rates between 1996 and 2002. In other specifications, I used the number of high school graduates between 1996 and 2003, but given that the population by age is available for a longer number of years, I decided to use the number of individuals aged 18 years old, as there is a high correlation between both variables. The source of these is the DANE (national department of statistics).

opportunity costs for acquiring human capital and often more education is perceived by young people as a good way to raise their chances to get a good job. Higher income relaxes credit constraints and is positively correlated with the expansion of higher education supply because institutions may set up new programs and open new branches in response to the observed or expected rise in potential demand.

Finally, another source of endogeneity must be considered. Although exposure to expansion of supply is completely exogenous (depending only on an individual's birth cohort), the intensity of the treatment is potentially endogenous because the individuals could have migrated seeking for better educational alternatives. If this is the case, the effect of higher education supply would be likely overestimated due to positive self-selection. To partially overcome this problem, I use the change in supply in the region of birth, which implies the assumption that the individuals was in the same region at the moment of taking the decision to enrol or not in higher education. However, alternative methods to address this problem will be addressed in section 5.

4.4 Estimated Models

The estimation method is based on Duflo's evaluation of the effect of the Indonesian government's school construction program between 1973 and 1978 (Duflo, 2001) and the analysis of the higher education expansion in Italy by Brati *et al.* (2008). Duflo uses a simple version of the model of endogenous schooling developed in Card (1999), and extends it in order to consider the general equilibrium implications of the school construction program, since such a large program could have affected the returns to education (the model is presented in Appendix 5 in a version adapted to our subject of interest). The empirical strategy of identification amounts to estimate a difference in difference estimator that controls for systematic variation of education both across regions and across cohorts. Bratti *et al* (2008), in turn, used the same strategy to evaluate the impact of the supply expansion in Italy, but included interactions with parental education in order to assess the differential impact of expansion of higher education supply across different levels of educational background.

Following these works, in order to assess the effect on higher education supply expansion on equality of opportunity in Colombia, I estimate the following reduced form to obtain a differences in differences estimator:

$$S_{i,j,k} = c_i + \alpha_{1j} region_i + \beta_{i,k} ybirth_i + \gamma_1 female_i + \gamma_2 edupar_i + \delta_1 (post_i * \Delta supply_j) + \delta_2 (post_i * regionvar_j) + \varepsilon_{ijk} \quad (1)$$

Where $S_{i,j,k}$ is the education attainment of an individual *i,* born in region j, in the year *k*. The constant is represented by c_i, while α_{1j} is a region of birth fixed effect and $\beta_{i,k}$ is a year of birth fixed effect. Region fixed effects capture regional time invariant unobservable variables while year fixed effects capture country-level time trends in the demand for education. The coefficients γ are associated with individual's gender and his/her background in terms of parental education. The treatment dummy $post_i$ indicates whether the individual belongs to the cohort exposed to the reform[18]. The variable $\Delta supply_j$ denotes the intensity of the growth of supply in the region *j*, i.e., the number of per capita increase in higher education supply in each region, and interacts with the treatment dummy. In this way, the coefficient δ_1 in equation (1) can be interpreted as an estimate of the impact of the program on the exposed cohort. This "differences in differences" estimation can be interpreted as the causal effect of the program, under the assumption that, in the absence of the expansion promoted by the Law 30, the increase in educational attainment would not have been systematically different in regions with low and high levels of supply growth.

The identification assumption that there are no omitted time-varying and region specific effects correlated with the program is satisfied by controlling for these factors. Then, the treatment dummy variable interacts as well with R_j, a vector of region specific variables that could be related with both the increase in supply and educational attainment (the absolute variation in unemployment rates, the growth rate in per capita real income and the change in the number of individuals aged 18 years old as an approach to potential demand). All these additional control variables are included as interactions with a post-reform dummy as they are expressed in changes. Finally, ε_{ijk} is a stochastic error term that reflects changes in all other factors affecting the educational attainment.

In order to analyse the differential effect of the expansion of supply by educational background, I also estimate the following reduce form:

$$S_{i,j,k} = c_i + \alpha_{1j} region_i + \beta_{i,k} ybirth_i + \gamma_1 female_i + \gamma_2 edupar_i + \delta_{1l}(post_i * edupar_i * \Delta supply_j) + \delta_2(post_i * regionvar_j) + \varepsilon_{ijk} \quad (2)$$

Parameters in equation (2) are the same as in equation (1), but it allows for heterogeneity effects due to different family backgrounds, so each δ_{1l} in this equation can be interpreted as an estimate of the impact of the program on the exposed cohort coming from families with the specific level of educational background.

[18] This P_i is the equivalent to e_k in the equation (6) in Appendix 4.

Parental education is measured with a synthetic measure of parental educational background, which defines four levels: *no education*, when neither the father nor the mother has any education; *low* when both parents have completed primary education or have some years of this level; *intermediate* when at least one parent has an upper secondary school diploma; and *high* when at least one parent has a higher education degree or has some years of tertiary education.

For the purpose of this paper, $S_{i,j,k}$ is defined as a dichotomous variable representing the educational outcome of interest –either "*graduating from higher education degree"* or "*enrolling in higher education"*–and takes the value one if the educational outcome has been achieved. Following the reference studies, I use a Linear Probability Model as a technique of estimation[19].

5. Results

5.1 Baseline models

As can be seen from baseline models (Table 1), the post-treatment dummy is positive and significant for both enrolment and graduation in the higher education system as a whole. The post-reform cohort has a probability of attending higher education 8.6 per cent greater than the pre-reform cohort (column (1)), and the probability of graduating is 5.6 per cent higher (column (2)).

As expected, parental education level is the most important determinant of higher educational achievement. Compared to individuals with parents with no education, the probability of attending higher education is 9 per cent higher for those individuals from households with parents with some primary education, 32 per cent higher for those with parents with intermediate educational level and 75 per cent higher for those whose parents have some tertiary education. It is also observed that the changes in per capita income at departmental level do not have a significant effect, while higher unemployment rates decrease the probability of enrolling and graduating from higher education, perhaps because it affects income negatively. As expected, the increase in the size of the population in the age of starting

[19] Though the LPM have some known problems, namely fitted values of the dependent variable outside the zero-one range and heteroskedastic error term, neither of these disadvantages seems critical because fitted values of $P(y = 1 \mid x)$ close to the mean of the data are unlikely to lie outside the zero-one range, and thus do not cause a problem if inference of average treatment effect or average treatment of the treated is desired, as is our case. A more important argument is that the LPM delivers unbiased and consistent estimates when variables uncorrelated with the included covariates are omitted from the regression, whereas nonlinear models do not have this property (see Cramer, 2005). Finally, one advantage is that the coefficients estimated in the LPM are direct estimates o f$\partial E[Y/X]/\partial X$, which is not the case in the nonlinear models, where the presence of interaction terms makes cumbersome the interpretation of the estimates (Ai and Norton, 2003 and Mullahy 1999).

higher education reduces the probability of attending and graduating from higher education, although this effect is significant only at a 10 per cent level.

5.2 Effect of the expansion of supply on the probability of enrolling in and graduating from higher education

The analyses for multiple types of higher education supply substantiate the expectations for the expansion of supply on the probability of holding a higher education degree or being enrolled in higher education. Table 2a presents the results from equation (1), this is, the effect of different measures of change in the expansion of supply on the probability of enrolling in higher education. I find that all variables have a positive effect on enrolment, except for the number of new public institutions. This may be explained by the fact that only a small number of institutions of this type were created during those years. It is important to mention that the most important effect is the number of new institutions, (column (1)) which suggests that there was indeed a cost-reduction effect.

Table 2b presents the results for the probability of graduating from higher education. Only the number of new degree programs had a positive effect on the probability of graduating, specially the private degrees (columns (5) and (6)). This result suggests that, even though the reduction of costs is important in order to wide access to higher education, the availability of new degree programs matters more to complete this educational level, perhaps reflecting the importance of variability effects.

Table 3a and 3b report the estimated coefficients of the interaction of higher education supply with the post-reform dummy and parental background ($\widehat{\delta_{1l}}$) in the estimation of the probability of enrolment and graduating from higher education, respectively (equation 2). Allowing for heterogeneity by parental education level produces mixed results. First, Table 3a shows that all variables, except the increase in the number of public institutions, increase the probability of attending higher education for those students with uneducated parents. Changes in the number of institutions also benefited students from low educational backgrounds, while an increase in the number of degrees had a positive and significant effect also for students from intermediate and low educational backgrounds. Two things are remarkable from these results. First, none of these measures of change in supply have a significant effect for those students from the most educated families. Second, while the effect of private programs is similar for all educational backgrounds, the effect of public programs tends to be proportional to the educational attainment of the parents.

When I focus on the probability of graduating, results change substantially. From Table 3b, I can conclude that there was a positive effect of new private degree programs for individuals for all backgrounds, except for those of the highest level of parental education (column (5)). Nevertheless, it is important to notice that the latter were the only students who benefited from the creation of new public institutions (column (3)). This result can be related with the fact that public institutions in Colombia have traditionally offered degree programs with the highest standards of quality and their admission process usually responds to a very demanding selection process based on academic merit. If individuals with parents with some higher education are better prepared in academic terms to pass such selection process, and successfully complete their educational process, then it could be expected that they benefited the most from the new supply of public institutions.

5.3 Effect of the expansion of supply on the probability of enrolling in and graduating from university

I test the effects of the expansion of supply exclusively on university level, which has received traditionally more recognition and a higher demand, while non-university level has been undervalued both socially and in the labour market. By doing so, it is possible to tell whether there has been a diversion effect, this is, whether individuals coming from less well-off backgrounds found new opportunities at the university level, the highest level in the hierarchically differentiated educational system, or whether, in contrast, they were diverted to new opportunities in the non-university system.

Therefore, I repeat the same regressions presented in the previous section but taking into account only students and graduates from the university level, and analyse only the effect of new universities and new university programs. Table 4 shows the baseline model. In contrast with the results for the higher education system as a whole, the post-treatment dummy is positive but non-significant for both enrolment and graduation dependent variables, which means that there are no differences neither in the probability of attending nor the probability of holding a university bachelor degree between the pre and post-reform cohorts. Furthermore, there are no significant effects of increasing supply, whatever indicator of supply is used (Tables 5a and 5b).

Nevertheless, heterogeneous effects by parental education level differ significantly only when considering the creation of new universities. The effect of higher supply of private universities benefits the enrolment of individuals with uneducated and low-educated parents (Table 6a, column (2)). On the other hand, it surprisingly reduces the probability of enrolment

for individuals with highly educated parents. This result may be signalling low quality universities, or new universities with less prestige, that disincentive the enrolment or the migration of individuals in higher income families.

The results for the probability of graduating from university follow different patterns between public and private supply (Table 6b, columns (2) and (3)). Expansion in the number of public institutions has a positive and significant effect only for individuals with highly educated parents (although significant only at 10 per cent level), which is in line with the finding for the whole higher education system. However, these same individuals have less probability to graduate when the supply of private institutions increases. This result is in line with the expectation for a lower quality or less prestigious new private universities, and the assumption that individuals from higher income families would have a lower threshold for leaving the programs or migrating.

It should be remembered that, during the analysed period, 18 new universities and 36 university institutions were created. However, many of the latter were not "new" institutions, but already existing higher education institutions that could change their academic character in order to achieve a "gradual development" towards university supply thanks to the Law 30. It is possible that this change had an incentive effect to those students from low-educated backgrounds as it implied a new opportunity to get a university degree. By contrast, this effect could not have affected the decisions of students from highly educated families, perhaps because this new supply was seen as a mere change of name by institutions that were not part of their choice set.

5.4 Discussion of results

The main impact of the expansion of higher education supply in the Nineties can be summarised in the following points:

(i) The creation of new institutions of higher education had a positive effect on the probabilities of enrolment for individuals with parents with none or low educational attainment. Furthermore, the creation of new private institutions increased the probabilities for individuals with parents with intermediate levels of education.

(ii) The creation of degree programs both from private and public offer had a positive effect on the probability of enrolment for individuals from all educational backgrounds. However, while the effect of private programs is similar for all educational backgrounds, the effect of public programs tends to be proportional to the educational attainment of the parents.

(iii) Regarding the probability of graduating, the only effect of new institutions is limited to public institutions, and only for individuals whose parents have high educational levels. However, there is a positive effect of the supply of private degree programs for individuals within the other groups (none, low and intermediate categories of parental education) and it increases proportionally with parental educational background.

(iv) Referring exclusively to the university system, the expansion of private universities had a positive effect on the probability of enrolment for individuals with none or low education and reduced the probability for those with higher educational background. The creation of new degree programs had no effect on enrolment.

(v) The probability of holding a university degree augmented significantly for students with high education levels as a consequence of the creation of new public institutions, although this effect is statistically significant only at ten per cent level.

These results suggest that the expansion of higher education supply had a *cost-reduction effect*, associated with the availability of new institutions and degree programs in the individuals' department of birth, so perhaps more students were able to enrol in higher education without moving to a different department. This effect is present for both the higher education system as a whole and the university system. In addition, the fact that new availability of programs is relevant to the probability of graduating from a higher education program signals that there was a *potential increase in labour market returns*, perhaps derived from a supply of courses in the private sector better suited for the local market needs, which motivated students to stay and complete this level. This effect, however, is restricted to non-university system, as there was no effect of new university programs neither on the probability of enrolment nor in the probability of graduating.

On the other hand, these results can be interpreted as an improvement in equality of opportunity in higher education achievement as the expansion of higher education supply has effectively increased the likelihood of enrolment and graduating for students with intermediate and less educated parents. However, this expansion has had only limited effects in terms of reducing existing inequality. First, new opportunities for students coming from less well-off backgrounds were concentrated in the non-university system, as the increasing supply did not contribute to improve enrolment and graduation probabilities for those students at the university level. Second, the fact that the supply of public institutions mostly benefited individuals from the most advantaged backgrounds is also remarkable. In this sense, despite the positive effect in higher educational attainment on individuals of less well-off backgrounds, the expansion of supply came with a process of *diversion*, whereby members of

this group might be channelled to educational opportunities less rewarded in labour market and considered of lower status by Colombian society.

Such diversion and the fact that public resources mostly benefited individuals from already advantaged environments can be explained by several factors. First, inequalities in the basic education, given that those students who can afford to pay for high-quality private primary and secondary education are often much better prepared for university entrance exams, which are the main mechanism of selection in high quality public universities[20]. Quality differences in basic education and tough admission policies lead to the situation in which affluent students are overrepresented in the public higher education institutions, while not so well prepared students from poor families are left with fewer choices, usually involving paying for education in private institutions that place less emphasis on test scores or forgoing higher education altogether.

A second explanation lies in the higher tuition levels in the private university system and the existence of restrictions in the credit market. The private sector offers courses that are affordable only to well-off segments of the population or those who have access to financial aid. Tuition levels vary according to institution and type of enrolment [21]. Private universities charge the highest yearly fee, followed by the newer University Institutions. The least expensive tertiary option is the non-university institutions which charge less than half the fee of the universities. In addition, the overall aid structure in Colombia has been inadequate and biased towards the middle class because a large proportion of the aid provided is devoted to credit rather than to scholarships. In 2002, only 5 per cent of students had access to public student loans institution[22]. All these limitations effectively reduce access to university for low cultural capital students and, as a consequence, access to university education remains highly unequal.

In the third place, the effects of the deep short-term recession experienced by Colombia at the end of the Nineties had a negative impact on participation at university level as well.

[20] The problem arises with the unobservable nature of ability –despite the big efforts and money spent on the design of revealing test–. Abilities are highly correlated both with genetic and environmental conditions of the family backgrounds, but the "signal" resulting from this test is unable to identify the pure genetic abilities in the students.

[21] There is a large heterogeneity within each group of institutions. For instance, the most expensive university course charged Col$8.6 million per year in 1999 compared to the least expensive at Col$299,000 per year. The vocationally oriented Technical Training Institutions that charge less than half the fee of universities (Col$1.3 million) are the least expensive.

[22]The reduced demand for loans in Colombia is linked to the declining attractiveness of borrowing resources. For instance, the real interest rate on ICETEX loans (*Instituto Colombiano de Crédito Educativo y Estudios Técnicos en el Exterior*), which reached 13 per cent in 2001 and is the lowest in the Colombian credit market, is substantially above real interest rates charged on the student loan schemes around the world (World Bank, 2003:55). Additionally, applicants must find two collateral guarantors to be eligible for such offers. While these instruments are important for high repayment rates; they severely hinder the access and attractiveness of the credit, especially to the poor. Furthermore, in order to reduce the fiscal costs of the student loans, some programs limit them to cover tuition expenditures solely and do not cover the living expenses.

According to the World Bank, the three year consecutive decline in entrants into private higher education of 15 per cent, 17 per cent and 4 per cent between 1997 and 1999 – amounting to 100,000 expected entries in total– can be attributed to the severe recession[23] (World Bank, 2003:53). Although, the decrease occurred in the lower socio economic strata, which couldn't set aside the required income for long term investment in tertiary education, middle and high income families were also affected. However, some of the high income families faced the drop in income by sending their children to public universities, were they were charged lower fees. As a consequence, students from high-income backgrounds increasingly attended public universities, while prospective students from poor and middle-income families exited the education system or entered to more affordable options in the non-university system.

In conclusion, the potential reduction of costs and increasing returns derived from expansion of higher education supply had a positive effect in equality of opportunity in tertiary education achievement. This effect, however, is driven mainly by the non-university system. The mechanisms of selection in the university sector –mainly meritocracy in the public sector and willingness to pay in the private– imply that there is indeed a trade-off between efficiency and equality in university education, since it would be efficient to focus resources on those students who comes from already advantaged backgrounds.

6. Robustness checks

6.1 Endogenous migration

Although exposure to expansion of supply is completely exogenous (depending only on an individual's birth cohort), the intensity of the treatment is potentially endogenous. Some individuals might have moved to regions in which the expansion of higher education supply was greater, precisely seeking for better opportunities to improve schooling levels or because these regions offered better employment opportunities. Although migration in Colombia is

[23] In the first half of the decade, economic growth accelerated to 4.6 per cent per annum, in a context of the economy overture and several structural reforms. This 'go' phase of the economy was followed by a downturn between 1997 and 2000 mainly due to a collapse of private investment. The GDP decreased to -4.5 per cent in 1999 and by 2000 the unemployment rate was up at an unprecedented rate of 20 per cent. The crisis also had a negative impact on enrolment at all levels of education. In 1996 and 1998, enrolment of 7–11 year olds from the poorest families declined from 87.3 per cent to 83.2 per cent respectively while enrolment rates of 12–17 year olds fell from 66.3 per cent to 64.6 per cent in 1998. Tertiary education also saw a decline in the number of new entrants by 19 per cent between 1997 and 1999 (World Bank, 2001).

high for other reasons than education[24], if this is the case, the effect of higher education supply would be likely overestimated due to positive self-selection.

The available data does not record the region of residence at age of 18 years, when the decision to enrol in higher education is typically made. Until know, this problem was addressed by using the supply in the individual's region of birth, assuming that it was the place where the individual was at the moment of taking the decision. In this section we analyse the problem with a different approach. In order to check if there is a differential effect for those individuals who have migrated, I estimated the baseline models including three different variables. The first one is a variable indicating whether the individual has migrated anytime, which comes for the question of whether the individual has lived all his life in the same municipality. The second variable is whether the individual has migrated to another department, which was built from comparing the department of residence at the moment of the survey and the department of birth. The third variable is if the individual migrated after he/she was 18 years old which was built by subtracting the years of living in the same municipality to the age at the moment of the survey.

Given the relatively high geographical mobility in Colombia, it is not surprising that almost half of the individuals were born in a town different from the town in which they were living at the moment of the survey (Appendix 4). However, only 21 per cent had changed their department of residence and 27 per cent arrived at their place of residence at the moment of the survey after they were 18 years old. As it is shown in Table 7, having migrated at any moment in the lifetime does not have a significant effect neither on the probability of enrolling nor on the probability of graduating in higher education. The same result is observed for those who migrated to a different department. In contrast, there is a statistically significant negative effect of having migrated after the individual was 18 years old, both for the probability of attending and holding a higher education degree. Table 8 shows that there is the same effect at the university level. These results indicate that, if any, the impact of the effect of supply would be downward biased.

Following Bratti *et al* (2008), this potential bias can be overcome by replicating the estimations on the sample of individuals for whom the department of residence the year of the survey coincides with their department of birth. Thus, the sample is reduced from 7,659 to 5,521 observations.

[24] According to the DANE, based on the Continuous Household Survey of 2005, of those who had migrated, 32 per cent moved because their home changed their place of residence, 17.5 per cent for job search, for family reasons in the 15.46 per cent of cases, and only 8.3 per cent for educational reasons.

The results are shown in Table 9a to 12b. Overall, the main results are unchanged and, as expected, higher coefficients than those observed in the whole sample are obtained. Some results, however, deserve a comment. First, regarding the probability of enrolling in higher education, the effect of the new private institutions is no longer significant (Table 9a). The same happens with the probability of enrolling in higher education for those individuals with uneducated parents. In contrast, the increase in the number of institutions (both public and private) has now a positive and significant effect on students from households with parents with intermediate educational level (Table 10b). Second, at university level, the number of new university degrees, in particular of public universities, has now a positive effect on the probability on enrolling in university (Table 11a). Analysing this effect by parental education level, a positive effect of new degrees on students with intermediate-educated parents appears as well as on those with low-educated parents, although both effects are significant only at 10 per cent level (Table 12a). In addition, the former were also benefited from new private degrees in terms of the probability of holding a university degree (Table 12b).

In summary, the results excluding those individuals who had migrated to a different department, potentially looking for new educational opportunities, confirm that the creation of both new higher education institutions and higher education programs had a positive effect on the probabilities of getting into higher education institutions and/or completing a higher education degree. Given that those individuals who migrated after the age of entry to higher education have a lower probability of achieving tertiary education, ignoring this effect might underestimate the effect of supply expansion, particularly for those individuals from intermediate cultural capital backgrounds.

6.2 Selection into high school graduation

Analysing higher education attendance for all individuals in the sample (i.e. including those who did graduate from high school as well as those who did not) might confound the effect of family background on making the transition from high school to higher education with the cumulative impact of background over all previous transitions (Heckman and Cameron, 1998). In turn, this might either underestimate or overestimate the effect of supply of higher education on the probabilities of enrolling and graduating. Ideally, the bias should be corrected using a two-stage estimation method, which requires an exclusion restriction to generate credible estimates, i.e., at least one variable that explains the probability of graduating from high school but unrelated to the probability of enrolling and graduating from higher education. Given the lack of additional data for the years in which it is assumed that both

cohorts were in high school[25], I decided to use the same strategy that Bratti *et al.* (2008) and repeat the estimates with a sample restricted to those who have already completed secondary education at the moment of the survey, which accounts for 3,280 observations.

The estimated models for the restricted sample are presented in Tables 13 to 18b. It is observed that the main results hold, but there are some important differences with the estimates for the whole sample. First, while with the whole sample the supply of new degrees have a positive effect on the probability of attending higher education, both the public and the private supply, with the restricted sample the supply of new private degrees is not statistically significant (Tables 2a and 14a).

Second, while the positive effect of the supply of new degrees on the probability of enrolling for those whose parents have low or intermediate levels of education is maintained, it is no longer significant for those whose parents have no education. It is also important to note that, in this case, the positive effect is related to the supply of public degree programs only, since the supply of private programs is not significant for any group of students (Table 3a and 15a, columns (4) and (6)).

Third, regarding the probability of graduating from higher education, the effect of the new supply of private degrees for those whose parents have no education is again positive, but the effect turns to be non-significant for those whose parents have a low educational level (Tables 3b and 15b, column (5)).

Finally, at the university level, the effect of the new supply of private institutions in the probability of enrolling for those whose parents have the highest educational level is negative but no longer statistically significant (Tables 6a and 18a, column (2)), although it remains significant when the probability of graduating is analysed (Tables 6b and 18b, column (2)).

7. Conclusions and further research

The Law 30 led to an extraordinary increase in higher education supply in Colombia during the Nineties by providing incentives for the creation of new degree programs and a wider participation of the private sector. Using data from two living standards surveys carried out in 1997 and 2003, the effect of this expansion on two different outcomes has been assessed: the probability of enrolling in higher education and the probability of holding a higher education degree. Since the expansion of supply might have benefited individuals with

[25] I ran different Heckman selection models using some variables measuring coverage in secondary education and the availability of educational resources at departmental level, such the pupil/teacher ratio in secondary education in each region. However, using these exclusion restrictions, the null hypothesis that the correlation between the residuals of both equations is equal to 0 could not be rejected at any statistically significant level.

different family backgrounds in a different way, different models were estimated allowing the heterogeneity of its effect across individuals.

The main results of this paper suggest that the expansion of tertiary education supply in Colombia had a positive effect on equality of opportunity in higher educational attainment, as it increased the probabilities of enrolment for individuals of less well-off backgrounds. Nevertheless, this effect is limited in two different ways. In the first place, the positive effect was driven mostly by the increasing supply in the non-university system. The increasing supply did not contribute to improve enrolment and graduation probabilities for individuals coming from less well-off backgrounds at the university level. In this sense, despite the positive effect in higher educational attainment on individuals of less well-off backgrounds, the expansion of supply in Colombia came with a process of *diversion*, as they were channelled to educational opportunities not only less rewarded in the labour market, but also considered of lower status by Colombian society. In the second place, it is remarkable that the supply of public institutions mostly benefited individuals from the most advantaged backgrounds and that the positive effect of new public degrees tended to be proportional to the educational attainment of the parents.

It is also important to remark the role played by private supply. Greater privatisation of higher education has been advocated by some governments as well as regional and international organisations as a way to fill the supply-demand gap left by the public sector, transfer the finance burden to higher education consumers and increase the efficiency and relevance of higher education and the private returns of education. There are some concerns, however, regarding the effects of this privatisation process on the equality of opportunity. The results of this paper show that private supply had an important role in increasing participation in higher education of students coming from less-advantaged backgrounds. However, the fact that this positive effect is mostly restricted to non-university system suggests that wider opportunities offer to these students are coming from private suppliers preferring to concentrate on shorter and often less resource-demanding type of degrees. A priori, it should not be a problem as the new supply may provide those students with the required knowledge and skills to find good opportunities in local labour markets. However, as it happens in Colombia, this kind of supply usually comes at the price of reducing quality, which is part of the source of the social undervaluation of this type of education.

Further research is needed regarding two main issues: Firstly, the criteria for the selection process used by different types of educational institutions and the kind and quality of their offers a might have differential impacts on educational opportunities. It is needed to further

explore the hierarchically differentiated higher education system and the stratification of students that resulted mainly from the differences in the quality of education, playing a determinant role in keeping a persistent inequality. In second place, inequalities in access to higher education might translate into inequalities in economic outcomes in a stronger way than it interprets for the effects of basic education. The increased demand by the economy for skilled workers has driven the increasing returns to quantity and quality of education. As the return to skill rises, the income gaps between people from different educational levels naturally widen. This implies a growing importance for studying the impact of the stratification created by the expansion of higher education on these income gaps and the effect of family backgrounds on the performances of graduate students transiting into the labour market.

Improving access to higher education for less-advantaged students is an important step to mitigate future inequalities. Further research about the mechanisms and policies to get this goal is an urgent task, even more in a country with high levels of income inequality as Colombia.

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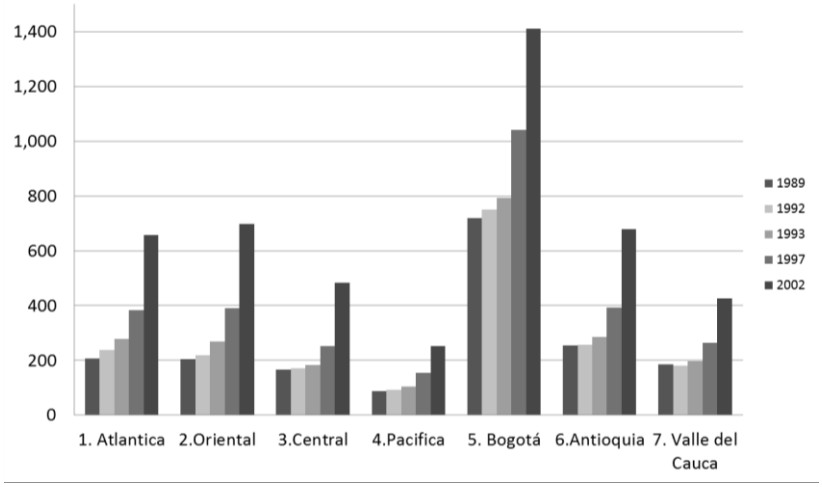
Figures

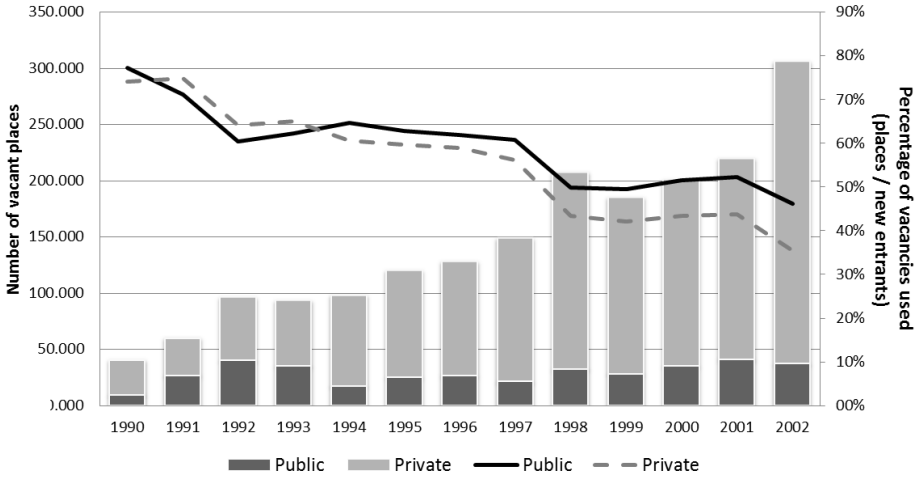
Higher education supply expansion 1989-2002

Figure 1. Number of undergraduate programs by region



Source: ICFES, Estadísticas de la Educación Superior

Figure 2. Oversupply of higher education places



Source: ICFES, Estadísticas de la Educación Superior

Figure 3. Number of higher education programs per capita (per 1000 inhabitants of 18 years old in 1994)

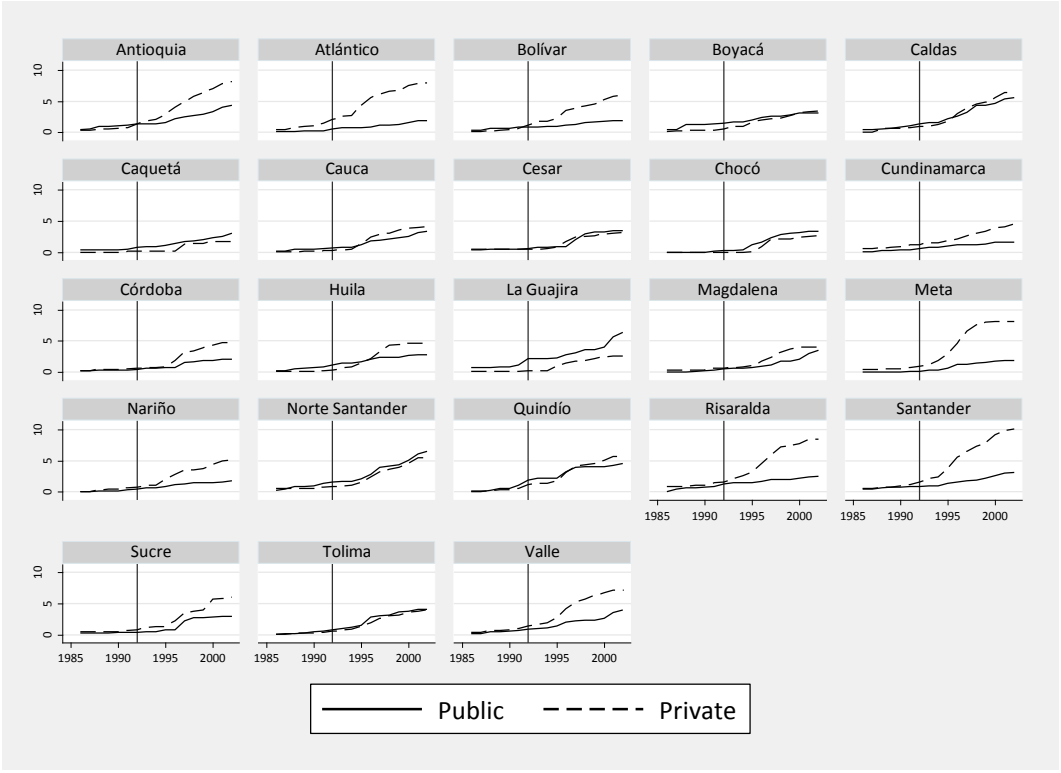


Figure 4. Number of university degree programs per capita (per 1000 inhabitants of 18 years old in 1994)

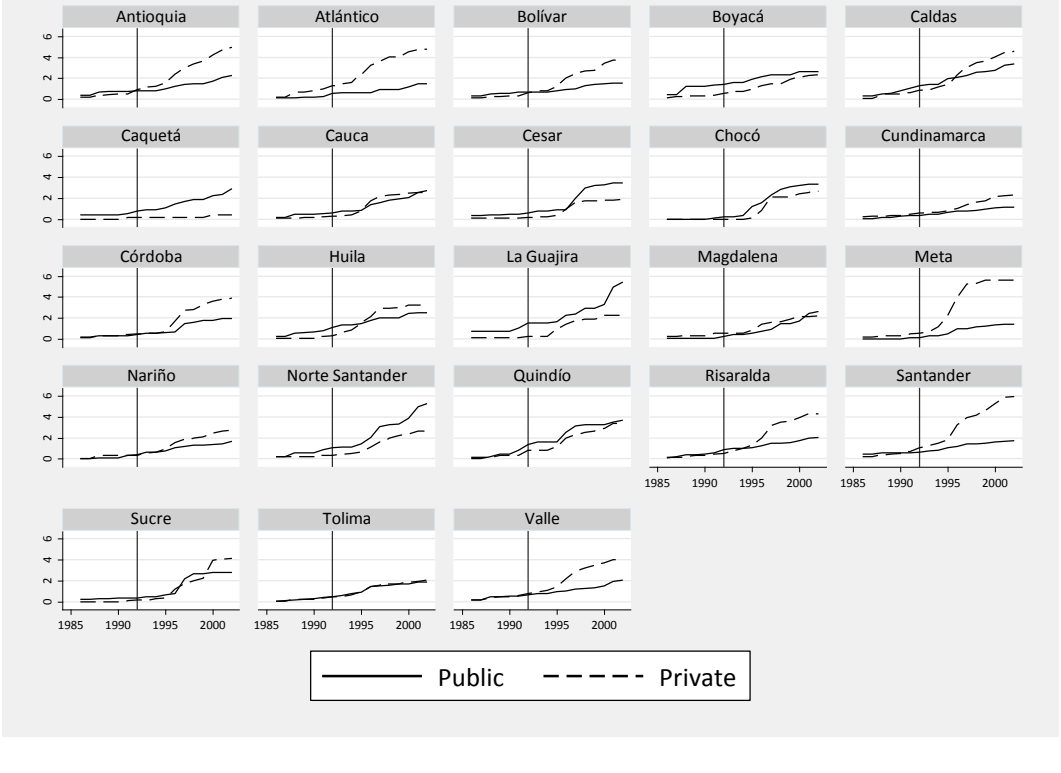
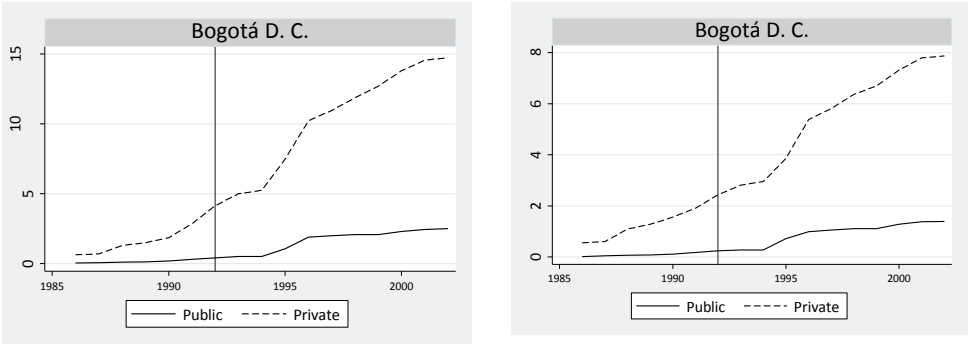


Figure 5. Number of higher education programs per capita in Bogotá (per 1000 inhabitants of 18 years old in 1994)

Total degree programs **University programs**



Tables

I. RESULTS FOR HIGHER EDUCATION: UNIVERSITY AND NON-UNIVERSITY EDUCATION

Table 1 - Baseline models
Probability of enrolling in and graduating from higher education

	(1) HE graduate or HE student		(2) HE graduate	
	(b)	(t)	(b)	(t)
Female	0.037***	(3.88)	0.029***	(3.46)
Post-treatment dummy	**0.086*** **	**(4.48)**	**0.056*** **	**(3.56)**
Parental education level (Ref: No education)				
Low	0.091***	(11.43)	0.038***	(6.23)
Intermediate	0.325***	(14.46)	0.146***	(8.45)
High	0.754***	(34.33)	0.358***	(11.38)
Departmental variables				
Post-treatment * ΔGDP per capita	0.077	(0.67)	0.093	(1.05)
Post-treatment * Δ Population aged 18	-0.003*	(-1.83)	-0.002*	(-1.78)
Post-treatment * Δ Unemployment rate	-0.772**	(-2.16)	-0.068	(-0.27)
Department of birth (Ref: Antioquia)				
Atlántico	0.021**	(2.30)	0.022***	(2.95)
Bolívar	-0.064***	(-10.59)	-0.015***	(-3.78)
Boyacá	-0.058**	(-2.76)	-0.055***	(-3.42)
Caldas	-0.045***	(-3.07)	-0.055***	(-5.11)
Caquetá	-0.140***	(-9.62)	-0.062***	(-4.47)
Cauca	-0.015**	(-2.59)	-0.035***	(-8.53)
Cesar	-0.111***	(-8.71)	-0.070***	(-7.46)
Córdoba	-0.030	(-1.63)	-0.048***	(-3.36)
Cundinamarca	0.026**	(2.65)	0.012*	(1.88)
Chocó	-0.033***	(-3.10)	-0.069***	(-9.98)
Huila	-0.044***	(-3.00)	-0.041***	(-4.09)
La Guajira	0.131***	(5.78)	0.067***	(4.00)
Magdalena	-0.099***	(-6.43)	-0.029**	(-2.60)
Meta	-0.014	(-0.75)	-0.008	(-0.55)
Nariño	-0.019***	(-3.58)	-0.021***	(-9.24)
Norte Santander	-0.065***	(-10.43)	-0.043***	(-8.82)
Quindío	-0.051***	(-3.83)	-0.013	(-1.36)
Risaralda	-0.061***	(-7.33)	-0.055***	(-8.27)
Santander	-0.013	(-0.79)	-0.012	(-0.85)
Sucre	0.011	(1.45)	-0.000	(-0.04)
Tolima	-0.056**	(-2.11)	-0.053**	(-2.57)
Valle	-0.021**	(-2.71)	-0.004	(-0.77)
Constant	0.025*	(1.81)	0.003	(0.25)
R-Squared	0.25		0.12	
Obs.	7659		7659	
AIC	5808.30		2199.04	
Pseudo-Log Likelihood	-2896.15		-1091.52	

Notes: Results of linear probability models. Heteroscedasticity robust standard errors clustered at department of birth. All models include year of birth dummy. *t* statistics in parentheses. * Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

Table 2a. Effect of supply expansion on the probability of enrolling in higher education

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post-treatment * Δ Supply	0.152***	0.067**	0.042	0.096***	0.052**	0.071**
	(2.90)	(2.20)	(0.80)	(4.42)	(2.37)	(2.40)
R-Squared	0.246	0.245	0.244	0.246	0.245	0.245
Obs.	7659	7659	7659	7659	7659	7659

Table 2b. Effect of supply expansion on the probability of graduating from higher education

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post-treatment * Δ Supply	0.034	0.005	0.029	0.051**	0.043***	0.010
	(0.72)	(0.19)	(0.79)	(2.42)	(3.36)	(0.34)
R-Squared	0.116	0.115	0.116	0.116	0.117	0.115
Obs.	7659	7659	7659	7659	7659	7659

Table 3a. Effect of supply expansion on the probability of enrolling in higher education: heterogeneous effect by parental education level

Coefficients of the interactions of HE supply with post-treatment dummy and parental education level

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post * No education* ΔSupply	0.144**	0.072*	0.009	0.092***	0.056**	0.062*
	(2.56)	(1.85)	(0.16)	(3.42)	(2.18)	(1.97)
Post * Low* ΔSupply	0.189***	0.080	0.065	0.108***	0.058**	0.077*
	(2.84)	(1.63)	(1.05)	(3.84)	(2.19)	(2.00)
Post * Intermediate* ΔSupply	0.141	0.095*	0.041	0.103**	0.057*	0.087**
	(1.40)	(1.89)	(0.50)	(2.62)	(1.85)	(2.16)
Post * High* ΔSupply	-0.112	-0.096	-0.077	0.005	-0.009	-0.012
	(-0.94)	(-1.62)	(-0.60)	(0.06)	(-0.16)	(-0.21)
R-Squared	0.247	0.246	0.245	0.247	0.246	0.246
Obs.	7659	7659	7659	7659	7659	7659

Table 3b. Effect of HE supply expansion on the probability of graduating from higher education: heterogeneous effect by parental education level

Coefficients of the interactions of HE supply with post-treatment dummy and parental education level

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
Parental education	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post * No education* ΔSupply	0.011	-0.003	-0.015	0.037	0.030*	-0.001
	(0.23)	(-0.10)	(-0.45)	(1.56)	(1.76)	(-0.02)
Post * Low* ΔSupply	0.022	0.003	-0.016	0.038	0.034**	-0.001
	(0.43)	(0.08)	(-0.45)	(1.60)	(2.16)	(-0.04)
Post * Intermediate* ΔSupply	0.059	0.021	0.078	0.098**	0.077***	0.054
	(0.67)	(0.50)	(1.05)	(2.54)	(3.28)	(1.59)
Post * High* ΔSupply	0.101	-0.011	0.320***	0.026	0.026	-0.017
	(0.68)	(-0.14)	(3.20)	(0.52)	(0.73)	(-0.35)
R-Squared	0.116	0.116	0.119	0.118	0.118	0.117
Obs.	7659	7659	7659	7659	7659	7659

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses. * Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

II. RESULTS FOR THE UNIVERSITY LEVEL ONLY

Table 4. Probability of enrolling and graduating from university

	(1) University graduate or university student		(2) University graduate	
	(b)	(t)	(b)	(t)
Female	0.019*	(1.82)	0.015**	(2.60)
Post-treatment dummy	**0.030**	**(1.42)**	**0.012**	**(0.65)**
Parental education level (Ref: No education)				
Low	0.060***	(6.03)	0.014**	(2.16)
Intermediate	0.252***	(10.29)	0.085***	(4.75)
High	0.649***	(22.81)	0.261***	(16.76)
Departmental variables				
Post-treatment * ΔGDP per capita	0.197*	(1.76)	0.216**	(2.09)
Post-treatment * Δ Population aged 18	-0.003*	(-1.86)	-0.002	(-1.44)
Post-treatment * Δ Unemployment rate	-0.467	(-1.56)	0.201	(0.86)
Department of birth (Ref: Antioquia)				
Atlántico	0.005	(0.69)	-0.003	(-0.50)
Bolívar	-0.052***	(-7.45)	-0.013**	(-2.60)
Boyacá	0.002	(0.11)	-0.005	(-0.28)
Caldas	-0.012	(-0.82)	-0.037***	(-3.13)
Caquetá	-0.059***	(-4.06)	0.009	(0.58)
Cauca	0.036***	(6.63)	0.003	(0.98)
Cesar	-0.076***	(-5.86)	-0.038***	(-3.78)
Córdoba	-0.005	(-0.26)	-0.027	(-1.68)
Cundinamarca	0.036***	(3.99)	0.012*	(1.86)
Chocó	0.030***	(2.82)	-0.006	(-0.70)
Huila	-0.004	(-0.38)	-0.010	(-1.21)
La Guajira	0.182***	(9.99)	0.097***	(6.72)
Magdalena	-0.080***	(-4.98)	-0.013	(-1.06)
Meta	0.067***	(3.58)	0.052***	(3.59)
Nariño	0.037***	(7.11)	0.018***	(6.41)
Norte Santander	-0.042***	(-6.54)	-0.033***	(-7.22)
Quindío	0.004	(0.39)	0.031***	(3.62)
Risaralda	0.013	(1.64)	0.005	(0.68)
Santander	0.023	(1.45)	0.010	(0.68)
Sucre	0.067***	(8.99)	0.042***	(7.24)
Tolima	-0.025	(-1.10)	-0.027	(-1.53)
Valle	-0.007	(-0.89)	0.003	(0.50)
Constant	0.011	(0.81)	-0.010	(-1.07)
R-Squared	0.23		0.11	
Obs.	7659		7659	

Notes: Results of linear probability models. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses. * significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

Table 5a. Effect of supply expansion on the probability of enrolling in university

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post-treatment * Δ Supply	0.084	0.034	0.023	0.027	0.010	0.026
	(1.58)	(1.24)	(0.37)	(1.03)	(0.57)	(1.10)
R-Squared	0.227	0.226	0.226	0.226	0.226	0.226
Obs.	7659	7659	7659	7659	7659	7659

Table 5b. Effect of HE supply expansion on the probability of graduating from university

	(2) Δ Institutions	(3) Δ Private institutions	(4) Δ Public institutions	(5) Δ Degrees	(6) Δ Private degrees	(7) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post-treatment * Δ Supply	-0.001	-0.018	0.038	0.001	0.013	-0.021
	(-0.02)	(-0.88)	(1.14)	(0.04)	(1.01)	(-1.08)
R-Squared	0.113	0.113	0.113	0.113	0.113	0.113
Obs.	7659	7659	7659	7659	7659	7659

Table 6a. Effect of HE supply expansion on the probability of enrolling in university: heterogeneous effect by parental education level

Coefficients of the interactions of university supply with post-treatment dummy and parental education level

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post * No education* ΔSupply	0.115**	0.074**	0.033	0.040	0.026	0.035
	(2.41)	(2.66)	(0.76)	(1.67)	(1.38)	(1.67)
Post * Low* ΔSupply	0.143**	0.064*	0.064	0.042	0.016	0.046
	(2.57)	(1.97)	(0.93)	(1.31)	(0.65)	(1.59)
Post * Intermediate* ΔSupply	0.014	0.019	-0.018	0.007	0.004	-0.003
	(0.17)	(0.42)	(-0.26)	(0.23)	(0.21)	(-0.08)
Post * High* ΔSupply	-0.252	-0.174**	-0.198	-0.052	-0.044	-0.059
	(-1.46)	(-2.15)	(-0.91)	(-0.71)	(-0.76)	(-0.86)
R-Squared	0.230	0.229	0.228	0.228	0.227	0.228
Obs.	7659	7659	7659	7659	7659	7659

Table 6b. Effect of supply expansion on the probability of graduating from university: heterogeneous effect by parental education level

Coefficients of the interactions of university supply with post-treatment dummy and parental education level

	(1) Δ Institutions	(2) Δ Private institutions	(3) Δ Public institutions	(4) Δ Degrees	(5) Δ Private degrees	(6) Δ Public degrees
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Post * No education* ΔSupply	-0.022	-0.009	0.002	-0.005	0.009	-0.020
	(-0.46)	(-0.30)	(0.06)	(-0.22)	(0.56)	(-1.08)
Post * Low* ΔSupply	0.007	-0.009	0.017	-0.005	0.007	-0.020
	(0.14)	(-0.38)	(0.53)	(-0.22)	(0.45)	(-0.94)
Post * Intermediate* ΔSupply	0.009	-0.015	0.070	0.027	0.037	-0.009
	(0.12)	(-0.42)	(1.17)	(0.80)	(1.58)	(-0.33)
Post * High* ΔSupply	-0.051	-0.099*	0.177*	-0.022	-0.001	-0.062
	(-0.38)	(-1.95)	(1.75)	(-0.41)	(-0.03)	(-1.39)
R-Squared	0.113	0.114	0.115	0.114	0.114	0.114
Obs.	7659	7659	7659	7659	7659	7659

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses.

* Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

III. RESULTS FROM ROBUSTNESS CHECK: MIGRATION

Table 7. Probability of enrolling and graduating in higher education: migration effects

	Probability of enrolling			Probability of graduating		
	(1)	(2)	(3)	(4)	(5)	(6)
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Parental education level						
(Ref: No education)						
Low	0.091***	0.091***	0.092***	0.038***	0.038***	0.038***
	(11.39)	(11.39)	(11.45)	(6.24)	(6.23)	(6.33)
Intermediate	0.325***	0.325***	0.325***	0.146***	0.146***	0.146***
	(14.41)	(14.33)	(14.52)	(8.44)	(8.38)	(8.50)
High	0.754***	0.754***	0.754***	0.358***	0.358***	0.358***
	(34.30)	(34.71)	(34.25)	(11.36)	(11.30)	(11.34)
Post-treatment dummy	0.085***	0.085***	0.085***	0.056***	0.055***	0.055***
	(4.44)	(4.41)	(4.61)	(3.50)	(3.58)	(3.50)
Migrated	-0.011			-0.002		
	(-0.93)			(-0.27)		
Migrated to another department		-0.002			-0.005	
		(-0.12)			(-0.40)	
Migrated after 18 years old			**-0.038****			**-0.019***
			(-2.62)			**(-1.75)**
R-Squared	0.246	0.246	0.248	0.117	0.117	0.118
Obs.	7659	7659	7659	7659	7659	7659

Table 8. Probability of enrolling and graduating in university: migration effects

	Probability of enrolling			Probability of graduating		
	(1)	(2)	(3)	(4)	(5)	(6)
	b/t	*b/t*	*b/t*	*b/t*	*b/t*	*b/t*
Parental education level	0.000	0.000	0.000	0.014**	0.014**	0.014**
(Ref: No education)						
Low	0.060***	0.060***	0.061***	(2.16)	(2.15)	(2.19)
	(6.01)	(6.02)	(6.02)	0.085***	0.085***	0.085***
Intermediate	0.252***	0.252***	0.252***	(4.75)	(4.68)	(4.77)
	(10.26)	(10.24)	(10.33)	0.261***	0.261***	0.262***
High	0.649***	0.649***	0.650***	(16.78)	(16.62)	(16.90)
	(22.92)	(23.10)	(23.06)	0.012	0.012	0.012
Post-treatment dummy	0.029	0.030	0.029	(0.64)	(0.67)	(0.61)
	(1.38)	(1.43)	(1.37)	-0.000		
Migrated	-0.011			(-0.08)		
	(-1.17)					
Migrated to another department		0.003			0.003	
		(0.25)			(0.29)	
Migrated after 18 years old			-0.036***			-0.018**
			(-3.29)			(-2.22)
Constant	0.016	0.011	0.021	-0.010	-0.011	-0.006
	(1.09)	(0.82)	(1.43)	(-0.94)	(-1.11)	(-0.58)
R-Squared	0.227	0.226	0.228	0.113	0.113	0.114
Obs.	7659	7659	7659	7659	7659	7659

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses.
* Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

SAMPLE OF INDIVIDUALS WHO DO NOT MIGRATE TO ANOTHER DEPARTMENT

Table 9a. Effect of supply expansion on the probability of enrolling in higher education

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.184***	0.074	0.049	0.159***	0.083***	0.099**
	(3.11)	(1.59)	(0.78)	(6.42)	(3.21)	(2.20)
R-Squared	0.230	0.229	0.228	0.232	0.231	0.230
Obs.	5221	5221	5221	5221	5221	5221

Table 9b. Effect of supply expansion on the probability of graduating from higher education

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.089*	0.027	0.048	0.064**	0.048***	0.019
	(1.99)	(0.84)	(1.24)	(2.56)	(3.14)	(0.55)
R-Squared	0.106	0.105	0.105	0.106	0.106	0.105
Obs.	5221	5221	5221	5221	5221	5221

Table 10a. Effect of supply expansion on the probability of enrolling in higher education: heterogeneous effect by parental education level

Coefficients of the interactions of HE supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.173***	0.084	0.008	0.141***	0.079**	0.085**
	(2.91)	(1.54)	(0.13)	(4.93)	(2.51)	(2.18)
Post * Low* ΔSupply	0.183**	0.065	0.044	0.155***	0.078**	0.089
	(2.45)	(0.98)	(0.59)	(5.04)	(2.67)	(1.66)
Post * Intermediate* ΔSupply	0.256**	0.147**	0.074	0.194***	0.103***	0.149***
	(2.26)	(2.64)	(0.79)	(4.20)	(2.86)	(3.01)
Post * High* ΔSupply	-0.003	-0.077	0.101	0.120	0.056	0.049
	(-0.02)	(-1.17)	(0.62)	(1.22)	(0.77)	(0.57)
R-Squared	0.231	0.231	0.228	0.233	0.231	0.231
Obs.	5221	5221	5221	5221	5221	5221

Table 10b. Effect of HE supply expansion on the probability of graduating from higher education: heterogeneous effect by parental education level

Coefficients of the interactions of HE supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.065	0.018	0.005	0.050	0.036	0.010
	(1.27)	(0.40)	(0.12)	(1.67)	(1.52)	(0.29)
Post * Low* ΔSupply	0.061	0.018	-0.014	0.048*	0.038**	0.003
	(1.08)	(0.38)	(-0.33)	(1.89)	(2.26)	(0.08)
Post * Intermediate* ΔSupply	0.173**	0.064*	0.127*	0.132***	0.093***	0.087*
	(2.36)	(1.80)	(2.00)	(2.96)	(3.54)	(2.06)
Post * High* ΔSupply	0.141	-0.005	0.433***	-0.010	-0.011	-0.034
	(0.80)	(-0.06)	(3.27)	(-0.18)	(-0.25)	(-0.58)
R-Squared	0.107	0.105	0.111	0.109	0.109	0.108
Obs.	5221	5221	5221	5221	5221	5221

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses.

* Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

SAMPLE OF INDIVIDUALS WHO DO NOT MIGRATE TO ANOTHER DEPARTMENT: UNIVERSITY LEVEL ONLY

Table 11a. Effect of supply expansion on the probability of enrolling in university

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.095	0.034	0.024	0.075**	0.038	0.052*
	(1.54)	(1.01)	(0.32)	(2.28)	(1.63)	(1.76)
R-Squared	0.202	0.201	0.201	0.203	0.202	0.202
Obs.	5221	5221	5221	5221	5221	5221

Table 11b. Effect of university supply expansion on the probability of graduating from university

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.038	-0.002	0.057	0.014	0.022	-0.013
	(0.71)	(-0.09)	(1.33)	(0.56)	(1.59)	(-0.52)
R-Squared	0.093	0.093	0.094	0.093	0.094	0.093
Obs.	5221	5221	5221	5221	5221	5221

Table 12a. Effect of HE supply expansion on the probability of enrolling in university: heterogeneous effect by parental education level

Coefficients of the interactions of university supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.115*	0.078*	0.021	0.076**	0.045*	0.053**
	(1.87)	(1.78)	(0.44)	(2.58)	(1.83)	(2.18)
Post * Low* ΔSupply	0.121*	0.046	0.039	0.076*	0.033	0.058
	(1.88)	(1.11)	(0.48)	(1.92)	(1.08)	(1.59)
Post * Intermediate* ΔSupply	0.104	0.063	0.023	0.085*	0.052*	0.055
	(0.96)	(1.06)	(0.26)	(2.02)	(2.05)	(1.38)
Post * High* ΔSupply	-0.194	-0.172*	-0.096	0.040	0.024	-0.012
	(-0.95)	(-1.79)	(-0.34)	(0.42)	(0.32)	(-0.13)
R-Squared	0.204	0.204	0.201	0.203	0.202	0.203
Obs.	5221	5221	5221	5221	5221	5221

Table 12b. Effect of supply expansion on the probability of graduating from university: heterogeneous effect by parental education level

Coefficients of the interactions of university supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.005	0.006	0.011	0.004	0.016	-0.015
	(0.07)	(0.12)	(0.27)	(0.15)	(0.84)	(-0.57)
Post * Low* ΔSupply	0.034	0.003	0.024	0.002	0.012	-0.018
	(0.62)	(0.10)	(0.57)	(0.07)	(0.73)	(-0.70)
Post * Intermediate* ΔSupply	0.110	0.024	0.129*	0.064	0.061**	0.024
	(1.36)	(0.60)	(1.88)	(1.57)	(2.33)	(0.70)
Post * High* ΔSupply	-0.064	-0.113**	0.221**	-0.039	-0.017	-0.070
Post * No education* ΔSupply	(-0.57)	(-2.56)	(2.50)	(-0.83)	(-0.50)	(-1.64)
						-0.015
R-Squared	0.095	0.095	0.097	0.098	0.098	0.096
Obs.	5221	5221	5221	5221	5221	5221

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses. * Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

IV. RESULTS FROM ROBUSTNESS CHECK: HIGH SCHOOL GRADUATES ONLY

Table 13. Baseline models
Probability of enrolling and graduating from higher education

	(1)		(2)	
	HE graduate or HE student		**HE graduate**	
Female	0.038**	(2.09)	0.046**	(2.49)
Post-treatment dummy	**0.122****	**(2.70)**	**0.099****	**(2.40)**
Parental education level (Ref: No education)				
Low	0.129***	(3.22)	0.048	(1.31)
Intermediate	0.326***	(8.11)	0.143***	(3.67)
High	0.666***	(17.75)	0.312***	(8.13)
Departmental variables				
Post-treatment * ΔGDP per capita	0.061	(0.28)	0.157	(0.77)
Post-treatment * Δ Population aged 18	-0.006**	(-2.44)	-0.005*	(-2.07)
Post-treatment * Δ Unemployment rate	-1.574*	(-1.95)	-0.006	(-0.01)
Department of birth (Ref: Antioquia)				
Atlántico	0.005	(0.34)	0.025	(1.68)
Bolívar	-0.137***	(-7.52)	-0.033***	(-3.14)
Boyacá	-0.028	(-0.61)	-0.113**	(-2.48)
Caldas	-0.090***	(-3.14)	-0.118***	(-4.84)
Caquetá	-0.316***	(-8.71)	-0.134***	(-3.96)
Cauca	-0.060***	(-4.02)	-0.085***	(-7.54)
Cesar	-0.184***	(-5.16)	-0.146***	(-5.17)
Córdoba	-0.009	(-0.23)	-0.094**	(-2.52)
Cundinamarca	0.061**	(2.39)	0.026*	(1.80)
Chocó	-0.017	(-0.58)	-0.148***	(-9.37)
Huila	0.027	(0.63)	-0.057**	(-2.13)
La Guajira	0.222***	(6.43)	0.130***	(4.42)
Magdalena	-0.203***	(-6.04)	-0.072**	(-2.26)
Meta	0.028	(0.74)	0.016	(0.42)
Nariño	-0.015	(-1.60)	-0.028***	(-4.40)
Norte de Santander	-0.104***	(-8.11)	-0.086***	(-7.19)
Quindío	-0.032	(-1.18)	0.008	(0.37)
Risaralda	-0.138***	(-7.21)	-0.125***	(-6.48)
Santander	-0.004	(-0.15)	-0.026	(-0.80)
Sucre	-0.006	(-0.37)	-0.016	(-0.97)
Tolima	-0.098**	(-2.52)	-0.112***	(-2.87)
Valle	-0.041*	(-2.04)	-0.007	(-0.49)
Constant	0.223***	(5.77)	0.081*	(2.04)
R-Squared	0.168		0.073	
Obs.	3280		3280	

Notes: Results of linear probability models. Heteroscedasticity robust standard errors clustered at department of birth. All models include year of birth dummy. *t* statistics in parentheses. * significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

Table 14a. Effect of supply expansion on the probability of enrolling in higher education

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.303***	0.156***	0.079	0.141***	0.059	0.138**
	(3.23)	(3.19)	(0.85)	(3.14)	(1.38)	(2.57)
R-Squared	0.169	0.168	0.166	0.168	0.166	0.168
Obs.	3280	3280	3280	3280	3280	3280

Table 14b. Effect of supply expansion on the probability of graduating from higher education

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.044	-0.000	0.049	0.085	0.076**	0.008
	(0.51)	(-0.00)	(0.58)	(1.70)	(2.50)	(0.13)
R-Squared	0.072	0.071	0.072	0.073	0.074	0.071
Obs.	3280	3280	3280	3280	3280	3280

Table 15a. Effect of supply expansion on the probability of enrolling in higher education: heterogeneous effect by parental education level

Coefficients of the interactions of HE supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.274**	0.218**	-0.030	0.161	0.114	0.147
	(2.09)	(2.10)	(-0.27)	(1.53)	(1.48)	(1.34)
Post * Low* ΔSupply	0.333***	0.161**	0.074	0.152**	0.057	0.143**
	(3.05)	(2.33)	(0.65)	(2.62)	(1.08)	(2.31)
Post * Intermediate* ΔSupply	0.335**	0.206**	0.139	0.168**	0.082	0.172**
	(2.10)	(2.60)	(1.18)	(2.51)	(1.47)	(2.37)
Post * High* ΔSupply	0.107	0.017	0.008	0.044	0.002	0.042
	(0.91)	(0.29)	(0.07)	(0.79)	(0.07)	(0.71)
R-Squared	0.170	0.169	0.166	0.169	0.167	0.169
Obs.	3280	3280	3280	3280	3280	3280

Table 15b. Effect of HE supply expansion on the probability of graduating from higher education: heterogeneous effect by parental education level

Coefficients of the interactions of HE supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.095	0.069	0.032	0.177*	0.141**	0.096
	(0.72)	(0.58)	(0.30)	(1.99)	(2.21)	(1.12)
Post * Low* ΔSupply	0.006	-0.009	-0.063	0.055	0.053	-0.017
	(0.06)	(-0.12)	(-0.82)	(0.98)	(1.37)	(-0.27)
Post * Intermediate* ΔSupply	0.074	0.014	0.117	0.143**	0.117***	0.061
	(0.53)	(0.21)	(0.95)	(2.12)	(3.02)	(0.94)
Post * High* ΔSupply	0.120	-0.020	0.352**	0.030	0.037	-0.046
	(0.69)	(-0.23)	(2.14)	(0.47)	(0.80)	(-0.75)
R-Squared	0.072	0.072	0.077	0.075	0.076	0.074
Obs.	3280	3280	3280	3280	3280	3280

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses.

* significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

RESULTS FOR THE UNIVERSITY LEVEL: HIGH SCHOOL GRADUATES ONLY

Table 16.Probability of enrolling and graduating from university

	(1)		(2)	
	University graduate or university student		**University graduate**	
Female	0.014	(0.67)	0.027**	(2.27)
Post-treatment dummy	0.025	(0.53)	0.025	(0.53)
Parental education level (Ref: No education)				
Low	0.094*	(2.03)	0.032	(0.86)
Intermediate	0.274***	(5.82)	0.110**	(2.52)
High	0.617***	(13.01)	0.273***	(8.51)
Departmental variables				
Post-treatment * ΔGDP per capita	0.367*	(1.74)	0.462**	(2.08)
Post-treatment * Δ Population aged 18	-0.005**	(-2.11)	-0.003	(-1.44)
Post-treatment * Δ Unemployment rate	-1.220	(-1.54)	0.354	(0.67)
Department of birth (Ref: Antioquia)				
Atlántico	0.004	(0.27)	0.002	(0.12)
Bolívar	-0.112***	(-5.65)	-0.029**	(-2.19)
Boyacá	0.096**	(2.21)	-0.011	(-0.23)
Caldas	-0.025	(-0.81)	-0.082***	(-2.96)
Caquetá	-0.154***	(-4.30)	0.020	(0.56)
Cauca	0.046***	(2.87)	-0.000	(-0.04)
Cesar	-0.127***	(-3.49)	-0.092***	(-2.94)
Córdoba	0.027	(0.71)	-0.065	(-1.59)
Cundinamarca	0.082***	(3.17)	0.025	(1.54)
Chocó	0.098***	(3.13)	-0.017	(-0.84)
Huila	0.094**	(2.31)	-0.011	(-0.43)
La Guajira	0.312***	(10.34)	0.184***	(6.60)
Magdalena	-0.146***	(-4.34)	-0.026	(-0.77)
Meta	0.193***	(4.91)	0.134***	(3.32)
Nariño	0.095***	(10.93)	0.049***	(7.28)
Norte Santander	-0.074***	(-5.40)	-0.090***	(-7.07)
Quindío	0.081***	(3.36)	0.098***	(4.86)
Risaralda	0.032*	(1.84)	0.013	(0.65)
Santander	0.065**	(2.47)	0.015	(0.44)
Sucre	0.126***	(8.52)	0.086***	(5.75)
Tolima	-0.026	(-0.74)	-0.053	(-1.45)
Valle	-0.010	(-0.50)	0.011	(0.69)
Constant	0.134***	(2.82)	-0.011	(-0.29)
R-Squared	0.180		0.100	
Obs.	3280		3280	

Notes: Results of linear probability models. Heteroscedasticity robust standard errors clustered at department of birth. All models include year of birth dummy. *t* statistics in parentheses. * significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

Table 17a. Effect of supply expansion on the probability of enrolling in university

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.218*	0.106	0.087	0.021	0.000	0.046
	(1.85)	(1.60)	(0.74)	(0.41)	(0.00)	(0.93)
R-Squared	0.182	0.181	0.180	0.180	0.180	0.180
Obs.	3280	3280	3280	3280	3280	3280

Table 17b. Effect of HE supply expansion on the probability of graduating from university

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post-treatment * Δ Supply	0.023	-0.033	0.108	-0.001	0.029	-0.045
	(0.21)	(-0.72)	(1.55)	(-0.02)	(0.93)	(-1.13)
R-Squared	0.100	0.100	0.102	0.100	0.101	0.101
Obs.	3280	3280	3280	3280	3280	3280

Table 18a. Effect of HE supply expansion on the probability of enrolling in university: heterogeneous effect by parental education level

Coefficients of the interactions of university supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.211	0.211*	-0.008	0.064	0.066	0.073
	(1.47)	(1.73)	(-0.07)	(0.93)	(1.17)	(1.03)
Post * Low* ΔSupply	0.298**	0.150*	0.120	0.048	0.006	0.084
	(2.35)	(2.02)	(0.87)	(0.76)	(0.15)	(1.51)
Post * Intermediate* ΔSupply	0.181	0.109	0.116	0.012	0.008	0.020
	(1.23)	(1.31)	(1.01)	(0.21)	(0.25)	(0.30)
Post * High* ΔSupply	-0.048	-0.069	-0.071	-0.055	-0.048	-0.046
	(-0.24)	(-0.68)	(-0.35)	(-0.76)	(-0.97)	(-0.63)
R-Squared	0.184	0.184	0.181	0.181	0.181	0.183
Obs.	3280	3280	3280	3280	3280	3280

Table 18b. Effect of supply expansion on the probability of graduating from university: heterogeneous effect by parental education level

Coefficients of the interactions of university supply with post-treatment dummy and parental education level

	(1) Δ Institutions *b/t*	(2) Δ Private institutions *b/t*	(3) Δ Public institutions *b/t*	(4) Δ Degrees *b/t*	(5) Δ Private degrees *b/t*	(6) Δ Public degrees *b/t*
Post * No education* ΔSupply	0.021	0.052	0.038	0.081	0.098	0.042
	(0.14)	(0.37)	(0.36)	(1.20)	(1.70)	(0.66)
Post * Low* ΔSupply	0.035	-0.013	0.053	-0.011	0.017	-0.041
	(0.33)	(-0.23)	(0.78)	(-0.21)	(0.49)	(-0.92)
Post * Intermediate* ΔSupply	0.027	-0.032	0.158	0.026	0.055	-0.036
	(0.20)	(-0.54)	(1.62)	(0.45)	(1.45)	(-0.76)
Post * High* ΔSupply	-0.045	-0.121*	0.245*	-0.050	-0.007	-0.111
	(-0.25)	(-1.77)	(2.05)	(-0.80)	(-0.15)	(-2.07)
R-Squared	0.100	0.102	0.104	0.102	0.103	0.103
Obs.	3280	3280	3280	3280	3280	3280

Notes: Results of linear probability models. All regressions include department of birth dummies, gender dummy, parental education variable, the interaction between post-treatment dummy and their interaction with three regional control variables. Heteroscedasticity robust standard errors clustered at department of birth. *t* statistics in parentheses.

* Significant at 10 per cent, ** significant at 5 per cent; *** significant at 1 per cent.

Appendix

Appendix 1. Gross enrolment ratio in tertiary education (%)

	1970	1980	1990	2000	2010
High income countries	28.3	34.8	43.3	56.1	72.8
Upper middle income countries	2.9	5.9	7.8	15.0	30.2
Middle income countries	4.4	6.4	8.0	13.3	24.5
Low income countries	1.4	2.5	3.4	4.2	8.5
Latin America & Caribbean (all income levels)	6.9	13.3	16.8	22.6	40.7
World	10.0	12.3	13.6	19.0	29.2

Source: World Bank EdStats

Note: The gross enrolment ratio is the total enrolment in tertiary education (ISCED 5 and 6), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.

Appendix 2. Some figures about higher education expansion in Colombia 1985 – 2002

	1985		1989		1993		1994		1997		2000		2002	
	N	*% of total*	*N*	*% of total*	*N*	*% of total*	*N*	*% of total*	*N*	*% of total*	*N*	*% of total*	*N*	*% of total*
Number of HE institutions	**225**	**100%**	**241**	**100%**	**255**	**100%**	**260**	**100%**	**269**	**100%**	**291**	**100%**	**319**	**100%**
Technical professional	62	27,6%	61	25,3%	52	20,4%	53	20,4%	52	19,3%	53	18,2%	52	16,3%
Technological	34	15,1%	45	18,7%	55	21,6%	59	22,7%	59	21,9%	65	22,3%	65	20,4%
University institutions	59	26,2%	62	25,7%	61	23,9%	61	23,5%	65	24,2%	78	26,8%	97	30,4%
Universities	70	31,1%	73	30,3%	87	34,1%	87	33,5%	93	34,6%	95	32,6%	105	32,9%
Number of private HE institutions	**156**	**69,3%**	**168**	**69,7%**	**178**	**69,8%**	**179**	**68,8%**	**187**	**69,5%**	**196**	**67,4%**	**216**	**67,7%**
Technical professional	53	85,5%	50	82,0%	42	80,8%	42	79,2%	41	78,8%	42	79,2%	41	78,8%
Technological	22	64,7%	31	68,9%	38	69,1%	41	69,5%	41	69,5%	42	64,6%	43	66,2%
University institutions	41	69,5%	44	71,0%	47	77,0%	47	77,0%	51	78,5%	57	73,1%	73	75,3%
Universities	40	57,1%	43	58,9%	51	58,6%	51	58,6%	54	58,1%	55	57,9%	59	56,2%
Undergraduate programs	**1.554**	**100%**	**1.556**	**100%**	**2.089**	**100%**	**2.265**	**100%**	**2.948**	**100%**	**3.513**	**100%**	**4.201**	**100%**
Technical professional	290	18,7%	297	19,1%	324	15,5%	340	15,0%	419	14,2%	478	13,6%	591	14,1%
Technological	247	15,9%	255	16,4%	452	21,6%	532	23,5%	617	20,9%	732	20,8%	925	22,0%
Universities	1017	65,4%	1004	64,5%	1313	62,9%	1393	61,5%	1912	64,9%	2303	65,6%	2685	63,9%
Private undergraduate programs			**1.097**	**70,5%**	**1.330**	**63,7%**	**1.478**	**65,3%**	**1.980**	**67,2%**	**2340**	**66,6%**	**2760**	**65,7%**
Technical professional					283	87,3%	297	87,4%	335	80,2%	388	81,2%	472	79,9%
Technological					298	65,9%	361	67,9%	405	65,8%	480	65,6%	598	64,6%
Universities					749	57,0%	820	58,9%	1184	61,9%	1472	63,9%	1690	62,9%
Enrollment by type of undergraduate programs *	**383.640**	**100%**	**473.747**	**100%**	**530.561**	**100%**	**552.528**	**100%**	**718.684**	**100%**	**878.174**	**100%**	**924.181**	**100%**
Technical professional	31.802	8,3%	37.918	8,0%	38.279	7,2%	32.164	5,8%	34.925	4,9%	41.639	4,7%	53.926	5,8%
Technological	40.156	10,5%	72.459	15,3%	81.231	15,3%	89.647	16,2%	92.737	12,9%	112.269	12,8%	127.928	13,8%
Universities	311.682	81,2%	363.370	76,7%	411.051	77,5%	430.717	78,0%	591.022	82,2%	724.266	82,5%	742.327	80,3%
Private enrollment by type of undergraduate programs*	**230.619**	**60,1%**	**285.227**	**60,2%**	**345.976**	**65,2%**	**359.995**	**65,2%**	**484.560**	**67,4%**	**543.930**	**61,9%**	**535.421**	**57,9%**
Technical professional			33.597	88,6%	34.331	89,7%	28.522	88,7%	29.739	85,2%	32.921	79,1%	35.103	65,1%
Technological			34.134	47,1%	47.023	57,9%	48.834	54,5%	57.217	61,7%	54.636	48,7%	51.694	40,4%
Universities			217.496	59,9%	264.622	64,4%	282.639	65,6%	397.604	67,3%	456.373	63,0%	448.624	60,4%

Source: ICFES, Estadísticas de la Educación Superior

** In column 1989 total enrolment correspond to 1990*

Appendix 3. Sample descriptive statistics

		Parental education level				Total
		No education	Low	Intermediate	High	
ECV 1997	Number of observations	405	1,908	509	120	**2,942**
	Per cent in sample	13,8	64,9	17,3	4,1	**100,0**
	Per cent with HE degree	0.4	4.2	12.5	36.7	**7.4**
	Per cent with degree or HE student	1.8	10.5	33.9	81.6	**18.6**
	Per cent with university degree	0.0	1.3	6.5	26.8	**3.8**
	Per cent with university degree or university student	1.4	7.7	27.9	71.7	**15.0**
ECV 2003	Number of observations	516	2,645	1,028	528	**4,717**
	Per cent in sample	10,9	56,1	21,8	11,2	**100,0**
	Per cent with HE degree	2.1	5.9	19.8	38.9	**11.9**
	Per cent with HE degree or HE student	2.9	12.2	36.1	76.5	**23.0**
	Per cent with university degree	1.1	2.0	10.8	26.4	**6.3**
	Per cent with university degree or university student	1.8	6.9	24.6	62.2	**15.8**

Appendix 4. Migration statistics

	Has migrated anytime	Has migrated to another department	Migrated after he/she was 18 years old
Cohort pre-reform	48 .0	20 .4	25 .9
Cohort post-reform	48 .8	21 .7	28 .1
Total	48 .5	21 .1	27 .1

Appendix 5. Estimated Model[26]

Consider an individual's utility function in the form U (w,S) = ln w(S) – $h(S)$, where $h(S)$ is the cost of schooling function and w(S) is the income of an individual with schooling S. Following Card, the marginal cost of schooling is written as $h'(S) = r_{ijk} + \boldsymbol{\phi} S$. Like Duflo, returns to schooling are assumed linear[27]:

$$y_{ijk} = \ln w_{ijk} = a_{ijk} + b_{ijk} S \quad (1)$$

where y_{ijk} is the logarithm of the wage of an individual i, born in region j, in cohort k. As individuals maximize expected utility, the optimal choice schooling implies:

$$S_{ijk} = \frac{E_k b_{ijk} - r_{jk}}{\phi} \quad (2)$$

[26] Based on Duflo (2001), p. 10 – 14.

[27] Card (1995) assumes concave returns, but Duflo abstracts this to focus on the most important assumptions underlying the identification strategy in this context.

where $E_k b_{ijk}$ denotes the expectation of future returns to education at a time when the individual makes his schooling decision, i.e, when he decides whether to enrol in higher education or not. In this model, schooling choices vary across individuals for two reasons: because individuals have different returns to schooling (i.e variation in b_{ijk}); and because individuals have higher or lower marginal rates of substitution between schooling and future earnings (i.e variation in r_{ijk}). Variation in b_{ijk} corresponds, loosely, to variation in "ability" whereas variation in r_{ijk} corresponds to variation in "access to funds" (family wealth) or in tastes for education (Card, 1994, 12). Heterogeneity is modelled additively: $b_{ijk} = b_{jk} + v_i$ and $r_{ijk} = r_{jk} + \omega_i$ where b_{jk} is the average returns to education for cohort k, in region j, and v_i is the individual deviation from the regional average. In the same way, r_{jk} is the average cost and ω_i is the individual deviation from regional average.

In order to capture the most important modifications induced by the expansion of the higher education supply, the cost of education at regional level is modelled as a linear function of the number of higher education institution (or the number of degree programs) per capita (Z_{jk}) and other regional characteristics not affected by this expansion (μ_{jk}):

$$r_{jk} = \alpha_1 Z_{jk} + \mu_{jk} \qquad (3)$$

Returns to education are in turn affected by the quality of education and the supply and demand for skills in the labour market. As in Duflo, they are expressed as a linear function of the average education in the region (S_j), the average education in the country ($\bar{\boldsymbol{S}}$), the quality of the schooling in the region at the time people received their education (q_{jk}), and regional economic conditions which will determine the demand for skills in the region (v_j):

$$b_{jk} = 2\beta_1 S_j + 2\beta_2 \bar{S} + \beta_3 q_{jk} + \upsilon_j \qquad (4)$$

The higher education expansion directly affected the cost of education and indirectly its returns, due to potential changes in education quality and to general equilibrium effects of an increase in educational level on the price of skills. Assume that the generation educated before the expansion did not anticipate it when choosing their education level ($E_0 Z_{jk} = Z_{j0}$ and $E_0 q_{jk} = q_{j0}$), then the increase in average education caused a reduction in actual returns to education of everybody in the labour market (equation 4), but it only affected the expected returns of the cohorts exposed to the expansion. Consider the average education of the old cohort, not exposed to the increase in higher education in the 1990's, denoted 0, and the younger cohort that enrolled in higher education after 1992, denoted k. Assuming (to simplify notation) that there are only two cohorts and that they have the same size[28], it can be computed for the expressions of these averages implied by the rational expectation equilibrium of this model. The difference between these two averages takes the following form:

$$S_{jk} - S_{j0} = \pi_0 + \pi_1\left(Z_{jk} - Z_{j0}\right) + \pi_2(q_{jk} - q_{jo}) + \xi_j \qquad (5)$$

Where π_0 is a constant term that incorporates the changes in the expected average education in the country, $\pi_1 = -\frac{\alpha_1}{\phi - \beta_1}$, $\pi_2 = \frac{\beta_3}{\phi - \beta_1}$, and ξ_j reflects changes in all other factors affecting returns and cost of education.

[28] This implies that $S_j = ½ (S_{j0} + S_{jk})$. Extending the model to several cohorts and different size is easy but makes notation unwieldy.

The increase in the higher education supply available between the younger cohort and the oldest cohort in the sample $\left(Z_{jk} - Z_{j0}\right)$ is a function of the change in the total number of new higher education institutions or degree programs per capita in the region, (denoted $\Delta SUPPLY_j$ above) and the exposure of this cohort to the expansion e_k, (denoted *post*) which is equal to 0 for non-exposed cohorts, and 1 for fully exposed cohort. The quality of education is not directly observed. The possibility that the expansion affected the diversity and quality of education can be captured by writing the change in quality as: $q_{jk} - q_{j0} = e_k(\lambda Z_{jk} - Z_{j0} + \rho_j)$. Therefore, the previous expression can be written as:

$$S_{jk} - S_{j0} = \pi_0 + e_k(\pi_1 + \lambda)Z_{jk} - Z_{j0} + \xi'_j \qquad (6)$$

Perception of Corruption and Public Support for Redistribution in Latin America

Mónica Oviedo*

Abstract

This paper studies the relationship between people's beliefs about the quality of their institutions, as measured by corruption perceptions, and preferences for redistribution. Perceived corruption shapes individuals' preferences for redistribution in three different manners. On the one hand, it undermines trust in government, which in turn reduces people's support for redistribution. On the other hand, given that corruption subverts equality of opportunity, both an opportunistic desire to capture rents from government intervention and a demand for fairness may increase people's support for redistribution. Thus, the effect of perceived corruption on redistribution cannot be signed a priori. Our novel empirical findings for Latin America suggest that perceiving corruption in the public sector as a widespread problem increases people's support for redistribution. We provide preliminary evidence about the importance of each of these three channels in explaining the positive relationship between perceived corruption and support for redistribution.

JEL: D31, D63, H1, H2, P16
KEYWORDS: Preference for redistribution, perception of corruption, political trust, fairness, rent-seeking, Latin America.

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1. Introduction

Political support for redistribution from the rich to the poor is a cornerstone in the design and functioning of the social contract and the stability of welfare systems. Redistributive policies are designed and executed by public officials in charge not only of handling a substantial amount of resources, but also of ensuring that these policies are impartially, effectively and efficiently implemented. However, where corruption in the public sector is widespread, welfare states are not efficient and well-functioning. Moreover, corruption may distort the redistributive role of government by mis-targeting redistributive programs or favouring special interests (Tanzi and Davoodi, 1997; Mauro, 1998; Rose-Ackerman, 1999; Gupta, Davoodi, and Tiongson, 2002, Bird et al., 2008). This paper examines whether corruption, as perceived by citizens, affects their willingness to support public policy aimed at reducing inequality.

Recent influential theoretical models and vast empirical evidence show that besides material conditions, values and beliefs greatly matter to shape attitudes towards redistribution and to explain cross country differences in the size and generosity of welfare states (Piketty, 1995, Alesina and Angeletos 2005b, Bénabou and Tirole 2006, Aghion *et al.* 2010). This literature has emphasized primarily on beliefs concerning individual prospects of social mobility and normative judgments regarding the sources of income inequality. Less attention has been paid, however, to the role of the perceived quality of the institutional environment, especially the perceived level of corruption.

Besides having pernicious consequences on public support for incumbent governments, and hurting support for democratic institutions (Della Porta, 2000, Seligson 2002, Canache and Allison 2003, Booth and Seligson 2009), corruption perceptions may also be important to understand differences in support for redistribution for at least three reasons. First, perceiving high levels of corruption may affect people's trust in public officials' willingness or ability to redistribute in an effective and impartial way, which may reduce support for redistribution (Robinson 2008, Kuziemko *et al.* 2013). Second, greater redistribution by a corrupt government may create further opportunities to those who are able to benefit from corruption, who will thus favour redistribution (Alesina and Angeletos 2005b). And third, corruption generates not only more inequality but also more unfairness, and a stronger desire for redistribution (Alesina and Angeletos 2005b). Since the first effect reduces support for redistribution but the last two are likely to increase it, the net impact of the perception of corruption on support for redistribution cannot be signed a priori.

We estimate the effect of perceptions of corruption on the probability of agreeing with state's intervention to reduce economic inequality, and explore the three pathways outlined above that may mediate this effect. As the causal link between beliefs and preferences runs in both directions —beliefs not only shape public policies, but are also influenced by policies and institutional environment—, the concern for potential endogeneity of perceptions of corruption is addressed through a simultaneous equation model using the level of bribery victimization as exclusion restriction.

Our empirical analysis employs data from the AmericasBarometer survey for 18 countries in Latin America, a region featuring very high and persistent inequality levels (World Bank 2006; Goñi et al. 2008; OECD 2009) and weak institutions with high levels of corruption (Transparency International 2009, Kaufmann et al. 2009), where redistributive policies are not effective at reducing economic disparities. As Alesina and Angeletos (2005b) point out, such bad equilibrium may result from corrupt governments receiving support from a coalition of those who benefit from high redistribution because they are in need, and those who are hurt by taxation but are close to the levers of power. Latin America is thus an especially appropriate region to examine the consequences of corruption for support for redistribution, and our findings may be informative for countries in similar regions such as Asia or Africa.

Our empirical results suggest that perceived corruption enhances support for redistributive policies. That is, rent seeking motives and fairness concerns seem to outweigh the effect of undermined trust in government and political institutions brought about by increased corruption. This conclusion is robust to different modelling options and various measures of support for redistribution.

We contribute to the literature in three ways. First, we provide new empirical evidence to the discussion of determinants of support for redistribution, emphasising the relevance of the perceived quality of the institutional framework in general, and perceptions of corruption and trust in government institutions in particular, an issue that has received little attention. Second, we address the potential endogeneity of perceptions of corruption using data on corruption victimization as exclusion restriction. Our approach to the endogeneity of perceptions of corruption differ from other studies, such as Di Tella and McCulloch (2006, 2009), who study the effect of corruption on market regulation and defend the exogeneity of these perceptions using anger as a proxy to perceived corruption. Finally, we also present novel empirical evidence from Latin America, a region where examining the link between corruption and support for redistributive policies is especially

pertinent, as it displays high levels of inequality, widespread corruption, and low levels of redistribution.[29]

The remainder of this paper is organized as follows. In Section 2 we present a brief summary of the literature on the relationship between perception of corruption and support for redistribution and the main hypotheses to be tested. A description of the data and some preliminary evidence is presented in Section 3, while the empirical strategy is explained in Section 4. Results are presented in Section 5, while Section 6 presents some robustness checks. The last section concludes and offers a discussion of further research.

2. Beliefs, perceptions of corruption and support for redistribution

Within the tradition of the median voter hypothesis, the extent of redistribution of income would be determined by the interest of the median-income voter, with individuals in the upper half of the income distribution supporting less redistribution and individuals in the bottom half supporting more (Meltzer and Richards 1981). In this model, the demand for redistribution reflects a balance between the disincentives generated by higher taxes (the cost of redistribution) and the medium and low classes' gains (the expected benefits). Under appropriate assumptions, it follows that the lower the median relative to the mean income, the more the median income person is likely to vote for redistribution. Consequently, more inequality is expected to lead to greater redistributive pressures.

Nevertheless, empirical evidence fails to support such prediction (Bénabou 1996, Perotti 1996, Rodríguez 1999). Neither the most unequal countries redistribute more, nor are the poor always in favour of redistribution. Over the last two decades, a large and influential literature has explained such failure arguing that, under imperfect information, agents with different beliefs will support different amounts of redistribution regardless of their level of income. Different sets of beliefs concerning the role of personal effort in potential or actual earnings capacity will lead to different societies to converge and remain in equilibria with dissimilar results in terms of inequality and redistribution. According to this literature, these beliefs are revealed, for instance, in individual prospects of upward mobility (Piketty 1995, Bénabou and Ok 2001, Alesina and La Ferrara 2005) and judgments about fairness of the observed income distribution (Fong 2001, Corneo and Gruner, 2002; Alesina and Angeletos, 2005a; Bénabou and Tirole, 2006).

[29] Significant empirical contributions, such as Gaviria (2008), Ardanaz (2009), Cramer and Kaufman (2009), Morgan and Kelly (2010) and Daude and Melguizo (2010), address the determinants of attitudes toward inequality and demand for redistribution using data for Latin America. Nevertheless, none of these studies addresses explicitly the consequences of perceived corruption.

These models explain how two different equilibria might arise: one with low taxes and low redistribution when the majority believe that the income-generating process is fair because effort is important, and another with high taxes and high redistribution when the majoritarian belief is that the process is unfair because luck or connections prevail[30]. In such models, multiple equilibria in the level of redistribution may be due to distortions in beliefs. That is, people can either make wrong judgments about the sources of inequality and the true role of effort in determining income levels (Piketty 1995), or find it optimal to deliberately bias their own perception of the truth (Bénabou and Tirole 2006).

However, multiple equilibria are possible not only because of distortions in beliefs, but also because of distortions in the institutional framework, which ultimately influences the functioning of the market where such beliefs are formed. In particular, extensive corruption, which is broadly referred to in the literature as "the abuse of public office for private gain" (Tanzi 1995, Kauffman 1997), has the potential to influence both, the actual distribution and individuals' attitudes towards redistribution.

Some studies show how corruption affects income distribution and distorts the redistributive role of government by different channels. For instance, corruption can substantially influence public expenditure and adversely affect the provision of publicly provided social services. Dishonest politicians may increase the government expenditure that is easier to collect bribes from and decrease the expenditure which provides fewer bribery opportunities, yielding a reduction in the level of social services available to the poor[31] (Tanzi and Davoodi 1997; Mauro 1998; Rose-Ackerman, 1999; Gupta, Davoodi, and Tiongson 2002). Furthermore, corruption also affects government revenues, which are the main source of public expenditure, by fostering both tax evasion and exemptions generally favouring the wealthy and well-connected, making the tax system less progressive (Tanzi and Davoodi 1997, Bird et al. 2008).

In addition, individual attitudes towards redistribution may be also affected by corruption, as perceived by people[32], through different channels. On the one hand, if perceiving a high level of corruption entails distrust in government, it may reduce people's

[30] These models would explain why social spending is relatively low in the United States, where a high percentage of the population attributes unequal outcomes to differences in effort and skill, while social spending is higher in continental Europe, where a much larger percentage of the population attributes income differences to luck or fate (Alesina et al. 2001, Fong 2001, Corneo and Gruner 2002).

[31] For example, corrupt officials tend to choose goods whose exact value is difficult to monitor (for instance, large infrastructure projects, military expenditure), while they significantly reduce government spending on education beacuase this sector does not provide as many lucrative opportunities for corruption compared to other spending components.

[32] Given the nature of corruption and the difficulty to measure it precisely, to some extent what matters in terms of public support for government policy is how it is perceived by citizens rather than the "actual" level of corruption.

willingness to support redistribution compared to a situation in which people find their government and political institutions to be honest and trustworthy. On the other hand, corruption not only distorts redistributive policy, perhaps reducing its effectiveness and increasing inequality, but also makes existing inequality to be considered more unfair. Furthermore, greater redistribution can expand opportunities for those who are most able to benefit from corruption. Thus, people perceiving a high level of corruption will demand more government intervention either because they want to reduce unfair inequality or because they seek to capture more benefits from a large corrupt government.

Corruption and distrust in government: a negative effect

Besides distorting redistributive policy, corruption erodes the rule of law and people's trust in government and political institutions (Rose-Ackerman 1999, Della Porta, 2000, Seligson 2002, Canache and Allison 2003, Booth and Seligson 2009). Where corruption is a widespread problem, government and public officials may be perceived as tailoring rights and regulations that will benefit those who pay for them, and perhaps incapable or unwilling to implement effective and fair policies. Such perceptions might undermine political support for redistributive policies, even in the presence of great levels of inequality. Citizens may be reluctant to support state intervention because a larger state could imply more room for corruption. A good example has been provided by the literature on tax morale. When corruption proliferates, citizens perceive that their interests are not properly represented in political institutions, perceive a low government efficacy, and thus have a low incentive to contribute (Bird et al. 2008, Togler 2005a, 2005b). By contrast, Algan et al. (2011), using the European Social Survey and the World Values Survey, have found that trust in the parliament, in politicians, in the legal system and in the efficiency and the equity of the tax authorities are positively associated with support for the welfare state.

Thus, perceiving high levels of corruption is expected to have a negative effect on support for redistribution as it is related with low levels of trust in government institutions. This would help explain why there are countries with high levels of pre-tax inequality but low levels of redistribution. As argued by Robinson (2008: 22), in countries with bad institutions, which tend to have high inequality, tax revenue is likely to be wasted in corruption or diverted by elites, and this will reduce demand for redistribution, even by poor people, at any level of inequality. An interesting example is given by Kuziemko et. al. (2013), who analyse the case of the United States, where despite the recent sharp increase

in inequality, there has been a decrease in stated support for redistribution. Using random survey experiments, these authors suggest that respondents perceive high inequality as evidence of government's limited ability to redistribute effectively, and, therefore, distrust in government inhibits respondents from translating concern for inequality into support for redistribution[33].

Corruption, fairness and opportunistic behaviour

Alesina and Angeletos (2005b) provide a different perspective to understand the role of perceived corruption in shaping public support for redistribution. Based on the basic redistribution model presented in Alesina and Angeletos (2005a), the authors develop a new dynamic model to show that a positive complementarity from past to current levels of redistribution and corruption arises either when inequality originating from corruption and rent seeking is considered unfair, or when the ability to engage in corruption is unevenly distributed across the population[34]. Such complementarity introduces multiple equilibria, and explains the persistence in the size of the government and the levels of corruption and inequality.

According to this approach, under the assumption that larger governments increase the scope of corruption, a history of large governments and extensive corruption implies that wealth distribution is rather "unfair" in the present, which in turn implies stronger support for redistribution for any given level of inequality. Two different sorts of attitudes would explain this association: fairness concerns and self-interest.

On the one hand, corruption and rent seeking are generally the outcome of connections and luck, and provide uneven benefits often resulting in an unfair distribution of the gains from public spending. In presence of high levels of corruption, people with fairness concerns will demand government intervention in order to reduce what they perceive as unfair inequality (the income-generating process is unfair because luck or connections prevail instead of effort). Therefore, at any level of inequality, an increase in the perceived corruption may induce higher demand for redistribution. An important implication is that an economy with less inequality may have more redistribution than another one with more inequality because more of that inequality is due to corruption and is thus considered unfair.

[33] In the study by Kuziemko et al. (2013) trust in government is measured through the perception that "Politicians in Washington work to enrich themselves and their largest campaign contributors, instead of working for the benefit of the majority of citizens".

[34] Corruption is added to the model by letting a fraction of government resources be up for grabs (Alesina and Angeletos, 2005b: 1230).

On the other hand, if the government is corruptible, individuals who are especially productive in rent-seeking —that is, in obtaining and maintaining wealth transfers through the power of the state (Buchanan 1980: 3-9) — may prefer a large amount of redistribution because it increases the rents they can extract from public spending. This effect is expected on the basis of two reasonable assumptions: first, that the larger the size of the government, the larger the scope for corruption; and second, that the capacity to benefit from public spending through corruption and rent-seeking activities is uneven distributed in the population. In terms of Alesina and Angeletos (2005b: 1228), "not all individuals have the same political connections, access to the bureaucracy, or moral hesitation in becoming corrupt". Then, as more redistribution can imply more government intervention and greater public expenditures, which in turn increase the probability of corruption[35], the more "able" individuals in rent seeking will support more redistribution.

Alesina and Angeletos point out that the implication of this kind of opportunistic behaviour is that a large corrupt government may obtain support from a sort of coalition of those who benefit from high redistribution because they are in need, and those who are hurt by taxation but are close to the levers of power. Moreover, they suggest that this is the case of various populist regimes in Latin America (2005b: 1240-1241).

Research question and testable hypotheses

The objective of this paper is to analyse the relationship between perceived corruption and public support for redistribution. In particular, the question is whether perceiving corruption among public officers discourages or, on the contrary, increases individual likelihood of favouring inequality-reducing policies. The above discussion outlines the potential effects to be expected and the main hypotheses that we will test in the empirical section. First, that a high level of perceived corruption makes people less willing to support redistribution compared to a situation in which people find their government and political institutions to be honest and trustworthy. Second, as the belief of a high level of corruption may introduce either distributional concerns or expectations of obtaining personal gains through rent-seeking, the alternative hypothesis is that believing that corruption in public sector is widespread increases the probability of supporting redistribution, at any level of inequality. Thus, the net effect of perceived corruption on

[35] At the same time, widespread corruption gives greater incentives for both public officials and private actors with better connections to engage in corruption because the expected cost of corrupt behaviour, including the probability of being detected and punished, tends to decrease as corruption spreads (Rose Ackerman, 1999).

public support for redistribution will depend on which one of the two is the dominant effect.

We would like to identify and quantify the magnitude of each of these three effects. However, data limitations prevent us from unravelling the contribution of each of these three effects to the net impact of perceived corruption on preferences for redistribution. Nonetheless, we provide preliminary and suggestive evidence of the importance of each of these mechanisms in Section 6.

3. Data

To analyse empirically the relationship between perceptions of corruption and public support for redistribution, we use data for 18 countries[36] from the 2008, 2010 and 2012 rounds of the AmericasBarometer, a survey carried out by the Latin American Public Opinion Project (LAPOP), supported by the United States Agency for International Development, the United Nations Development Program, the Inter-American Development Bank, and Vanderbilt University. In 2004, LAPOP established the AmericasBarometer as face-to-face regularly conducted surveys of democratic values and citizens' behaviours, with a principal focus on Latin American democracies.

AmericasBarometer surveys use a common design for the construction of a multi-staged, stratified probabilistic sample of approximately 1,500 individuals in each country per year, and stratified by major regions of the country and by urban and rural areas within municipalities. For the sample of 18 countries used in this paper, the pooled cross-section database counts 90,861 observations of individuals over 18 years of age[37]. Due to the definition of some variables, the presence of missing values in some explanatory variables, and the definition of the exclusion restriction[38], the sample used in all estimations described below is reduced to 76,246 observations, which accounts for the 84 per cent of the initial sample.

Across countries, sample sizes range from 990 in Paraguay in 2012, to 2,804 in Ecuador in 2010. For that reason, following LAPOP methodological guidelines, we reweight the sample so that each country/year sample accounts for 1,500 observations.

[36] Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Bolivia, Peru, Paraguay, Chile, Uruguay, Brazil, Venezuela, Argentina and Dominican Republic.

[37] 29,934 observations in 2008, 31,671 in 2010 and 29,256 in 2012.

[38] "Doesn't know" answers and non-responses are tried as missing values. In addition, in order to build the exclusion restriction used in section 4, we limit the sample only to provinces with more than 30 observations in each of the observed years.

This way, every country has the same impact on the overall sample as any other country[39]. We prefer not to reweight by population size, because in this case Brazilians and Mexicans would explain most of the variance of preferences in the region. Sample details can be found in Table A2 in the Appendix A.

Support for redistribution Different questions have been used in the literature in order to elicit individual preferences for redistribution. Most of these questions ask explicitly for respondent's support to the role of government in reducing income inequality. This type of questions do not spell out the mechanisms through which redistribution can be accomplished (higher taxes, more progressive taxes, greater government spending), but they provide an adequate measure for the preferences for political redistribution, as traditionally used in the empirical literature (Corneo and Gruner, 2002, Alesina and Giuliano 2009).

In particular, we use the following question from the AmericasBarometer[40]: "*The government should implement strong policies to reduce income inequality between the rich and the poor. To what extent do you agree or disagree with this statement?"* Possible responses range from 1 to 7, where '1' means "strongly disagree" and '7' means "strongly agree", so higher values indicate increasing support for redistribution. Average responses do not vary much across countries, but as Figure 2 shows, a greater variance is observed in the percentage of people strongly in favour of redistribution. Strong support for reducing inequality ranges from 31 per cent in Venezuela and Bolivia to 64 per cent in Paraguay. However, the distribution of the level of agreement with the statement within each country is clearly negatively skewed as most of the respondents express the highest levels of agreement —see Figure 3. For this reason, and for convenience in the interpretation of results, we focus our analysis on individuals expressing strong agreement with redistribution. The dependent variable is thus built as a binary variable taking value 1 if the individual reports strong agreement with redistribution (*i.e.* her response is 7), and 0 otherwise.

Perception of corruption To measure perception of corruption, we use a dummy variable that equals one if respondents answered "very common" to the following question*: "Taking into account your own experience or what you have heard, corruption among public*

[39] For more details about survey design and weighting scheme see: http://www.vanderbilt.edu/lapop/survey-designs.php

[40] In the Spanish-language version of the questionnaire, the word "el estado" (the State) is used since the term "el gobierno" (the government) refers to the incumbent administration rather than the state apparatus: " *El Estado debe implementar políticas firmes para reducir la desigualdad de ingresos entre ricos y pobres"*.

officials is very common, common, uncommon, or very uncommon?". On average, 44 per cent of respondents report corruption among public officials to be a very common problem in their country, 36 per cent believe it is common, nearly 16 per cent regard it as uncommon, and only 4 per cent think corruption is very uncommon. The country with the lowest percentage of respondents holding the belief that corruption is a very common problem is Uruguay (23 per cent), followed by Chile (27), whilst more than 54 per cent hold this perception in the Dominican Republic and Argentina (see Table 1 and Figure 2).

An important caveat regarding the variable measuring perception of corruption is in order. Corruption is an expression that evokes a variety of actions. When respondents are asked about "corruption", they may have in mind bribery, dishonesty, failure to implement policies or programs, poor quality administration, or something else[41]. The question used in this paper makes no sharp distinction between petty and grand corruption. Moreover, it puts emphasis on both people's experience and information they have "heard", which may condition individuals' answers. Therefore respondents may have in mind both own, friends', or relatives' experiences with public officials in common situations and well-known cases of grand corruption when answering the question.

In addition, as can be seen from Figure 4, there is only a moderate correlation between the percentage of people regarding corruption as a very common problem and the most often used measures of perception of corruption at aggregate level, the Corruption Perceptions Index (CPI) by International Transparency Organization (0.66) and the Control of Corruption Index by the World Bank (0.68), which rely mainly on experts' perceptions. The correlation becomes even less strong when the cases of Chile and Uruguay, which show a low level of corruption according to both individuals' perceptions and experts' opinions, are excluded from the sample. It is remarkable, for instance, that a country with a relatively low CPI index, like Costa Rica, shows higher levels of perception of corruption measured at individual level from the AmericasBarometer (44 per cent for the whole sample, 52 per cent in 2010) than other countries with a considerably greater CPI index, such as Nicaragua, Brazil or Venezuela, to mention but a few.

These differences might be due not only to methodological differences across these measures, but also to the fact that only a minority of people actually interact with public officers and probably their perceptions are more related to the intensity of media coverage of important cases of corruption. However, it is worth noting that the "accuracy" of

[41] Different interpretations of corruption may be determined by cultural characteristics. Nonetheless, comparisons between countries that belong to the same geographic region and share similar cultural roots should be meaningful enough.

perceptions of corruption regarding "true" levels of corruption is not a concern for us, for two reasons. First, because there is no reliable and homogeneous way to measure the "true" level of corruption in a country, so it is impossible to know to what extent individual perceptions differ from reality. And second, because what matters is that people's preferences (and presumably their choices) depend on their beliefs, regardless of whether individuals' judgments of reality are accurate or not.

Control variables Other individual and country level variables that previous studies have found relevant to understand differences in attitudes towards redistribution are used as controls (Alesina and Giuliano 2009). At individual level we include gender, age, ethnic identification, religion, having children, years of education, labour status, whether the respondent is exposed to political news on a daily basis, and the level of wealth.

Regarding the latter, there are two alternatives to capture differences in income and wealth from LAPOP survey data. The first option is the income range reported by respondents which, according to the questionnaire design, represents the household total monthly income, including remittances from abroad and the income of all the working adults and children. However, we decided not to consider this measure in the final specifications not only because there is a lot of non-response in this variable, but also because the scale used in the 2012 wave is not comparable with the scale used in previous waves. The second alternative is to use data of assets ownership. We built a linear wealth index by country and year using principal-components analysis to derive weights[42]. This method provides a simple technique for creating a long-run household wealth proxy in the absence of either income or expenditure reliable data. Table A4 in the appendix A shows variations by quintile of the wealth index across income deciles in the 2008 and 2010 waves. In line with other studies (Filmer and Pritchett 2001, Gasparini *et al.* 2008), we find a correlation of 0.5 between the decile of self-reported income and the wealth index.[43] This moderate correlation is driven not only by income measurement errors,[44] but also by the

[42] We follow Filmer and Pritchett (2001). As a robustness check we compare the quantiles obtained from this method with those that result from polychoric principal components (Kolenikov and Angeles 2009), and find that both methods yield very similar results — 98 per cent of the quantiles are the same. Table A1 in the appendix lists the variables included.

[43] Filmer and Pritchett (2001), for instance, find correlation coefficients between the asset index and expenditures between 0.43 and 0.64 for developing countries. Gasparini et al. (2008), using data for Latin America and the Caribbean from the Gallup World Poll of 2006, construct an indicator of deprivation based on a multidimensional non-monetary index by taking into account information on durable goods and access to some facilities (water, electricity, telephone, etc.), and find a correlation between this index and self-reported household income to be 0.46.

[44] Measurement error arises, for instance, from large non-response rates, from income being usually reported in brackets (leading to just a rough measure of income), and because the questionnaire may be answered by a household member, who is not necessarily the one who knows her household income better.

fact that asset-based measures reflect the long term economic status of individuals or households and, therefore, do not necessarily take into account fluctuations in the short term income.

As stated in the previous section, the literature has emphasized the role of beliefs regarding the justice of the income distribution, expectations of upward mobility, subjective evaluations of own economic position, and ideology among others. In spite of this, we avoid including subjective variables as controls to avoid additional sources of endogeneity, possible at the cost of setting aside measuring important determinants, such as upward mobility prospects. Likewise, we prefer not to include ideology, as traditionally measured in the left-right scale. Previous evidence indicates ideology is not statistically significant to explain individual's position regarding inequality in Latin America[45] (Ardanaz 2009, Morgan and Kelly 2010). Perhaps this is not surprising given the wide differences in the meaning and traditions of ideological cleavages between and within Latin American countries (Colomer 2005). Indeed, almost 20 per cent of the respondents were unable to place themselves on this scale.

At aggregated level, besides the level of inequality, other variables have been found to explain differences across countries, such as the level of poverty, unemployment and the size of the welfare state (proxied in this case by the size of the social public expenditure), which we include as additional controls. In particular, we use the Gini coefficient (and the income share ratio between the top and the bottom quintiles of the income distribution, in some robustness checks), the national poverty rate, the national rate of unemployment, and the social expenditure as percentage of the GDP. To avoid potential problems of endogeneity, we used these indicators lagged one or two years with respect to the survey year. Since the data for some countries are not updated on a yearly basis, we use the last available figure prior to the date of the survey. The main source of all these data is CEPALSTAT, the website of statistical information by the Economic Commission for Latin America and the Caribbean (ECLAC). Summary statistics of all the variables is available in Table A3 in the Appendix A.

[45] When we include ideology in our estimations we do find a significant effect which shows that right-wing individuals express less support for the welfare state. However, its inclusion does not change the results regarding perceived corruption.

4. Empirical strategy

In order to evaluate the overall effect of perceptions of corruption on popular support for redistribution, we first estimate a simple reduced form of individual preferences for redistribution, which are modelled by a latent variable y_i^* as follows:

$$y_i^* = c_i\gamma + x_i\beta + \varepsilon_i \quad (1)$$

where y_i^* stands for the individual support for redistribution and c_i is a variable capturing the individuals' perception of corruption, that is, his or her belief of how widespread corruption among public officials is; x_i denotes a vector of both individual characteristics (such as age, gender, level of wealth, occupation, etc.) and country level characteristics that affect directly the individual likelihood of favouring redistribution[46]; and ε_i is the error term assumed to be independent of regressors x_i and c_i. The vectors β and γ are parameters to be estimated. The parameter γ expresses the correlation between the perceived level of corruption and the probability of favouring redistributive policy.

The variable y_i^* is not observed. Instead we observe a variable y_i that equals 1 if individual strongly favours redistribution, and 0 otherwise. Assuming a normal distributed error term, y_i is estimated using a probit regression model. The observed binary y_i and the latent variable y_i^* are related as follows:

$$y_i = \begin{cases} 1 & if \ y_i^* > 0 \\ 0 & if \ y_i^* \leq 0 \end{cases} .$$

For a given value of the set of dependent variables x_i, we have

$$P(y_i = 1 \mid x_i, c_i) = P(\varepsilon_i < c_i\gamma + x_i\beta) = \Phi(c_i\gamma + x_i\beta),$$

where Φ is the cumulative density function for the standard normal distribution. The estimation of the parameters is performed by maximizing the log likelihood:

$$\ln \mathcal{L}(\beta, \gamma) = \sum_{i=1}^{n} [y_i ln\, \Phi(c_i\gamma + x_i\beta) + (1 - y_i) \ln(1 - \Phi(c_i\gamma + x_i\beta))].$$

We must be cautious, however, in interpreting the results in terms of causality, as observed relationships may only reflect co-variation driven by third, omitted variables, which capture unobservable differences between citizens. It is possible that the same unobserved factors influencing the propensity to advocate greater redistribution are generating endogenous variation in the level of perceived corruption and thus either overstate or understate the impact that perceptions of corruption has on attitudes towards redistribution. For instance, perceptions of corruption depend on how a society

[46] For simplicity, we omit here country subscript.

understands the rules and what constitutes a deviation (Melgar et al. 2009), which in turn depends on unobserved personal characteristics (values and moral views, aversion to inequality, for instance) that may also affect views on inequality. In a related work, Di Tella and McCulloch (2006, 2009) acknowledge that a positive effect of perception of corruption on demand for regulation, for instance, might simply identify a fixed trait of left-wing citizens, namely a greater tendency to regard corruption as a pervasive phenomenon, or less tolerance with corruption than right-wingers. Therefore, the validity of the conclusions on the sign of γ depends on a proper treatment of the potential endogeneity problem.

In linear models with an endogenous right-hand side variable instrumental variables techniques are a common solution. However, in non-linear models this procedure is no longer directly applicable because this sort of models is not invertible and there is no expression of the error term[47] (Arellano, 2007). A way of addressing endogeneity is the use of simultaneous bivariate models which imply the estimation of the joint probability distribution of two or more variables in a simultaneous specification (Wooldridge, 2010). Specifically, we use a recursive bivariate probit model (Greene and Hensher, 2009), an extension of the univariate probit regression model, where the disturbances of the two equations are assumed to be correlated. The recursive version of the bivariate probit allows us to estimate the effect of interest while accounting for unobserved confounders. The general specification is as follows:

$$y_i^* = x_{1i}\beta_1 + c_i\gamma + \varepsilon_{1i} \qquad y_i = 1\ if\ y_i^* > 0,\ 0\ otherwise \qquad (2a)$$

$$c_i^* = x_{2i}\beta_2 + \varepsilon_{2i} \qquad c_i = 1\ if\ c_i^* > 0,\ 0\ otherwise \qquad (2b)$$

where c_i^* and y_i^* are continuous latent variables which determine the observed binary outcomes y_i, c_i, which equal 1 if the corresponding latent variable is greater than a given threshold. x_{1i} and x_{2i} are vector of variables explaining perceptions of corruption and attitudes towards redistribution respectively, while β_1 and β_2 are vectors of unknown parameters. The parameter γ is an unknown scalar, and it is again the main parameter of interest, which can be understood as the average treatment effect of perceiving a high level of corruption. Finally, ε_{1i} and ε_{2i} are error terms that are independent of x_{1i} and x_{2i} but not necessarily independent of each other. In other words, the explanatory variables in the model satisfy the conditions of exogeneity such that $E[x_{1i}\varepsilon_{1i}] = 0$ and $E[x_{2i}\varepsilon_{2i}] = 0$, but the error terms ε_{1i} and ε_{2i} are assumed to be distributed as bivariate standard normal with correlation ρ, this is: $F(\varepsilon_{1i}, \varepsilon_{2i}) = \Phi_2(\varepsilon_{1i}, \varepsilon_{2i}, \rho)$, where Φ_2 denotes the cumulative

[47] As in any latent variable model, in this setting y^* is not observed, only y_i is. The "residual" would have no meaning even if the true parameters were known. As a robustness check we provide OLS and IV estimates of a "linearized" version of the categorical dependent variables (see Section 7.2).

density function of the bivariate standard normal distribution. The joint distribution of c_i and y_i (conditional on x_{1i} and x_{2i}) has four elements:

$$P_{11} = P(y_i = 1, c_i = 1 \mid x_{i1,} x_{i2,}) = \Phi_2(x_{1i}\beta_1 + c_i\gamma,\ x_{2i}\beta_2, \rho)$$
$$P_{10} = P(y_i = 1, c_i = 0 \mid x_{i1,} x_{i2,}) = \Phi_2(x_{1i}\beta_1, -x_{2i}\beta_2, -\rho)$$
$$P_{01} = P(y_i = 0, c_i = 1 \mid x_{i1,} x_{i2,}) = \Phi_2(-x_{1i}\beta_1 - c_i\gamma,\ x_{2i}\beta_2, -\rho)$$
$$P_{00} = P(y_i = 0, c_i = 0 \mid x_{i1,} x_{i2,}) = \Phi_2(-x_{1i}\beta_1,\ -x_{2i}\beta_2,\ \rho)$$

Thus, estimation of the parameters is performed by maximizing the log likelihood:

$$\ln \mathcal{L}(\beta_1, \beta_2, \gamma; \rho) = \sum_{i=1}^{n} \left[\begin{matrix} y_i c_i \ln(P_{11}) + (1 - y_i) c_i \ln(P_{01}) + y_i(1 - c_i)\ln(P_{10}) \\ +(1 - y_i)(1 - c_{i)} \ln(P_{00}) \end{matrix} \right]$$

The recursive bivariate probit model introduces two sources of dependence between c_i and y_i, related to the parameters γ and ρ, respectively. While the joint model simplifies to two univariate probit equations under independence of the structural errors ($\rho = 0$), this does not mean that c_i and y_i are independent because the first probit equation of the recursive base model gives the probability of y_i conditional on c_i. Therefore, full independence of c_i and y_i would require $\rho = 0$ and $\gamma = 0$ (Winkelmann 2011: 4).

In this setting, the exogeneity condition is stated in terms of the correlation coefficient; the variable c_i is endogenous when $corr(\varepsilon_{1i}, \varepsilon_{2i} | x_{1i}, x_{2i}) = \rho \neq 0$. On the contrary, when ρ=0, y_i and ε_{2i} are uncorrelated and therefore c_i is exogenous. Thus, the null hypothesis of interest is that ρ=0, that is, an exogeneity hypothesis. The usual parametric approaches to exogeneity testing, such as the likelihood ratio test and the 't-test' based on the maximum likelihood estimator of ρ, are suitable for endogeneity testing in this kind of models (Monfardine and Radice, 2008). Whenever the exogeneity hypothesis cannot be rejected, the model can be simplified and estimated as two separate models for each outcome of interest.

Identification strategy

The parameters in the system of equations (2a and 2b) are usually identified by imposing an exclusion restriction on vectors x_1 and x_2, i.e. at least one element of x_2 should not be present in x_1 to avoid that identification strongly relies on functional form and non-linearity. One should find at least one variable that is believed to be correlated with c_i but independent of y_i. This variable could be included only in x_2 to obtain the consistent estimates of γ, β_1 and ρ.

As exclusion restriction we use the provincial percentage of the population victimized by bribery, namely, the percentage of respondents in the same province who stated having been asked for a bribe either by a police officer or a government employee in the twelve months previous to the survey[48]. In the final sample, 10.4 per cent of respondents were asked for a bribe by a police officer, while 5.4 per cent were asked for a bribe by a government employee. In total, 12 per cent of the survey sample was victim of bribery. Countries with highest level of bribery are Bolivia, Mexico and Peru, with shares above 20 per cent, while countries at the other end are Chile (2.7), Uruguay (5.3) and Brazil (5.1) (See Table 2).

Previous evidence has revealed that social environment has a strong influence on individual attitudes towards corruption. Ceteris paribus, individuals living in regions where people are on average relatively less averse to corruption tend as well to be more forgiving of corruption (Gatti et al 2003). Likewise, it is reasonable to argue that, ceteris paribus, the prevalence of bribery in the region where the individual lives is an important determinant of his or her perception of corruption, and that such prevalence affects individual's support for redistribution only through this perception rather than directly. Living in a region where a high percentage of the population has been asked for a bribe increases the probability of considering corruption as very widespread. We use aggregate levels of bribery occurrence rather than individual victimization because individual characteristics do determine the likelihood of people being victimized by corruption[49]. We do not discard that national-level variables, particularly the GDP per capita, are also determinants of the probability of being bribed, but we are able to control for these characteristics, and we expect other non-observable characteristics to be captured by country fixed effects.

The database contains observations for 362 provinces, and there are 984 provinces/year units in total. We only consider provinces with at least 30 observations per year; therefore the number of provinces is reduced to 301, with 759 provinces/year units. Figure 5 shows the distribution of the percentage of the population reporting having faced bribery at a province level.

Next, we present the results of the probit and bivariate probit models and discuss the issue of endogeneity of perceived corruption. Since the endogeneity tests cannot reject the

[48] The wording of each question is: "Has a police officer ask you for a bribe during the past year?", "During the past year, did any government employee ask you for a bribe?" The latter question includes several specific situations: at the respondent's workplace, or in the courts, or in public health services, or at school.

[49] Individuals who are wealthier, highly educated, and living in bigger cities are more likely to be asked for a bribe. On the other hand, women and older people are less likely to be victims of bribery.

exogeneity of the perceptions of corruption, we employ simple probit models to explore the three mechanisms that may explain the relationship between perception of corruption and support for redistribution.

5. Empirical results

5.1 Effect of perceived corruption on support for redistribution

Columns 2 and 4 in Table 3 present the estimated marginal effects of perceiving a high level of corruption on the probability to strongly support redistributive policies from univariate and bivariate probit models respectively. The main result is that the effect of perceived corruption is positive in both models, namely, those who regard corruption as a very common problem are more likely to favour support redistribution. The marginal effect in the univariate probit model is 9.1 percentage points, while in the bivariate model the effect is three and a half times larger. These results can be interpreted as the positive effect of perceived corruption dominating the potential negative effect of corruption related to distrust in government intervention.

5.2 Is perceived corruption endogenous?

As observed at the bottom of Colum 4 in Table 3, the sign of the estimated correlation of the two error terms, ρ, is negative, but it is not significantly different from zero. The hypothesis of exogeneity can be tested using a likelihood ratio test based on the idea that if ρ equals zero, the log-likelihood for the bivariate probit will be equal to the sum of the log-likelihoods from the two univariate probit models. Since we use heteroscedasticity robust clustered standard errors[50], this becomes a Wald test. The statistic of this test equals to 2.45, and it is distributed as a chi square with one degree of freedom under the null hypothesis, with a p-value of 0.12. Then, the hypothesis that errors in both equations are independent cannot be rejected. This means that perception of corruption and attitudes towards government intervention in reducing inequalities can be modelled separately.

An alternative test of the null hypothesis of exogeneity uses an extension of the Rivers and Vuong (1988) approach, which implies a two-stage method, namely, obtaining the generalised residuals from the first-stage equation, estimating the second-step probit

[50] The error terms are assumed to be correlated within clusters, but uncorrelated across clusters. Failure to control for within-cluster error correlation can lead to very misleadingly small standard errors, and consequent misleadingly large t-statistics and low p-values. Given the sampling design of the Americas Barometer, following Cameron and Miller (2013: 22) we cluster at the level of the primary sampling unit, this is, the main regions in which each country's sample is stratified.

that includes such residuals as explanatory variable, and conducting a *t*-test on the estimate of the residuals. As usual, the null hypothesis is that corruption perception is exogenous[51]. As can be seen from Table 4, the residuals are not significantly different from zero. The *t*-test yields a chi squared statistic equal to 2.40, with a p-value of 0.120. Thus, again we cannot reject the hypothesis of exogeneity.

It is also important to observe in Table 3 that the exclusion restriction is significant at 1 per cent level to explain individual perception of corruption; a change of one percentage point in the share of people victim of bribery at provincial level changes the probability of perceiving corruption by 0.4 percentage points. Not only the *t*-test statistic (5.29) is one of the highest statistics amongst the set of covariates, but also different tests in the context of instrumental variables estimation prove the validity of this exclusion restriction (see Section 7).

As the hypothesis of exogeneity cannot be rejected, the following analyses are based on the estimates of the univariate probit models.

5.3 Explaining perceptions of corruption

What explains that some individuals perceive more corruption than others? The probit estimates of the first column of Table 3 show that women, Catholics, and those who identify themselves as white or mestizo are less likely to consider corruption as very common, while this perception tends to increase with age. Labour status is also important to understand differences in perceptions. People out of the labour force and public sector employees are less concern about corruption than workers in the private sector, while the unemployed are the most likely to perceive corruption as a widespread problem. People living in large or national capital cities are more likely to perceive high levels of corruption compared to those living in small or medium-sized cities or in rural areas. Wealthier people, particularly those at the fourth and fifth quintiles of the wealth index, more educated individuals, and those who are aware of political news on a daily basis are more likely to consider that corruption among public officials is very common. Interestingly, in our sample there is only a moderate correlation between years of education and being daily aware of political information (0.16, see Table A5 in the appendix A), which suggests that

[51] See Wooldridge (2010: 597). For this test, we estimate c_i using maximum likelihood estimation. Under the assumption that the distribution of $\epsilon_{1i}|x_{1i}$ follows a probit model, the standardized residuals are defined according to the following formula: $e = \frac{c_i - \Phi[x_{2i}\beta_1]\phi[x_{2i}\beta_1]}{\Phi(x_{2i}\beta_2)[1-\Phi(x_{2i}\beta_2)]}$.

specific and well-publicized events might have a large impact on the respondents' perception of corruption[52].

The country of residence matters as well. Citizens from Guatemala and Dominican Republic are more likely to perceive higher levels of corruption, while people in Chile and Uruguay are the least concerned about it. Unemployment rates increase the belief that corruption is a very common problem, but the level of social expenditures as a percentage of GDP has no effect, so larger welfare systems do not seem to generate greater concerns for corruption among citizens in the region.

It is also worth noting that while some variables influence both perceptions of corruption and support for redistribution in the same direction (as it is the case of the ethnic identification, being catholic, being aware of news on a daily basis), other variables act in the opposite direction, notably being public sector employee and the wealth index.

5.4 Perceptions of corruption and (dis)trust in government institutions

As the overall effect of perceived corruption among public officers on the probability of supporting redistribution has been found to be positive, it is possible to conclude that the potential negative effect outweighs the positive one. According to our hypotheses, the perception of high levels of corruption entails a negative effect if distrust in government institutions brought about by corruption makes people less willing to support redistribution, compared to a situation where people find their government and political institutions to be honest and trustworthy. To find out whether indeed distrust in government reduces people's support for redistribution and accounts for some of the estimated overall effect of perceived corruption on support for redistribution, we include an additional variable to our baseline model (1), measuring individual's level of trust in government and political institutions, to obtain specification (3). Parameter φ captures now the partial effect of trust in government, t_i, on support for redistribution, given the perception of corruption, while γ' is the direct effect of perceived corruption on support

[52] Melgar et al. (2010) analyse a similar question. They analyse the probability of perceiving the highest level of corruption in 33 countries using data from the 2004 International Social Survey Program, which includes six Latin American countries (Brazil, Mexico, Venezuela, Chile and Uruguay). Our results regarding labour market status and country level variables are generally in line with theirs, but gender and education effects differ. They find that being a woman is positively correlated with the perception of corruption, while having completed higher secondary education have the opposite effect. Differences in these results may be explained by the fact that men and more educated individuals are more exposed to incidents of corruption in Latin America for several reasons, for instance because they are more active in the labour market, or because they deal more often with governmental bureaucracy (See Swamy et al. 2001 and Mocan 2004 for a gender analysis). In our sample, for instance, while 17.4 per cent of men and 25 per cent of individuals with higher education were asked for a bribe during the last twelve months, while this was the case for only 8.4 per cent of women and 18 per cent of those with secondary education or less.

for redistribution —which includes all other possible mechanisms besides political trust—, given t_i.

$$y_i^* = x_i\beta + c_i\gamma' + t_i\varphi + \varepsilon_i \quad (3)$$

The difference between γ' (from eq. (3)) and γ (from eq. (1)), then, expresses the extent to which the relationship between perceived corruption, c_i, and support for redistribution, y_i^*, is mediated or explained by political trust, t_i, that is, it measures the indirect effect of c_i on y_i^* running through t_i (Imai et al. 2010, Karlson and Holm 2011).

In linear regression models, this decomposition is straightforward by comparing the estimated coefficient of the variable of interest between the reduced model without the additional control variable (i.e. γ in equation (1)) and a full model, which includes one or more additional control variables (i.e. γ' in equation (3)). However, this strategy cannot be used in the context of nonlinear probability models because the estimated coefficients of nested models are not comparable. Logit or probit models return coefficient estimates equal to the ratio of the true regression coefficient to a scale parameter, which is a function of the error standard deviation —and therefore on the other variables that are included in the model. Notwithstanding this, we report in Table 6 estimates from a linear probability model, since the interpretation of the decomposition is more direct. As Table A6 in Appendix B shows, our decomposition results do not change when we use the Karlson-Holm-Breen (KHB) method, developed to compare the estimated coefficients between two nested non-linear probability models (Karlson and Holm 2011, Kohler et al. 2011, Karlson et al. 2012). Appendix B outlines the KHB method and shows, in Table A6, that decomposition results are very similar to those obtained from a linear probability model.

To define our variables of trust in government institutions, we follow the literature on political trust (Rothstein 2008, Svallfors 1999, 2002 and 2012), and use some measures similar to those used in Algan et al. (2011 and 2014). As respondents may make judgements about the incumbent government rather than political institutions in general, we use principal component analysis to compute two indices —by country and year— that measure trust in political institutions and trust in the incumbent government, from a set of variables measuring different aspects of political trust (specific questions and wording are available in Table A1 in the Appendix A).

The first index is based on survey questions about respondents' trust in political institutions in general, the national parliament and the justice system, whereas the second index tries to approach different aspects of individuals' assessment of the incumbent

government trustworthiness and effectiveness, including the extent to which the incumbent government fights poverty.

We first check whether perceived corruption brings about distrust in government institutions. Table 5 shows estimates of two simple regressions of each of the two indices of trust in the incumbent government and in the political system on perceived corruption and the same sate of controls as in Table 3 —that estimates equation (1), and suggests that indeed perception of corruption is inversely correlated with both indices of political trust. In particular, believing that corruption is very common reduces the index of trust in the incumbent government and in political institutions by 0.55 and 0.67 standard deviations respectively, so we could observe a variation in the effect of perceived corruption once we control for political trust.

Having asserted the negative relationship between perceived corruption and our indices of political trust, next we can test whether including either of our indices of political trust in our baseline model (equation (1)) erodes the effect of perceived corruption on support for redistribution. This is precisely what equation (3) does, and estimates of the variables of interest are shown in Table 6. For comparative purposes, Table 6 also includes the baseline model of equation (1) in Columns (1) and (4).[53] Columns (2) and (5) show the effect of each index of political trust when perceived corruption is not included in the model. Following previous findings by Algan *et al.* (2011) about the non-monotonic relationship between the share of trustworthy individuals and the size of the welfare state, political trust is allowed to have a non-monotonous relationship with support for redistribution —by including a quadratic term in political trust.[54] Finally, columns (3) and (6) show estimates from the specifications where both perceived corruption and political trust are included.

As expected, the estimates of columns (2) and (4) suggest a U-shape effect of political trust. As observed in Figure 6, both individuals who consider political institutions less or more trustworthy are more prone to strongly support redistribution than individuals with intermediate levels of trust.[55]

[53] A new baseline model is estimated each time because sample size is different due to missing values and because the question of confidence in the current government was not included in some countries in 2012.

[54] Algan et al. (2011) show that uncivic individuals support more redistribution than civic individuals because they manage to evade taxes while benefit the most from public transfers. So, when the share of uncivic individuals increases, there are two effects. On the one hand, people want less social benefits because they expect more fraud and less efficiency, but on the other hand, demand for redistribution increases because there are more uncivic individuals asking for a high level of transfers. This is consistent with the argument of Alesina and Angeletos (2005b) that individuals who are more able to benefit from rent-seeking would support more redistribution when corruption is widespread.

[55] To test the robustness of this result, we use each indicator of political trust separately as well, sometimes taking into account only those who responded the highest and the lowest level of trust, but the results remained basically unaffected.

The decomposition of the direct and indirect effects of political trust shows that controlling for political trust effectively changes the average marginal effects of perception of corruption compared to the baseline model. When political trust is not controlled for, the average marginal effect of perceiving corruption is 9.3 and 9.1 percentage points (columns (1) and (4)) for each sample. This effect is reduced to 8.2 and 8.1 when trust in the political system and trust in incumbent government are included in the model, respectively.

This strategy, however, is not free of endogeneity concerns. These effects should be interpreted with caution because they only identify causal mediation effects under the sequential ignorability assumption (Imai et. al 2010). This means that not only perception of corruption should be conditionally independent of unobservables ε_i, given covariates x_i, but also that the mediator variable (political trust) should be conditionally independent of unobservables ε_i, given background covariates x_i and c_i. As in the case of perceived level of corruption, the association between individuals' political trust and their willingness to support state intervention may be attributed to some common but unobserved factors.

A way to deal with this problem would be to estimate a recursive system which allows for correlation of unobserved determinants of corruption perception, trust in government, and support for redistribution. Identification in this model, however is difficult, as it is challenging to find a valid exclusion restriction, that is, a variable that affects political trust, and does not affect directly neither the perception of corruption nor support for redistribution.

5.5 Some insights into the positive effect

This section investigates the two channels that may be responsible of the positive effect of perceived corruption on support for redistribution. That is, the opportunistic desire to capture rents from redistributive policy (perhaps from greater government expenditures), and the belief that the current distribution of economic opportunities is not fair due to corruption.

Unfortunately, scarcity of information in the Americas Barometer to capture opportunistic motives and fairness concerns imposes severe limitation to our analysis and prevents us from accounting the extent to which these two channels explain the estimated relationship between perceived corruption and support for redistribution. In addition, as in the case of political trust, above, proper identification of the sources of the effects requires exogenous variation in observed motivations, which is also not possible with available data.

Opportunistic motivations

As a proxy of opportunistic motivations, we present evidence of the effects of different variables related to what Alesina and Angeletos (2005b) call the ability to benefit from corruption, lobbying, and other forms of rent-seeking, namely, political connections, access to the bureaucracy, negotiation power vis-á-vis bureaucrats, or no moral hesitation in becoming corrupt. Certain groups have more opportunities to obtain and maintain wealth transfers through the power of the state. Being a public sector employee; belonging to an association of professionals, merchants, manufacturers or farmers; or attending meetings of a political party or a political organization might increase the opportunities to engage in such type of activities. In addition, access to bureaucracy can be proxied by a variable measuring whether the respondent has requested help from a government official or agency in order to solve problems of their community. We consider those who have requested help to a member of the National Assembly (Representative, Senator); a local public official or a local government member (a mayor or municipal councilperson); or any state agency or public agency or institution. Finally, the question of whether the respondent thinks that paying a bribe is justified is used as a proxy to moral qualms about participating in corruption (specific questions and wording are available in Table A1 in the Appendix A).

One important result from Table 3 is that public sector employees not only are less likely to perceive high levels of corruption, but also are more willing to support redistribution than employees in the private sector (a significant difference of 2.5 percentage points). Occupational self-selection in the public sector may be motivated by altruistic considerations, such as public service motivation or a sort of identification with the government agency's "mission" pursued in the provision of collective goods (Francois 2000, Besley and Ghatak 2005), but also by self-interested motivations, such as risk aversion if public sector employment offers a lower risk to be dismissed in case of low-productivity outcomes (Böhm and Riedel 2013), or even a greater opportunity to benefit from redistributive expenditures. As has been argued by some authors, many governments use public sector employment for redistributive purposes across income groups or regions, as a way of reducing unemployment, or for patronage, that is, as a way of transferring rents to political supporters (Alesina *et al.* 2000, Robinson and Verdier 2002). Cowen *et al.* (1994)

also suggest that some public policies generate rents to public officials, so rent seeking may motivate them to support the provision of public goods[56].

Results in Table 7 show that individuals who have political connections are more likely to support inequality-reducing policies: belonging to a political party increases the likelihood to support redistribution by 1.5 percentage points relative to those who do not, and those who have requested help from public officials, and government members either at local or national level are 3.3, 3.2 and 4.5 percentage points more likely to strongly agree with government intervention, respectively.[57] We may interpret this effect as confirming the theoretical premise that those who can benefit from government intervention, ceteris paribus, will support redistribution, not precisely because they are in need and will thus receive the (monetary and in-kind) benefits provided by the redistributive policy, but because they may benefit in an indirect manner, through rent-seeking. The marginal effect of perceived corruption on support for redistribution, however, does not change when any of the proxies for opportunistic motivations are included in the empirical model. This finding suggests that the positive effect of perceived corruption is not mediated at all by opportunistic motivations. In other words, the latter only affect preferences for redistribution directly and not through perceived corruption.

Fairness concerns

Finally, individuals may deem inequality brought about by connections and corruption as less desirable than inequality resulting from effort. If this is the view of those who see corruption as a widespread problem, they will be more prone to consider inequality as a matter of social injustice and thus, demand more government intervention. Using public opinion data from Latinobarometro surveys conducted in 1997, 2001, and 2002, Cramer and Kaufman (2009) show that those who believe that corruption has increased in recent years are six per cent more likely to judge their country' distribution as very unfair. Unfortunately, our data does not allow us to examine the same relationship, but we can observe from Figure 7 that there is a positive relationship between the percentage of people stating that corruption is very common in the Americas Barometer

[56] An example given by Rose-Ackerman (1978, p 62) is that allowing a policeman to accept bribes may improve the enforcement because the desire to collect bribes can encourage greater police effort (Corruption, a study in political economy. New York, Academic Press. Cited by Cowen, p. 136).

[57] A linear probability model yields the same results (estimates available upon request). Other variables that may proxy rent-seeking, such as thinking that sometimes paying a bribe is justified, having requested help from a parliament member or belonging to an association (other than a political party) are found not to be significant (not shown).

and the percentage of people reporting that the distribution of income in their country is unfair in the Latinobarometro of the corresponding year.

6. Additional robustness checks

In this section we check the robustness of our key findings. First, in section 7.1 we use a different modelling strategy to test the endogeneity of perceived corruption. In particular, we take advantage of the categorical nature of the variable, which we have dichotomize so far for convenience, and employ the so-called probit-adapted ordinary least squares (POLS) and instrumental variables techniques to account for endogeneity. In section 7.2, we employ two alternative survey questions to capture people's support for redistribution. Unlike the survey question we have used so far, the first alternative asks about who should be responsible to ensure the wellbeing of individuals, while the second alternative question inquires about the appropriate income tax structure.

6.1 Alternative method to address endogeneity

The original scale of responses in the question we use to measure support for redistribution ranges from "1" (strongly disagree) to "7" (strongly agree). This variable is ordinally continuous; no cardinal meaning could be assigned to the numerical values, which means that a change in values, for instance, from 1 to 2 could be qualitatively different from a change from 6 to 7. For convenience, until now we have worked with a dichotomous variable to compare those individuals who expressed strong agreement with the rest of respondents. In doing so, however, we are ignoring the whole distribution of the variable. In order to account for it, and to check the robustness of the main results with an instrumental variable approach (IV), we use the so-called probit-adapted ordinary least squared method (POLS) originally proposed by van Praag and Ferrer-i-Carbonell (2008) in the context of satisfaction and happiness studies.

The POLS operationalization is a simple OLS model that uses a 'rough cardinalisation' of the ordinal dependent variable compatible with the ordered probit assumption about the normality of the underlying latent variable (van Praag and Ferrer-i-Carbonell 2008: 28). For a given value of the original ordinal variable, the value of the "cardinalised" dependent variable is computed by taking the conditional mean of the standard normally distributed variable, calculated on the base of the frequencies of the ordinal ratings in the sample. Defining for each response category *j* its corresponding sample share p_j (*i.e.* response frequencies) and defining

$$\mu_1 = -\infty$$
$$\mu_2 = \Phi^{-1}(p_2)$$
$$\ldots$$
$$\mu_j = \infty,$$

respondents' answers can be replaced by their conditional expectations[58]:

$$\tilde{y}_i = E(y_i^* \mid y_i = j) = E(y_i^* \mid \mu_{j-1} \leq y_i^* < \mu_j) = \frac{\phi(\mu_{j-1}) - \phi(\mu_j)}{\Phi(\mu_j) - \Phi(\mu_{j-1})}$$

where μ_j denotes the quantiles of the standard normal distribution for the sample cumulative relative frequencies of the seven response categories *j* = (1, ... ,7), and ϕ stands for the standard normal density function. We then run OLS and IV regressions on the transformed values, $\tilde{y}_i$. The results can be interpreted in terms of standard deviation units of the support for redistribution measure. As in previous sections, we use the provincial share of respondents who were victim of bribery in the year before the survey as instrumental variable. We argue that this share has a direct effect on the level of perceived corruption, but it is correlated with individual support for redistribution only through this perception, and not directly.

Table 8 shows the results of the OLS and IV estimates[59]. OLS estimates of perceived corruption are positive and statistically significant (columns 1 and 3). However, IV estimates are not statistically significant, even though they are also positive, and more than four times larger. Standard errors on the IV estimates are likely to be larger than OLS estimates, and much larger if the excluded instrumental variables are only weakly correlated with the endogenous regressors. Therefore, besides testing the endogeneity of perceptions of corruption, we must check the validity of the instrument.

All the tests that we present in Table 9 suggest that perception of corruption is indeed an exogenous variable and that our instrument is not weak and thus it is valid.

According to the result of the endogeneity test reported in the upper panel of Table 9, the null hypothesis of exogeneity cannot be rejected (*p*-value of 0.348).[60]

Regarding the instrument, there are two validity concerns we must address. First, as we mentioned above, if the instrument is only weakly correlated with the endogenous variable, we face finite-sample bias, and the standard *t*-statistic may be meaningless if the

[58] Maddala (1983, p. 366).

[59] The first stage equation in the IV estimates is the regression of perception of corruption, as in Table 3 column (1). It should be noted that accounting for endogeneity with either the IV or bivariate probit approaches leads to different estimates because both procedures yield different measures: average treatment on the treated (ATT) and local average treatment effect (LATE) respectively.

[60] Unlike the traditional Durbin-Wu-Hausman test, the statistic reported is robust to several violations of heteroscedasticity, like clustered standard errors (Baum *et al*. 2007: 482).

weakness is severe. Second, the inconsistency introduced by even small covariance between the instrument and the unobserved determinants of the outcome variable, will be exacerbated when the instrument is weak. Instrument exogeneity is usually verified with overidentifying restriction tests, which in turn require more than one instrument for a single endogenous regressor. Since we only have one instrument, we can only present the results of underidentification tests, which check whether the equation is identified, i.e., that the excluded instrument is 'relevant', in the sense of being correlated with the endogenous regressor.

Generally, with a single excluded instrumental variable, if one wanted to restrict the bias of the IV estimator to five per cent of the OLS bias, an F statistic over 10 is required to suggest instruments are sufficiently strong (Stock and Yogo, 2005). According to the first stage results from Table 9, the F-statistic in the IV specifications equals 28.41, so we should not worry about weakness of our instrument. The same conclusion is reached with the Cragg-Donald Wlad F statistic and the Kleibergen-Paap Wald rank F statistic, which is robust to heteroscedastic clustered standard errors. However, Montiel Olea and Pflueger (2013) show that both the robust and the non-robust F statistics may be high even when instruments are weak[61]. They propose then to test the null hypothesis that the proxy of the estimator asymptotic bias (called Nagar estimator) is large relative to a benchmark for both Two-Stage Least Squares (TSLS) and Limited Information Maximum Likelihood (LIML), namely that the bias exceeds a fraction τ of a "worst-case" benchmark. This benchmark agrees with the OLS bias when errors are conditionally homoscedastic and serially uncorrelated. The test rejects the null hypothesis when the test statistic, the effective F statistic, exceeds a critical value, which depends on the significance level α, and the desired threshold τ. As it is shown in Table 9, the effective F statistic is 30.23, and at a significance level of 5 per cent, the statistic exceeds the critical value of 23.1, which corresponds to a τ of 10 per cent. This means that we can reject the null hypothesis of a LIML bias above 10% of the OLS bias with one instrument in the absence of homoscedasticity[62]. Since the null hypothesis is rejected, we can conclude that instruments are strong enough and proceed using standard inference.

We finally use an underidentification test, which is a Lagrange multiplier test. This is essentially the test of the rank of a matrix: under the null hypothesis that the equation is

[61] Similarly, when the estimation is performed with heteroscedasticity robust clustered standard errors, the Cragg-Donald-based weak instruments test is no longer valid.

[62] We use the command "weakivtest" in Stata.

underidentified, the matrix of reduced form coefficients on the *L* excluded instruments has rank equal to *K-1* where *K* is the number of endogenous regressors. Under the null hypothesis, the statistic is distributed as chi-squared with degrees of freedom equal to (*L-K+1*). A rejection of the null indicates that the matrix is full column rank, i.e., the model is identified. The results shown at the bottom of Table 9 suggest that we can reject the null hypothesis of underidentification i.e., the excluded instrument is relevant —the Kleibergen-Paap rk LM statistic is 19.9 with a p-value of 0.[63]

6.2 Alternative measures of support for redistribution

Preferences for redistribution are supposed to capture people's views about the role of the state in altering the distribution of income (and wealth) originating in the markets. The question we use certainly has this emphasis. However, this sort of questions does not make explicit the way people prefer this intervention to be carried out. We test the robustness of our results by performing the same analysis with two alternative questions. The first one measures the respondents' agreement with greater levels of state responsibility for provision of welfare, while the second one is more explicit about the mechanisms, in particular, progressive of taxation.

The first question is "*The government, rather than individuals, is the main responsible in ensuring the well-being of the people. To what extent do you agree or disagree with this statement?*"[64] In this case, we use a very similar sample to the previous one (75,552 observations) and obtain almost the same results. First, as can be observed at the bottom of Table 10, the sign of the estimated ρ in the bivariate model is negative, but it is not significantly different from zero. Thus, once again we cannot reject the hypothesis that errors in both equations are independent. In addition, the estimated marginal effect of perceived on the probability to strongly support redistributive policies from the univariate probit model is 9.4 percentage points, very similar to the result we obtained with the main support for redistribution question (see Table 3).

For the second question, we use a subsample from the 2010 round of the AmericasBarometer, which includes a question regarding attitudes towards progressive taxation. Specifically, the survey asks the following: *Suppose a rich person has $1 and a poor*

[63] Following Bound, Jaeger and Baker (1995), the partial R^2 on the excluded instruments in the first-stage regression has been adopted as a rough guide to the quality of IV estimates, as it can be interpreted as the proportion of the variance explained by the addition of the IV to the model. Our partial R^2 is just 0.002, which could casts doubt on the strength of the instrument. This result however is in sharp contrast to the F-test and to the rest of the tests of Table 9, so we believe that we do not have a weak instrument.

[64] El Estado (gentilicio), más que los individuos, debería ser el principal responsable de asegurar el bienestar de la gente. ¿Hasta qué punto está de acuerdo o en desacuerdo con esta frase?

person has $1. In your opinion, how much tax each person should pay? Possible answers to this question are: (1) *the rich 30 cents and the poor 30 cents;* (2) *the rich 40 cents and the poor 30 cents;* (3) *the rich 50 cents and the poor 20 cents;* (4) *the rich 60 cents and the poor 10 cents*. Therefore, those who answered (1) prefer a flat tax (taking an equal proportion of income from each person), while those who choose (4) prefer the most progressive scheme. Hence, we use a dependent variable that ranges from 1 to 4, where the higher the value, the stronger the degree of support for redistribution[65]. We employ an ordered probit model to account for the character of this variable, and include country fixed effects and the same control variables at individual level as in the previous estimations.

The subsample contains data for 6,453 observations from four countries: Mexico, Brazil, Argentina and Venezuela[66]. However, given the missing values in other variables, the final sample only comprises 5,221 observations. The distribution of this variable is more polarised than the previous dependent variables. A flat tax scheme (30/30) is preferred by 35 per cent of respondents, while the most progressive alternative (60/10) was chosen by 39 per cent of them. There are little differences across countries, as observed in Figure 8. Estimation results displayed in Table 11 show that this way of measuring support for redistribution is also positively correlated with perceiving a high level of corruption. Believing that corruption among public sector officers is very common increases the probability of strongly agreeing with the statement "*Government should implement firm policies to reduce income inequality*" by 11.2 percentage points, while it rises the probability of thinking that a rich person should pay 60 cents while a poor person should pay 10 cents by 4.6 percentage points (columns 2 and 4 respectively).

7. Concluding remarks

As individual preferences eventually translate into policies via some aggregation mechanism, identifying the factors behind public support for public policy is an important issue. We investigate the effect of perceived corruption on people's support for redistribution, a relationship that has received little attention in previous literature on preferences for redistribution. Perceived corruption shapes individuals' preferences for redistribution in three different manners. While perceived corruption may reduce people's

[65] The order was changed to get an index from less to more support for a redistributive scheme. In Spanish, the question is: "Suponga que una persona rica tiene 1 peso y una persona pobre tiene 1 peso. ¿En su opinión, cuánto impuesto debería pagar cada persona?"

[66] The rate of non-response was 7.2 per cent for the total sample, being the lowest in Mexico (3.5) and the highest in Venezuela (11.7).

support for redistribution, because it undermines trust in government, it may also increase support for redistribution for two reasons: an opportunistic desire to capture rents from government intervention, and increased demand for fairness given that corruption subverts equality of opportunity. Thus, the net effect of perceived corruption on redistribution cannot be signed a priori.

We study empirically corruption and preferences for redistribution in a sample of 18 countries in Latin America, a region that suffers from high levels of inequality and weak institutions, where democratic systems are still consolidating, using data from the 2008, 2010 and 2012 rounds of the AmericasBarometer. Our novel empirical findings suggest that perceiving corruption in the public sector increases people's support for redistribution. The experience of Latin America should also provide direct evidence on the effects other countries and regions in Africa and Asia should expect.

Our findings take due account of the potential endogeneity between perceived corruption and support for redistribution, and are robust to using different measures of preferences for redistribution, that focus on different implications of redistributive policies and that have been found to affect the support people report for redistribution (Alesina and LaFerrara 2005).

We also provide preliminary evidence about the relevance of each of these three channels in explaining the positive relationship between perceived corruption and support for redistribution. In line with related findings by Algan et al. (2011), we find a non-linear relationship between political trust and perceived corruption: respondents who are both more trustful and more distrustful of government and political institutions are more likely to support redistributive policies relative to those who express intermediate levels of trust. Consistent with our premise, our findings also suggest that about one sixth of the effect of perceived corruption on support for redistribution is accounted for by political trust.

As far as the positive rent seeking channel is concerned, our findings suggest that rent seeking only has a direct effect on support for redistribution, which is independent from or additional to the effect of perceived corruption, as the estimated impact of perceived corruption on support for redistribution is not altered by the inclusion of rent seeking variables in the empirical model. Fairness motives cannot be properly addressed with our data. Nonetheless we provide suggestive evidence that they may be part of the story.

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Figures

Figure 1. Levels of Redistribution in Latin American and OECD Countries

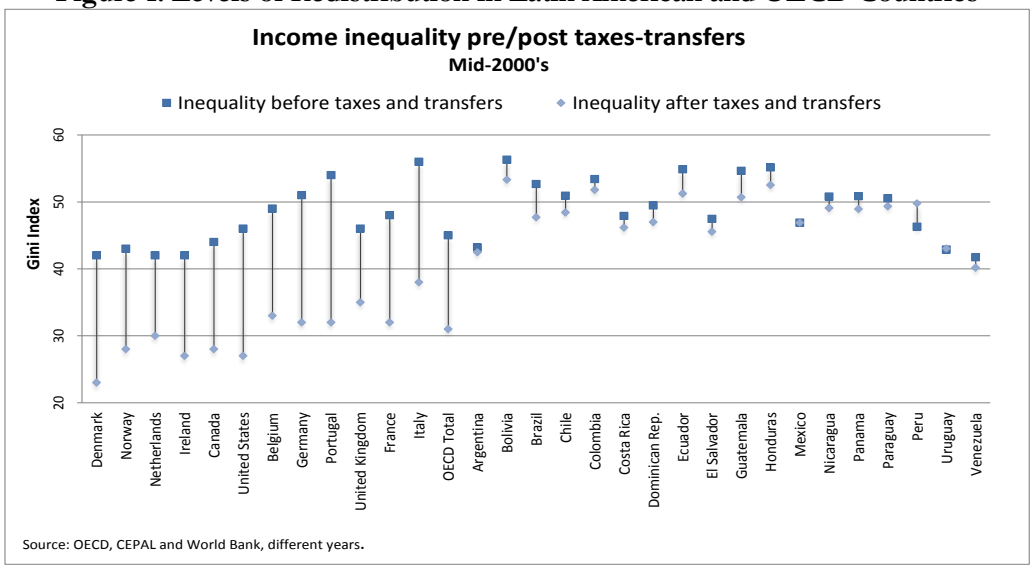


Figure 2. Support for Redistribution and Perception of Corruption

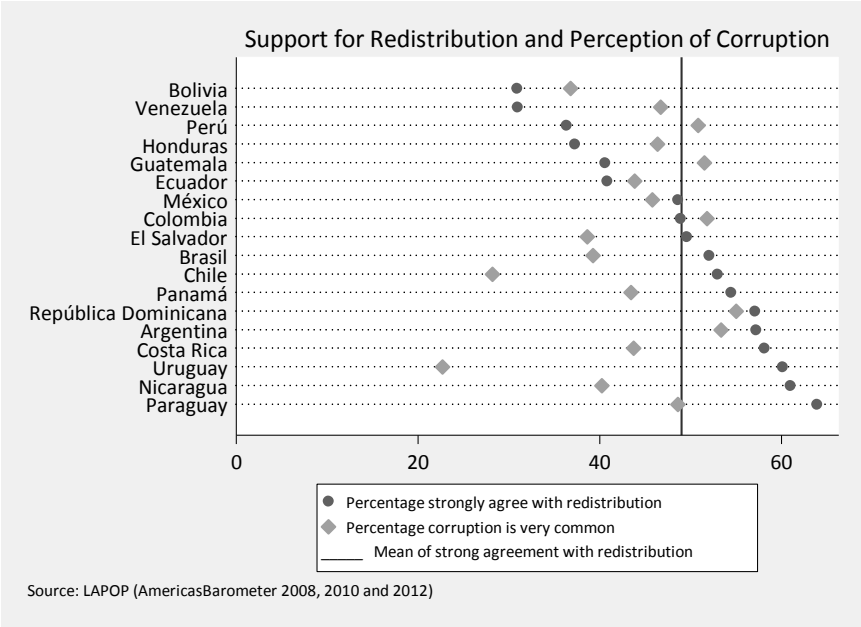
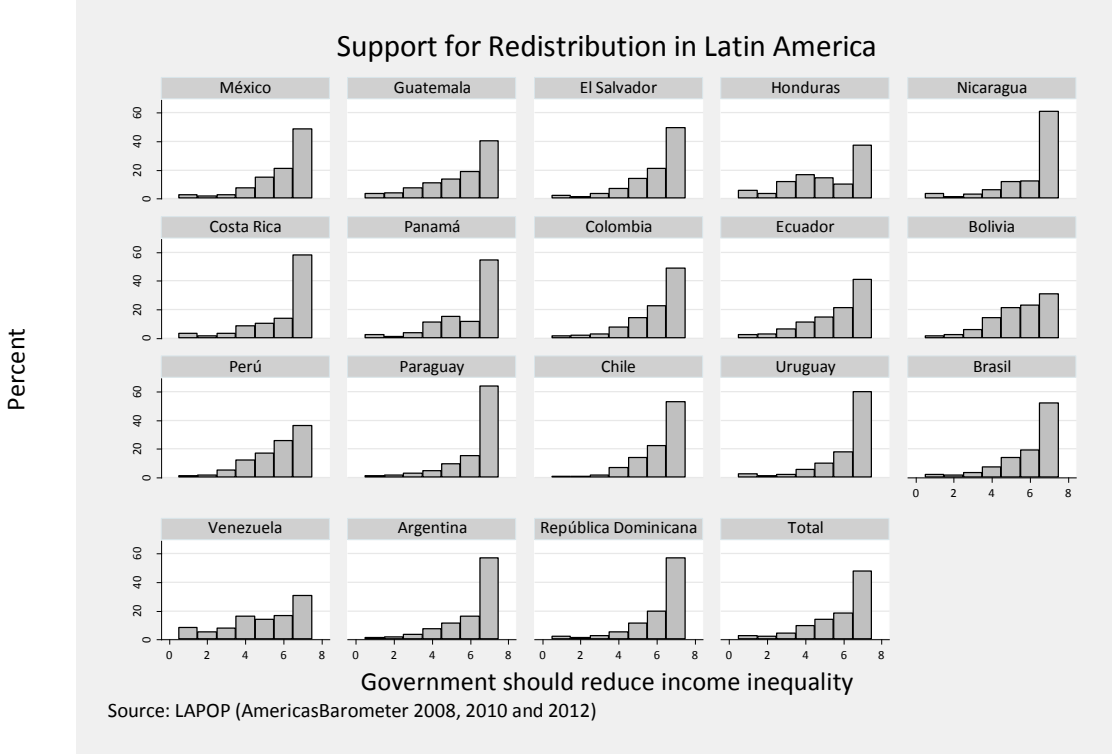
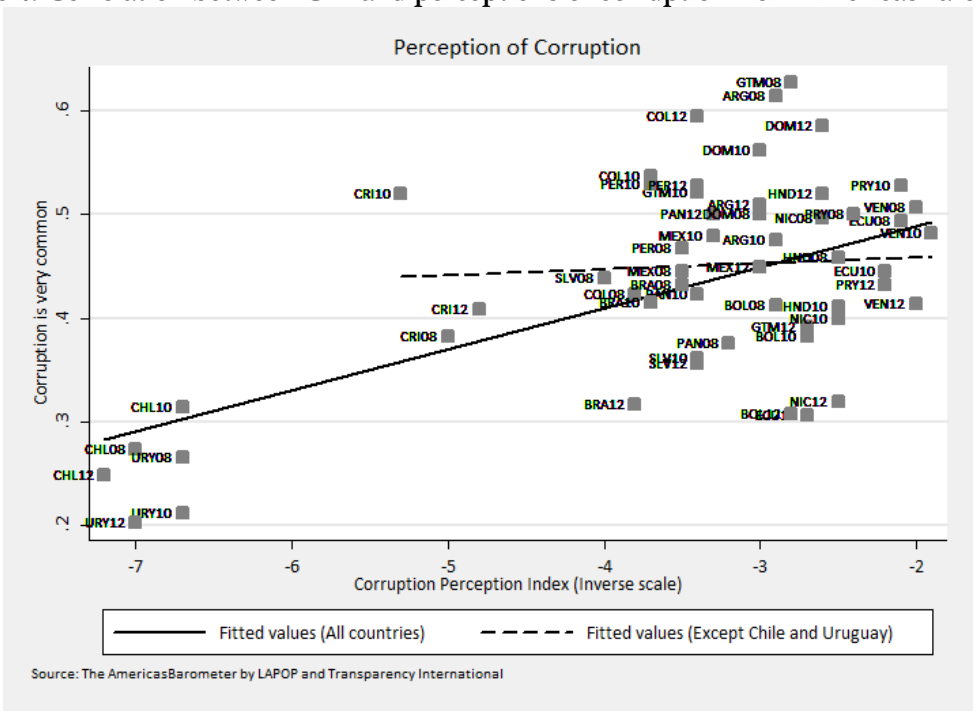


Figure 3. Distribution of support for redistribution – dependent variable



Source: LAPOP (AmericasBarometer 2008, 2010 and 2012)

Figure 4. Correlation between CPI and perceptions of corruption from AmericasBarometer



Source: The AmericasBarometer by LAPOP and Transparency International

Figure 5. Bribery victimization at Province Level

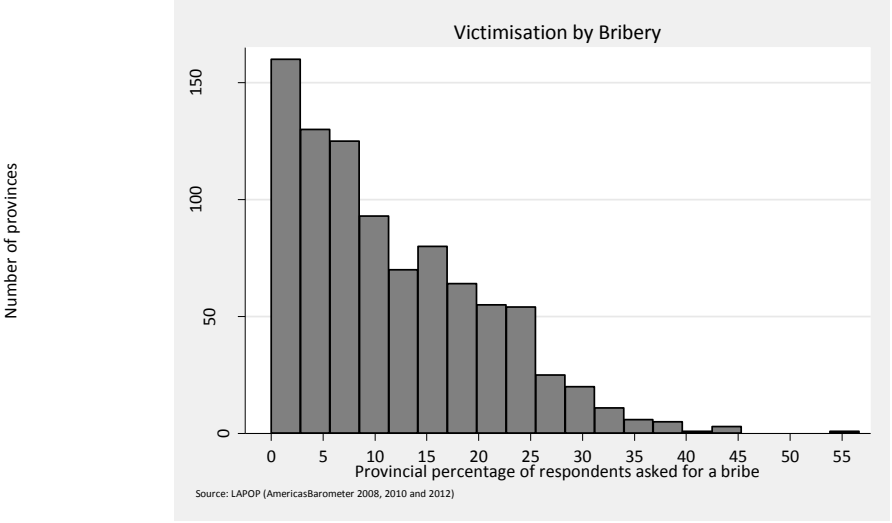


Figure 6. Effect of Trust in Government Institutions on Support for Redistribution

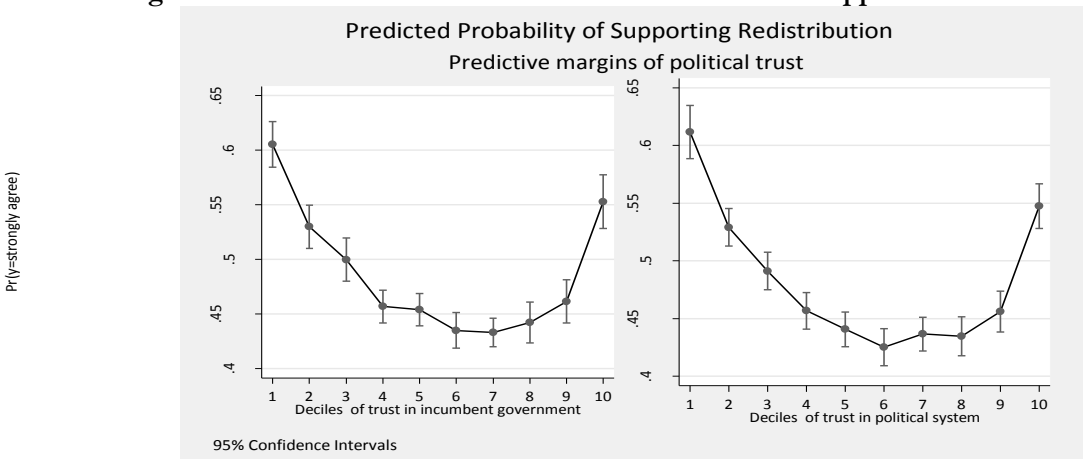


Figure 7. Perception of Corruption and Perception of Income Distribution

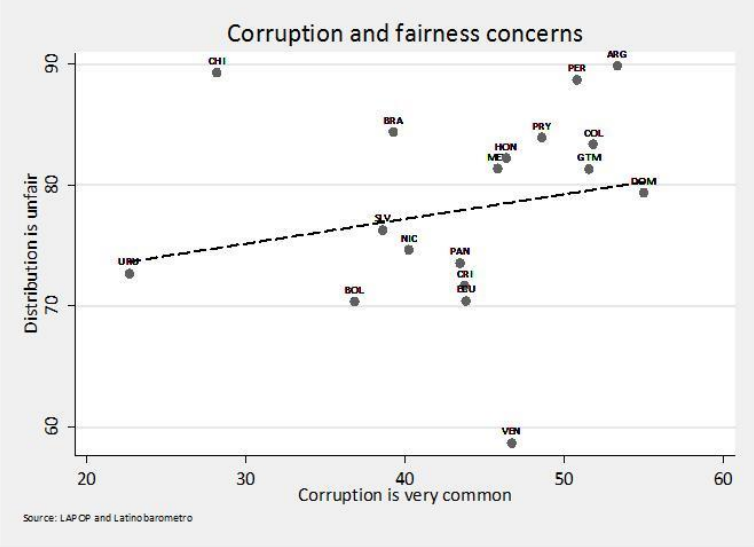
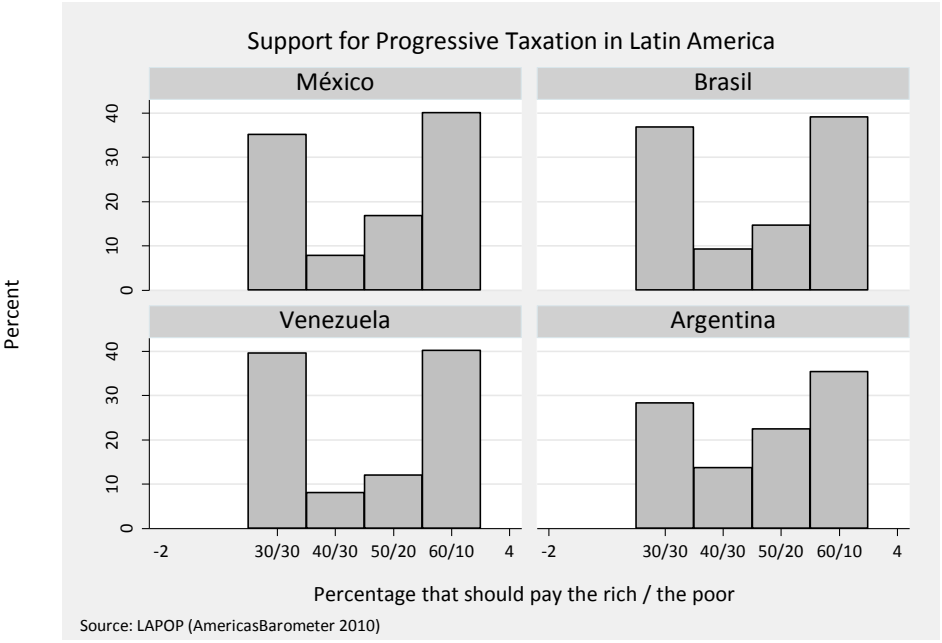


Figure 8. Support for Progressive Taxation.
Selected countries



Tables

Table 1. Perception of the extent of corruption among public officials

	Very uncommon	Uncommon	Common	Very common	Total
Mexico	2.2	13.0	39.2	45.6	100.0
Guatemala	4.8	15.9	27.4	51.9	100.0
El Salvador	6.8	23.2	31.5	38.5	100.0
Honduras	3.3	16.0	34.6	46.1	100.0
Nicaragua	7.0	21.8	30.5	40.7	100.0
Costa Rica	2.3	14.0	40.1	43.6	100.0
Panama	3.1	11.3	41.9	43.7	100.0
Colombia	3.3	12.7	31.1	52.9	100.0
Ecuador	3.2	15.6	37.0	44.2	100.0
Bolivia	2.4	17.0	43.7	36.9	100.0
Peru	2.4	13.6	33.0	51.0	100.0
Paraguay	2.8	11.3	36.0	49.9	100.0
Chile	4.1	19.4	48.5	28.1	100.0
Uruguay	5.5	23.4	48.3	22.9	100.0
Brazil	8.9	19.3	32.7	39.2	100.0
Venezuela	2.0	10.9	40.2	47.0	100.0
Argentina	1.3	6.9	37.6	54.2	100.0
Dominican Republic	6.1	12.0	27.4	54.5	100.0
Total	4.0	15.6	36.9	43.5	100.0

Table 2. Bribery victimization by year and country.
Was asked for a bribe by either a Public Employee or a Police Officer

	2008	2010	2012	Total
Mexico	20.8	27.6	21.5	23.3
Guatemala	12.5	16.0	19.3	15.9
El Salvador	8.5	7.7	6.7	7.7
Honduras	9.5	11.1	18.6	13.1
Nicaragua	11.3	8.8	5.9	8.7
Costa Rica	10.5	7.3	7.1	8.3
Panama	5.0	5.3	3.9	4.7
Colombia	6.5	7.9	11.4	8.6
Ecuador	16.0	13.4	18.5	16.0
Bolivia	23.6	22.5	23.6	23.3
Peru	20.5	22.2	18.8	20.5
Paraguay	14.8	17.1	15.6	15.8
Chile	2.4	2.9	2.9	2.7
Uruguay	4.9	5.5	4.8	5.1
Brazil	3.9	6.7	5.4	5.3
Venezuela	6.4	11.9	8.7	9.0
Argentina	18.8	14.9	11.5	15.1
Dominican Republic	11.2	12.7	17.1	13.7
Total	11.5	12.3	12.3	12.0

Table 3. Support for Redistribution and Perception of Corruption

	Univariate Probit Models				Bivariate Probit Model (Pr[y=1 , c=1])			
	(1) Perceived Corruption		(2) Redistribution		(3) Perceived Corruption		(4) Redistribution	
	dy/dx	(t)	dy/dx	(t)	dy/dx	(t)	dy/dx	(t)
Corruption is very common			**0.091*** **	**(13.70)**			**0.325*** **	**(3.56)**
Provincial bribery victimization	**0.004*** **	**(5.29)**			**0.004*** **	**(11.58)**		
Female	-0.014***	(-3.01)	-0.004	(-0.91)	-0.014***	(-3.40)	-0.004	(-1.02)
White or Mestizo	-0.012*	(-1.82)	-0.018***	(-2.80)	-0.011**	(-2.28)	-0.015**	(-2.42)
Age	0.002***	(6.55)	0.000	(0.45)	0.002***	(12.02)	0.000	(0.81)
Has children	0.000	(0.06)	0.026***	(4.63)	0.000	(0.02)	0.021***	(3.26)
Catholic	-0.013**	(-2.22)	-0.029***	(-5.02)	-0.012***	(-2.95)	-0.024***	(-3.59)
Labour status: Worker in private sector (Ref.)								
Inactive	-0.013**	(-2.01)	0.000	(0.02)	-0.013**	(-2.42)	0.000	(0.01)
Unemployed	0.021**	(2.01)	0.007	(0.79)	0.021**	(2.49)	0.007	(0.85)
Worker in public sector	-0.033***	(-3.04)	0.025***	(2.67)	-0.033***	(-4.14)	0.020**	(2.08)
Employer or entrepreneur	-0.027	(-1.61)	-0.022	(-1.15)	-0.026*	(-1.84)	-0.018	(-1.16)
Self-employed	0.010	(1.35)	0.001	(0.11)	0.010*	(1.75)	0.001	(0.20)
News daily	0.034***	(5.23)	0.028***	(4.18)	0.033***	(7.91)	0.024***	(3.33)
Wealth index: Quintile 1 (Ref.)								
Quintile 2	0.006	(0.87)	-0.010	(-1.33)	0.006	(0.97)	-0.008	(-1.29)
Quintile 3	0.012	(1.55)	-0.016	(-1.64)	0.012*	(1.95)	-0.013	(-1.51)
Quintile 4	0.020***	(2.59)	-0.022*	(-1.94)	0.020***	(3.15)	-0.018*	(-1.74)
Quintile 5	0.033***	(3.68)	-0.050***	(-4.48)	0.033***	(4.74)	-0.041***	(-3.41)
Education (years)	0.005***	(5.01)	-0.001	(-1.31)	0.006***	(10.24)	-0.001	(-1.01)
Size of place: Capital or big city (Ref.)								
Medium city	-0.015*	(-1.69)	0.033***	(2.69)	-0.015***	(-2.61)	0.030***	(2.83)
Small city	-0.023**	(-2.45)	0.008	(0.76)	-0.022***	(-3.76)	0.009	(1.01)
Rural	-0.021**	(-2.39)	0.013	(1.39)	-0.021***	(-3.90)	0.013	(1.64)
Gini index	0.005	(0.99)	-0.000	(-0.07)	0.005***	(3.82)	-0.000	(-0.13)
Poverty	-0.002	(-0.70)	0.005*	(1.92)	-0.002*	(-1.72)	0.004*	(1.77)
Unemployment rate	0.015**	(1.99)	-0.005	(-0.62)	0.014***	(5.61)	-0.003	(-0.50)
Social expenditures (%GDP)	0.002	(0.21)	-0.019**	(-2.37)	0.002	(0.70)	-0.015*	(-1.77)
2008 (Ref.)								
2010	-0.015	(-0.80)	0.025	(1.16)	-0.014**	(-2.24)	0.018	(0.97)
2012	-0.034	(-1.06)	0.081***	(2.83)	-0.034***	(-3.91)	0.062**	(2.09)
Mexico (Ref.)								
Guatemala	0.132*	(1.94)	-0.215***	(-4.22)	0.132***	(5.30)	-0.146**	(-2.49)
El Salvador	0.007	(0.13)	-0.017	(-0.35)	0.008	(0.42)	-0.001	(-0.04)
Honduras	0.088	(1.06)	-0.237***	(-3.99)	0.086***	(2.71)	-0.163***	(-2.79)
Nicaragua	0.004	(0.06)	0.044	(0.70)	0.005	(0.18)	0.047	(0.90)
Costa Rica	-0.019	(-0.28)	0.302***	(5.36)	-0.017	(-0.57)	0.280***	(3.84)
Panama	-0.007	(-0.16)	0.076**	(1.98)	-0.000	(-0.01)	0.081**	(2.42)
Colombia	0.001	(0.02)	0.062	(1.20)	0.006	(0.30)	0.061	(1.40)
Ecuador	-0.024	(-0.66)	-0.107***	(-3.46)	-0.021	(-1.59)	-0.074**	(-2.34)
Bolivia	-0.104	(-1.48)	-0.067	(-0.91)	-0.107***	(-3.86)	-0.061	(-1.11)
Peru	0.029	(0.97)	-0.127***	(-3.68)	0.032**	(2.29)	-0.093***	(-2.80)
Paraguay	0.063	(1.44)	0.042	(0.85)	0.064***	(3.28)	0.044	(1.07)

Table 3. Cont.

	Univariate Probit Models				Bivariate Probit Model (Pr[y=1 , c=1])			
	(1) Perceived Corruption		(2) Redistribution		(3) Perceived Corruption		(4) Redistribution	
	dy/dx	(t)	dy/dx	(t)	dy/dx	(t)	dy/dx	(t)
Chile	-0.209***	(-3.99)	0.224***	(3.87)	-0.202***	(-8.82)	0.202***	(3.15)
Uruguay	-0.235***	(-2.66)	0.388***	(5.61)	-0.232***	(-7.12)	0.366***	(3.53)
Brazil	-0.122	(-1.39)	0.326***	(4.13)	-0.122***	(-2.93)	0.304***	(3.01)
Venezuela	0.054	(0.83)	-0.097	(-1.54)	0.058***	(2.94)	-0.067	(-1.33)
Argentina	0.005	(0.04)	0.394***	(5.53)	0.004	(0.10)	0.377***	(3.66)
Dominican Rep.	0.104**	(2.30)	-0.017	(-0.40)	0.107***	(6.37)	0.001	(0.04)
athrho							**-0.505**	**(-1.57)**
Pseudo R-Squared	0.033		0.041					
Obs.	76,246		76,246			76,246		
AIC	89953.9		90240.2			180180.9		
Pseudo-Log Likelihood	-44932.9		-45076.1			-90002.4		
Wald test of rho=0						**Chi2(1) = 2.450 Prob > chi2 = 0.1175**		

Average marginal effects of univariate and recursive bivariate probit models where each dependent variable equals to 1 if the respondent strongly agrees with the statement "Government should implement strong policies to reduce income inequality". t-statistics in parenthesis. Standard errors are clustered at region level. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 4. Test of Exogeneity Based on Generalised Residuals

	(2) Baseline	(3) Generalised residuals
	b/t	b/t
Corruption	0.238***	1.03**
	(13.66)	(2.01)
Generalised residuals		-0.49
		(-1,55)
R-Squared	0.041	0.041
Obs.	76246	76246
Pseudo-Log Likelihood	-45076.1	-45069.7

Results of the coefficient of generalised residuals in a probit model of support for redistribution. Models include the same set of controls than in Table 3. Standard errors are clustered at region level. t-statistics in parenthesis

*significant at 10 per cent; **significant at 5 per cent

Table 5. Perception of Corruption and Trust in Government Institutions

	(1) Index of trust in incumbent government		(2) Index of trust in political system	
	b	t	b	t
Corruption is very common	**-0.546*** **	**(-19.74)**	**-0.669*** **	**(-21.22)**
Female	-0.057***	(-3.19)	0.037**	(2.16)
White or Mestizo	0.013	(0.43)	0.011	(0.35)
Age	0.000	(0.29)	0.000	(0.38)
Has children	-0.029	(-1.36)	-0.069***	(-3.42)
Catholic	0.055***	(2.68)	0.077***	(3.09)
Labour status: Worker in private sector (Ref.)				
Inactive	0.082***	(4.26)	0.147***	(6.65)
Unemployed	-0.049	(-1.50)	-0.056	(-1.50)
Worker in public sector	0.283***	(6.44)	0.292***	(7.09)
Employer or entrepreneur	0.074	(1.53)	0.050	(1.00)
Self-employed	-0.027	(-1.23)	-0.045*	(-1.68)
News daily	0.100***	(4.44)	0.090***	(3.38)
Wealth index: Quintile 1 (Ref.)				
Quintile 2	-0.048*	(-1.74)	-0.054*	(-1.90)
Quintile 3	-0.117***	(-3.23)	-0.103***	(-2.71)
Quintile 4	-0.100***	(-2.80)	-0.082**	(-2.49)
Quintile 5	-0.125***	(-2.85)	-0.104***	(-2.70)
Education (years)	-0.012***	(-4.56)	-0.014***	(-3.60)
Size of place: Capital or big city (Ref.)				
Medium city	0.052	(1.43)	0.170***	(4.53)
Small city	0.155***	(4.16)	0.250***	(5.97)
Rural	0.181***	(5.57)	0.345***	(8.75)
Gini index	0.005	(0.46)	-0.001	(-0.07)
Poverty	0.003	(0.63)	0.005	(0.77)
Unemployment rate	0.003	(0.16)	0.003	(0.16)
Social expenditures (%GDP)	-0.006	(-0.49)	-0.005	(-0.28)
2008 (Ref.)				
2010	0.030	(0.72)	0.044	(0.86)
2012	0.050	(1.07)	0.042	(0.66)
Mexico (Ref.)				
Guatemala	-0.069	(-0.29)	-0.104	(-0.41)
El Salvador	-0.021	(-0.11)	-0.082	(-0.39)
Honduras	-0.130	(-0.51)	-0.210	(-0.77)
Nicaragua	-0.083	(-0.36)	-0.165	(-0.65)
Costa Rica	0.086	(0.46)	0.040	(0.19)
Panama	0.042	(0.26)	0.057	(0.33)
Colombia	0.043	(0.21)	0.070	(0.35)
Ecuador	0.030	(0.19)	-0.047	(-0.29)
Bolivia	0.012	(0.05)	-0.036	(-0.14)
Peru	0.095	(0.50)	0.100	(0.58)
Paraguay	-0.072	(-0.35)	-0.117	(-0.58)
Chile	0.071	(0.39)	0.068	(0.36)
Uruguay	0.127	(0.54)	0.065	(0.23)
Brazil	0.109	(0.35)	0.159	(0.56)
Venezuela	0.110	(0.61)	0.085	(0.41)
Argentina	0.180	(0.77)	0.239	(0.88)
Dominican Rep.	-0.022	(-0.12)	0.018	(0.11)
Constant	-0.124	(-0.21)	0.034	(0.06)
R-Squared	0.044		0.0549	
Obs.	72,204		66,608	
AIC	259,913.8		257,289.2	
Pseudo-Log Likelihood	-129,912.9		-128,600.6	

Coefficients of OLS models where each dependent variable is an index of trust. Standard errors are clustered at region level. t-statistics in parenthesis. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 6. Effect of Perception of Corruption on Support for Redistribution Net of Political Trust

	Trust in political system			Trust in incumbent government		
	Baseline model	Political trust	Perceived corruption + Political trust	Baseline model	Trust in incumbent government	Perceived corruption + Trust in incumbent government
	(1)	(2)	(3)	(4)	(5)	(6)
Corruption is very common	**0.093*** (13.51)**		**0.082*** (11.78)**	**0.091*** (13.86)**		**0.081*** (12.62)**
Trust in political system		-0.012*** (-4.23)	-0.007** (-2.60)			
Trust in political system squared		0.014*** (19.65)	0.014*** (19.62)			
Trust in incumbent government					-0.015*** (-3.59)	-0.010** (-2.46)
Trust in incumbent government squared					0.017*** (14.53)	0.016** (14.39)*
R-Squared	0.056	0.063	0.069	0.056	0.059	0.065
Obs.	66,608	66,608	66,608	72,204	72,204	72,204
AIC	92863.211	92394.699	91965.047	100469.844	100469.844	100006.360
Pseudo-Log Likelihood	-46387.606	-46152.350	-45936.524	-50189.922	-50189.922	-49957.180

Results of linear probability models where the dependent variable equals to 1 if the respondent strongly agrees with the statement: "The Government should implement strong policies to reduce income inequality between the rich and the poor". All models include country fixed effects and the same variables as in column 4 in Table 3. Standard errors are clustered at region level. t-statistics in parenthesis. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 7. Support for Redistribution and Opportunistic Motives

	(1) b/t	(2) b/t	(3) b/t	(4) b/t	(5) b/t	(6) b/t	(7) b/t
Corruption is very common	0.091*** (13.77)	0.091*** (13.71)	0.091*** (13.71)	0.091*** (13.70)	0.091*** (13.69)	0.091*** (13.72)	0.091*** (13.73)
Bribe is sometimes justified	-0.011 (-1.52)						
Have request help from public officials		0.033*** (5.06)					
Have request help from a parliament member			0.010 (0.84)				
Have request help from a local government member				0.032*** (4.52)			
Have request help from a national government member					0.045*** (4.92)		
Belong to an association						-0.010 (-1.27)	
Belong to a political party							0.015** (1.97)
R-Squared	0.041	0.042	0.041	0.041	0.041	0.041	0.041
Obs.	74,208	76,246	76,246	76,246	76,246	76,246	76,246
Pseudo-Log Likelihood	-43,871.2	-45,053.1	-45,0750.7	-45,060.2	-45,056.3	-45,074.8	-45,072.8

Average marginal effects of probit models where each dependent variable equals to 1 if the respondent strongly agrees with the statement "Government should implement strong policies to reduce income inequality". All models include country fixed effects and the same variables as in column 4 in Table 3. Standard errors are clustered at region level. t-statistics in parenthesis. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 8. Support for Redistribution and Perception of Corruption. Robustness check: Instrumental Variables

	(1) OLS		(2) IV		(3) POLS		(4) IV-POLS	
	Original variable		Original variable					
	b	t	b	t	b	t	b	t
Corruption is very common	**0.195*** **	**(8.20)**	**0.715**	**(0.74)**	**0.138*** **	**(10.09)**	**0.652**	**(1.24)**
Female	-0.022	(-1.62)	-0.015	(-0.81)	-0.012	(-1.48)	-0.005	(-0.44)
White or Mestizo	-0.043**	(-2.05)	-0.036	(-1.47)	-0.029**	(-2.41)	-0.023	(-1.55)
Age	-0.001	(-1.57)	-0.002	(-0.99)	-0.000	(-1.03)	-0.001	(-1.27)
Has children	0.075***	(5.10)	0.075***	(5.10)	0.047***	(5.15)	0.047***	(5.04)
Catholic	-0.055***	(-3.31)	-0.048**	(-2.35)	-0.041***	(-4.01)	-0.034***	(-2.84)
Inactive	-0.016	(-0.84)	-0.008	(-0.37)	-0.006	(-0.58)	0.001	(0.10)
Unemployed	-0.013	(-0.43)	-0.024	(-0.66)	-0.001	(-0.04)	-0.011	(-0.55)
Worker in public sector	0.110***	(4.16)	0.128***	(3.25)	0.062***	(3.79)	0.079***	(3.58)
Employer or entrepreneur	-0.166***	(-2.92)	-0.152**	(-2.39)	-0.083**	(-2.43)	-0.069*	(-1.85)
Self-employed	-0.031	(-1.58)	-0.036	(-1.59)	-0.012	(-1.02)	-0.017	(-1.20)
News daily	0.092***	(4.15)	0.074*	(1.86)	0.056***	(4.33)	0.039*	(1.69)
Wealth index (quintile 2)	-0.028	(-1.24)	-0.031	(-1.27)	-0.018	(-1.35)	-0.021	(-1.46)
Wealth index (quintile 3)	-0.041	(-1.57)	-0.047	(-1.57)	-0.027*	(-1.67)	-0.033*	(-1.83)
Wealth index (quintile 4)	-0.063**	(-2.03)	-0.074*	(-1.88)	-0.040**	(-2.10)	-0.051**	(-2.18)
Wealth index (quintile 5)	-0.180***	(-4.82)	-0.198***	(-3.51)	-0.106***	(-4.91)	-0.124***	(-3.88)
Education (years)	0.001	(0.22)	-0.002	(-0.45)	-0.000	(-0.25)	-0.003	(-1.10)
Medium city	0.087**	(2.18)	0.100**	(1.98)	0.057**	(2.44)	0.070**	(2.42)
Small city	0.051	(1.42)	0.069	(1.45)	0.026	(1.26)	0.044*	(1.71)
Rural area	0.055**	(2.00)	0.072*	(1.76)	0.031*	(1.85)	0.047**	(2.04)
Gini index	-0.004	(-0.27)	-0.007	(-0.51)	-0.002	(-0.21)	-0.005	(-0.63)
Poverty	0.026***	(3.00)	0.027***	(3.08)	0.014***	(2.82)	0.014***	(2.93)
Unemployment rate	-0.046*	(-1.95)	-0.053**	(-2.08)	-0.022	(-1.55)	-0.029*	(-1.94)
Social expenditures (%GDP)	-0.055**	(-2.00)	-0.054**	(-2.08)	-0.035**	(-2.20)	-0.034**	(-2.32)
2010	0.249***	(3.36)	0.252***	(3.43)	0.118***	(2.74)	0.121***	(2.87)
2012	0.346***	(3.79)	0.355***	(3.91)	0.194***	(3.56)	0.203***	(3.80)
Guatemala	-1.218***	(-4.79)	-1.255***	(-4.86)	-0.661***	(-4.40)	-0.698***	(-4.59)
El Salvador	-0.190	(-1.09)	-0.168	(-0.94)	-0.089	(-0.87)	-0.066	(-0.64)
Honduras	-1.694***	(-5.52)	-1.710***	(-5.55)	-0.881***	(-5.02)	-0.897***	(-5.05)
Nicaragua	-0.288	(-1.31)	-0.265	(-1.18)	-0.088	(-0.69)	-0.066	(-0.50)
Costa Rica	1.000***	(3.25)	1.016***	(3.37)	0.625***	(3.55)	0.642***	(3.76)
Panamá	0.186	(1.15)	0.227	(1.24)	0.123	(1.37)	0.164	(1.60)
Colombia	0.405**	(2.28)	0.426**	(2.37)	0.206*	(1.97)	0.227**	(2.13)
Ecuador	-0.442***	(-3.33)	-0.411***	(-2.83)	-0.259***	(-3.33)	-0.228***	(-2.70)
Bolivia	-0.243	(-0.93)	-0.202	(-0.79)	-0.145	(-0.95)	-0.105	(-0.72)
Perú	-0.256*	(-1.88)	-0.268*	(-1.88)	-0.198**	(-2.51)	-0.209**	(-2.44)
Paraguay	-0.171	(-1.00)	-0.184	(-1.05)	-0.040	(-0.39)	-0.052	(-0.50)
Chile	1.168***	(4.19)	1.312***	(3.48)	0.632***	(4.04)	0.774***	(3.69)
Uruguay	1.591***	(3.74)	1.718***	(3.72)	0.947***	(3.83)	1.073***	(4.14)
Brasil	1.248***	(3.08)	1.321***	(3.30)	0.748***	(3.19)	0.820***	(3.61)
Venezuela	-0.638***	(-2.68)	-0.652***	(-2.87)	-0.332**	(-2.42)	-0.345***	(-2.64)
Argentina	1.618***	(3.55)	1.599***	(3.60)	0.964***	(3.67)	0.946***	(3.77)
República Dominicana	-0.164	(-1.03)	-0.189	(-1.15)	-0.077	(-0.83)	-0.101	(-1.05)
Constant	5.773***	(10.19)	5.770***	(10.26)	-0.001	(-0.00)	-0.003	(-0.01)
R-Squared	0.064		0.037		0.065			
Obs.	76,246		76,246		76,246		76,246	
AIC	278343.6		-140192.9		195617.5		201622.8	
Pseudo-Log Likelihood	-139127.8		280473.9		-97764.7		-100767.4	

Dependent variable is the level of respondent's agreement with the statement "Government should implement strong policies to reduce income inequality". The First stage regression has the same specification of the model presented in column (1) in Table (3). Standard errors are clustered at region level. t-statistics in parenthesis. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 9. Test of endogeneity and validity of instruments

	Original variable (y= 1, … ,7)	POLS
Endogeneity test of endogenous regressors: C-statistic Ho: variables are exogenous	Robust score chi2(1): 0.278 Chi-sq(1) p-val = 0.5977	Robust score chi2(1): 0.879 Chi-sq(1) p-val = 0.3485
First-stage regression summary statistics		
R-sq.	0.0435	0.0435
Adjusted R-sq.	0.0429	0.0429
Partial R-sq.	0.0016	0.0016
F test of excluded instruments (F statistic adjusted for 108 clusters) Angrist-Pischke multivariate F test of excluded instruments	F(1, 107) = 28.41 Prob > F = 0.0000	F(1, 107) = 28.41 Prob > F = 0.0000
Weak identification test Ho: equation is weakly identified Stock-Yogo weak ID test critical values for single endogenous regressor: 10% maximal LIML size 16.38 15% maximal LIML size 8.96 20% maximal LIML size 6.66 25% maximal LIML size 5.53	Cragg-Donald Wald F statistic 122.113 Kleibergen-Paap Wald rk F statistic 28.414	Cragg-Donald Wald F statistic 122.11 Kleibergen-Paap Wald rk F statistic 28.41
Weak-instrument-robust inference Tests of joint significance of endogenous regressors B1 in main equation Ho: B1=0 and orthogonality conditions are valid	Anderson-Rubin Wald test F(1,107)= 0.52 p-val=0.4721 Anderson-Rubin Wald test Chi-sq(1)= 0.53 p-val=0.4683 Stock-Wright LM S statistic Chi-sq(1)= 0.51 p-val=0.4744	Anderson-Rubin Wald test F(1,107)= 1.42 p-val=0.2355 Anderson-Rubin Wald test Chi-sq(1)= 1.44 p-val=0.2306 Stock-Wright LM S statistic Chi-sq(1)= 1.36 p-val=0.2436
Montiel-Pflueger robust weak instrument test Critical Values % of Worst Case Bias LIML tau=5% 37.418 tau=10% 23.109 tau=20% 15.062 tau=30% 12.039	Effective F statistic: 30.235 Confidence level alpha: 5%	Effective F statistic: 30.235 Confidence level alpha: 5%
Underidentification test Ho: matrix of reduced form coefficients has rank=K-1 (underidentified) Ha: matrix has rank=K (identified)	Kleibergen-Paap rk LM statistic: Chi-sq(1)=19.87 p-value =0.0000	Kleibergen-Paap rk LM statistic: Chi-sq(1)= 19.867 p-value = 0.0000

Statistics robust to heteroscedasticity and clustering on primary sampling unit (subnational regions).
L1 is the number of excluded instruments and K1=number of endogenous regressors.

Table 10. Support for Redistribution and Perception of Corruption. Robustness check: Alternative dependent variable definition

Government, more than individuals, is the most responsible for ensuring the well-being of the people

	(1) Probit model Redistribution		(2) Bivariate probit model Redistribution		Corruption Perception	
	AME	t	AME	t	AME	t
Corruption is very common	**0.094*** **	**(12.52)**	**0.250***	**(1.75)**		
Provincial bribery victimization			**0.001**	**(0.93)**	**0.004*** **	**(5.25)**
Female	-0.006	(-1.60)	-0.006	(-1.64)	-0.015***	(-3.15)
White or Mestizo	-0.012*	(-1.69)	-0.011	(-1.56)	-0.012*	(-1.85)
Age	0.001***	(5.31)	0.001***	(4.15)	0.002***	(6.69)
Has children	0.015**	(2.57)	0.013**	(2.23)	-0.000	(-0.00)
Catholic	-0.033***	(-6.34)	-0.029***	(-3.97)	-0.012**	(-2.13)
Labour status: Worker in private sector (Ref.)						
Inactive	0.001	(0.10)	0.001	(0.10)	-0.013*	(-1.91)
Unemployed	0.005	(0.62)	0.005	(0.67)	0.021**	(1.97)
Worker in public sector	0.026***	(2.84)	0.022**	(2.21)	-0.033***	(-2.98)
Employer or entrepreneur	-0.001	(-0.07)	-0.002	(-0.10)	-0.029*	(-1.68)
Self-employed	0.011*	(1.74)	0.010*	(1.70)	0.010	(1.42)
News daily	0.026***	(4.54)	0.023***	(3.56)	0.033***	(5.17)
Wealth index: Quintile 1 (Ref.)	0.000	(.)	0.000	(.)	0.000	(.)
Quintile 2	-0.013*	(-1.89)	-0.012*	(-1.71)	0.005	(0.80)
Quintile 3	-0.015*	(-1.73)	-0.013	(-1.60)	0.012	(1.53)
Quintile 4	-0.020**	(-2.11)	-0.017*	(-1.88)	0.020***	(2.63)
Quintile 5	-0.022**	(-2.15)	-0.019**	(-1.97)	0.033***	(3.69)
Education (years)	-0.001*	(-1.84)	-0.001	(-1.44)	0.006***	(5.03)
Size of place: Capital or big city (Ref.)						
Medium city	0.037***	(3.50)	0.034***	(3.34)	-0.014	(-1.57)
Small city	0.018*	(1.80)	0.017*	(1.90)	-0.022**	(-2.33)
Rural	0.021**	(2.33)	0.020**	(2.36)	-0.020**	(-2.26)
Gini Index	-0.000	(-0.10)	-0.001	(-0.14)	0.005	(0.92)
Poverty	0.003	(1.48)	0.003	(1.37)	-0.001	(-0.61)
Unemployment rate	-0.006	(-0.72)	-0.005	(-0.62)	0.014*	(1.88)
Social expenditures (%GDP)	-0.022***	(-3.26)	-0.019**	(-2.25)	0.002	(0.24)
2008 (Ref.)						
2010	0.038*	(1.78)	0.031	(1.49)	-0.014	(-0.77)
2012	0.087***	(3.42)	0.074**	(2.34)	-0.034	(-1.06)
Mexico	0.000	(.)	0.000	(.)	0.000	(.)
Guatemala	-0.112**	(-2.38)	-0.082	(-1.56)	0.131*	(1.89)
El Salvador	0.053	(1.15)	0.052	(1.31)	0.006	(0.12)
Honduras	-0.099	(-1.62)	-0.073	(-1.27)	0.084	(1.00)
Nicaragua	0.198***	(3.17)	0.179***	(2.82)	0.001	(0.02)
Costa Rica	0.405***	(9.75)	0.377***	(5.14)	-0.017	(-0.24)
Panama	0.106***	(2.60)	0.101***	(2.64)	0.000	(0.00)
Colombia	0.142***	(3.09)	0.127***	(2.59)	0.008	(0.18)
Ecuador	0.003	(0.09)	0.007	(0.26)	-0.023	(-0.64)
Bolivia	0.078	(1.23)	0.058	(0.96)	-0.107	(-1.53)
Peru	-0.065**	(-2.01)	-0.051*	(-1.71)	0.031	(1.02)
Paraguay	0.149***	(3.26)	0.134***	(2.99)	0.064	(1.44)
Chile	0.234***	(4.02)	0.208***	(3.00)	-0.201***	(-3.73)
Uruguay	0.511***	(9.88)	0.487***	(5.41)	-0.232***	(-2.62)
Brazil	0.351***	(4.86)	0.320***	(3.13)	-0.118	(-1.33)
Venezuela	0.088	(1.51)	0.078	(1.55)	0.054	(0.83)
Argentina	0.504***	(9.76)	0.481***	(5.32)	0.008	(0.07)
Dominican Republic	0.075*	(1.91)	0.072**	(2.14)	0.107**	(2.33)
athrho			**-0.315**	**(-0.85)**		
Wald test of rho=0			**chi2(1) = .72962 Prob > chi2 = 0.3930**			
R-Squared	0.043					
Obs.	75,552		75,552			
Pseudo-Log Likelihood	-44088.9		-88600.9			

Average marginal effects of univariate and recursive bivariate probit models where each dependent variable equals to 1 if the respondent strongly agrees with the statement "Government more than individuals, is the most responsible for ensuring the well-being of the people". Standard errors are clustered at region level. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 11. Support for Redistributive Taxation and Perception of Corruption
Robustness check: Alternative dependent variable definition

	Government should reduce income inequality				How much tax each person should pay?			
	(1)		(2)		(3)		(4)	
	b	t	AME	t	b	t	AME	t
Corruption is very common	**0.291*** **	**(7.84)**	**0.112*** **	**(7.99)**	**0.121*** **	**(3.65)**	**0.046*** **	**(3.66)**
Female	-0.006	(-0.15)	-0.002	(-0.15)	-0.034	(-0.97)	-0.013	(-0.97)
White or Mestizo	0.026	(0.53)	0.010	(0.53)	0.038	(0.85)	0.014	(0.85)
Age	-0.004***	(-2.59)	-0.001***	(-2.60)	0.003**	(1.98)	0.001**	(1.98)
Has children	0.068	(1.43)	0.026	(1.43)	0.053	(1.26)	0.020	(1.26)
Catholic	-0.018	(-0.44)	-0.007	(-0.44)	0.017	(0.48)	0.007	(0.48)
Occupation: Worker in private sector (Ref.)								
Inactive	0.051	(0.93)	0.020	(0.94)	0.033	(0.70)	0.013	(0.70)
Unemployed	0.024	(0.32)	0.009	(0.32)	-0.064	(-0.95)	-0.024	(-0.96)
Worker in public sector	0.058	(0.78)	0.022	(0.78)	0.030	(0.45)	0.011	(0.45)
Employer or entrepreneur	0.130	(1.00)	0.050	(1.00)	-0.313***	(-2.83)	-0.110***	(-3.02)
Self-employed	0.020	(0.36)	0.008	(0.36)	0.024	(0.51)	0.009	(0.51)
News daily	0.192***	(4.94)	0.074***	(4.98)	-0.027	(-0.77)	-0.010	(-0.77)
Wealth index: Quintile 1 (Ref.)	0.000	(.)	0.000	(.)	0.000	(.)	0.000	(.)
Quintile 2	0.159***	(2.67)	0.061***	(2.67)	-0.045	(-0.82)	-0.017	(-0.82)
Quintile 3	0.110*	(1.81)	0.042*	(1.81)	-0.085	(-1.54)	-0.033	(-1.54)
Quintile 4	0.005	(0.09)	0.002	(0.09)	-0.176***	(-3.20)	-0.066***	(-3.20)
Quintile 5	-0.026	(-0.40)	-0.010	(-0.40)	-0.219***	(-3.77)	-0.082***	(-3.77)
Education (years)	-0.006	(-1.12)	-0.002	(-1.12)	-0.016***	(-3.14)	-0.006***	(-3.14)
Size of place: Capital or big city (Ref.)								
Medium city	0.095*	(1.89)	0.037*	(1.89)	-0.028	(-0.63)	-0.010	(-0.63)
Small city	-0.198***	(-3.79)	-0.077***	(-3.80)	-0.007	(-0.14)	-0.003	(-0.14)
Rural	0.009	(0.12)	0.004	(0.12)	0.068	(0.98)	0.026	(0.98)
Mexico								
Brazil	0.276***	(5.33)	0.107***	(5.36)	-0.071	(-1.53)	-0.026	(-1.53)
Venezuela	-0.057	(-0.93)	-0.022	(-0.93)	-0.011	(-0.20)	-0.004	(-0.20)
Argentina	0.266***	(4.39)	0.103***	(4.41)	0.102**	(1.97)	0.039**	(1.97)
cut1 Constant	0.257**	(2.22)			-0.433***	(-4.21)		
cut2 Constant					-0.172*	(-1.67)		
cut3 Constant					0.262**	(2.55)		
Obs.	5,221		5,221		5,221		5,221	
AIC	6033.100		.		11258.046		.	
Pseudo-Log Likelihood	-2992.550				-5603.023			

Coefficients and average marginal effects of probit (Columns 1 and 2) and ordered probit (Columns 3 and 4) models. Standard errors are clustered at region level. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Appendix A

Table A1. Data Sources and Definitions

Variables	Definition and Questions	Variable in LAPOP
Dependent variable		
Government should reduce inequality	The (Country) government should implement strong policies to reduce income inequality between the rich and the poor. To what extent do you agree or disagree with this statement? 1 means "strongly disagree" and 7 means "strongly agree."	ROS4
Individual variables		
Female	Dummy variable equal to 1 if respondent is female and 0 if male.	Q1
Age	Years	Q2
Has children	Dummy variable equal to 1 if respondent has any children and equals to 0 if the individual has no children.	Q12
White or Mestizo	Dummy variable equal to 1 if white or mestizo and 0 otherwise	ETID
Catholic	Dummy variable equal to 1 if "Catholic" and 0 otherwise	Q3C
Labour status	Set of dummy variables equal to 1 if the individual is: "Inactive" (a student, or taking care of the home, or retired, a pensioner or permanently disabled to work, or not working and not looking for a job); "Unemployed" (actively looking for a job); "Worker in public sector" (salaried employee of the government or an independent state-owned enterprise); "Employer or entrepreneur" (owner or partner in a business), and "Self-employed". The reference category is "Worker in private sector" (salaried employee in the private sector).	OCUP4A and OCUP1A
News daily (Access to political information)	We would like to know how much information about politics and the country is known by the people. About how often do you pay attention to the news, whether on TV, the radio, newspapers or the internet? Dummy variable equal to 1 if "Daily" and equal to 0 otherwise	A1, A2, A3 and A4i (2008) and GI0 (2010)
Education	Years of education	ED
Size of place	Set of dummy variables equal to 1 if the individual lives in the Capital or a big city (reference), a middle size town, a small town or in the rural area.	TAMANO
Self reported income and wealth		
Income decile	Income range of total monthly household income, including remittances from abroad and the income of the all working adults and children. 10 deciles built by LAPOP based on the currency and distribution of each country in 2008 and 2010 while 16 are used in 2012. Observations with "No income" were dropped.	Q10 and Q10new
Wealth index	Quintile of a wealth index built from a principal component analysis of dummy variables indicating ownership of the following assets: television, refrigerator, landline telephone, cellular telephone, car, washing machine, microwave oven, motorcycle, indoor plumbing, indoor bathroom, computer, and internet.	R1 to R18
Perceptions about corruption, government and political institutions		
Perception of corruption	Taking into account your own experience or what you have heard, corruption among public officials is [1] Very uncommon [2] Uncommon [3] Common [4] Very uncommon. We use a binary version of this variable, it equals 1 if response is [4]	EXC7.
Pay a bribe is justified	Do you think, given the way things are, sometimes paying a bribe is justified? Dummy variable equal to 1 if "yes"	EXC18
Was asked for a bribe	Dummy variable equal to 1 if in the last twelve months individual were asked for a bribe by a police officer, or by any government employee, or in their work, or in the courts, or in public health services, or at school.	EXC2 to EXC16
Trust in incumbent government	To what extent do you trust the national government? To what extent do you trust the president? To what extent would you say the current government fights poverty? To what extent would you say the current government combats government corruption? Speaking in general of the current administration, how would you rate the job performance of President: very well, well, neither well nor poorly, poorly, or very poorly? Except for the last question, options range from 1 to 7, where 1 means "Not at all" and 7 means "A lot"	B14
Trust in political institutions	To what extent do you think that citizens' basic rights are well protected by the political system of (country)? To what extent do you trust the justice system of (country)? To what extent do you think the courts in (country) guarantee a fair trial? To what extent do you trust the Parliament of (country)? Speaking of National Parliament, and thinking of members as a whole, without considering the political parties to which they belong, do you believe that the members of the National Parliament are performing their jobs: very well, well, neither well nor poorly, poorly, or very poorly? To what extent do you respect the political institutions of your country? Except for the last question, options range from 1 to 7, where 1 means "Not at all" and 7 means "A lot".	B2

Table A1. Cont.

Approach to opportunistic behaviour		
	Sometimes people and communities have problems that they cannot solve by themselves, and so in order to solve them they request help from a government official or agency In order to solve your problems have you ever requested help or cooperation from...?Dummy variable equals one if respondent have requested help to i) A member of the National Assembly (Representative, Senator), a local public official or local government for example, a mayor or municipal councilperson; any ministry or minister (federal), state agency or public agency or institution.	CP2, CP4, CP4a
	Please tell me if you attend meetings of these organizations once a week, once or twice a month, once or twice a year, or never. CP9. Meetings of an association of professionals, merchants, manufacturers or farmers? CP13. Meetings of a political party or political organization?	CP9 and CP13
Country level variables		
Poverty rate	Percentage of population living below the national poverty line	CEPALSTAT
Unemployment rate	Open unemployment rate. Average annual rate of the active population unemployed.	
Social expenditures (%GDP)	Social public expenditure as percentage of the Gross Domestic Product (GDP). The public social expenditure includes spending on education, health and nutrition, social security, employment, social welfare, housing, water and sewerage system. Estimates based on official country figures	
Gini coefficient	Measure of income inequality. It is an index that varies between 0 and 100, where 0 corresponds to absolute equality and 100 to absolute inequality	

Table A2. Observations by country and year, Americas Barometer

Country	2008	2010	2012	Total
Mexico	1,235	1,259	1,247	3,741
Guatemala	1,163	1,199	1,036	3,398
El Salvador	1,442	1,472	1,284	4,198
Honduras	1,241	1,369	1,330	3,940
Nicaragua	1,156	1,218	1,454	3,828
Costa Rica	1,311	1,395	1,375	4,081
Panama	1,380	1,415	1,470	4,265
Colombia	1,247	1,291	1,146	3,684
Ecuador	2,672	2,805	1,107	6,584
Bolivia	2,603	2,576	2,583	7,762
Peru	1,280	1,333	1,319	3,932
Paraguay	1,022	1,287	987	3,296
Chile	1,363	1,760	1,372	4,495
Uruguay	1,336	1,343	1,203	3,882
Brazil	1,151	2,026	1,217	4,394
Venezuela	1,194	1,178	1,300	3,672
Argentina	1,133	1,105	1,258	3,496
Dominican Republic	1,188	1,220	1,190	3,598
Total	25,117	27,251	23,878	76,246

Table A3. Summary Statistics of dependent and independent variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
Government should reduce income inequality	76246	0.478	0.500	0	1
Perception of corruption	76246	0.432	0.495	0	1
Female	76246	0.505	0.500	0	1
White or mestizo	76246	0.815	0.389	0	1
Age	76246	39.068	15.783	18	99
Has any children	76246	0.735	0.442	0	1
Catholic	76246	0.681	0.466	0	1
Labour status					
Inactive	76246	0.383	0.486	0	1
Unemployed	76246	0.062	0.241	0	1
Worker in private sector (Ref.)	76246	0.196	0.397	0	1
Worker in public sector	76246	0.075	0.263	0	1
Employer or entrepreneur	76246	0.018	0.133	0	1
Self-employed	76246	0.267	0.443	0	1
Daily exposure to mass media	76246	0.689	0.463	0	1
Wealth index	76246	0.090	1.789	-10.05	6.94
Education (years)	76246	9.436	4.449	0	18
Size of the place of residence					
Capital or big city (Ref.)	76246	0.418	0.493	0	1
Medium city	76246	0.167	0.373	0	1
Small city	76246	0.145	0.352	0	1
Rural area	76246	0.270	0.444	0	1
Gini coefficient	76246	0.512	0.046	0.397	0.59
Poverty rate (%)	76246	36.774	16.261	5.7	68.9
Unemployment rate	76246	7.295	1.963	3.1	12.99517
Social expenditure as % of GDP	76246	13.934	5.668	7	27.78
Year					
2008 (Ref.)	76246	0.329	0.470	0	1
2010	76246	0.357	0.479	0	1
2012	76246	0.313	0.464	0	1
Political trust					
Index of trust in incumbent government	72204	-0.013	1.495	-5.569	6.118.
Index of trust in political institutions	50859	-0.025	2.253	-8.364	8.434
Opportunistic motives					
Bribe is sometimes justified	74208	0.147	0.354	0	1
Have request help from public officials	76246	0.178	0.382	0	1
Have request help from a parliament	76246	0.046	0.210	0	1
Have request help from a local government member	76246	0.127	0.333	0	1
Have request help from a national government member	76246	0.074	0.262	0	1
Belong to an association	76246	0.131	0.337	0	1
Belong to a political party	76246	0.133	0.339	0	1
Alternative dependent variables					
Support for progressive taxation. *How much tax each person should pay?*					
the rich 30 cents and the poor 30 cents	5221	0.354	0.478	0	1
the rich 40 cents and the poor 30 cents	5221	0.09	0.294	0	1
the rich 50 cents and the poor 20 cents	5221	0.162	0.368	0	1
the rich 60 cents and the poor 10 cents	5221	0.389	0.487	0	1
The government, more than individuals, is the most responsible for ensuring the well-being of the people.	75552	0.427	0.494	0	1

Table A4. Income decile and quintiles of wealth index

Income decile	Quintiles of wealth index					Total
	1st	2nd	3rd	4th	5th	
1st (Lowest)	51.47	25.28	14.43	6.54	2.29	100.00
2nd	36.53	26.75	19.41	12.73	4.58	100.00
3rd	26.46	27.31	22.35	16.3	7.58	100.00
4th	16.07	23.38	25.28	22.14	13.13	100.00
5th	9.27	17.87	23.35	26.09	23.42	100.00
6th	6.03	13.13	22.86	26.95	31.03	100.00
7th	3.26	9.5	17.9	26.25	43.09	100.00
8th	3.73	6.16	13.72	26.6	49.79	100.00
9th	2.64	5.63	8.62	24.5	58.61	100.00
10th (Highest)	1.48	2.64	4.43	18.89	72.56	100.00
Total	21.79	20.83	20.45	19.13	17.80	100.00

Calculated using Americas Barometer 2008 and 2010
Polyserial correlation:
N = 53,121
Rho = .538
S.e. = .003

Table A5. Polychoric correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	Female	1.000								
(2)	White or Mestizo	0.027	1.000							
(3)	Age	-0.020	-0.003	1.000						
(4)	Has children	0.224	-0.055	0.636	1.000					
(5)	Catholic	0.050	0.079	0.106	0.067	1.000				
(6)	Labour status	-0.470	-0.050	-0.037	0.076	-0.013	1.000			
(7)	News daily	-0.070	0.098	0.121	0.116	0.067	0.013	1.000		
(8)	Quintile of wealth	-0.048	0.198	-0.044	-0.139	0.037	0.018	0.173	1.000	
(9)	Education (years)	-0.037	0.162	-0.297	-0.314	0.047	0.053	0.163	0.474	1.000
(10)	Size of town	-0.032	-0.100	-0.029	0.062	0.056	0.050	-0.141	-0.410	-0.317

All correlations are significant at 1 per cent.

Appendix B: Perception of corruption and (dis)trust in government institution with the Karlson-Holm-Breen (KHB) method.

In order to compute whether distrust in government reduces people's support for redistribution and accounts for some of the estimated overall effect of perceived corruption on support for redistribution, section 6.4 reports decomposition results from linear probability models. As pointed out in section 6.4, however, this strategy is not the most statistically rigorous decomposition one can employ to this end.

In this Appendix, we outline and report decomposition results from the Karlson-Holm-Breen (KHB) method, developed to compare the estimated coefficients between two nested non-linear probability models (Karlson and Holm 2011, Kohler et al. 2011, Karlson et al. 2012). The KHB-method decomposes the total effect of a variable into a direct (unmediated by the additional controls) and an indirect effect (mediated by the additional controls) by comparing the full model (our eq. (3)) with an alternative model that replaces the additional control variable (t_i in our model) with the residuals from a regression of the additional control variable on the variable of interest, $\widehat{\omega}_i = t_i - c_i\hat{\theta}$. Therefore, this method allows us to separate the change in the coefficient that is due to mediation from the change that is due to rescaling.

The KHB-method decomposition results reported in Table A6 are very similar to those obtained from a linear probability model (see Table 6). The decomposition of the direct and indirect effects of political trust shows that controlling for political trust effectively changes the coefficients and average marginal effects of perception of corruption compared to the baseline model. When political trust is not controlled for, the average marginal effect of perceiving corruption is 9.2 percentage points and this effect is reduced to 8.1 when trust in the political system is included in the model (columns (1) and (3)); similarly, the average marginal effect of perceiving corruption changes to 8.1 from 9.1 when we control for trust in incumbent government (columns (4) and (6)). Moreover, the differences between estimates of perception of corruption in the reduced model (γ) and estimates in the full model (γ') are positive and statistically significant according to the KHB-method results. As indicated by the confounding (or mediation) ratio[67], the total effect is around 1.1 times larger than the mediation effect of political trust, while the percentage of reduction in the coefficient of perception of corruption due to the mediation effect of trust in the political system is 12.2. Therefore, although most of the change in the coefficient is due to the rescaling factor, nearly one sixth of the effect of perceived corruption on support for redistribution is mediated by political trust.

[67] Mediation and confounding are different but related concepts. A confounder is a variable that distorts the association between the independent variable and the main outcome. A mediator is also associated with both the independent and dependent variables, but is part of the hypothesised causal chain between the independent and dependent variables. As a confounder cannot be distinguished from a mediator on statistical grounds (MacKinnon et. al 2000), the confounding ratio obtained with the KHB-method can be also interpreted as a mediation ratio.

Table A6. Effect of Perception of Corruption Net of Political Trust. Decomposition Using the KHB-Method

	Trust in political system			Trust in incumbent government		
	Baseline model	Political trust	Perceived corruption + Political trust	Baseline model	Trust in incumbent government	Perceived corruption + Trust in incumbent government
	(1)	(2)	(3)	(4)	(5)	(6)
Coefficients	**(Total effect)**		**(Direct effect)**	**(Total effect)**		**(Direct effect)**
Corruption is very common	**0.242*** (13.65)**		**0.216*** (11.84)**	**0.238*** (13.98)**		**0.215*** (12.65)**
Index of political trust		-0.031*** (-4.21)	-0.020*** (-2.59)		-0.039*** (-3.55)	-0.026** (-2.43)
Index of political trust ^2		0.038*** (19,04)	0.038*** (18.99)		0.045*** (14,29)	0.044*** (14.14)
Marginal Effects						
Corruption is very common	**0.092*** (13.70)**		**0.081*** (11.90)**	**0.091*** (14.03)**		**0.081*** (12.72)**
Index of political trust		-0.012*** (-4.49)	-0.008*** (-2.80)		-0.015*** (-3.71)	-0.010** (-2.55)
Difference of coefficients **(Indirect effect)**			**0.026*** (5.55)**			**0.023*** (4.18)**
Confounding ratio			1.139			1.119
Percentage of reduction due to confounding effect			12.2			12.2
Rescaling factor			1.014			1.014
R-Squared	0.041	0.047	0.051	0.041	0.044	0.048
Obs.	66,608	66,608	66,608	72,204	72,204	72,204
Pseudo-Log Likelihood	-39431.6	-39219,0	-39026.5	-42647.1	-42529.7	84738.4

Results of probit models where the dependent variable equals to 1 if the respondent strongly agrees with the statement: "The Government should implement strong policies to reduce income inequality between the rich and the poor". All models include country fixed effects and the same variables as in column 4 in Table 3. Standard errors are clustered at region level. t-statistics in parentheses. *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent
Decomposition based on the results of probit models. The confounding ratio measures the impact of confounding net of rescaling. The percentage reduction measures the percentage change in the coefficient of the perception of corruption variable that can be attributed to the confounding effect of political trust net of scaling. Finally, the rescale factor measures the impact of rescaling, net of confounding.

The good, the bad and the ugly: The socio-economic impact of drug cartels and their violence in Mexico*

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Abstract

This paper assesses the impact that drug cartels and their associated violence have had on development in Mexico. For this purpose, we monitor official and media reports to identify where cartels have operated with and without drug related homicides. Using the difference-in-difference kernel matching method, we find that on the one hand, inequality declined to a large extent in areas where cartels were active without incidents of drug related homicides. On the other, poverty increased in areas that had both the lowest and the highest rates of drug related homicides. Two reasons could explain this increase in poverty. In the most violent areas the number of employers and remunerations declined in key industries, such as manufacturing. In the least violent areas poverty increased possibly due to people migrating from the more violent places.

JEL CLASSIFICATION: K49, O160, O170, R59, C26

KEYWORDS: Drug Cartels, violence, poverty, inequality, education, migration, Kernel matching

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1. Introduction

Once upon a time, drug cartels operated "peacefully" in Mexico, smuggling illegal drugs to the United States. As the new millennium approached, cartels started fighting one another for territory. About 6,680 people died as a result of the battle among cartels between 2001 and 2005 (Ríos and Shrik, 2011). Felipe Calderón, the then recently elected President, concerned about the growing violence, declared war against cartels in December 2006. Instead of focusing on seizing drugs, as many of his predecessors had done, Calderón deployed more than 40,000 soldiers to tackle cartels in several areas (BBC News, 2009). He also arrested more cartel leaders than ever before.[68] As efforts against cartels intensified, so did the violence and bloodshed (Dell, 2011). Over 63,000 killings occurred, the majority alleged drug traffickers, just between 2006 and 2012 (Molzahn et al., 2013; SNSP, 2011).[69] Cities and towns turned into battlefields with the local population becoming pray to extortions and other thefts (Gutiérrez-Romero and Conte, 2014).

Earlier studies have found that unemployment and migration from border areas to the United States increased in areas affected by drug related homicides (BenYishay and Pearlman, 2013; Dell, 2011; Ríos, 2014b; Robles et al., 2013). We contribute to the literature by estimating, for the first time, the impact that drug cartels and separately drug related homicides have had on poverty and inequality. We also explore how drug trafficking and drug violence could have affected these statistics. We do so by assessing the changes in internal migration, education drop out, economic activity, and the number of employers, employees, remunerations and investment across various industries.

We evaluate the impact of cartels and drug related homicides using the difference-in-difference kernel matching estimator (Heckman et al., 1998). Specifically, we estimate the change in outcomes before (2000-2005) and after cartels settled in areas for the first time (2006 or afterwards). We compare that change in outcomes to the ones experienced in areas that did not have cartels or drug related homicides over the same periods. We match areas -treatment and controls- based on their characteristics and their likelihood of experiencing cartels and drug related homicides. We identify the factors influencing the likelihood of areas having cartels and their associated violence according to the recent

[68] Twenty eight top tier cartel kingpins were arrested or killed during Calderon's administration (Guerrero-Gutiérrez, 2011). Another 36,332 people were arrested for drug offenses -more than triple the number of arrests of the previous administration of Vicente Fox (Molzahn et al., 2013). Public security spending also increased seven times faster under Calderón's than under Fox's administration (Justice in Mexico Project, 2011).

69 According to the Mexican General Attorney 90% of these casualties were members of drug cartels, 7% members of the army and police forces and the rest civilians.

literature. These factors, described in detail in the next section, refer to the stricter policies imposed against cartels, and the political decentralization that Mexico experienced (Castillo et al. 2012; Dell, 2011; Ríos, 2014a).

To identify the areas where cartels have been active (with and without related homicides) we survey official records; national and international media reports; and specialized blogs. We also use the recently released official statistics on drug related homicides that are available only for the period December 2006 until September 2011 (SNSP, 2011). These statistics give the location and number of people killed in the battles among cartels and with the state authority. We also use the population and economic censuses, and poverty statistics, all representative at municipality level.

We find that in areas where cartels were active without incidents of drug related homicides inequality declined but had no changes in poverty. In contrast, in areas that had both the lowest and the highest rates of drug related homicides poverty increased whilst inequality did not change. Two reasons could explain this increase in poverty. The number of employers and remunerations in manufacturing declined in the areas with the highest rates of drug related homicides. Changes in population size and migration patterns also suggest people moved from more to less violent areas, perhaps relocating poor people within the country.

These impacts refer only to the areas that experienced cartels or drug related homicides for the first time in 2006 or afterwards, the period during which drug cartels expanded to new regions. Focusing on this period has the main advantage of capturing the immediate short-term impacts of cartels moving on to new areas. But it has the disadvantage of excluding those areas that suffered drug violence much earlier. In the robustness section we show that areas that experienced drug related homicides in an earlier period, during 2001-2005, also suffered an immediate rise in poverty, which increased even further during 2006-2010.

The paper continues as follows: The next section explains the reasons behind drug cartels fighting each other. Section 3 discusses the impact that cartels and their violence can have on development. Section 4 presents the econometric method and databases used. Section 5 estimates the impact of cartels and drug related homicides on welfare statistics. Section 6 tests the mechanisms that could explain our results. Section 7 shows the robustness checks, and Section 8 concludes.

2. The causes of Mexican drug violence

Most illegal drugs consumed today in the United States come through Mexico (Payan, 2006).[70] It is no coincidence the world's biggest consumer of narcotics and the world's biggest supplier of narcotics happen to be neighbours (Keefe, 2012).

Drug trafficking is not new in Mexico. Cartels have been active in the country for over a century, and until recently without mayor episodes of violence. The peaceful coexistence among cartels was possible thanks to their agreement with some members of the state-authority, dominated by the 71-year old ruling Institutional Revolutionary Party (PRI). PRI's authoritarian regime enjoyed a strong supremacy of power across all levels of government. The lack of power switching, and the weak checks and balances, made the political system not only permissive, but protective of drug cartels (Astorga and Shirk, 2011; Buscaglia, 2013). In exchange for bribes, cartels were given protection from members of the state-authority to work in certain areas and shipment routes, called *plazas*. Campbell (2009) describes "Control of a *plaza* gives the drug lord and police commander of an area the power to charge less powerful traffickers tolls. . . The cartel that has the most power in a particular *plaza* receives police and military protections for its drug shipments." (p. 23-24). These *plazas* came with a code of conduct. Cartels needed to restrain from selling drugs in the domestic market, inciting violence and fighting directly with the state-authority (Gómez and Fritz, 2005). Cartels that violated agreements -for instance by trespassing into areas not authorised to work in- would be penalised by the state seizing drugs or eventually arresting or killing the cartel's leaders (Guerrero-Gutiérrez, 2009).

By the late 1990s, PRI's domination was met with growing internal political opposition, resulting in major electoral reforms in 1997. These reforms increased electoral victories for opposition parties at the sub-national level.[71] Battles among cartels over territory soon emerged. PRI's defeat in the 2000 presidential election to the National Action Party (PAN) was a further blow to the stability and mediating role the state-authority had played with organised crime (Ríos, 2014a). So the turf war among drug lords intensified. At least 8,901 people were executed in the turf war among cartels during much of President Fox's administration 2001-2006 (Molzahn et al., 2012; Ríos and Shrik, 2011). The victims were mainly cartels members and to lesser extent policemen and military

[70] Ninety per cent of cocaine and a third of heroin and marijuana available in the US enter via Mexico (Cook, 2007).

[71] Ríos (2014a) explains that 2,162 out of the 2,475 municipalities were ruled by the same party across all levels in 1990. The number of municipalities sharing the same party across all government's levels declined to 1,654 in 1998 and to 1,433 in 2010.

personnel.[72] In response to the new wave of violence, Fox increased security expenditure in areas mostly affected by violence. In 2006, the PAN party won for the second time the presidency. However the victory of PAN's candidate, Felipe Calderón, was marred by allegations of rigging and stealing the presidency from the closest contender from the Party of Democratic Revolution. To regain legitimacy, critics suggest, Calderón chose to tackle the growing problem of drug violence (Ravelo, 2012).

Calderón actively prosecuted drug cartels with military force in their hotspots, reducing temporarily the violence in 2007.[73] However, violence ignited again in 2008 and to unforeseen levels in 2010.[74] According to official statistics, 47,515 people died because of the conflict among cartels and the state from December 2006 to September 2011. These casualties represent half of all national homicides (Figure 1). By 2011, Mexico had 12 out of the 50 most violent cities in the world (CCSPJP, 2011).

Despite the efforts against drug trafficking, cartels also multiplied. In 2006, there were six major cartels, by 2010 they had multiplied to 16 (Guerrero-Gutiérrez, 2011). The number of cartels increased partly because some fractured into two or more over leadership disputes. New cartels also emerged. Others became transnational, like the Sinaloa cartel, allegedly active now in over 50 countries (Keefe, 2012).

Several researchers agree that Calderón's enforcement strategy was largely responsible for increasing drug violence and multiplying cartels (Dell, 2011; Escalante, 2011; Guerrero-Gutiérrez, 2011; Lessing, 2012; Merino, 2011; Osorio, 2012). For instance, Guerrero-Gutiérrez (2011) using event history analysis shows that after the government arrest of a cartel's kingpin, drug related violence immediately follows and intensifies over three months as drug cartels fight over leadership. Similarly, Dell explains that Mayors from the PAN party are more likely to ask for federal support to intensify crackdowns against cartels. Using regression discontinuity, Dell shows the probability of experiencing drug related homicides increased by nine percentage points in municipalities where the PAN party won the local elections (by a close margin compared to areas where the PAN lost by a close margin). The drug violence spread to areas with good transport networks and in close proximity to borders and the coast. Overall, Dell estimates that cartel attempts

[72] Half of the executions took place in Michoacán, a state by the pacific coast, which witnessed the cartels "La Familia" and "Los Zetas" battle over territory. Another 30% of the executions were concentrated in the northern states of Sinaloa and Tamaulipas. The violence also affected major cities such as Acapulco, Guadalajara, Mexico City and Tijuana.

[73] According to official estimates 60% of the police force was already infiltrated by drug-traffickers, one of the reasons why Calderón deployed the army instead (Guerrero-Gutiérrez, 2011; Salinas de Gortari, 2011).

[74] Two parallel conflicts fuelled this violence (The Economist, 2012). The Sinaloa cartel fell out with its former allies, the cartels of Juarez, Tijuana and Culiacán. Also, the Gulf cartel fell out with the Zetas, an ex-military group that it had hired as its enforcer since 1996.

to control new territories after the arrest or death of rival cartel leaders explain over 85% of drug related homicides.

Ríos (2014a) provides a complementary explanation for the drug violence. She recalls that during the permissive era of the PRI's 71-year ruling, the state would arrest and even kill drug's lords from time to time. Yet, cartels would not retaliate with violence. So, Ríos argues that decentralization is the key element that drove the new violence under the Fox and Calderon administrations. The decentralization meant that for the first time some municipalities did not share the same political party as the federal or state administration. Hence, the coordination between different levels of state-authority and cartels became difficult. Cartels were forced to seek new agreements with the new political actors, and armed themselves to protect their territory or confront rivals.

The ease with which cartels armed themselves is explained by Dube et al. (2013). They recall that in 2004 the US Federal Assault Weapon Ban expired. The expiry of this law lifted the prohibition on domestic sales of military-style firearms in most of the US, but with important differences across border states. California retained the pre-existing state-level ban. In contrast, many other US-Mexican border states did not, including Texas, Arizona and New Mexico. This explains why homicides rose by 60% more in Mexican municipalities at the non-California entry ports, in comparison with municipalities 100 miles away.

Castillo et al. (2012) explain yet another change, outside of Mexican politics, that contributed further to the violence. Colombia's anti-drug strategy shifted in July 2006 when Juan Manuel Santos (today's President of Colombia) became the Minister of Defence. This new strategy shifted the emphasis from attacking the drug production chain to seizing cocaine, intercepting drug shipments and destroying cocaine processing labs. This policy drove Colombian cartels to relocate in Mexico. As the supply of cocaine was successfully reduced, the price of street cocaine in the US increased. This incentivised criminal organisations to fight to keep their lucrative market, fuelling more violence.

3. The impact of drug cartels and their violence

Drug cartels represent an important industry in the economy. According to RAND Corporation Mexican cartels make about $6.6 billion in gross revenue from exporting drugs just to the US (Keefe, 2012). Lee estimates that more than 50% of the profits earned by the cartel's leaders never return to the country (Cited by Ríos, 2008). The drug money that eventually makes its way back to Mexico will bribe whoever needs to be bribed to keep the

business going.[75] Some of these drug profits will also fund growing more marijuana and poppy, producing more synthetic drugs (mainly methamphetamine and ecstasy), and buying more cocaine from South America. Ríos (2008) estimates that the illicit drug industry hires 468,000 people in Mexico, making it the fourth largest employer among all the main industries. Cartels' direct labour demand includes low-skill workers to produce and transport the drugs to the US, and high-skill workers such as chemists, lawyers, accountants and those in charge of security. Security services, for instance, include trained mercenaries, but also civilians watching out for any changes in federal security or along the US border, known as falcons (Keefe, 2012).

The job opportunities and extra capital offered by cartels have the potential to benefit the economy, reduce poverty and inequality in the local areas where they work. There is anecdotal evidence that some rural areas have benefited from drug money. For instance, Marín (2002) recalls that he expected to find poverty and lack of infrastructure in his field work in rural areas in Sinaloa, the cradle of drug trafficking in Mexico. He found the opposite. Farmers he interviewed recounted that out of need, they chose to work for drug dealers instead. One of the interviewees explained "…[Drug traffickers] pay in cash, upfront, up to five years in advance. They absorb any real losses, give good profits, subsidise irrigation infrastructure, harvest and help farmers that get arrested by soldiers by financially supporting their families and paying the lawyers" (p. 4, own translation).

Drug money also gets "legalized" by filtering into various industries, such as real estate, finance and retailing. These industries are easy targets as they can receive large amounts of cash and due to weak regulation in money laundering. Although drug cartels may filter capital into local economies, over time drug money can affect long-term development. The endemic corruption that allows cartels to operate might distort incentives for investing in other sectors. Drug money that gets legalized can also drive legitimate businesses into bankruptcy. Former State Department official Jonathan Winer explains "…the drug trafficker is happy to pay 6% or 8% or 10% loss, reverse interest, to have that money laundered. So they have a competitive advantage over everybody. So they go into a business…they can take...over. " (Zill and Berman, 2013).

Drug violence is another externality. Cartels have two options when their informal pacts with the state break down: exit business or resort to violence to establish control over territory. Violence is aimed at building the organization's reputation and inhibiting

[75] Genaro García Luna, Mexico's former secretary of public security, estimates cartels spend more than a billion dollars annually just bribing the Mexican municipal police (Keefe, 2012).

deviations from agreements and potential rivals. For this purpose, Mexican cartels have hired militias. Typically, these militias had been people who deserted the army or police. But, as the violence spread and intensified, cartels have also recruited unemployed youth (usually with a criminal record), and even children. Between 30,000 and 50,000 children in Mexico have been recruited by various cartels as mercenaries (Derechos Infancia, 2010). Cartels then, can reduce the human capital stock if young people drop out of school for short-term profit or because of drug dependency.

Violence, whether resulting from war or crime, can affect development (Soares, 2009). In Mexico, the drug related violence apart from its large humanitarian costs; has also affected civilian populations and businesses. Using crime victimization surveys in Mexico, Gutiérrez-Romero and Conte (2014) find that population in areas affected by drug related homicides increased their security spending and changed behaviour to prevent being victims of crime (such as avoiding going out at night). Despite these extra precautions, extortions and other thefts increased in these areas. The extra risks associated with living in these areas provide people incentives to flee. As a result, local businesses might see their market shrinking and their costs rising. Cost could rise out of the need of increasing security spending, potentially paying higher salaries to keep personnel, and the possibility of cartels extorting firms directly. Thus, businesses might either reduce their investment or eventually flee the area, destructing jobs (Evans et al., 2012; Rodríguez and Sánchez, 2012). This could explain why other studies have found that unemployment increased in areas affected by drug related violence in Mexico (BenYishay and Pearlman, 2013; Dell, 2011; Robles et al., 2013).

The high incidence of drug related homicides, casualties mostly of Mexican origin, suggests that some of the local population is involved in drug trafficking. Thus, it is not obvious whether poverty will be affected and how. Government intervention might be able to offset some of the negative impacts of drug violence by transferring extra resources to people and areas that need it. However, if government's extra security spending comes at the expense of reducing social and public services, then government intervention might be unable to offset a potential negative effect. Remittances, a large source of income for many Mexican families, could also offset some of the impacts of the drug violence.

3.1 A theoretical model on the impact of drug cartels and their violence

We summarise our discussion on the potential impact of drug cartels on development by adapting the standard neoclassical growth model. We assume that a country has $i=1,\ldots,n$ municipalities. Municipality i has a Cobb-Douglas production function, with constant returns to scale as in Eq.(1).

$$Y_{it} = AK_{it}^{\alpha} L_{it}^{1-\alpha} \qquad (1)$$

where Y_{it} is municipality output at time t. A is the level of technology, K_{it} is the municipality's level of capital and L_{it} is the level of labour. Assume the capital comes from two industries: a legal one and an illegal one dedicated to trafficking drugs. The total amount of capital is given by $K_{it} = \varphi K_{it}^{l} + (1-\varphi)K_{it}^{d}$, where K_{it}^{l} is the amount of capital in the legal industry and K_{it}^{d} is the amount of capital in the illegal drugs industry. The share of capital coming from each industry depends on φ, a parameter measuring the strength of institutions, which influences how easily drug cartels can operate. Similarly, the total amount of labour is given by $L_{it} = \varphi L_{it}^{l} + (1-\varphi)L_{it}^{d}$, where L_{it}^{l} is the amount of labour in the legal industry and L_{it}^{d} is the amount of labour in the illegal drug industry. For simplicity we ignore the stock of human capital.

Assuming a constant saving rate, s, such that $S_t=sY_t$, and a capital depreciation rate δ per period, which we assume to be equal in both industries, the annual investment is equal to $I_t = \Delta K_{t+1} + \delta K_t$. The dynamics of capital accumulation are given then by Eq. (2)

$$K_{i,t+1} = (1-\delta)K_{it} + sY_{it} \qquad (2)$$

Expressing quantities in per capita terms, the intensity of capital is given by $k_{it} = K_{it} / L_{it}$ and the production function $y_{it} = Y_{it} / L_{it}$. Thus, dividing Eq. (2), the capital accumulation by L_{it}, we obtain:

$$(1+n)k_{i,t+1} = (1-\delta)k_{it} + sy_{it} \qquad (3)$$

where n is the population growth rate.

Following the modification proposed by Miguel and Roland (2011), we assume that there is a minimum subsistence consumption level, $c_{min}>0$, below which consumption cannot fall. Then, the savings per capita in municipality i will be given by $s_{it}=\min\{y_{it}-c_{min}, sy_{it}\}$. In the case where the per capita consumption hits the c_{min} constraint, then the municipality will be caught in a poverty trap. In such a case, there will be no further per capita accumulation, $k_{i,t+1} \le k_{it}$. A poverty trap will arise if and only if

$$Ak_{it}^{\alpha} \le (n+\delta)k_{it} + c_{\min} \qquad (4)$$

There is a $k_{trap}>0$, below which inequality (4) is satisfied. A higher minimum consumption, faster population growth and higher depreciation all increase the poverty trap level of k_{trap}.

Assuming that there is no factor mobility across municipalities, in terms of capital or population, the steady-state level of capital accumulation per capita, k^* will be defined by $(1+n)k^* = (1-\delta)k^* + sAk^{*\alpha}$. Thus, municipalities with a higher level of total capital (regardless if legal or illegal in origin) will converge to a higher steady state than those with lower level of total capital.

Now assume that at a later time, $m<n$ municipalities face an idiosyncratic shock: drug related violence. This random shock represents an extra expense, in terms of consumption of security measures which affects both industries. Depending on the magnitude of the extra expense required to safeguard security, investors might be able to stay afloat, that is if $k>k_{trap}$. Investors in the formal and illegal industries however, might face a different ability and willingness to compensate for the shock. Consider that in net terms total capital falls below the level needed k_{trap}. Then, municipality m will fall into a poverty trap permanently if there is no factor mobility, or government or remittance assistance that could absorb the shock. The rest of the municipalities not experiencing such a shock will continue along their normal path of growth.

A different scenario could emerge if capital and labour could flow into municipalities not affected by the shock until the marginal returns of these factors is equalized across the affected and non-affected municipalities. Also external intervention (in the form of government aid or remittances) could increase the income of the affected municipalities. Whether these municipalities manage to escape the poverty trap will depend on the size of the intervention.

In our empirical analysis we will be unable to provide a break down of capital coming from legal or illegal industries. However, we can evaluate what happened, in net terms, to the number of owners, employees, remunerations and investment across various industries. These changes could reveal if production factors shifted from more to less violent areas, for instance. We would expect larger changes in industries with more flexibility to outsource their production to other areas, or which depend more on national or international markets, rather than the local market, such as manufactures. Businesses that depend more on the local market might find it more difficult to shift their production to avoid violence, thus are more likely to adjust more slowly.

In the next section we evaluate empirically the impact of cartels and their violence. These will reveal short-term impacts. However, our theoretical discussion here, suggests that some of these impacts could also persist in the long-run.

4. Econometric strategy and data sources

To estimate the impact of drug cartels and their associated violence we rely on the methods proposed by the quasi-experimental literature. Quasi-experiments do not assign treatments randomly.[76] So, we cannot estimate accurately the impact of drug violence by simply comparing areas that experienced this violence and those that did not. This simple comparison would ignore that drug cartels might be more active in certain areas given their underlying characteristics, such as closeness to the US border and degree of political decentralization. This simple comparison would also ignore that areas might suffer changes not necessarily because of the drug violence, but perhaps due to unobserved characteristics, such as levels of corruption.

To address these concerns we combine the difference-in-difference estimator with propensity score matching, as proposed by Heckman et al. (1997). This estimator compares the change in outcomes of treated areas, before and after they get treated, to the change in outcomes of "comparable" areas used as control group. These areas are matched based on the likeness of their characteristics. To this end, Rosenbaum and Rubin (1983) estimate a propensity score, which measures the conditional probability of areas receiving the treatment (D_i=1) given a vector of observable baseline characteristics X_i. Areas are then matched according to their propensity scores, p_i, which summarise in a single index the distribution of their baseline characteristics.

$$p_i = \text{pr}(D_i = 1 \mid X_i) \qquad (6)$$

Based on the estimated propensity score, Heckman et al. (1997) estimate the average treatment effect on the treated (ATT) as in Eq. (7):

$$ATT = \frac{1}{n_1}\sum_{i=1}^{n_1}\left[(Y_{1ti} - Y_{0t'i}) - \sum_{j=1}^{n_0} W(i,j)(Y_{0tj} - Y_{0t'j}) \right] \qquad (7)$$

where Y_1 and Y_0 are the observed mean outcomes under the condition of treatment and non-treatment respectively. t denotes the time point after treatment, and t' the time point

[76] According to Shadish et al. (2002) "Assignment to conditions is by means of self-selection, by which units choose treatment for themselves, or means of administrative selection, by which ...bureaucrats… or others decide which persons should get which treatment." (p. 13-14)

before treatment. n_1 represents the size of the treatment group and n_0 the size of the control group, both in the common support area of the estimated propensity scores. $W(i,j)$ represents the weights assigned to each control municipality *j*, which depend on the particular matching estimator employed. We use kernel matching, which uses the estimated propensity scores to calculate a weighted mean such that it gives more weight to those control municipalities that are closer matches and downweights more distant observations. Kernel matching also has the advantage of using more observations than other matching algorithms, thereby reducing the estimation's variance (Guo and Fraser, 2010, p. 245).Thus, the weighting function is equal to:

$$w_{ij} = \frac{G\left[\frac{p_j - p_i}{a_n}\right]}{\sum_{k=1}^{n_0} G\left(\frac{p_k - p_i}{a_n}\right)} \qquad (8)$$

where $G(\cdot)$ denotes the kernel function. a_n is a bandwidth parameter, and p_i is the estimated propensity score of the treated municipalities. p_j and p_k are the estimated propensity scores of municipalities in the control group.

Combining the PSM and DD has two main advantages. First, we match comparable treatment and control areas based on their observable characteristics. Second, by estimating the changes over time we remove time invariant unobserved characteristics that might affect outcomes (Smith and Todd, 2005). Our estimator could still be biased if there are any time variant unobserved characteristics that affect our outcomes over time. We could face this issue, if for instance, municipalities suffering from drug related homicides receive more subsidies than other areas to cope with the harmful effect of the violence. To lessen the risk of such a bias, we estimate the PSM-DD estimator controlling for covariates that might have changed over time thereby influencing our outcomes, as in Eq. (9).[77] We estimate this regression using panel fixed effects at municipality level.

$$Y_{it}(w_i) = \beta_0 + \beta_1 Post_t + \beta_2 Treatment_i + \beta_3 (Post_t * Treatment_i) + \beta_4 r_{it} + u_i + \varepsilon_{it} \qquad (9)$$

where Y_{it} is the outcome of interest for the municipality *i* at time *t* (*t*=0 before, and *t*=1 after treatment). $Treatment_i$ is a dummy variable equal to 1 for treated and 0 for the control municipalities. $Post_i$ is a dummy variable representing whether the observation is after

[77] We estimate all regressions in Stata with the command xtreg. We obtain the kernel-weighs using the command psmatch2 by Leuven and Sianesi (2003).

treatment. Thus, the regression coefficient β_3 measures the difference-in-difference estimator. That is the impact of cartels (or drug related homicides). u_i and ε_{it} represent the residuals. r_{it} is a vector of time-varying variables. These are: the growth in remittances and poor-relief subsidies per capita, both at municipality level; and the state's unemployment rate to consider the labour market of the region. All variables in r_{it} are lagged by two years to avoid having endogeneity issues with the intensity of drug related violence.

4.1 Data

We use the 2005 and 2010 population censuses to assess the impact on inequality (Gini coefficient), migration, education and electricity consumption. As the 2005 mid-census does not provide figures for unemployment, for that statistic we use the 2000 and 2010 censuses.

We also use the official poverty statistics. An independent Mexican institute, CONEVAL, estimated these statistics combining household surveys (Encuesta Nacional de Ingreso y Gasto) with the population census using small-area statistics.

To identify the mechanisms affecting our poverty and other welfare measures, we analyse four industries: manufacturing, retail trade, wholesale trade, and real estate. Specifically, we analyse the number of business-owners, employees, remunerations, and investment of each of these industries at municipality level.[78] Since surveys are unrepresentative at that small-area level, instead we use the economic census of 2004 and 2009. These censuses were conducted between 1 January to 31 December 2003 and 2008 respectively.

We do not analyse other industries, such as construction and finance, because the census does not distinguish in which municipalities their production took place.

Drug related homicides

To identify which areas experienced drug violence we use two data sources: official statistics and online reports. [79] The official statistics refer to the casualties credited to the conflict among cartels and the state. According to these, 1,148 out of 2,456 municipalities experienced at least one drug related homicide between December 2006 and December

[78] Total investment refers to stock variation of gross fixed capital stock, so it can take positive or negative values.

[79] Previous articles have monitored online media records to identify where cartels operate with and without drug violence at small area level (Osorio, 2012; Coscia and Ríos, 2012). To the best of our knowledge, none of these datasets have been available to public. In contrast to these previous efforts, we searched for online reports manually, not relying on automated algorithms. Reading the media reports and watching the online TV reports help us to reduce errors as to where cartels operated with and without violence.

2010. In total there were 34,612 drug related homicides during that period, 42% concentrated in just 2 out of the 32 Mexican states (Table A.1 in Appendix).

For the period during which there are no official statistics on drug related casualties we surveyed government and media reports, as well as specialized blogs. Our search was limited to identifying which municipalities experienced killings as a direct result of confrontations among cartels and the state. (That is, we do not estimate the incidence of drug related homicides.)

There are disadvantages in using media reports to detect drug cartels. For instance, for fear of retaliation some journalists are censoring news on cartels. [80] Thus, we left our search open to all online media reports, not focusing on a particular local or national media. We also surveyed online government reports to lessen a potential bias in media self-censorship. Although the government until 2006 was not systematically counting the number of drug related homicides, bulletins reporting such incidents were issued occasionally.

We found that 248 municipalities experienced drug related homicides between January 2000 and December 2005. Most of these areas, Osorio (2012) also identified as having been affected by drug violence during the same period (Figure 2).[81] Ninety per cent of these municipalities experienced drug related homicides again between December 2006 and September 2011, according to official statistics.

We also surveyed online reports for drug related homicides for the period where there is official information on these casualties. Our search during that period focused only on the areas that official statistics regarded as free of drug related homicides. We found 63 municipalities with media reporting drug related homicides in these areas, yet not appearing in the official statistics. We excluded these 63 areas from our analysis to lessen the risk of potential double counting of casualties (in case the government identified these casualties but credited them to other areas), and also to control for potential differences in the definitions used by the government and media houses as to what counts as drug related homicides.

[80] Mexico ranked as the fifth deadliest place in the world for journalists in 2010 with over 30 deaths or disappearances of journalists and media workers since Calderón took office (Committee to Protect Journalists, 2010).
[81] Osorio (2012) monitored 11 national newspapers; 47 local newspapers; and press releases from the army, navy, federal police and the Attorney General's Office.

Cartels without drug related homicides

We also surveyed online reports to identify the areas where cartels are active without instances of drug related homicides. We surveyed government bulletins, for instance, on arrests of drug cartels members, seizing of drugs or drugs labs, as well as online media reports and specialized blogs. We found 243 municipalities where cartels were active without instances of drug related homicides between January 2000 and December 2005. Another 145 municipalities had cartels working without instances of drug related homicides from January 2006 until December 2010.

5. Estimating the impact of cartels and drug related homicides

5.1 Control group selection

We use as control group (for all our treatment groups described below) municipalities that were free of cartels and drug related homicides during 2000-2010. Some of these control municipalities are near areas that experienced drug related violence, a closeness that could bias our impact estimates. To minimise this possibility we exclude "buffer" municipalities. That is, areas free of drug related homicides during 2000-2010, but which are near to those municipalities that experienced drug related homicides.[82] In the next section we present the results which remove buffer areas located within 10 kilometres of the epicentre of affected areas. These are our preferred results as the remaining control areas are still near enough to the treated areas to serve as proxies of the labour market conditions of the affected areas, yet without being too close thereby minimizing spill over effects. In Section 7 we show that our results remain similar even if we remove buffer areas that are further away from the affected areas.

5.2 Treatment group selection

We estimate separately two types of impacts: drug cartels being active in an area with and without violence. To measure the impact of drug cartels alone, without violence, we define the treatment group as municipalities where cartels moved into to traffic drugs, and did so for the first time between December 2006 and December 2010, and that did not suffer any drug related homicides during 2000-2010.

To measure the impact of drug related homicides we define the treatment group as municipalities that experienced at least one drug related homicide for the first time between

[82] Table 5 shows that in 20% of buffer areas homicide rates increased by two or more standard deviations above their historical average.

December 2006 and December 2010 according to official records, and that did not have any cartels or drug related homicides during 2000-2005.

Given the high variance in drug related homicide rates, the impact of this violence is unlikely to be linear or even quadratic. To assess whether the impact differed according to the intensity of homicides, we divide the second treatment group into four subgroups. The first subgroup consists of municipalities in the tenth decile according to their rate of drug related homicides per 100,000 inhabitants. This group has a much higher average drug related homicide ratio (282.2) than the rest (22.4). We split the remaining 90% of the areas affected by drug related homicides into equally sized tertiles. The large differences in drug related homicide rates between the top decile and the rest of tertiles remain after we select further the treatment and control groups, as shown in Figure A.1

5.3 Propensity score matching

We estimate the propensity scores of areas experiencing cartels with and without violence using probit models. In these models we use covariates that jointly influence the likelihood of treatment and outcomes. Following the literature on drug cartels, we use as covariates: municipalities' ruling party (PAN or PRI); a dummy variable on whether the municipality has the same ruling party as the state (decentralized). We also use: municipality's population size; location (by coast or border); closest distance to border and coast; GDP per capita; percentage of children attending school; percentage of households receiving remittances; subsidies received; trends in homicide rates; whether urban, rural or mixed.

Table A.2 shows the results from the probit regressions, as marginal effects, for the two types of treatments: experiencing cartels with and without drug related homicides. Table A.2 also includes the scores for each of the four subgroups treated by drug related homicides (the 10th decile and tertiles). We estimate these scores ensuring they satisfy the balancing property within the region of common support.[83] Then, we match the treatment and control areas using Epanechnikov kernel matching with a bandwith of 0.06.

Table A.3 shows that there are no statistically significant differences in the covariates used to estimate the propensity scores between the matched treatment and control areas. These matched areas have the same distribution of characteristics before treatments began (Table A.4). Also, the distribution of their propensity scores overlap well, as Figure A.2 shows.

[83] Following Dehejia and Wahba (2002), we identify the region of common support as the overlap between the two distributions of the propensity scores of the treatment and control groups.

In Table A.5 we show the areas we use as treatment and control groups by state. Figure 3 shows the matched areas used to estimate the impact of cartels without incidents of drug related homicides. We have 70 treated municipalities and 409 control municipalities within the region of common support. Figure 4 shows the areas used to estimate the impact of drug related homicides. We remain with 668 treated municipalities and 554 control ones within the region of common support. Figure 4 also shows that the areas least affected by drug related homicides (first and second tertile) are mostly in the south and central part of the country. The areas with the highest levels of drug related homicides are in the northern part of the country. This confirms the intensity of battles among cartels intensifies closer to the US border, the end drug market.

We find the matched treatment and control areas had parallel trends across various statistics long before treatment began, which is essential for the difference-in-difference estimator to be unbiased. Figure A.3, A.4 and A.5 show the trends in total homicide rates, poverty and an index of marginalization[84] between the treatment and control group from 1990 until 2010. Figure A.3, Panel A shows that treatment areas where cartels were active without drug related homicides had a parallel trend in total homicide rates with their control group from 1990 until 2008. In 2009, the control group reported even more deaths, reflecting that this treatment group was not affected by drug related homicides. Similarly, Fig A.3 Panel B shows the treatment areas that were affected by drug related homicides had a parallel trend in total homicide rates with their control group from 1990 until mid-2000. This parallel trend breaks after 2006, when this treatment group started experiencing drug related homicides, unlike the controls.

After ensuring the matched areas are suitable treatment and control groups we ran the panel fixed effects regression. We included as covariates: the growth in remittances, poor-relief subsidies per capita and the state's unemployment rate. To avoid endogeneity problems we include all these lagged for two years.

[84] The index of marginalization measures the percentage of population: that cannot read or write, without complete primary, without drainage or bathroom, without electricity, without piped water, co-habiting in overcrowding conditions, living in a household without soil floor; living in population of less than 5,000 inhabitants, earning up to two minimum salaries.

5.4 Estimated impacts

Impact on poverty and inequality

We analyse the impact on three measures of poverty. Food poverty measures the percentage of the population that cannot buy a basic food basket. Capability poverty adds those who cannot cover their health and education needs. And patrimony poverty adds those who cannot cover their clothing, housing and public transport needs.

Areas where cartels were active without drug related homicides did not suffer a change in poverty, relative to their control group. However, inequality in these areas decreased by 0.391 standard deviations (Table 1, panel A, columns 1-4).

In contrast, inequality did not change in areas affected by drug related homicides, relative to their control groups. However, food poverty increased (by 0.170 standard deviations) among the areas in the top decile of highest rate of drug related homicides. Patrimony poverty also increased (by 0.153 standard deviations) among the areas that experienced the lowest rate of drug related homicides, relative to their control group. In net terms, drug related homicides increased the number of people living in food poverty by 25,577 and the number of people living in patrimony poverty by 88,966 in these areas.

It is unclear why drug related homicides had a non-linear effect on poverty, affecting only the areas with the highest and lowest drug related homicide rates. The geographic location of these areas might explain these results. Areas in the first tertile are along the route where cartels traffic cocaine from South America to US, but not where the cultivation of marijuana and poppy has increased the most. So, the economic benefits that cartels bring to these areas might not offset the negative effects caused by the violence, thereby increasing poverty. In contrast, the areas with most drug related homicides are in regions that experienced a sharp increase in cultivation of illegal drugs. These are mostly in states by the Pacific coast and the so called golden triangle formed by Sinaloa, Durango and Chihuahua. The sharp increase in drug production is also reflected in the efforts of the Mexican government to destroy illegal crops there (Figure 5). The drug economy in these areas might offset some of the negative effects of the violence. But, it is likely that as the violence intensifies, so do its negative effects. This could explain why we find an increase in poverty in areas in the top decile.

Impact on migration and population size

We evaluate the impact on migration by focusing on two indicators. The percentage of people who claimed to have lived in another state five years ago and the percentage of people who claimed to have lived in the US five years ago. We are likely to

underestimate migration patterns using these statistics as they do not capture, for instance, if people relocated within the same state, but to a safer municipality. To capture some of these internal migration patterns we also assess the change in municipalities' population size.

We find that, areas where drug cartels were active without drug related homicides did not experience as a result changes in their population size or migration patterns (Table 1, panel A, columns 5-7). Neither of these statistics changed in areas with the highest drug related homicides rates. In contrast, areas with the lowest drug related homicide rates, in the first tertile, had a large increase in the percentage of people who lived in another state five years ago (1.55 standard deviation). Population size also increased in these areas, and those in the second tertile, relative to their control group (Table 1, panel B, column 7). These impacts suggest that population might have migrated from more to less violent areas.

Impact on human capital

To assess the impact on human capital we focus on: the percentage of children aged 6-14 out of school and the percentage of population aged 15+ without complete primary.[85] Neither of these statistics changed in areas where cartels were active without drug related homicides (Table 1, panel A, columns 8-9). In contrast, both statistics increased in areas that experienced at least one drug related homicide, and especially so in the areas with the lowest rates of drug related homicides. The percentage of children aged 6-14 out of school also increased in the areas in the second tertile (Table 1, panel B, column 8).

Earlier we showed that both internal migration and population size increased in areas with the lowest incidence of drug related homicides. Thus, education outcomes might have worsened because of population pressures. Table 1 columns 10-11 show that the population of education age increased in areas in the first and second tertile, while it decreased in areas in the top ten decile of drug related homicides. Nonetheless, the number of schools and teachers per pupil did not change in the first tertile, and the ratio of teachers per pupil even improved among the areas in the second tertile (Table 1, columns 12-13). Thus, it is unlikely that education outcomes worsened because of a shrinking supply of schooling. Rises in poverty, drug dependency and children engaging in drug trafficking could perhaps explain the rise in schooling dropout. Our results then add evidence to the

[85] In the Mexican schooling system children aged 6-11 are normally in primary school, those aged 12-14 in secondary school and those aged 15-18 in high school.

detrimental effects of violence on education found by Magaloni (2012) who show test scores worsened in areas affected by drug violence.

Impact on economic activity and unemployment

We estimate the impact on area's economy by assessing the changes in electricity consumption. The literature uses this statistic to measure changes in overall activity, especially in the informal economy. For instance, Robles et al. (2013) find that electricity consumption did not change in areas with the highest increase in overall homicides rates - drug related and not- in Mexico. Suggesting the economy in these areas did not slow down, despite the violence.

We find no change in consumption of electricity in areas where cartels operated peacefully, or in the bottom 90 percent of drug related homicides (Table 1, columns 14-15). However, electricity consumption increased in areas with the highest rates of drug related homicides, in the tenth decile. Despite the high-level of drug violence, the economy in these areas increased, suggesting that it was driven by the informal activity. We explore next the impact on unemployment rates, another statistic of economic activity.

Previous studies have found that unemployment rates increased in municipalities affected by drug related homicides using quarterly labour surveys. Although these surveys are nationally representative, they are not representative at municipality level. Since our interest is to measure the impacts at small area level we instead use the population censuses, which are representative at municipality level. Since unemployment rates are not available in the mid census, conducted in 2005, we can only estimate the change in unemployment rates between the years 2000 and 2010.

We find no impact on the unemployment rate or number of unemployed in areas where cartels were active but without drug related homicides (Table 1 panel A, columns 16 and 17). Similarly, the number of unemployed remained unchanged across all the subgroups affected by drug related homicides. However, the unemployment rate decreased among the municipalities with the lowest incidence of drug related homicides, whilst remaining unchanged in the other groups.

Our results on unemployment do not necessarily contradict earlier studies. We are using different data sources, and exploring changes over different periods. Importantly our definition of treatment varies as well. In Section 7, we show that unemployment increased among the areas that experienced the highest jump in overall homicides rates, when we use the same treatment definition as Robles et al.

6. Potential mechanisms: Impact of cartels and drug related homicides on industries

In this section, we evaluate the impact on key industries. We do so to understand why cartels and drug violence affected poverty and other welfare statistics. We take the information on industries from the economic census. Since the economic censuses were conducted in different years to the population census used earlier, we redefine slightly our treatment and control groups.[86]

Areas that did not have cartels nor drug related homicides during 2000-2008 serve as our control group. As before, we exclude from this group buffer areas within 10 kilometres of those that experienced at least one drug related homicide during 2000-2008.

We redefine slightly the first treatment group as: municipalities where cartels moved into to traffic drugs for the first time between December 2006 and December 2008; and that did not suffer any drug related homicides during 2000-2008.

The second treatment group is: municipalities that experienced for the first time at least one drug related homicide between December 2006 and December 2008; and that did not have any cartels or drug related homicides during 2000-2005. As before, we divide the areas that experienced drug related homicides into four subgroups (by tertiles and the top tenth decile).

6.1 Propensity score matching

We estimate the likelihood -propensity scores- of areas experiencing cartels with and without violence using probit regressions. To estimate these scores we use the same covariates as in the previous section. We show the results of these probit regressions, as marginal effects, in Table A.6. All estimated scores satisfy the balancing property. The distribution of scores overlap well between the treatment and control groups (Figure A.6). There are no statistically significant differences in the covariates used to estimate the propensity scores between the matched treatment and control areas (Table A.7). These areas, also had on average the same distribution of characteristics before treatments began (Table A.8)

After matching the areas, we include as controls in the panel fixed effects regression: the two year lagged growth in remittances, poor-relief subsidies per capita and the state's unemployment rate.

[86] The latest economic census refers to data gathered in 2008. Thus, we are unable to assess the impact of drug related homicides that peaked in 2010. According to official records there were 9,725 drug related homicides between 2006-2008. This figure increased to 34,612 deaths during 2006-2010. Between December 2008 and December 2010 drug related homicides spread to 195 municipalities that had previously been free from drug related homicides.

6.2 Estimated impacts

Impact on manufacturing

The number of owners, workers and remunerations declined in the manufacturing industry in areas where cartels were active without drug related homicides (Table 2, panel A, column 1-3). Also in areas with the highest rates of drug related homicides, those in the 10 decile. (Table 2, panel B, column 1, 2 and 3). Similarly, the number of owners declined in the areas in the first tertile (column 2).

The increase in extortions and thefts that the most violent areas experienced could perhaps explain the decline in the number of owners in manufacturing, thus in remunerations. This decline in remunerations supports the findings of Velásquez (2014) who using a panel survey shows total earnings declined in areas with the highest homicide rates. It is less clear why the number of owners declined also in the areas where drug cartels operate without drug related homicides.

Impact on retailing and wholesale business

Cartels allegedly launder money in the industries of retailing and wholesale business (The Economist, 2014). We cannot infer whether such allegations are true. However, our results reveal how resilient these industries have been in areas affected by cartels and drug violence.

In the areas where cartels were active without drug related homicides investment increased in the industry of wholesale business (Table 2, column 12).Similarly, in areas that experienced at least one drug related homicide, investment in wholesale business increased. In these areas, also the number of owners and employees increased in retailing, as well as the number of employees in wholesale business (Table 2, columns 5-12).

Impact on real estate

Major real estate agencies argue that the drug violence has harmed them as people are reluctant to buy properties in affected areas (Sigler, 2012). Cartels have also allegedly harmed "legitimate" investors in real estate by laundering money in this industry (CNN Expansión, 2010). We cannot ascertain whether these allegations are true. However, our findings fail to suggest a slow down of this industry in most of affected areas, relative to the control group.

For instance, we do not find any change in number of employees, owners, remunerations or investment in real estate in areas where cartels were active without drug

related homicides (Table 2, panel A, columns 13-16). Similarly, these statistics did not change when analysing together the areas that experienced at least one drug-related homicide or when grouping the areas by tertiles. However, we do find that the number of workers, employers and investment declined in real estate in the areas with the highest drug related homicide, in the top 10 decile.

Impact on total tax revenue

We analyse next the net change in tax revenue, as this statistic might reveal overall changes in the "legitimate" economy (Table 2 column 17). Tax revenue did not change among the areas where drug cartels have been active without drug related homicides. Tax revenue increased only in the areas with the lowest rates of drug related homicides (first tertile). This increase of tax revenue is consistent with the fall in unemployment rates in these areas, and with the increase in the number of workers in whole sale business in these areas as well.

In sum, we find no much evidence of economic slowdown in the areas with the lowest rates of drug related homicides that could explain its increase in poverty. As shown earlier, the population increased in areas least affected by the violence relative to their control group. So, population movements from more to less violent areas could perhaps have relocated poor people in the country. Population could have moved into areas least affected by drug related homicides despite of experiencing drug violence, given that they also improved their economy, relative to their control group (in terms of unemployment rates and tax revenue).

7. Robustness checks

7.1 Buffer areas

In our earlier analysis of the impact of cartels and drug related homicides we excluded buffer areas to reduce the chances of effects spilling over to these areas. We set an arbitrary radius of 10 kilometres near treated areas. We also test the extent to which our estimators change when we vary the boundaries for the exclusion of buffer areas. Since most municipalities are geographically small, removing areas within a radius of 40 kilometres excludes about 90% of the control areas, resulting in too small a control group. Hence, we tested our main results excluding buffer areas within 15 and 20 kilometres, finding very similar results.

For instance, Table A.9 presents the results of excluding buffer areas within a radius of 20 kilometres. Setting this boundary excludes another 406 control areas. However, the patterns of inequality, poverty, migration and education remain the same as those presented earlier.

7.2 Placebo tests

We use placebo tests to assess the robustness of our findings. To this end, we randomly assign the areas used as control group to two placebo treatments. One treatment assumes that cartels were active in the area without drug related homicides. The second treatment assumes areas experienced drug related homicides. In this second treatment, we also assign different rates of drug related homicides, according to the ones in fact experienced by treated areas. We produce these random placebo treatments so we remain with the same ratio of areas in the control and placebo treated as the one found between our treated and control areas.

We use probit regressions to estimate the propensity scores. As before, we assume the baseline period is 2000-2005 and the treatment period is 2006 or after. We use the same covariates in these regressions as before. The matched placebo and control areas have the same distribution of characteristics.

Table A.10 shows the placebo test finds 10 out of the 102 ATT coefficients statistically significant when analysing the impact on welfare statistics. That is a 10% rate likely to have been found by chance. Using the non-placebo data we found 23 out of 102 ATT coefficients statistically significant at 10% level.

Table A.11 shows the placebo test finds 8 out of the 106 ATT coefficients significant when analysing the impact on industries. That is a rate of 8% likely to have been found by chance. In contrast, we found 21 out of 106 ATT coefficients statistically using the non-placebo data.

Second placebo test (using 1990-2000 as pre-treatment vs. 2001-2005 as post-treatment)

We perform additional placebo tests. This time we assume that our treatment areas were affected by cartels or drug related homicides earlier than they were. We set this placebo treatment so the pre-treatment period dates back to 1990-2000 and the post-treatment refers to 2001-2005. We use as control group the same areas as in our central analysis in Sections 5 and 6.

Table A.12 shows the results of this placebo test for our main welfare statistics of poverty, inequality, total population and human capital. From the 42 ATT presented, only

two are statistically significant at 10% significance level. For the period 2000 vs. 2005 we do not have statistics on unemployment. So we instead tested changes in GDP per capita finding that none turn statistically significant (hence not shown in the table).

In sum, all these placebo tests suggest the impacts showed earlier are unlikely to have been driven by chance or by unobserved characteristics.

7.3 Changes in total homicides rates 2006-2010

So far, we have evaluated the impact of areas experiencing extra homicides caused by the turf war among cartels and the state. A different research question would be to evaluate the impact of the change in the level of total homicides rates, whether drug related or not. This is also an important issue as there is the possibility that other homicides might have increased in areas where cartels hold battles. For instance, Robles et al. have evaluated the impact on areas that experienced an increase by two or more standard deviations in their total homicide rates since 2006 with respect to their historical average. They found that 26.3% of the municipalities in the country experienced such an increase in their total homicide rates. Using instrumental variables, these authors find that unemployment rates increased in these areas, as mentioned earlier.

We re-estimate the impact on all our statistics, following the definition of Robles et al. Specifically, we redefine treatment areas as those that experienced an increase of two or more standard deviations in the total homicides rates in any pair of years since 2006 with respect to the historical average homicide rate 1998-2005. The control group are those areas that experienced a smaller change in homicide rates than the treated. We test this impact with the same method we used before, difference-in-difference with kernel matching.

Tables 3 and 4 show the impact in areas that experienced an increase of two or more standard deviations in homicides rates on welfare statistics and key industries. A problem with using this treatment definition is that it includes areas that experienced drug related homicides or cartels earlier than 2006. Hence, in these tables we also present the results of excluding areas that experienced cartels or drug related homicides during 2000-2005 and excluding from the control group buffer areas within a radius of 10 kilometres. Robles et al. did not exclude from their analysis neither of these areas.

Despite our differences in method and data sources used we find similar results to those of Robles et al. That is, unemployment rates increased (by 0.196 standard deviation) among the areas that experienced an increase of two or more standard deviations in their historic homicides rates. The increase in unemployment is even sharper when excluding

buffer areas and those areas that had cartels or drug related homicides during 2000-2005. Similarly, we do not find a change in the electricity consumption in these areas.

In addition, we do not find a change in poverty rates but we still find a harmful effect on education outcomes, and an increase in inequality (Table 4, Panel A, columns 1-9). We find no impact on tax revenue. Across all the industries analysed investment declined only in manufacturing (Table 4 Panel B). In contrast to our earlier results the number of workers and owners decreased in retailing (Table 5, columns 5-6). Similarly, the number of owners decreased for wholesale business.

The differences with the results we presented earlier are due to the differences in the areas being compared. Table 5 shows among the areas that experienced a jump in their total homicide rates the percentage that were used in our earlier analysis as treated, control or buffer areas. For instance, only 3.98% of the areas that experienced an increase of two- or more standard deviations from their historical homicide rates are within the top ten decile of areas with the highest drug related homicide rate. The other three tertile groups (the areas divided according to their drug related homicides rates) are evenly spread among those areas that experienced a sharp jump in their total homicides rates.

7.4 Impact on areas that experienced drug related homicides since 2001

So far, we have estimated the impact for areas that experienced cartels or drug related homicides for the first time in 2006 or afterwards. This period is of particular importance as violence intensified to unprecedented levels and cartels expanded to areas that had not experienced cartels nor drug violence before. However, by focusing on this period we exclude from our analysis those areas that experienced violence since the beginning of the millennium, when the drug violence started.

In this sub-section we assess the impact on the areas that experienced drug related homicides, during 2001-2005. For this purpose, we redefine our treatment areas as those municipalities that were free of cartels and drug related homicides during 1990-2000 but that experienced drug related homicides during 2001-2005. The controls are areas that at no point experienced cartels or drug related homicides during 1990-2010.

We identified the areas where cartels were active with and without drug related homicides by surveying government and media reports. We estimate the impact of drug related homicides for all areas that experienced at least one drug related homicide, without subdividing this group further according to the intensity of violence. As before, we use difference-in-difference kernel matching to assess the impacts of cartels and their violence.

We use roughly the same covariates as before to estimate the propensity score, but lagged for our new baseline period 2000.[87]

In Figure 6 we show the matched treatment and control areas that satisfy the region of common support in the propensity score matching. None of these areas have statistically significant differences in covariates used to match them nor in the baseline characteristics. Figure 7 shows that the matched areas had parallel trends in both homicides rates and poverty statistics before the violence erupted among cartels.

Table 6 shows that poverty increased in the areas that were affected by drug related homicides during 2001-2005, relative to their control group. The majority of these areas (86%) also experienced drug related homicides during 2006-2010. Poverty increased even more during that period, probably reflecting as well that the number of killings intensified. We also find a decline in the number of workers in manufacturing between 2000 and 2010.[88] Thus, the overall impact on areas that were affected by drug violence since beginning of the new millennium are in line with our previous analysis, despite looking at an earlier start period and overall longer time frame.

8. Conclusion

We quantified the impact of drug cartels and drug related homicides on development in Mexico. Using the difference-in-difference kernel matching, we found that inequality declined in areas where drug cartels were active without drug related homicides. These areas did not have any other impacts in terms of poverty, human capital or population size relative to their control group. We found a different picture for areas suffering drug related homicides. For instance, poverty increased in the areas that experienced both the highest and lowest rates of drug related homicides.

We adapted a theoretical model on poverty traps first proposed by Miguel and Roland (2011) to consider an economy with two industries: a formal and an illegal one (drugs). We used this model to show that although all our empirical findings refer to short-term impacts, some of them could persist in the long-run. Particularly so, for the case in poverty as we found a decline in human capital, number of employers, and jobs in some industries in the areas affected by drug violence. These areas then need urgent complementary policies to ensure that these negative impacts do not persist over time. We

[87] Specifically we used, the 1990 marginalization index; 1990 Gini index; minimum distance to US border; 2000 GDP per capita; 1990 population measured in logarithm; whether municipality was decentralized in 1998; trends in homicides rates 1990-1997.

[88] For this group we did not find any other statistically significant impacts, hence we did not present them but are available on request.

showed that children are dropping out of school in these areas, despite not experiencing a decline in the number of schools or teachers per pupil population. Thus, likely reasons for school dropout are rises in poverty, engaging in drug trafficking and drug dependency.

These findings deepen our understanding of the effects drug cartels have on development, when engaging in violence and not. Policy implications as to whether and how to regulate drug markets are not obvious. However, this paper has contributed to the debate on what the priorities should be for policy makers to lessen the negative effects of drug trafficking and violence.

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Figures

Figure 1 Homicide rates in Mexico 2004-2012

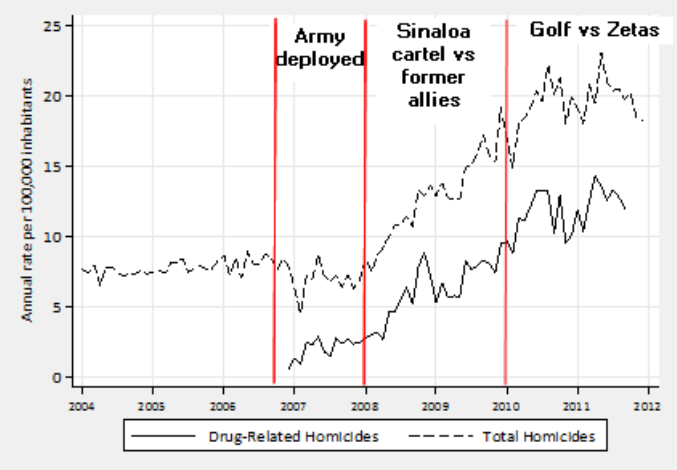
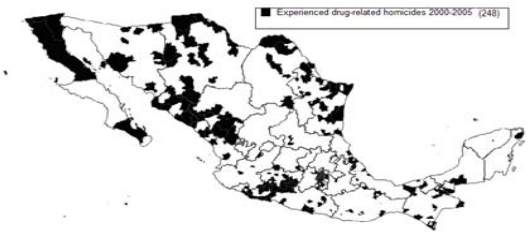


Figure 2 Municipalities experiencing drug related homicides during 2000-2005

Panel A



Source: Authors own estimates from surveying media, specialized blogs and official records.

Panel B

Source: Osorio (2012). Note: Map displayed in 3-dimension with kernel distributions to depict intensity of drug-related homicides.

Figure 3 Municipalities where cartels started operating for the first time in 2006 or after without drug related homicides vs. controls in region of common support

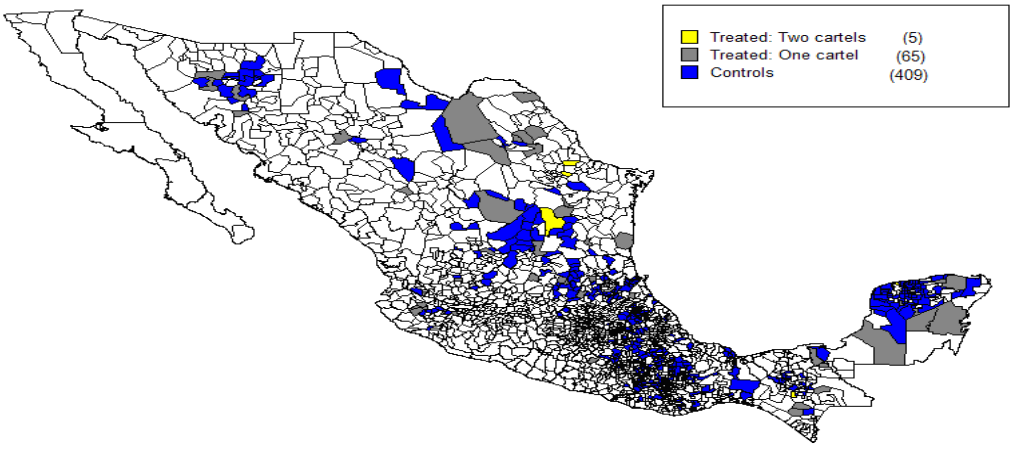


Figure 4 Municipalities that experienced drug related homicides for the first time in 2006 or after vs. controls in region of common support

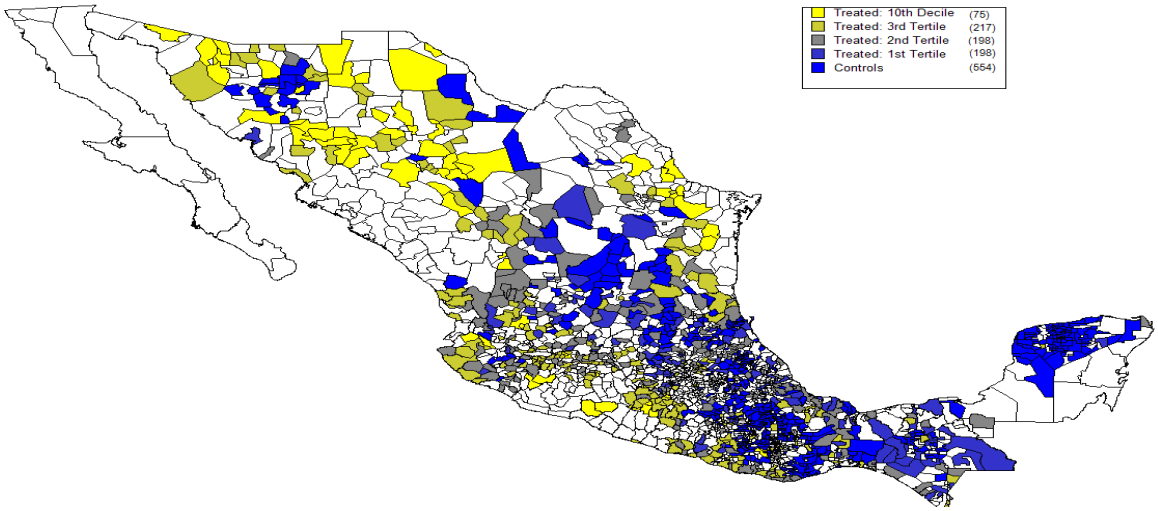
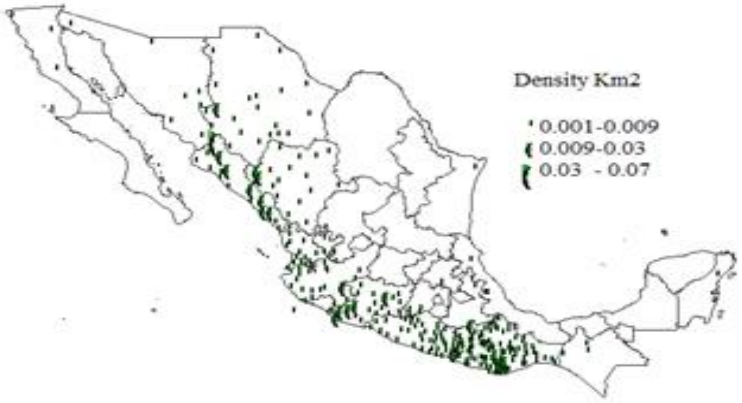
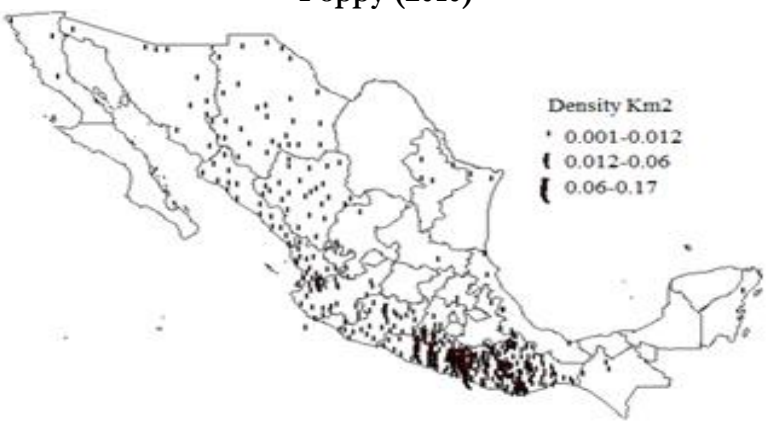


Figure 5 Illicit crops eradication

Marijuana (2008)



Poppy (2010)



Source: Ministry of National Defence (SEDENA), Mexico.

Figure 6 Municipalities that experienced drug related homicides for the first time in 2001 or after vs. controls in region of common support

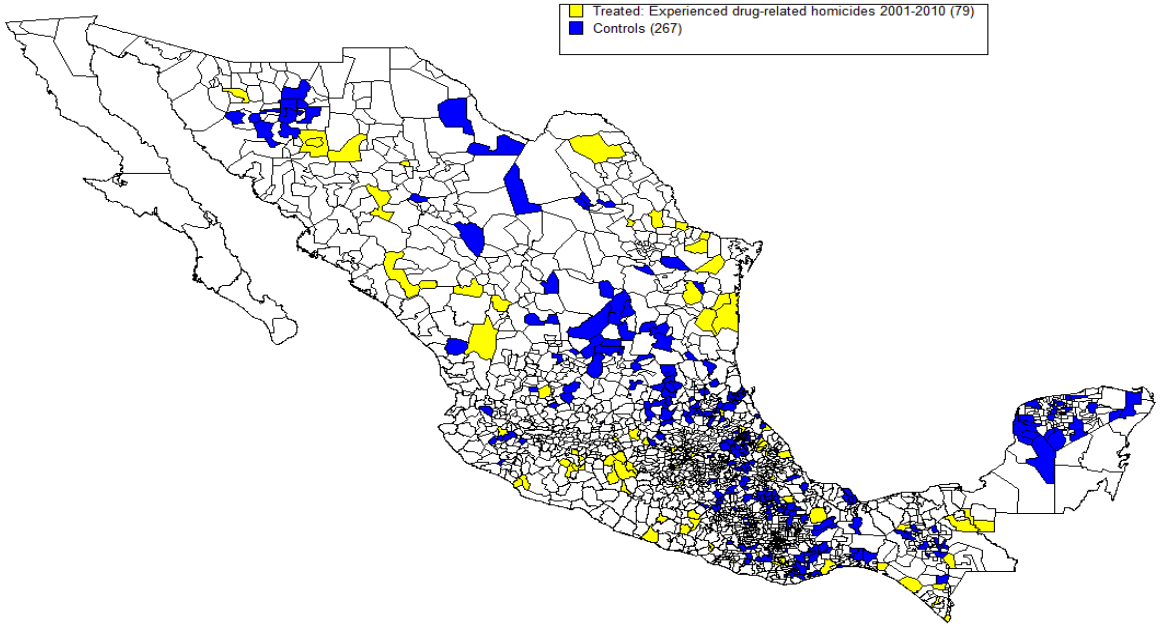
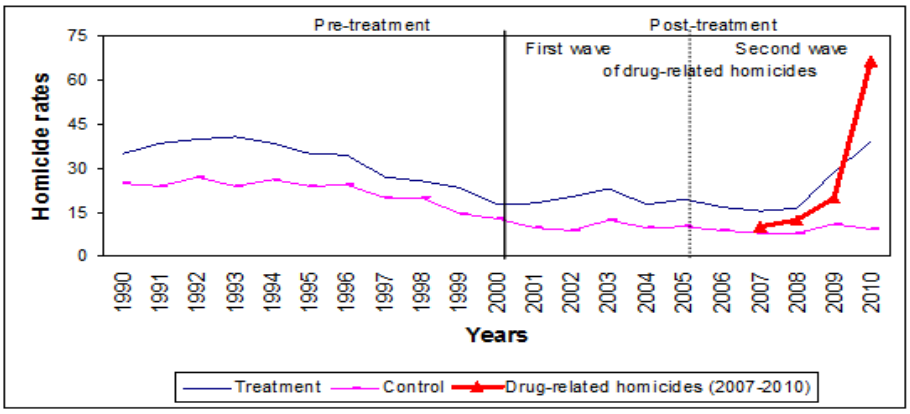
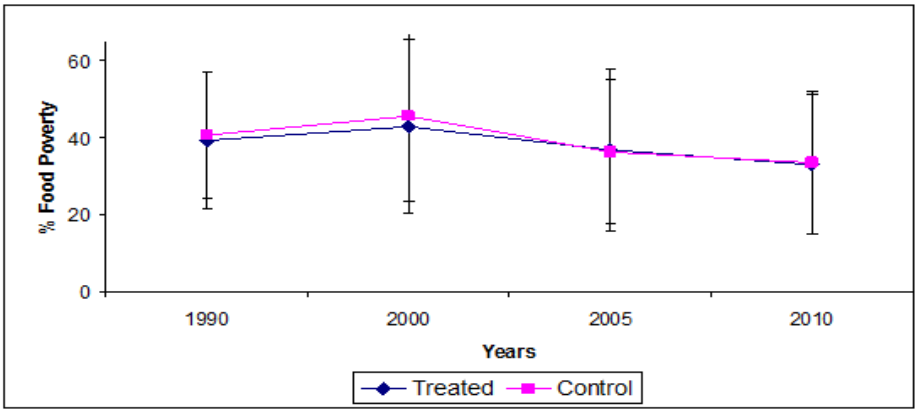


Figure 7 Homicide rates and food poverty in municipalities that experienced drug related homicides for the first time in 2001 or after vs. controls in region of common support

Panel A



Panel B



Tables

Table 1
Impact of cartels and drug related homicides on welfare

	(1) Food poverty	(2) Capability poverty	(3) Patrimony poverty	(4) Gini	(5) Lived in another state 5 years	(6) Lived in U.S. 5 years ago	(7) Total population	(8) Aged 6-14 out of school	(9) Aged 15+ without primary	(10) Population aged 6-14	(11) Population aged 15-17	(12) Schools (primary to highschool) per pupil	(13) Teachers (primary to highschool) per pupil	(14) Total energy consumption	(15) Energy consumption per capita	(16) Unemployment rate 2000-2010	(17) Number unemployed 2000 vs 2010
Panel A: Cartels without drug related homicides																	
ATT: time*treated	-0.197	-0.186	-0.148	-0.391***	0.169	-0.930	-0.030	0.052	-0.001	0.003	-0.001	-0.029	0.029	-0.069	0.019	-0.358	-1.566
	(0.150)	(0.152)	(0.156)	(0.136)	(0.205)	(0.671)	(0.044)	(0.066)	(0.024)	(0.017)	(0.024)	(0.041)	(0.059)	(0.184)	(0.087)	(0.612)	(1.144)
Observations	958	958	958	958	958	958	958	958	958	958	958	924	822	582	582	949	949
R-squared	0.072	0.057	0.033	0.148	0.343	0.356	0.098	0.403	0.902	0.053	0.254	0.202	0.224	0.065	0.018	0.540	0.351
Panel B: Drug related homicides																	
Areas with at least one drug related homicide																	
ATT: time*treated	-0.033	-0.028	-0.013	0.073	0.530*	0.725	0.080	0.093***	0.032*	0.049**	0.033	-0.013	0.042	-0.370	-0.069	-0.347	-0.823
	(0.053)	(0.057)	(0.071)	(0.081)	(0.299)	(0.758)	(0.050)	(0.035)	(0.017)	(0.023)	(0.032)	(0.019)	(0.028)	(0.390)	(0.128)	(0.427)	(1.822)
Observations	2,484	2,484	2,484	2,480	2,484	2,484	2,484	2,484	2,484	2,484	2,484	2,332	2,042	1,504	1,504	2,468	2,468
R-squared	0.052	0.029	0.004	0.179	0.089	0.502	0.112	0.404	0.893	0.015	0.213	0.117	0.209	0.015	0.008	0.605	0.414
Top 10 decile of drug related homicides																	
ATT: time*treated	0.170*	0.156	0.105	-0.212	-0.105	0.103	0.010	0.005	0.013	-0.039***	-0.032**	0.059	-0.036	0.782*	3.574*	-0.163	0.773
	(0.093)	(0.103)	(0.134)	(0.177)	(0.131)	(0.586)	(0.030)	-0.129	(0.031)	(0.014)	(0.014)	(0.082)	(0.103)	(0.466)	(1.996)	(0.818)	(1.023)
Observations	1,022	1,022	1,022	1,020	1,022	1,022	1,022	1,022	1,022	1,022	1,022	998	796	404	404	1,015	1,015
R-squared	0.073	0.062	0.055	0.177	0.313	0.424	0.062	0.224	0.843	0.175	0.054	0.078	0.112	0.063	0.287	0.575	0.331
Third tertile of drug related homicides																	
ATT: time*treated	0.032	0.041	0.070	0.045	0.145	0.642	0.023	0.086	0.018	0.005	0.011	0.014	0.137***	-1.256	-0.319	0.557	1.182
	(0.064)	(0.067)	(0.082)	(0.101)	(0.157)	(0.694)	(0.033)	(0.053)	(0.022)	(0.015)	(0.020)	(0.031)	(0.046)	(0.852)	(0.290)	(0.481)	(1.264)
Observations	1,428	1,428	1,428	1,428	1,428	1,428	1,428	1,428	1,428	1,428	1,428	1,374	1,160	766	766	1,420	1,420
R-squared	0.107	0.073	0.029	0.136	0.248	0.430	0.053	0.336	0.861	0.043	0.165	0.166	0.299	0.027	0.032	0.568	0.331
Second tertile of drug related homicides																	
ATT: time*treated	-0.089	-0.086	-0.056	0.035	0.577	-1.082	0.083*	0.096*	0.028	0.065**	0.024	-0.038	0.122**	0.481	-0.010	-0.106	0.264
	(0.063)	(0.066)	(0.080)	(0.111)	(0.591)	(0.823)	(0.047)	(0.050)	(0.022)	(0.030)	(0.032)	(0.026)	(0.060)	(0.671)	(0.190)	(0.489)	(1.796)
Observations	1,180	1,180	1,180	1,178	1,180	1,180	1,180	1,180	1,180	1,180	1,180	1,134	1,038	750	750	1,172	1,172
R-squared	0.133	0.090	0.018	0.128	0.074	0.500	0.207	0.449	0.905	0.022	0.244	0.219	0.323	0.033	0.023	0.625	0.381
First tertile of drug related homicides																	
ATT: time*treated	0.065	0.090	0.153*	-0.050	1.556**	0.039	0.322**	0.113**	0.042*	0.151***	0.158***	-0.035	0.001	-0.571	-0.396	-1.538**	1.373
	(0.083)	(0.083)	(0.088)	(0.144)	(0.663)	(0.867)	(0.128)	(0.054)	(0.025)	(0.057)	(0.060)	(0.025)	(0.043)	(0.407)	(0.295)	(0.691)	(2.875)
Observations	728	728	728	728	728	728	728	728	728	728	728	682	670	570	570	718	718
R-squared	0.044	0.038	0.053	0.119	0.132	0.625	0.126	0.587	0.929	0.064	0.312	0.237	0.267	0.042	0.030	0.718	0.332

*Controls used in specifications (1) to (15): poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Controls used in specifications (16) and (17): poor-relief subsidies per capita and state's unemployment rate, all lagged for two years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table 2
Impact of drug cartels and drug related homicides on industries and tax revenue

	Manufactures				Retail trade				Wholesale business				Real Estate				Tax revenue
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	workers	owners	remuneration	investment	workers	owners	remuneration	investment	workers	owners	remuneration	investment	workers	owners	remuneration	investment	
Panel A: Cartels without drug related homicides																	
ATT: time*treated	-0.298*	-0.089**	-0.348***	-0.871	-0.099	-0.128	-0.087	-0.091	0.018	0.117	-0.040	0.564*	0.038	-0.014	-0.453	-1.233	0.627
	(0.176)	(0.042)	(0.086)	(0.610)	(0.118)	(0.105)	(0.106)	(0.468)	(0.310)	(0.185)	(0.215)	(0.331)	(0.125)	(0.051)	(0.423)	(0.834)	(0.542)
Observations	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354
R-squared	0.110	0.120	0.125	0.128	0.519	0.470	0.061	0.011	0.206	0.403	0.071	0.069	0.117	0.119	0.047	0.044	0.271
Panel B: Drug related homicides																	
Areas with at least one drug related homicide																	
ATT: time*treated	-0.114	0.027	-0.115	-0.212	0.182**	0.166**	0.147*	0.228	0.401***	0.141	0.010	1.304**	0.064	0.018	-0.057	-0.610	0.375
	(0.072)	(0.031)	(0.091)	(0.280)	(0.079)	(0.077)	(0.076)	(0.223)	(0.132)	(0.097)	(0.136)	(0.528)	(0.061)	(0.039)	(0.172)	(0.894)	(0.357)
Observations	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556	2,556
R-squared	0.071	0.108	0.052	0.020	0.442	0.425	0.050	0.007	0.151	0.370	0.024	0.013	0.110	0.103	0.014	0.008	0.080
Top 10 decile of drug related homicides																	
ATT: time*treated	-0.551**	-0.192***	-0.522**	-0.395	0.238	0.159	-0.021	-0.006	0.260	0.300	-0.179	0.257	-0.255*	-0.268*	-0.287	-0.602*	0.101
	(0.258)	(0.069)	(0.214)	(0.355)	(0.175)	(0.181)	(0.146)	(0.226)	(0.233)	(0.470)	(0.198)	(0.304)	(0.140)	(0.144)	(0.331)	(0.337)	(0.139)
Observations	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
R-squared	0.040	0.046	0.081	0.054	0.392	0.399	0.075	0.009	0.141	0.210	0.031	0.037	0.074	0.090	0.013	0.015	0.132
Third tertile of drug related homicides																	
ATT: time*treated	-0.049	0.119	-0.188*	0.126	-0.047	-0.025	-0.027	-0.393	0.088	0.058	-0.107	0.550	0.092	0.069	-0.199	8.455	0.751
	(0.115)	(0.099)	(0.104)	(0.293)	(0.143)	(0.144)	(0.105)	(0.528)	(0.157)	(0.139)	(0.173)	(0.793)	(0.079)	(0.060)	(0.198)	(8.589)	(0.577)
Observations	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816	1,816
R-squared	0.076	0.123	0.086	0.041	0.432	0.428	0.089	0.020	0.157	0.403	0.029	0.033	0.183	0.129	0.027	0.032	0.056
Second tertile of drug related homicides																	
ATT: time*treated	-0.071	0.065	-0.121	-0.691**	0.153	0.152	0.068	0.134	0.480**	0.064	0.004	0.280	0.208	0.007	0.049	-0.891	0.077
	(0.088)	(0.080)	(0.096)	(0.338)	(0.135)	(0.142)	(0.110)	(0.268)	(0.216)	(0.132)	(0.150)	(0.301)	(0.230)	(0.142)	(0.219)	(0.896)	(0.365)
Observations	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270
R-squared	0.152	0.238	0.090	0.063	0.469	0.433	0.038	0.013	0.160	0.435	0.032	0.030	0.112	0.270	0.017	0.040	0.128
First tertile of drug related homicides																	
ATT: time*treated	0.065	-0.205***	0.176	-2.799	0.108	-0.071	0.122	2.138	0.611***	-0.046	0.166	2.386	0.082	-0.043	0.338	2.296	13.868***
	(0.147)	(0.050)	(0.175)	(2.910)	(0.131)	(0.120)	(0.093)	(1.605)	(0.188)	(0.114)	(0.144)	(1.880)	(0.095)	(0.072)	(0.208)	(2.761)	(4.672)
Observations	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950
R-squared	0.072	0.076	0.056	0.022	0.484	0.452	0.059	0.057	0.200	0.453	0.084	0.012	0.119	0.080	0.029	0.011	0.136

*Controls used in all specifications: Poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table 3
Impact on welfare statistics among municipalities that had two or more standard deviations increase in their total homicide rates

	(1) Food poverty	(2) Capability poverty	(3) Patrimony poverty	(4) Gini	(5) Lived in another state 5 years ago	(6) Lived in U.S. 5 years ago	(7) Total population	(8) Aged 6-14 out of school	(9) Aged 15+ without primary	(10) Population aged 6-14	(11) Population aged 15-17	(12) Schools (primary to highschool) per pupil	(13) Teachers (primary to highschool) per pupil	(14) Total energy consumption	(15) Energy consumption per capita	(16) Unemployment rate 2000-2010	(17) Number unemployed 2000 vs 2010
Panel A																	
ATT: time*treated	0.016	0.013	0.002	0.109***	0.020	0.722***	0.042**	0.043**	-0.007	0.013	0.020*	0.012	0.023	0.059	0.040	0.196*	0.239
	(0.034)	(0.035)	(0.037)	(0.037)	(0.036)	(0.261)	(0.017)	(0.021)	(0.008)	(0.010)	(0.012)	(0.013)	(0.018)	(0.036)	(0.031)	(0.100)	(0.303)
Observations	4,764	4,764	4,764	4,758	4,764	4,764	4,764	4,764	4,764	4,764	4,764	4,516	3,868	2,848	2,848	4,732	4,732
R-squared	0.026	0.015	0.009	0.039	0.079	0.237	0.055	0.249	0.809	0.019	0.063	0.116	0.193	0.004	0.003	0.528	0.139
Panel B: Excluding buffer areas and municipalities that experienced cartels or drug-related homicides during 2000-2005																	
ATT: time*treated	0.017	0.015	0.011	0.089	0.128***	0.803***	0.042**	0.062**	-0.009	0.028**	0.021*	0.004	0.001	0.052	0.029	0.638**	0.606*
	(0.043)	(0.044)	(0.048)	(0.057)	(0.042)	(0.275)	(0.018)	(0.029)	(0.010)	(0.012)	(0.012)	(0.020)	(0.026)	(0.041)	(0.049)	(0.253)	(0.345)
Observations	2,682	2,682	2,682	2,680	2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,502	2,208	1,652	1,652	2,666	2,666
R-squared	0.042	0.025	0.005	0.041	0.072	0.333	0.060	0.279	0.855	0.022	0.099	0.118	0.228	0.013	0.004	0.542	0.160

*Controls used in specifications (1) to (15): poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Controls used in specifications (16) and (17): poor-relief subsidies per capita and state's unemployment rate, all lagged for two years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table 4
Impact on industries among municipalities that had two or more standard deviations increase in their total homicide rates

	Manufactures				**Retail trade**				**Wholesale business**				**Real Estate**				**Tax revenue**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Panel A	workers	owners	remuneration	investment	workers	owners	remuneration	investment	workers	owners	remuneration	investment	workers	owners	remuneration	investment	
ATT: time*treated	-0.005	0.086	-0.046	0.048	-0.094**	-0.101*	-0.062	-0.045	-0.048	-0.128**	0.014	-0.044	-0.017	-0.029	-0.104	-0.147	0.036
	(0.064)	(0.116)	(0.047)	(0.080)	(0.043)	(0.052)	(0.044)	(0.089)	(0.054)	(0.061)	(0.046)	(0.101)	(0.062)	(0.055)	(0.066)	(0.204)	(0.084)
Observations	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742	4,742
R-squared	0.047	0.063	0.047	0.003	0.461	0.449	0.063	0.012	0.093	0.328	0.058	0.015	0.084	0.056	0.017	0.007	0.063
Panel B: Excluding buffer areas and municipalities that experienced cartels or drug-related homicides during 2000-2005																	
ATT: time*treated	0.085	0.152	-0.051	0.182*	-0.125*	-0.104	-0.094	0.235	-0.059	-0.194**	0.013	0.111	0.002	0.011	-0.056	0.414	0.120
	(0.109)	(0.171)	(0.057)	(0.106)	(0.064)	(0.074)	(0.064)	(0.188)	(0.073)	(0.086)	(0.056)	(0.211)	(0.095)	(0.091)	(0.079)	(0.785)	(0.117)
Observations	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758	2,758
R-squared	0.058	0.052	0.052	0.009	0.466	0.452	0.057	0.014	0.131	0.334	0.045	0.011	0.061	0.043	0.018	0.010	0.039

*Controls used in all specifications: poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table 5
Municipalities that had two or more standard deviations increase in historical homicide rates

	According to Robles et al definition: Had jump in total homicides rates by two or more standard deviations from historical average	
	Observations	Percentage
Used as controls no drug related homicides 2000-2010	167	16.2
1st Tertile of drug related homicides 2006-2010	124	12.03
2nd Tertile of drug related homicides 2006-2010	123	11.93
3rd Tertile of drug related homicides 2006-2010	123	11.93
10th Decile of drug related homicides 2006-2010	41	3.98
Municipalities excluded from earlier analysis:		
Had drug related homicides during 2000-2005	145	14.06
Areas (control or treated areas) had cartels operating during 2000-2005	108	10.47
Buffer areas, without drug related homicides	200	19.4
Total	1,031	100

Table 6
Impact on municipalities that experienced drug related homicides during 2001-2010

	Changes 2000 vs. 2005						Changes 2000 vs. 2010							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Food poverty	Capability poverty	Patrimony poverty	Gini	Total population	Workers in manufactures	Food poverty	Capability poverty	Patrimony poverty	Gini	Total population	Unemployment rate	Number unemployed	Workers in manufactures
ATT: time*treated	0.174*	0.150	0.091	-0.123	0.001	-0.599	0.112*	0.106*	0.086	-0.075	-0.033	-1.012	-2.320	-1.046*
	(0.101)	(0.103)	(0.105)	(0.114)	(0.042)	(0.469)	(0.066)	(0.062)	(0.059)	(0.112)	(0.082)	(0.639)	(1.753)	(0.546)
Observations	672	672	672	672	672	672	672	672	672	672	672	672	672	672
R-squared	0.247	0.197	0.055	0.429	0.016	0.048	0.629	0.576	0.193	0.773	0.117	0.585	0.448	0.075

Excluding buffer areas. Controls used in all specifications: poor-relief subsidies per capita, and state's unemployment rate, all lagged for 1998 and 2002. Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.10*

Appendix

Figure A.1 Rate of drug related homicides per 100,000 inhabitants by tertiles and 10th decile in region of common support

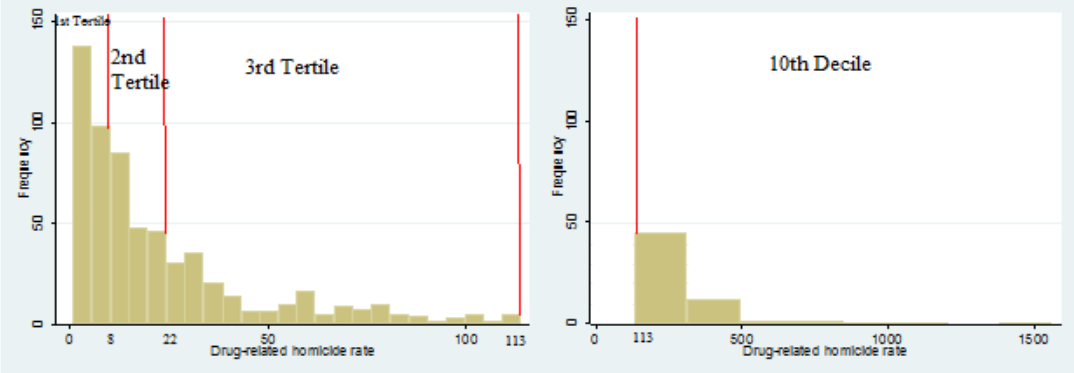
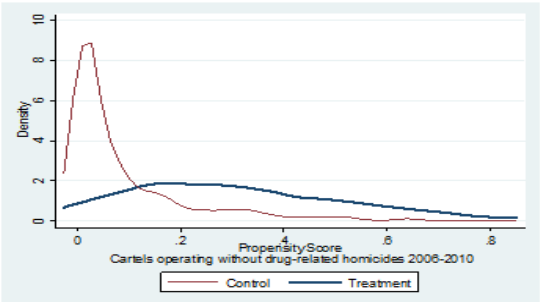


Figure A.2 Distribution of propensity scores between treatment and control groups

Panel A: Cartels without drug-related homicides



Panel B: Experiencing drug-related homicides

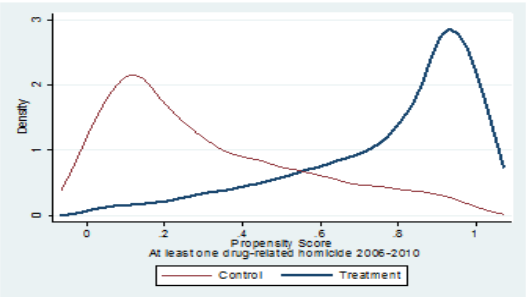
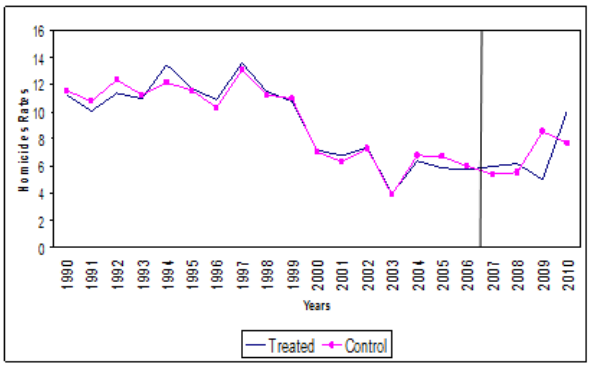


Figure A.3 Trends in homicides rates between treatment and controls after kernel matching

Panel A: Cartels without drug-related homicides



Panel B: Experiencing drug-related homicides

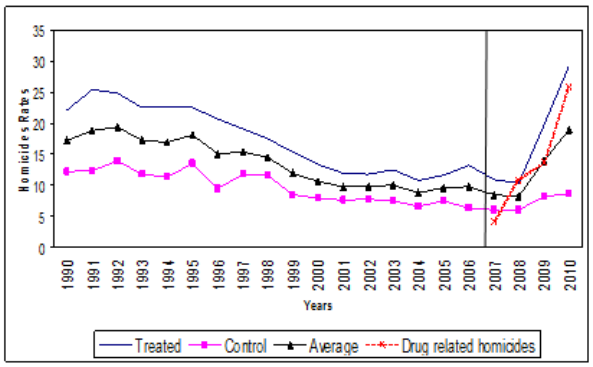
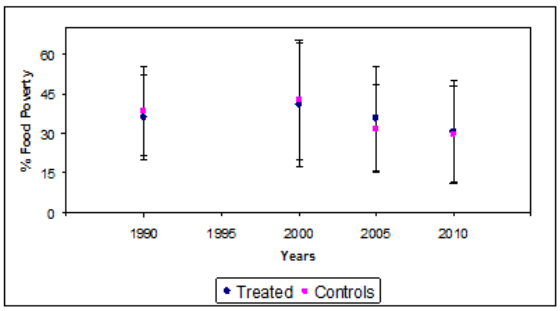


Figure A.4 Trends in food poverty between treatment and controls after kernel matching

Panel A: Cartels without drug-related homicides



Panel B: Experiencing drug-related homicides

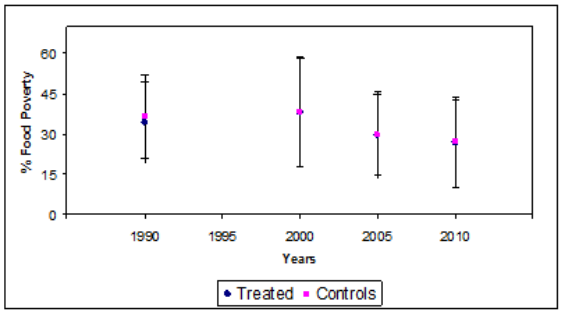
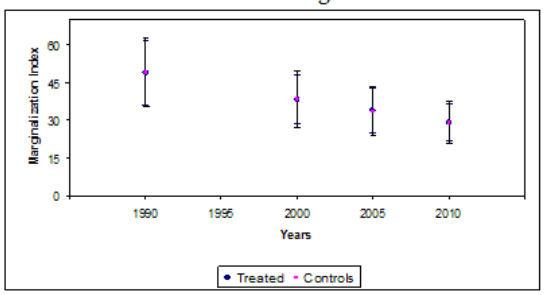


Figure A.5 Trends in marginalization index between treatment and controls after kernel matching

Panel A: Cartels without drug-related homicides



Panel B: Experiencing drug-related homicides

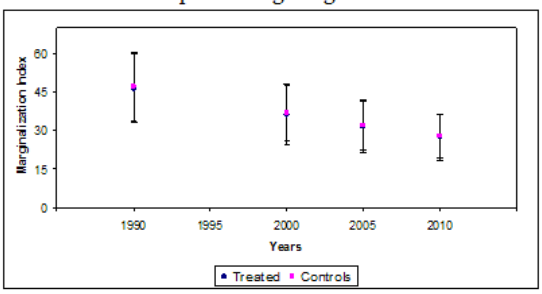
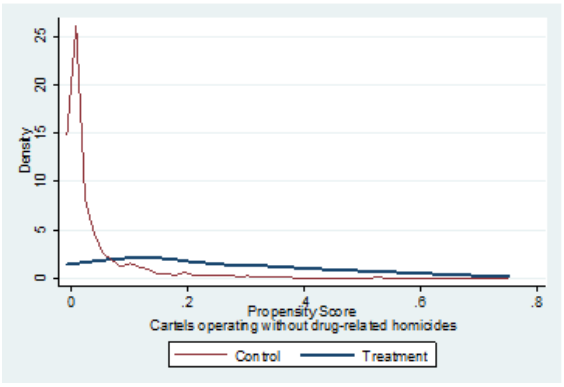


Figure A.6 Distribution of propensity scores between treatment and control groups

Panel A: Cartels without drug-related homicides



Panel B: Experiencing drug-related homicides

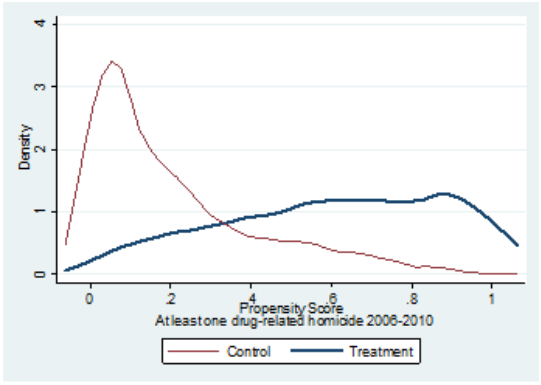


Table A.1 Drug related homicides 2006-2010 by State

State	Total population 2010	Drug related homicides December 2006	Jan-Dec 2007	Jan-Dec 2008	Jan-Dec 2009	Jan-Dec 2010	Drug related homicides 2006-2010	Contribution to national drug related homicides 2006-2010
Aguascalientes	1,191,091	0	37	38	31	46	152	0.4%
Baja California	3,173,198	8	209	778	484	540	2,019	5.8%
Baja California Sur	644,860	0	6	2	1	10	19	0.1%
Campeche	825,716	0	8	7	6	10	31	0.1%
Chiapas	4,819,742	0	57	82	88	77	304	0.9%
Chihuahua	3,414,751	1	244	2,118	3,345	4,427	10,135	29.3%
Coahuila	2,758,418	0	18	78	179	384	659	1.9%
Colima	653,431	0	2	12	33	101	148	0.4%
Distrito Federal (Mexico City)	8,798,672	1	182	144	135	191	653	1.9%
Durango	1,637,236	0	108	276	674	834	1,892	5.5%
Guanajuato	5,507,486	0	51	79	234	152	516	1.5%
Guerrero	3,390,421	12	299	412	879	1,137	2,739	7.9%
Hidalgo	2,676,778	0	43	38	34	52	167	0.5%
Jalisco	7,374,128	1	70	148	261	593	1,073	3.1%
México	4,357,209	0	111	364	440	623	1,538	4.4%
Michoacán	1,781,476	24	328	289	590	520	1,751	5.1%
Morelos	15,200,000	0	32	48	114	335	529	1.5%
Nayarit	1,089,174	0	11	28	37	377	453	1.3%
Nuevo León	4,664,076	4	130	105	112	620	971	2.8%
Oaxaca	3,808,686	0	62	122	87	167	438	1.3%
Puebla	5,794,763	0	6	22	28	51	107	0.3%
Querétaro	1,836,171	0	5	6	13	13	37	0.1%
Quintana Roo	1,341,166	0	26	29	32	64	151	0.4%
San Luis Potosí	2,588,808	0	10	34	8	135	187	0.5%
Sinaloa	2,772,029	3	426	1,084	1,059	1,815	4,387	12.7%
Sonora	2,670,440	5	141	252	365	495	1,258	3.6%
Tabasco	2,246,282	1	27	35	65	73	201	0.6%
Tamaulipas	3,278,354	0	80	96	90	1,209	1,475	4.3%
Tlaxcala	1,176,409	0	0	3	6	4	13	0.0%
Veracruz	7,647,431	1	75	65	133	179	453	1.3%
Yucatán	1,957,360	1	4	18	1	2	26	0.1%
Zacatecas	1,493,518	0	18	25	50	37	130	0.4%
Total	112,569,280	62	2,826	6,837	9,614	15,273	34,612	100%

Source: Population INEGI (2012). Drug related homicides SNSP (2011).

Table A.2
Probit marginal effects: Propensity scores used to match areas and evaluate impact on welfare statistics

			Drug related homicides by sub-groups			
	Cartels but no drug-related homicides	At least one drug related homicide	10th decile	3rd Tertile	2nd Tertile	1st Tertile
	(1)	(2)	(3)	(4)	(5)	(6)
Index of marginalization 2000	-0.000	-0.001	-0.000	-0.004	-0.002	0.000
	(0.002)	(0.003)	(0.001)	(0.003)	(0.002)	(0.000)
Capability poverty, 2000	-0.010**	-0.028***	-0.006	-0.023***	-0.004	
	(0.005)	(0.009)	(0.004)	(0.009)	(0.006)	
Food poverty, 2000	0.009*	0.021**	0.005	0.018**	-0.001	-0.001
	(0.005)	(0.009)	(0.003)	(0.009)	(0.006)	(0.000)
Decentralized, 2005	-0.053**	0.070*	0.001	-0.027	0.012	-0.018
	(0.025)	(0.039)	(0.015)	(0.047)	(0.035)	(0.020)
Mixed type municipality (urban/rural)	-0.059***	-0.052	-0.020	-0.063	0.002	-0.004
	(0.017)	(0.056)	(0.016)	(0.049)	(0.043)	(0.004)
Mixed type*Decentralized	0.039		0.102	0.242**	0.085	
	(0.065)		(0.088)	(0.106)	(0.076)	
Rural*Distance to north border	-0.000	0.000	-0.000	0.000	0.000*	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Log Population 2005	0.045	-0.017	0.016	0.043	0.594***	0.167*
	(0.096)	(0.177)	(0.049)	(0.172)	(0.185)	(0.101)
Squared log population	-0.000	0.015	-0.001	0.003	-0.024***	-0.007*
	(0.005)	(0.010)	(0.003)	(0.010)	(0.009)	(0.004)
Log GDP per capita 2005	0.015	0.170**	0.017	0.122	0.003	0.000
	(0.038)	(0.078)	(0.024)	(0.075)	(0.056)	(0.008)
%Children school attendance 2005	-0.001	-0.008***	-0.004***	-0.009***	-0.002	
	(0.001)	(0.003)	(0.001)	(0.003)	(0.002)	
Remmittances	0.002	0.011***	0.004**	0.024***	0.021***	0.000
	(0.002)	(0.002)	(0.002)	(0.006)	(0.007)	(0.000)
Squared remmitances	-0.000		-0.000*	-0.000***	-0.001***	
	(0.000)		(0.000)	(0.000)	(0.000)	
Municipality ruled by PAN only	0.001	-0.112**	-0.013	-0.082**	-0.043	-0.005
	(0.023)	(0.049)	(0.011)	(0.038)	(0.030)	(0.006)
Municipality ruled by PRI only	-0.029	-0.011	-0.003	-0.077*	-0.017	-0.003
	(0.022)	(0.048)	(0.014)	(0.043)	(0.032)	(0.005)
Homicide rate*decentralized 2005	0.000		-0.000	-0.001	-0.003	-0.000
	(0.000)		(0.001)	(0.002)	(0.002)	(0.000)
Total homicide rate 1990	0.000					
	(0.000)					
Total homicide rate 1991	-0.001					
	(0.000)					
Total homicide rate 1993	0.000					
	(0.000)					
Total homicide rate 1995	-0.000					
	(0.000)					
Total homicide rate 1996	0.000					
	(0.000)					
Total homicide rate 1997	0.001**					
	(0.000)					
Total homicide rate 1999	0.001*					
	(0.000)					
Total homicide rate 2000	-0.001					
	(0.001)					
Total homicide rate 2001	-0.000					
	(0.001)					
Total homicide rate 2003	-0.003***					
	(0.001)					
Total homicide rate 2004			0.001	0.009***	0.004***	0.000
			(0.001)	(0.002)	(0.002)	(0.000)
Squared Homicide rate 2004			-0.000	-0.000**	-0.000	
			(0.000)	(0.000)	(0.000)	
Distance to pacific coast			-0.000***			
			(0.000)			
Miniumum distance to north border			-0.000*			
			(0.000)			
Squared distance to north border			0.000			
			(0.000)			
Dummy, by pacific coast or not				0.320*	0.243	0.094
				(0.167)	(0.165)	(0.097)
Minimum distance to any border (north, south, pacific coast)				-56.790**	-43.642**	
				(24.307)	(20.249)	
Decentralized*Minimum distance to any border (north, south, pacific coast)						0.000
						(0.000)
Pseudo R2	0.26	0.40	0.48	0.40	0.48	0.63
Observations	653	1,368	659	815	810	823

*(*) dF/dx is for discrete change of dummy variable from 0 to 1, z and P>|z| correspond to the test of the underlying coefficient being 0. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10.*

Table A.3
Balancing test for covariates used to estimate propensity score to assess the impact on welfare statistics

	Panel A: Cartels without drug related homicides			Panel B: Drug related homicides														
	All that experienced at least one-drug related homicide						10th Decile			3rd Tertile			2nd Tertile			1st Tertile		
	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff
Index of marginalization 2000	38.47	38.61	0.924	36.2	36.81	0.594	35.81	32.71	0.138	37.17	36.63	0.681	36.95	36.93	0.985	36.68	37.45	0.694
Capability poverty, 2000	47.96	49.97	0.555	45.1	45.24	0.947	37.1	32.25	0.215	46.23	44.75	0.568	46.74	46.26	0.852			
Food poverty, 2000	40.93	42.9	0.554	37.87	38.18	0.874	31.12	26.49	0.204	39.11	37.88	0.619	39.31	38.9	0.867	41.68	42.6	0.722
Decentralized, 2005	0.36	0.36	0.937	0.47	0.5	0.611	0.61	0.52	0.351	0.46	0.47	0.825	0.44	0.42	0.666	0.42	0.5	0.417
Mixed type municipality (urban/rural)	0.26	0.25	0.968	0.33	0.32	0.847	0.23	0.31	0.413	0.34	0.34	0.983	0.35	0.33	0.86	0.29	0.23	0.41
Mixed type*Decentralized	0.06	0.04	0.616				0.11	0.07	0.428	0.1	0.1	0.843	0.12	0.09	0.4			
Rural*Distance to north border	391.16	392.91	0.975	382.82	379.26	0.922	327.47	299.94	0.646	412.18	390.3	0.641	408.48	371.93	0.45			
Log Population 2005	9.25	9.3	0.736	9.69	9.62	0.502	8.71	8.45	0.182	9.23	9.16	0.568	9.68	9.7	0.867	10.48	10.45	0.762
Squared log population	86.73	87.74	0.727	94.96	93.64	0.498	77.2	72.62	0.168	86.29	84.98	0.542	94.36	94.74	0.853	110.41	109.56	0.689
Log GDP per capita 2005	10.8	10.79	0.872	10.84	10.85	0.689	10.92	11.01	0.141	10.82	10.86	0.409	10.8	10.83	0.552	10.81	10.78	0.536
Children school attendance 2005	64.07	63.78	0.679	63.59	63.24	0.494	62.61	64.21	0.18	63.52	63.63	0.852	64.04	63.87	0.801			
Remmitances	7.73	7.41	0.819	8.48	8.47	0.994	10.05	9.26	0.611	9.89	9.72	0.879	7.6	7.87	0.78	6.08	5.71	0.678
Squared remmittances	146.93	140.4	0.884				173.25	153.77	0.639	183.38	177.91	0.875	119.19	120.08	0.971			
Municipality ruled by PAN only	0.37	0.38	0.908	0.26	0.28	0.801	0.21	0.2	0.82	0.23	0.27	0.487	0.26	0.27	0.796	0.35	0.32	0.727
Municipality ruled by PRI only	0.41	0.41	0.995	0.49	0.53	0.452	0.56	0.59	0.694	0.47	0.44	0.626	0.48	0.52	0.589	0.46	0.49	0.739
Homicide rate*decentralized 2005	2.56	2.68	0.924				11.52	5.98	0.159	6.84	6.76	0.961	3.96	3.05	0.333	2.66	3	0.67
Homicide rate1990	11.24	11.54	0.896															
Homicide rate1991	10.06	10.73	0.773															
Homicide rate1993	10.97	11.18	0.928															
Homicide rate1995	11.69	11.57	0.956															
Homicide rate1996	10.86	10.32	0.827															
Homicide rate1997	13.55	13.04	0.894															
Homicide rate1999	10.73	10.96	0.929															
Homicide rate2000	7.16	7	0.912															
Homicide rate2001	6.77	6.32	0.746															
Homicide rate2003	3.91	3.86	0.952															
Homicide rate 2004							16.39	11.48	0.241	12.54	12.11	0.826	8.87	8.34	0.699	6.48	6.33	0.887
Squared homicide rate 2004							1088.34	576.07	0.355	510.43	471.61	0.779	221.85	199.1	0.703			
Distance to pacific coast							287.01	269.5	0.599									
Distance to north border							480.84	448.17	0.583									
Squared distance to north border							338745.1	306080.1	0.595									
By pacific coast										0.03	0.02	0.622	0.03	0.02	0.67	0.03	0.02	0.325
Minimum distance to any border (north, south, pacific coast)										0	0	0.707	0	0	0.519			
Decentralized*Distance north border																331.51	367.39	0.591

Sources: Decentralized, own estimates using official electoral results. Data on distances own estimates using geo-coding provided by INEGI. Rest of indicators from INEGI.

Table A.4
Descriptive statistics of welfare statistics across matched areas that fall in the region of common support

	Panel A: Cartels no drug-related homicides					Panel B: Drug-related homicides									
						At least one drug-related homicides					10th Decile				
	2005		2010		ATT (no controls)	2005		2010		ATT (no controls)	2005		2010		ATT (no controls)
	Control	Treated	Control	Treated		Control	Treated	Control	Treated		Control	Treated	Control	Treated	
Food poverty	32.10	33.69	32.69	34.48	-0.180	29.90	28.86	29.44	28.33	-0.017	26.95	17.38	26.18	24.29	0.212**
	(13.49)	(17.25)	(17.19)	(19.09)	(0.152)	(11.83)	(14.20)	(15.85)	(16.09)	(0.052)	(11.38)	(8.510)	(17.26)	(17.32)	(0.099)
Capability poverty	40.93	42.17	42.27	43.83	-0.168	38.42	37.20	38.76	37.28	-0.013	34.66	24.42	34.90	32.18	0.216**
	(14.04)	(17.67)	(18.21)	(20.16)	(0.154)	(12.63)	(15.10)	(16.99)	(17.48)	(0.056)	(12.38)	(9.925)	(18.81)	(19.17)	(0.109)
Patrimony poverty	63.97	64.12	67.09	67.58	-0.128	61.26	59.97	63.94	61.82	-0.004	56.25	47.27	59.97	55.46	0.209
	(12.78)	(15.79)	(16.36)	(18.17)	(0.157)	(12.21)	(14.65)	(15.81)	(16.76)	(0.071)	(12.51)	(12.33)	(17.96)	(19.23)	(0.141)
Gini	42.27	44.11	41.84	41.84	-0.363**	43.03	42.93	41.24	42.17	0.114	42.94	43.74	40.33	41.95	-0.171
	(3.845)	(3.111)	(3.899)	(4.246)	(0.141)	(3.616)	(3.767)	(3.822)	(4.010)	(0.093)	(3.526)	(4.080)	(3.308)	(3.574)	(0.253)
Lived in another state 5 years ago	232.8	365.3	361.0	432.4	0.140	316.5	391.8	473.7	622.9	0.556*	115.4	118.1	192.9	180.4	-0.188
	(289.0)	(447.5)	(434.6)	(572.5)	(0.196)	(342.5)	(584.6)	(518.9)	(1491.9)	(0.296)	(135.3)	(148.2)	(239.1)	(194.5)	(0.174)
Lived in U.S. 5 years ago	53.32	53.50	260.6	211.7	-0.951	83.56	89.21	378.4	419.6	0.673	54.90	58.83	258.6	250.7	0.173
	(82.20)	(72.20)	(340.8)	(311.5)	(0.693)	(103.4)	(107.3)	(410.1)	(424.8)	(0.805)	(68.60)	(56.37)	(287.0)	(255.3)	(0.658)
Total population	20598.9	25898.0	21343.9	21527.1	-0.042	25617.8	29047.7	27137.2	29778.1	0.072	10071.6	12349.1	11972.4	13220.8	0.023
	(17006.1)	(19482.7)	(18732.3)	(17777.5)	(0.046)	(20260.1)	(24366.6)	(22240.7)	(27257.5)	(0.050)	(9206.6)	(12129.3)	(13381.3)	(11696.7)	(0.035)
Aged 6-14 out of school	5.922	5.113	5.073	5.205	0.042	5.933	6.807	4.876	6.012	0.091**	7.393	7.639	5.802	6.796	0.012
	(2.454)	(2.041)	(2.666)	(2.884)	(0.072)	(2.300)	(3.593)	(2.431)	(3.389)	(0.039)	(2.602)	(4.555)	(3.081)	(3.815)	(0.128)
Aged 15+ without primary	42.10	37.82	36.57	35.51	-0.001	39.18	36.92	34.03	33.45	0.036**	43.31	37.46	37.30	34.37	-0.017
	(8.961)	(9.489)	(9.137)	(9.911)	(0.024)	(8.706)	(10.36)	(8.912)	(9.918)	(0.018)	(8.079)	(11.02)	(9.007)	(9.954)	(0.040)
Population aged 6-14	4409.1	5587.5	4290.9	4456.5	0.003	5498.0	6098.2	5374.5	5897.4	0.052**	2129.4	2432.4	2313.7	2445.3	-0.043***
	(3759.4)	(4372.5)	(3851.7)	(3915.1)	(0.017)	(4444.7)	(5245.6)	(4482.6)	(5442.1)	(0.024)	(2090.8)	(2390.7)	(2730.0)	(2190.9)	(0.016)
Population aged 15-17	1403.3	1769.5	1472.1	1509.3	0.003	1728.8	1949.9	1832.8	2006.6	0.042	681.4	796.3	784.9	852.5	-0.028*
	(1183.0)	(1341.8)	(1293.7)	(1321.5)	(0.024)	(1368.9)	(1646.3)	(1491.3)	(1799.8)	(0.032)	(641.3)	(778.8)	(906.8)	(769.0)	(0.015)
Schools (primary to highschool) per pupil	103.8	110.5	110.2	116.7	-0.030	101.2	89.12	106.0	97.67	-0.010	158.5	125.7	148.2	142.3	0.124*
	(57.07)	(58.91)	(57.99)	(56.59)	(0.044)	(50.89)	(48.45)	(52.03)	(52.26)	(0.019)	(69.41)	(73.43)	(65.39)	(74.59)	(0.074)
Teachers (primary to highschool) per pupil	304.4	320.8	327.7	338.3	0.025	292.5	285.3	313.1	313.5	0.049*	319.2	336.3	335.9	348.5	0.022
	(62.27)	(79.18)	(78.18)	(86.60)	(0.063)	(60.58)	(66.33)	(72.51)	(73.33)	(0.028)	(54.98)	(75.24)	(74.26)	(74.04)	(0.088)
Total energy consumption (thousands of pesos)	16.93	19.02	20.46	15.44	-0.087	22.11	34.52	29.89	30.78	-0.420	10.31	24.37	13.84	28.26	0.726*
	(17.99)	(17.98)	(34.62)	(19.45)	(0.187)	(21.91)	(89.55)	(43.85)	(71.18)	(0.397)	(10.39)	(50.08)	(30.80)	(52.39)	(0.439)
Energy consumption per capita	11093.0	8095.9	8941.7	6849.9	0.016	10089.5	11581.1	11283.1	10230.7	-0.084	23157.4	16368.3	9118.4	20360.9	2.951
	(24862.5)	(6100.4)	(13493.7)	(4989.8)	(0.087)	(15809.8)	(24775.6)	(19593.8)	(19200.8)	(0.132)	(47905.7)	(21774.4)	(8947.0)	(41133.6)	(1.994)
Unemployment rate 2000-2010	0.808	0.990	4.188	3.906	-0.383	0.969	1.153	4.738	4.631	-0.300	1.123	1.152	4.642	5.023	-0.347
	(0.474)	(0.607)	(3.303)	(3.122)	(0.609)	(0.488)	(0.694)	(3.178)	(2.564)	(0.441)	(0.616)	(0.792)	(2.891)	(2.551)	(0.841)
Number unemployed 2000 vs 2010	50.17	66.69	322.4	267.8	-1.736	70.01	98.06	494.3	476.7	-0.861	29.37	54.64	199.4	234.6	1.018
	(53.62)	(55.91)	(420.7)	(271.7)	(1.137)	(72.41)	(105.0)	(576.2)	(483.0)	(2.041)	(27.57)	(80.05)	(276.5)	(258.3)	(0.960)
Number municipalities	409	70				554	688				441	70			

*Descriptives are not in standardized form. Average Treatment effect on the Treated (ATT) estimated with kernel matching, no controls and using standardized variables. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.4 (*continuation*)

Panel B: Drug-related homicides

	3rd Tertile					2nd Tertile					1st Tertile				
	2005		2010		ATT (no controls)	2005		2010		ATT (no controls)	2005		2010		ATT (no controls)
	Control	Treated	Control	Treated		Control	Treated	Control	Treated		Control	Treated	Control	Treated	
Food poverty	29.31	28.71	29.13	29.32	0.052	31.77	31.54	29.65	28.48	-0.092	33.48	29.57	30.74	30.91	0.065
	(11.59)	(13.41)	(16.00)	(16.69)	(0.064)	(11.79)	(13.96)	(15.26)	(14.81)	(0.062)	(11.17)	(13.80)	(14.69)	(15.81)	(0.081)
Capability poverty	37.68	37.08	38.40	38.33	0.064	40.45	40.14	39.03	37.70	-0.086	42.72	38.17	40.36	40.31	0.088
	(12.53)	(14.49)	(17.34)	(17.83)	(0.069)	(12.46)	(14.48)	(16.35)	(16.06)	(0.065)	(11.26)	(14.82)	(15.21)	(16.96)	(0.083)
Patrimony poverty	60.35	60.00	63.55	62.87	0.097	63.16	62.88	64.25	62.86	-0.047	66.15	61.20	65.80	65.07	0.144
	(12.38)	(14.69)	(16.27)	(16.33)	(0.084)	(11.67)	(13.03)	(15.02)	(15.15)	(0.078)	(9.535)	(14.73)	(12.84)	(15.78)	(0.092)
Gini	42.93	42.23	41.37	42.06	0.065	43.44	42.64	41.85	41.85	0.070	43.48	43.41	41.93	42.54	-0.029
	(3.867)	(3.487)	(3.667)	(4.373)	(0.106)	(3.636)	(3.675)	(3.758)	(3.792)	(0.113)	(3.156)	(3.682)	(4.053)	(3.951)	(0.158)
Lived in another state 5 years ago	221.1	245.9	313.4	412.2	0.162	291.2	512.7	436.2	686.5	0.529	535.2	1262.4	785.3	1712.9	1.452**
	(266.2)	(307.2)	(388.0)	(692.6)	(0.157)	(297.0)	(2365.5)	(445.2)	(3258.6)	(0.548)	(408.4)	(4325.3)	(601.4)	(5274.8)	(0.622)
Lived in U.S. 5 years ago	64.16	80.14	295.6	360.5	0.763	75.88	77.35	377.0	318.5	-0.937	108.0	117.8	580.0	566.5	0.017
	(81.88)	(101.1)	(341.2)	(389.4)	(0.703)	(92.33)	(117.2)	(404.7)	(333.5)	(0.825)	(122.2)	(170.3)	(516.2)	(597.2)	(1.100)
Total population	17930.0	20410.0	18196.6	20913.4	0.017	23677.6	27391.5	25233.9	25878.2	0.070	40733.0	59486.7	43967.9	60983.3	0.304**
	(15463.5)	(18905.1)	(17503.4)	(22147.9)	(0.034)	(16704.9)	(28936.7)	(19328.7)	(29326.3)	(0.050)	(19927.6)	(104487.0)	(20996.6)	(111040.5)	(0.126)
Aged 6-14 out of school	6.277	6.812	5.197	6.152	0.074	5.855	6.615	5.008	5.453	0.083	5.819	6.412	5.141	5.818	0.112*
	(2.559)	(4.452)	(2.558)	(3.994)	(0.057)	(2.295)	(2.642)	(2.322)	(2.258)	(0.053)	(1.966)	(2.859)	(2.223)	(3.125)	(0.063)
Aged 15+ without primary	41.40	38.02	36.03	35.00	0.014	39.85	37.10	34.35	33.49	0.023	37.46	35.60	32.48	32.19	0.044*
	(9.231)	(10.36)	(9.079)	(9.791)	(0.023)	(8.455)	(11.58)	(8.266)	(10.41)	(0.022)	(7.532)	(10.54)	(7.844)	(10.52)	(0.025)
Population aged 6-14	3776.5	4212.1	3606.7	4212.7	0.004	5095.5	5583.4	5001.5	5048.9	0.062**	8862.5	11998.9	8839.9	11422.7	0.148***
	(3399.1)	(3930.5)	(3550.8)	(4403.4)	(0.014)	(3745.9)	(5624.1)	(3958.5)	(5529.9)	(0.029)	(4389.3)	(17648.3)	(4281.4)	(16664.0)	(0.055)
Population aged 15-17	1208.0	1373.6	1243.3	1450.2	0.015	1609.4	1797.5	1722.2	1718.8	0.027	2768.1	3830.3	3005.4	3862.0	0.152**
	(1059.7)	(1279.4)	(1192.4)	(1508.6)	(0.021)	(1152.4)	(1825.9)	(1325.8)	(1818.9)	(0.031)	(1349.7)	(5947.1)	(1419.9)	(5799.2)	(0.060)
Schools (primary to highschool) per pupil	109.2	95.71	113.4	106.2	0.027	97.51	89.15	102.3	98.20	-0.029	85.19	75.75	87.67	81.87	-0.038
	(57.71)	(54.23)	(54.68)	(58.05)	(0.032)	(46.67)	(47.97)	(47.57)	(50.33)	(0.026)	(37.96)	(34.35)	(39.27)	(37.53)	(0.026)
Teachers (primary to highschool) per pupil	304.8	295.7	327.1	332.3	0.154***	294.9	285.1	313.2	317.1	0.140**	283.8	266.9	292.4	289.7	0.022
	(59.09)	(76.84)	(70.31)	(75.22)	(0.047)	(61.22)	(61.19)	(66.31)	(74.54)	(0.058)	(56.18)	(54.19)	(60.12)	(64.63)	(0.046)
Total energy consumption (thousands of pesos)	17.38	32.96	24.76	19.83	-1.320	20.13	25.23	28.00	31.11	0.407	33.29	88.28	48.86	73.06	-0.553
	(18.79)	(132.8)	(47.42)	(59.95)	(0.899)	(18.88)	(63.79)	(43.37)	(114.3)	(0.623)	(23.42)	(252.2)	(48.63)	(211.0)	(0.436)
Energy consumption per capita	12079.5	13323.2	12277.3	8655.6	-0.337	9048.7	7438.7	10233.1	7972.5	-0.024	8570.7	10970.5	11058.4	9346.1	-0.393
	(21223.0)	(42053.7)	(23236.6)	(14517.2)	(0.302)	(9866.2)	(6460.0)	(16759.4)	(16733.0)	(0.185)	(6022.1)	(17137.6)	(14647.6)	(11679.3)	(0.311)
Unemployment rate 2000-2010	0.919	1.256	4.271	4.991	0.599	0.927	1.191	4.630	4.838	-0.048	0.995	1.138	5.020	4.400	-1.522**
	(0.525)	(0.878)	(2.994)	(2.853)	(0.471)	(0.455)	(0.689)	(3.127)	(2.853)	(0.462)	(0.426)	(0.609)	(2.884)	(2.127)	(0.695)
Number unemployed 2000 vs 2010	47.27	78.68	295.2	369.8	1.144	62.27	104.2	436.0	469.3	0.439	113.0	210.3	834.5	972.9	1.236
	(50.53)	(100.3)	(390.5)	(444.2)	(1.160)	(54.89)	(183.9)	(477.8)	(636.0)	(1.740)	(81.81)	(495.0)	(637.7)	(1867.2)	(2.981)
Number municipalities	532	182				428	162				162	202			

*Descriptives are not in standardized form. Average Treatment effect on the Treated (ATT) estimated with kernel matching, no controls and using standardized variables. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.5
Number of municipalities included as control and treated to measure impact of welfare statistics by state

	Panel A: Experienced drug-cartels for the first time after 2006 but no drug-related homicides vs. controls								Panel B: Experienced drug related homicides for the first time after 2006 vs. controls						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Number municipalities	Excluded from analysis[a]	Excluded for being buffer area	Treated	Control	Treated in common support	Control in common support	% Municipalities analysed in treatment and control in common support	Excluded from analysis[b]	Excluded for being buffer area	Treated	Control	Treated in common support	Control in common support	% Municipalities analysed in treatment and control in common support
Aguascalientes	11	10	1	0	0	0	0	0%	2	1	8	0	7	0	64%
Baja California	5	5	0	0	0	0	0	0%	5	0	0	0	0	0	0%
Baja California Sur	5	4	0	1	0	1	0	20%	3	0	2	0	0	0	0%
Campeche	11	5	0	1	5	1	5	55%	4	0	2	5	1	5	55%
Chiapas	118	57	25	8	28	8	22	25%	28	25	37	28	35	28	53%
Chihuahua	67	61	2	1	3	1	3	6%	19	2	43	3	38	3	61%
Coahuila	38	23	2	8	5	7	4	29%	18	2	13	5	7	5	32%
Colima	10	9	0	0	1	0	1	10%	3	0	6	1	5	1	60%
Distrito Federal (Mexico City)	16	16	0	0	0	0	0	0%	16	0	0	0	0	0	0%
Durango	39	35	1	1	2	1	2	8%	22	1	14	2	14	2	41%
Guanajuato	46	37	2	4	3	3	3	13%	8	2	33	3	18	3	46%
Guerrero	81	72	5	2	2	1	0	1%	32	5	42	2	39	1	49%
Hidalgo	84	38	28	3	15	3	13	19%	3	28	38	15	32	14	55%
Jalisco	125	94	12	11	8	9	8	14%	22	12	83	8	68	8	61%
Michoacán	113	102	11	0	0	0	0	0%	50	11	52	0	50	0	44%
Morelos	33	31	2	0	0	0	0	0%	19	1	13	0	0	0	0%
México	125	101	20	1	3	1	3	3%	40	20	62	3	53	3	45%
Nayarit	20	16	2	0	2	0	1	5%	2	2	14	2	11	2	65%
Nuevo León	51	37	5	5	4	5	4	18%	22	5	20	4	16	4	39%
Oaxaca	570	138	205	4	223	4	98	18%	54	205	88	223	87	202	51%
Puebla	217	42	85	4	86	4	65	32%	7	85	39	86	35	84	55%
Querétaro	18	10	2	0	6	0	6	33%	3	1	8	6	5	6	61%
Quintana Roo	9	6	0	2	1	2	1	33%	4	0	4	1	1	1	22%
San Luis Potosí	58	24	10	2	22	2	22	41%	4	10	22	22	19	22	71%
Sinaloa	18	18	0	0	0	0	0	0%	16	0	2	0	0	0	0%
Sonora	72	47	4	4	17	4	17	29%	20	4	31	17	28	17	63%
Tabasco	17	15	1	1	0	1	0	6%	7	1	9	0	6	0	35%
Tamaulipas	43	33	2	2	6	2	4	14%	20	2	15	6	13	5	42%
Tlaxcala	60	8	46	0	6	0	6	10%	0	46	8	6	6	6	20%
Veracruz	212	98	75	2	37	2	37	18%	27	75	73	37	71	37	51%
Yucatán	106	5	9	5	87	5	74	75%	7	9	3	87	2	85	82%
Zacatecas	58	31	14	3	10	3	10	22%	8	14	26	10	21	10	53%
Total	2,456	1,228	571	75	582	70	409	20%	495	569	810	582	688	554	51%

[a] Excluded if had drug related homicides during 2000-2010 or if had cartels operating in municipality before 2006. [b] Excluded if had cartels or drug related homicides during 2000-2005. Also excluded if municipality experienced drug related homicides after 2006 according to media but not to official statistics.

Table A.6
Probit marginal effects: Propensity scores used to match areas and evaluate impact on industries

			Drug related homicides by sub-groups			
	Cartels without drug related homicides	At least one drug related homicide	10th decile	3rd Tertile	2nd Tertile	1st Tertile
	(1)	(2)	(3)	(4)	(5)	(6)
Decentralized, 2005	-0.001	0.127***	0.038***	0.026	0.001	0.014
	(0.005)	(0.033)	(0.015)	(0.021)	(0.002)	(0.021)
Mixed type municipality (urban/rural)	-0.006	-0.025	-0.010	0.009	0.001	-0.074***
	(0.005)	(0.044)	(0.009)	(0.028)	(0.003)	(0.018)
Rural*Distance to north border	-0.000	0.000	0.000	0.000*	0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log Population 2005	0.011*	-0.000	0.029	0.281***	0.069*	
	(0.006)	(0.167)	(0.031)	(0.086)	(0.041)	
Log GDP per capita 2005	0.019*	0.322***	0.035**	0.090**	0.014	0.078**
	(0.011)	(0.071)	(0.016)	(0.036)	(0.011)	(0.037)
%Children school attendance 2005	0.000	-0.002	-0.000	-0.001	0.000	-0.000
	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.001)
Remmittances	0.000	0.006***	0.000	0.008***	0.001	-0.002**
	(0.000)	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)
Municipality ruled by PAN only	0.003	-0.053	-0.006	0.005	-0.003	0.065**
	(0.005)	(0.039)	(0.006)	(0.021)	(0.003)	(0.030)
Municipality ruled by PRI only	-0.001	0.045	0.010	0.021	0.000	0.038
	(0.005)	(0.041)	(0.010)	(0.021)	(0.002)	(0.026)
Total homicide rate 2004	0.000		0.001***	0.001*	0.000	-0.000
	(0.000)		(0.000)	(0.001)	(0.000)	(0.000)
Homicide rate*decentralized 2005	-0.001		-0.001*	-0.000	0.000	
	(0.000)		(0.000)	(0.001)	(0.000)	
Total homicide rate 1991	0.000					
	(0.000)					
Total homicide rate 1993	-0.000					
	(0.000)					
Total homicide rate 1995	0.000					
	(0.000)					
Total homicide rate 1996	0.000					
	(0.000)					
Total homicide rate 1999	-0.000					
	(0.000)					
Total homicide rate 2000	-0.000					
	(0.000)					
Total homicide rate 2001	-0.000					
	(0.000)					
Total homicide rate 2003	0.000					
	(0.000)					
Index of marginalization 2000		-0.002	-0.000	-0.002	-0.000	-0.007***
		(0.003)	(0.000)	(0.001)	(0.000)	(0.002)
Capability poverty, 2000		-0.008	-0.001	-0.008**	0.001	0.016***
		(0.008)	(0.001)	(0.004)	(0.001)	(0.004)
Food poverty, 2000		0.006	0.001	0.008*	-0.001	-0.015***
		(0.008)	(0.002)	(0.004)	(0.001)	(0.004)
Squared log population		0.012	-0.002	-0.012***	-0.003*	
		(0.009)	(0.002)	(0.005)	(0.002)	
Mixed type*Decentralized			0.014	0.075	0.001	0.072
			(0.026)	(0.052)	(0.004)	(0.055)
Squared remmitances			-0.000	-0.000**	-0.000	
			(0.000)	(0.000)	(0.000)	
Squared Homicide rate 2004			-0.000**	-0.000	-0.000	
			(0.000)	(0.000)	(0.000)	
Dummy, by pacific coast or not			0.020	0.071		
			(0.040)	(0.064)		
Miniumum distance to north border			-0.000			
			(0.000)			
Minimum distance to any border (north, south, pacific coast)				-10.447		
				(10.566)		
Pseudo R2	0.30	0.35	0.27	0.26	0.43	0.27
Observations	965	1,401	973	1,066	1,068	1,069

*(*) dF/dx is for discrete change of dummy variable from 0 to 1, z and P>|z| correspond to the test of the underlying coefficient being 0. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10*

Table A.7
Balancing test for covariates used to estimate propensity score to assess the impact on industries

	Panel A: Cartels without drug related homicides			Panel B: Drug related homicides														
				All that experienced at least one-			10th Decile			3rd Tertile			2nd Tertile			1st Tertile		
	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff	Mean treated	Mean controls	p-value for diff
Index of marginalization 2000				35.12	35.11	0.992	37.09	36.27	0.68	34.39	34.17	0.866	34.43	34.24	0.891	31.1	31.99	0.567
Capability poverty, 2000				44.4	44.11	0.856	41.73	39.79	0.642	41.68	40.91	0.752	45.1	45.16	0.977	41.86	45.25	0.144
Food poverty, 2000				37.11	36.95	0.921	35.58	33.72	0.637	34.94	34.37	0.807	37.39	37.45	0.979	34.06	37.26	0.158
Decentralized, 2005	0.4	0.31	0.302	0.49	0.52	0.549	0.71	0.7	0.958	0.52	0.48	0.407	0.39	0.42	0.555	0.47	0.47	0.906
Mixed type municipality (urban/rural	0.23	0.23	0.907	0.32	0.31	0.76	0.17	0.13	0.525	0.4	0.43	0.68	0.29	0.27	0.761	0.27	0.24	0.541
Mixed type*Decentralized							0.1	0.08	0.676	0.2	0.18	0.683	0.11	0.1	0.934	0.13	0.11	0.606
Rural*Distance to north border	361.17	321.72	0.604	357.37	361.06	0.907	386.3	386.06	0.997	341.39	319.2	0.604	379.04	373.27	0.909	237.05	258.83	0.609
Log Population 2005	10.01	9.88	0.489	9.86	9.81	0.57	8.57	8.41	0.364	9.59	9.52	0.432	10.08	10.1	0.809			
Squared log population				98.16	97.27	0.58	74.53	71.93	0.381	92.93	91.36	0.401	102.04	102.4	0.829			
Log GDP per capita 2005	10.91	10.91	0.996	10.87	10.87	0.888	10.92	10.94	0.742	10.9	10.9	0.887	10.87	10.88	0.876	11	10.95	0.334
Children school attendance 2005	64.37	64.06	0.719	63.69	63.54	0.728	62.61	63.15	0.568	63.63	63.46	0.763	64.37	63.8	0.366	64.27	63.87	0.541
Remmittances	7.73	7.66	0.957	8.37	8.21	0.811	8.82	9.37	0.69	9.67	9.81	0.881	8.44	8.05	0.668	5.74	5.36	0.528
Squared remmitances							147.41	161.62	0.717	165.98	169.89	0.886	127.19	119.79	0.741			
Municipality ruled by PAN only	0.35	0.31	0.618	0.26	0.24	0.393	0.21	0.25	0.596	0.27	0.25	0.733	0.2	0.2	0.945	0.34	0.3	0.506
Municipality ruled by PRI only	0.4	0.47	0.449	0.49	0.48	0.908	0.54	0.49	0.511	0.5	0.49	0.922	0.51	0.48	0.642	0.45	0.5	0.443
Total homicide rate 2004	6.25	5.81	0.746				20.27	18.15	0.637	11.6	11.53	0.98	10.32	9.11	0.339	6.76	6.04	0.548
Homicide rate*decentralized 2005	1.64	1.2	0.382				11.63	10.57	0.787	6.49	5.33	0.494	4.31	3.95	0.731			
Homicide rate1991	13.49	13.19	0.925															
Homicide rate1993	12.05	12.32	0.919															
Homicide rate1995	16.11	15.55	0.873															
Homicide rate1996	13.17	12.79	0.892															
Homicide rate1999	8.53	8.02	0.803															
Homicide rate2000	7.69	7.68	0.996															
Homicide rate2001	7.25	6.98	0.871															
Homicide rate2003	8.68	7.91	0.659															
Squared Homicide rate 2004							1080.31	952.75	0.712	523.82	569.1	0.893	242.09	203.66	0.519			
By pacific coast							0.02	0.03	0.818	0.09	0.07	0.6						
Distance north border							495.42	488.3	0.903									
Minimum distance to any border (north, south, pacific coast)										0	0	0.829						

Table A.8
Descriptive statistics of industries across matched areas that fall in the region of common support

		Panel A: Cartels without drug related homicides					Panel B: Drug related homicides									
							At least one drug-related homicides					10th Decile				
		2005		2010		ATT (no	2005		2010		ATT (no	2005		2010		ATT (no
		Control	Treated	Control	Treated	controls)	Control	Treated	Control	Treated	controls)	Control	Treated	Control	Treated	controls)
Manufactures	workers	227.1	159.1	293.5	168.5	-0.234	187.3	175.5	267.9	219.5	-0.135*	116.5	180.5	194.3	105.5	-0.652*
		(310.5)	(240.3)	(387.5)	(206.0)	(0.162)	(287.0)	(364.6)	(352.6)	(312.7)	(0.075)	(234.8)	(603.6)	(381.6)	(98.68)	(0.348)
	owners	45.63	34.40	83.01	55.63	-0.105**	40.74	37.11	77.15	77.28	0.018	28.11	31.76	79.38	51.42	-0.205***
		(89.40)	(26.28)	(168.5)	(47.92)	(0.044)	(71.06)	(51.31)	(153.3)	(109.8)	(0.031)	(87.92)	(47.63)	(277.2)	(38.00)	(0.071)
	remuneration	45.43	54.16	57.29	52.25	-0.346***	43.72	43.81	53.40	49.25	-0.108	30.48	35.75	40.78	27.90	-0.547**
		(40.09)	(54.44)	(46.95)	(56.34)	(0.098)	(41.98)	(47.81)	(50.56)	(41.53)	(0.089)	(37.03)	(48.36)	(50.46)	(24.32)	(0.218)
	investment	9916.1	48466.1	20307.8	11687.5	-1.491	13591.5	16711.1	21332.4	17204.8	-0.219	11080.1	-150.8	21108.7	288.3	-0.303
		(43615.4)	(238357.6)	(87462.7)	(43226.0)	(1.134)	(61325.5)	(85402.8)	(82252.2)	(89736.1)	(0.269)	(53965.2)	(6789.1)	(90114.5)	(723.5)	(0.263)
Retail trade	workers	252.8	270.9	367.9	368.5	-0.123	213.0	198.9	332.2	341.8	0.164**	161.0	195.6	265.4	327.2	0.168
		(189.5)	(163.6)	(191.3)	(209.7)	(0.120)	(164.0)	(159.0)	(177.8)	(193.6)	(0.079)	(133.7)	(191.2)	(154.3)	(270.0)	(0.176)
	owners	166.6	178.0	253.1	248.7	-0.142	153.3	146.7	244.6	254.4	0.143*	121.1	137.9	210.8	233.1	0.027
		(116.7)	(100.7)	(122.5)	(130.4)	(0.109)	(115.5)	(113.5)	(126.7)	(137.2)	(0.077)	(96.86)	(126.4)	(126.9)	(160.8)	(0.172)
	remuneration	34.85	38.15	38.37	40.05	-0.068	34.53	32.54	36.08	36.93	0.121	31.48	33.27	32.08	34.50	0.008
		(22.10)	(12.70)	(14.99)	(12.54)	(0.120)	(23.17)	(22.13)	(13.00)	(13.19)	(0.076)	(27.16)	(25.83)	(19.77)	(20.81)	(0.148)
	investment	7603.5	6298.5	7995.0	6729.5	0.011	4446.5	4480.1	4517.8	5293.8	0.198	1085.0	1603.9	963.8	745.2	0.063
		(11193.3)	(8250.9)	(11681.8)	(12480.2)	(0.467)	(7403.8)	(8501.8)	(7842.9)	(9913.9)	(0.220)	(3109.8)	(4100.7)	(3194.8)	(3451.6)	(0.286)
Wholesale business	workers	33.57	40.31	41.51	49.66	0.058	28.16	26.82	38.14	44.68	0.367***	11.57	15.79	18.94	26.50	0.100
		(34.04)	(48.46)	(36.57)	(43.60)	(0.279)	(31.51)	(38.63)	(36.97)	(51.96)	(0.129)	(20.67)	(28.15)	(28.20)	(46.74)	(0.206)
	owners	6.179	7.555	11.82	13.51	0.046	5.973	5.978	11.66	12.20	0.104	3.475	5.273	8.679	10.00	-0.060
		(5.800)	(6.709)	(7.846)	(9.229)	(0.178)	(6.121)	(6.751)	(8.029)	(9.121)	(0.096)	(6.421)	(9.292)	(11.04)	(13.04)	(0.408)
	remuneration	52.68	63.93	61.61	69.32	-0.093	50.41	50.50	58.17	57.74	-0.006	24.38	32.21	32.55	33.16	-0.158
		(44.20)	(44.54)	(39.10)	(37.44)	(0.206)	(48.32)	(51.98)	(42.17)	(39.33)	(0.135)	(40.43)	(43.71)	(39.24)	(41.56)	(0.161)
	investment	2977.3	2102.6	1419.3	2492.2	0.655*	2388.1	2580.0	1586.8	5356.3	1.278**	437.2	461.6	382.6	346.8	0.356
		(6377.0)	(4099.8)	(3354.3)	(5493.7)	(0.348)	(6016.3)	(13394.5)	(3445.1)	(26275.8)	(0.509)	(1868.6)	(1741.1)	(1695.5)	(937.5)	(0.390)
Real Estate	workers	7.150	6.808	9.927	9.161	-0.030	5.273	4.495	8.503	8.355	0.055	4.090	6.204	5.776	6.298	-0.116
		(12.36)	(8.270)	(9.664)	(12.08)	(0.118)	(10.36)	(6.875)	(9.393)	(8.715)	(0.060)	(20.51)	(14.68)	(11.26)	(10.28)	(0.149)
	owners	4.738	3.894	7.359	5.818	-0.052	3.431	3.204	5.822	5.696	0.010	3.335	4.542	4.411	4.061	-0.107
		(9.259)	(4.238)	(7.570)	(5.296)	(0.052)	(8.019)	(5.154)	(6.430)	(5.896)	(0.039)	(20.03)	(10.91)	(8.182)	(5.772)	(0.147)
	remuneration	20.05	23.23	21.42	18.75	-0.410	17.39	15.70	20.79	18.23	-0.075	6.305	11.01	6.706	8.351	-0.245
		(20.93)	(31.82)	(24.29)	(19.44)	(0.372)	(19.51)	(19.76)	(27.26)	(20.50)	(0.171)	(14.40)	(24.20)	(23.94)	(14.57)	(0.276)
	investment	151.8	580.4	238.1	120.6	-1.408	162.7	135.6	394.6	157.2	-0.621	22.61	159.7	88.65	11.12	-0.570*
		(498.2)	(2254.9)	(1636.8)	(418.8)	(0.928)	(642.6)	(759.6)	(2374.2)	(959.3)	(0.848)	(214.4)	(610.3)	(1204.6)	(68.64)	(0.323)
Taxes		2090.8	2448.6	3351.6	4047.1	0.250	1886.2	1951.5	2992.8	3507.1	0.381	603.6	1042.1	917.3	1492.0	0.112
(thousands pesos)		(2724.4)	(2741.1)	(4820.3)	(5355.4)	(0.496)	(2856.9)	(3525.8)	(4810.4)	(9091.6)	(0.342)	(1089.3)	(2366.9)	(1757.1)	(3385.0)	(0.148)
Number municipalities		637	40				874	404				602	48			

*Descriptives are not in standardized form. Average Treatment effect on the Treated (ATT) estimated with kernel matching, no controls and using standardized variables. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.8 (*continuation*)

		Panel B: Drug related homicides														
		3rd Tertile					2nd Tertile					1st Tertile				
		2005		2010		ATT (no	2005		2010		ATT (no	2005		2010		ATT (no
		Control	Treated	Control	Treated	controls)	Control	Treated	Control	Treated	controls)	Control	Treated	Control	Treated	controls)
Manufactures	workers	173.2	188.4	239.1	244.9	-0.062	222.3	139.9	290.3	195.4	-0.061	331.0	258.7	408.6	329.9	0.049
		(295.1)	(332.7)	(327.4)	(307.1)	(0.115)	(347.6)	(219.8)	(357.9)	(250.3)	(0.085)	(461.7)	(475.9)	(522.2)	(569.7)	(0.145)
	owners	36.13	43.60	74.87	98.21	0.113	39.94	38.34	71.75	75.51	0.044	52.32	33.32	122.4	65.46	-0.213***
		(68.55)	(55.43)	(136.2)	(156.1)	(0.099)	(49.00)	(62.87)	(76.82)	(96.64)	(0.075)	(114.8)	(28.61)	(307.4)	(48.91)	(0.051)
	remuneration	39.35	38.98	50.94	44.29	-0.176*	46.02	44.33	56.93	50.50	-0.123	45.76	60.14	51.81	70.71	0.204
		(40.57)	(33.32)	(52.42)	(29.89)	(0.098)	(43.04)	(52.30)	(47.80)	(48.74)	(0.098)	(50.61)	(57.37)	(46.16)	(50.28)	(0.186)
	investment	12005.4	7303.7	17132.2	9213.8	0.144	22064.4	15571.3	35604.8	4555.9	-0.747**	36913.6	110834.3	57756.0	74038.5	-2.048
		(63761.7)	(45095.1)	(77209.1)	(52876.4)	(0.304)	(78005.8)	(69461.0)	(116169.6)	(48413.7)	(0.365)	(95807.1)	(636675.5)	(154194.2)	(202633.3)	(2.565)
Retail trade	workers	200.8	207.2	344.6	347.1	-0.059	230.5	198.9	356.8	341.8	0.112	245.9	220.0	386.9	370.1	0.095
		(167.2)	(154.9)	(172.2)	(188.7)	(0.148)	(175.1)	(162.2)	(182.3)	(189.4)	(0.129)	(179.6)	(159.9)	(179.5)	(165.7)	(0.134)
	owners	144.4	154.6	258.8	267.6	-0.044	164.9	150.5	259.5	258.6	0.116	180.4	150.6	292.1	253.3	-0.086
		(118.3)	(110.0)	(125.9)	(142.4)	(0.150)	(124.1)	(119.5)	(129.1)	(139.5)	(0.136)	(129.4)	(106.7)	(132.2)	(111.2)	(0.122)
	remuneration	30.87	30.29	36.71	35.56	-0.039	35.28	33.89	37.75	36.90	0.025	31.28	36.39	34.22	41.75	0.111
		(23.64)	(19.12)	(14.52)	(13.21)	(0.107)	(22.63)	(25.07)	(11.25)	(11.93)	(0.109)	(23.48)	(20.16)	(16.08)	(9.328)	(0.090)
	investment	3180.4	3207.5	3596.1	3878.5	-0.457	5341.0	4799.0	5092.9	5784.9	0.064	5042.8	14886.6	4956.1	17426.7	2.458
		(6246.8)	(5745.7)	(6973.6)	(8933.9)	(0.569)	(7744.1)	(9053.2)	(7543.9)	(10964.7)	(0.294)	(8662.3)	(27554.4)	(7894.8)	(28537.2)	(1.649)
Wholesale business	workers	25.53	24.01	37.47	37.63	0.072	32.98	30.89	44.10	52.36	0.415**	33.31	39.95	42.82	61.39	0.587***
		(32.49)	(32.13)	(35.12)	(36.67)	(0.156)	(33.43)	(48.65)	(39.22)	(68.22)	(0.209)	(38.69)	(41.41)	(42.87)	(47.20)	(0.190)
	owners	5.529	6.323	12.08	13.04	0.030	6.255	6.384	12.55	12.90	0.071	6.413	5.721	13.27	11.99	-0.080
		(6.493)	(6.844)	(8.425)	(10.15)	(0.136)	(5.421)	(6.861)	(6.955)	(8.240)	(0.136)	(7.404)	(4.742)	(9.945)	(5.389)	(0.114)
	remuneration	44.40	48.17	54.36	53.59	-0.124	56.83	53.40	65.90	61.07	0.009	41.38	62.36	51.19	76.92	0.151
		(50.51)	(58.62)	(40.04)	(37.60)	(0.174)	(46.00)	(46.67)	(39.73)	(32.67)	(0.156)	(41.25)	(46.29)	(42.82)	(40.05)	(0.142)
	investment	1628.7	1935.6	1064.0	4436.0	0.492	3179.3	2448.2	2145.3	2556.2	0.321	2310.3	8605.7	1922.8	12836.4	2.245
		(4944.0)	(9308.7)	(2801.2)	(30791.3)	(0.855)	(7081.1)	(7776.2)	(3947.0)	(6349.1)	(0.297)	(5233.2)	(27617.9)	(4132.5)	(35071.3)	(1.800)
Real Estate	workers	4.539	4.264	8.577	9.667	0.094	6.335	3.948	9.108	7.947	0.213	6.270	6.262	10.75	10.90	0.066
		(8.840)	(5.600)	(9.261)	(10.68)	(0.081)	(11.48)	(4.597)	(8.156)	(7.368)	(0.245)	(14.50)	(5.850)	(13.60)	(9.947)	(0.086)
	owners	3.326	3.249	5.914	6.785	0.070	3.422	2.754	6.302	5.533	-0.027	4.458	3.790	7.847	6.444	-0.050
		(8.193)	(4.419)	(6.400)	(7.340)	(0.059)	(4.293)	(3.399)	(5.758)	(5.165)	(0.140)	(13.74)	(3.500)	(9.421)	(4.575)	(0.065)
	remuneration	13.49	13.60	18.18	16.12	-0.225	21.46	15.45	23.86	18.90	0.060	15.73	24.54	16.57	28.63	0.332
		(17.04)	(18.79)	(25.05)	(23.72)	(0.201)	(22.46)	(18.52)	(28.01)	(16.99)	(0.216)	(19.06)	(21.60)	(21.79)	(21.10)	(0.206)
	investment	115.3	27.49	218.6	71.08	9.050	177.3	223.8	379.1	322.6	-1.366	74.39	427.2	107.1	299.2	1.952
		(556.3)	(77.23)	(1392.2)	(310.1)	(9.307)	(622.1)	(1080.0)	(2147.6)	(1697.6)	(1.095)	(330.2)	(1111.5)	(846.9)	(2119.1)	(2.499)
Taxes percapita (thousands pesos)		1483.0	3583.9	2190.1	5335.7	0.838	2097.9	3015.5	3353.1	4969.5	0.473	1451.5	12291.1	2299.8	27317.5	11.815***
		(2219.5)	(17110.6)	(3572.3)	(25666.2)	(0.622)	(2849.9)	(7292.6)	(4852.9)	(15462.3)	(0.580)	(2418.7)	(29877.8)	(4464.2)	(74889.2)	(3.623)
Number municipalities		767	141				513	122				840	135			

*Descriptives are not in standardized form. Average Treatment effect on the Treated (ATT) estimated with kernel matching, no controls and using standardized variables. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.9
Impact of drug cartels and drug-related homicides on welfare statistics excluding buffer areas within 20km

	(1) Food poverty	(2) Capability poverty	(3) Patrimony poverty	(4) Gini	(5) Lived in another state 5 years ago	(6) Lived in U.S. 5 years ago	(7) Total population	(8) Aged 6-14 out of school	(9) Aged 15+ without primary	(10) Population aged 6-14	(11) Population aged 15-17	(12) Schools (primary to highschool) per pupil	(13) Teachers (primary to highschool) per pupil	(14) Total energy consumption	(15) Energy consumption per capita	(16) Unemployment rate 2000-2010	(17) Number unemployed 2000 vs 2010
Panel A: Cartels without drug related homicides																	
ATT: time*treated	-0.315	-0.289	-0.229	-0.558**	0.418	-0.644	-0.149***	0.059	0.028	0.035*	0.021	-0.043	-0.090	0.057	0.100	-0.438	-1.427
	(0.223)	(0.222)	(0.220)	(0.249)	(0.326)	(0.661)	(0.053)	(0.116)	(0.035)	(0.019)	(0.034)	(0.065)	(0.114)	(0.189)	(0.090)	(0.879)	(1.881)
Observations	398	398	398	398	398	398	398	398	398	398	398	390	362	250	250	396	396
R-squared	0.140	0.126	0.104	0.159	0.353	0.377	0.212	0.298	0.879	0.142	0.236	0.145	0.209	0.052	0.043	0.513	0.367
Panel B: Drug related homicides																	
Areas with at least one drug related homicide																	
ATT: time*treated	0.075	0.084	0.107	0.040	0.395*	0.594	0.082	0.070	0.030*	0.100***	0.079**	-0.033	0.009	-0.255	0.029	-0.034	1.223
	(0.076)	(0.081)	(0.095)	(0.125)	(0.226)	(0.857)	(0.057)	(0.058)	(0.018)	(0.021)	(0.032)	(0.029)	(0.045)	(0.342)	(0.054)	(0.489)	(2.255)
Observations	1,592	1,592	1,592	1,588	1,592	1,592	1,592	1,592	1,592	1,592	1,592	1,508	1,350	1,004	1,004	1,583	1,583
R-squared	0.075	0.051	0.034	0.173	0.255	0.464	0.133	0.341	0.904	0.029	0.190	0.142	0.224	0.008	0.010	0.610	0.408
Top 10 decile of drug related homicides																	
ATT: time*treated	0.217*	0.216	0.200	-0.401	0.024	-0.026	-0.008	-0.153	0.033	-0.023	-0.016	0.111	0.204	0.954	1.919	0.420	0.969
	(0.129)	(0.141)	(0.168)	(0.275)	(0.179)	(0.520)	(0.033)	(0.271)	(0.036)	(0.016)	(0.015)	(0.083)	(0.172)	(0.654)	(1.199)	(1.047)	(1.457)
Observations	230	230	230	228	230	230	230	230	230	230	230	222	188	124	124	230	230
R-squared	0.166	0.156	0.129	0.246	0.264	0.447	0.096	0.171	0.867	0.211	0.058	0.035	0.148	0.073	0.230	0.674	0.389
Third tertile of drug related homicides																	
ATT: time*treated	0.008	0.021	0.058	0.019	0.063	0.888	0.031	0.068	0.019	0.043***	0.045**	-0.007	0.154**	-0.680	0.075	0.100	1.463
	(0.075)	(0.079)	(0.092)	(0.160)	(0.188)	(0.889)	(0.048)	(0.076)	(0.025)	(0.013)	(0.022)	(0.036)	(0.061)	(0.741)	(0.176)	(0.586)	(2.143)
Observations	792	792	792	792	792	792	792	792	792	792	792	752	650	444	444	790	790
R-squared	0.132	0.105	0.070	0.170	0.305	0.405	0.103	0.301	0.863	0.143	0.191	0.226	0.339	0.014	0.067	0.598	0.350
Second tertile of drug related homicides																	
ATT: time*treated	-0.145	-0.138	-0.106	-0.219	0.943	0.351	0.243**	0.105	0.074***	0.166***	0.126**	-0.065**	0.047	1.887	0.282	0.240	9.166*
	(0.125)	(0.129)	(0.133)	(0.226)	(0.848)	(1.873)	(0.108)	(0.094)	(0.024)	(0.039)	(0.056)	(0.029)	(0.059)	(1.326)	(0.177)	(0.515)	(4.930)
Observations	714	714	714	712	714	714	714	714	714	714	714	678	622	474	474	712	712
R-squared	0.160	0.123	0.062	0.112	0.092	0.364	0.099	0.380	0.913	0.054	0.144	0.267	0.308	0.036	0.044	0.681	0.198
First tertile of drug related homicides																	
ATT: time*treated	0.183	0.213	0.269**	-0.057	0.878*	0.630	0.280*	0.088	0.070***	0.153***	0.163**	-0.053	-0.074	-0.606	-0.014	-0.460	9.389*
	(0.126)	(0.130)	(0.129)	(0.290)	(0.454)	(1.225)	(0.143)	(0.098)	(0.025)	(0.042)	(0.074)	(0.042)	(0.075)	(0.701)	(0.312)	(0.928)	(4.813)
Observations	464	464	464	464	464	464	464	464	464	464	464	442	436	372	372	458	458
R-squared	0.073	0.051	0.036	0.137	0.227	0.546	0.111	0.520	0.941	0.058	0.252	0.393	0.367	0.037	0.060	0.744	0.252

*Controls used in specifications (1) to (15): poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Controls used in specifications (16) and (17): poor-relief subsidies per capita and state's unemployment rate, all lagged for two years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.10
Placebo impact on welfare statistics, splitting control group into control and placebo treatment (2000-2005 vs. 2006-2010)

	(1) Food poverty	(2) Capability poverty	(3) Patrimony poverty	(4) Gini	(5) Lived in another state 5 years ago	(6) Lived in U.S. 5 years ago	(7) Total population	(8) Aged 6-14 out of school	(9) Aged 15+ without primary	(10) Population aged 6-14	(11) Population aged 15-17	(12) Schools (primary to highschool) per pupil	(13) Teachers (primary to highschool) per pupil	(14) Total energy consumption	(15) Energy consumption per capita	(16) Unemployment rate 2000-2010	(17) Number unemployed 2000 vs 2010
Panel A: Cartels without drug related homicides																	
ATT: time*treated	-0.134*	-0.127	-0.111	-0.047	-0.135**	0.188	-0.028	-0.020	-0.039	-0.008	-0.005	0.089	0.046	0.056	0.130**	1.017	-0.454
	(0.081)	(0.082)	(0.086)	(0.105)	(0.064)	(0.462)	(0.026)	(0.103)	(0.029)	(0.012)	(0.015)	(0.079)	(0.057)	(0.100)	(0.058)	(0.830)	(0.784)
Observations	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,084	892	524	524	1,091	1,091
R-squared	0.040	0.058	0.132	0.059	0.263	0.195	0.090	0.163	0.827	0.052	0.224	0.145	0.121	0.029	0.024	0.391	0.199
Panel B: Drug related homicides																	
Areas with at least one drug related l	-0.078	-0.066	-0.048	-0.077	0.077	-0.095	-0.012	0.085	-0.021	-0.010	-0.008	-0.072	0.026	-0.287*	-1.028**	0.063	-0.100
ATT: time*treated	(0.059)	(0.060)	(0.064)	(0.084)	(0.068)	(0.301)	(0.019)	(0.059)	(0.021)	(0.008)	(0.012)	(0.052)	(0.050)	(0.158)	(0.512)	(0.523)	(0.587)
	1,148	1,148	1,148	1,148	1,148	1,148	1,148	1,148	1,148	1,148	1,148	1,132	932	552	552	1,141	1,141
Observations	0.025	0.043	0.114	0.058	0.265	0.217	0.066	0.210	0.829	0.075	0.193	0.151	0.133	0.035	0.033	0.391	0.175
R-squared																	
Top 10 decile of drug related homicides																	
ATT: time*treated	-0.058	-0.044	-0.024	-0.083	0.174	-0.026	0.003	0.046	-0.009	0.002	0.039	-0.037	-0.080	-0.754	-0.728	1.579	0.339
	(0.106)	(0.105)	(0.102)	(0.141)	(0.119)	(0.457)	(0.050)	(0.115)	(0.062)	(0.014)	(0.031)	(0.083)	(0.080)	(0.549)	(0.621)	(1.622)	(1.057)
Observations	458	458	458	458	458	458	458	458	458	458	458	458	370	210	210	456	456
R-squared	0.026	0.058	0.189	0.180	0.294	0.227	0.050	0.263	0.737	0.068	0.191	0.190	0.167	0.054	0.053	0.355	0.233
Third tertile of drug related homicides																	
ATT: time*treated	-0.141**	-0.127*	-0.090	-0.146	0.164	0.057	-0.025	0.120	0.007	-0.003	-0.002	-0.095	-0.015	-0.260	-0.688	-0.341	-0.200
	(0.069)	(0.069)	(0.073)	(0.121)	(0.112)	(0.415)	(0.026)	(0.074)	(0.027)	(0.010)	(0.018)	(0.059)	(0.060)	(0.161)	(0.431)	(0.664)	(0.833)
Observations	642	642	642	642	642	642	642	642	642	642	642	638	528	306	306	637	637
R-squared	0.042	0.064	0.152	0.054	0.256	0.223	0.057	0.227	0.834	0.047	0.241	0.143	0.116	0.045	0.047	0.435	0.188
Second tertile of drug related homicides																	
ATT: time*treated	-0.106	-0.092	-0.092	0.015	0.084	-0.327	-0.015	0.033	-0.010	-0.025*	-0.019	-0.039	0.044	-0.630	-2.110	-0.335	-0.482
	(0.086)	(0.087)	(0.093)	(0.129)	(0.117)	(0.291)	(0.023)	(0.089)	(0.027)	(0.015)	(0.016)	(0.063)	(0.086)	(0.438)	(1.747)	(0.733)	(0.628)
Observations	570	570	570	570	570	570	570	570	570	570	570	562	440	248	248	566	566
R-squared	0.057	0.079	0.141	0.054	0.212	0.248	0.102	0.214	0.862	0.074	0.168	0.136	0.096	0.056	0.032	0.376	0.180
First tertile of drug related homicides																	
ATT: time*treated	0.010	0.012	0.027	-0.009	0.039	-0.085	-0.001	0.084	-0.058**	-0.018**	-0.020	-0.053	0.031	-0.139	-0.854	-0.028	0.196
	(0.086)	(0.090)	(0.103)	(0.104)	(0.092)	(0.451)	(0.026)	(0.073)	(0.028)	(0.009)	(0.016)	(0.059)	(0.059)	(0.150)	(0.705)	(0.612)	(0.882)
Observations	630	630	630	630	630	630	630	630	630	630	630	622	522	316	316	626	626
R-squared	0.025	0.038	0.099	0.086	0.341	0.210	0.096	0.230	0.847	0.166	0.197	0.146	0.214	0.032	0.087	0.452	0.197

Controls used in specifications (1) to (15): Poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Controls used for specifications (16) and (17): Poor-relief subsidies per capita and state's unemployment rate, all lagged for two years.
*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.11
Placebo impact on industries, splitting control group into control and placebo treatment (2000-2005 vs. 2006-2008)

	Manufactures				Retail trade				Wholesale business				Real Estate				Tax revenue
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	workers	owners	remuneration	investment	workers	owners	remuneration	investment	workers	owners	remuneration	investment	workers	owners	remuneration	investment	
Panel A: Cartels without drug related homicides																	
ATT: time*treated	-0.161	-0.494***	-0.036	0.030	0.081	0.095	-0.193	0.005	0.402	0.161	0.222	0.187	-0.046	0.001	0.145	1.310	0.212
	(0.155)	(0.170)	(0.095)	(0.106)	(0.213)	(0.250)	(0.118)	(0.057)	(0.404)	(0.365)	(0.246)	(0.131)	(0.214)	(0.216)	(0.205)	(1.289)	(0.249)
Observations	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746
R-squared	0.130	0.087	0.126	0.028	0.500	0.486	0.136	0.002	0.093	0.202	0.073	0.017	0.089	0.082	0.048	0.040	0.068
Panel B: Drug related homicides																	
Areas with at least one drug related h	-0.106	-0.077	-0.056	-0.114*	0.058	0.057	-0.067	0.021	0.066	0.029	0.019	0.082*	-0.023	-0.070	0.072	0.125	0.006
ATT: time*treated	(0.122)	(0.153)	(0.055)	(0.060)	(0.085)	(0.096)	(0.076)	(0.041)	(0.092)	(0.103)	(0.074)	(0.042)	(0.240)	(0.292)	(0.103)	(0.179)	(0.074)
	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834	1,834
Observations	0.096	0.075	0.090	0.010	0.500	0.492	0.111	0.002	0.101	0.249	0.048	0.005	0.049	0.043	0.022	0.002	0.038
R-squared																	
Top 10 decile of drug related homicides																	
ATT: time*treated	0.223	0.582	-0.199*	-0.045	-0.100	-0.076	-0.096	0.203	-0.090	0.142	0.172	0.614	0.593	0.102	0.054	0.052	0.017
	(0.495)	(0.649)	(0.108)	(0.039)	(0.194)	(0.228)	(0.152)	(0.221)	(0.152)	(0.226)	(0.206)	(0.377)	(0.502)	(0.175)	(0.197)	(0.187)	(0.074)
Observations	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
R-squared	0.094	0.101	0.110	0.006	0.535	0.524	0.183	0.179	0.145	0.371	0.100	0.351	0.148	0.130	0.062	0.013	0.130
Third tertile of drug related homicides																	
ATT: time*treated	-0.165	-0.160	-0.043	-0.116	0.022	-0.016	-0.109	0.040	-0.094	0.015	-0.180	0.064	-0.274*	-0.315**	-0.107	0.777	-0.034
	(0.164)	(0.204)	(0.071)	(0.090)	(0.114)	(0.129)	(0.137)	(0.092)	(0.117)	(0.158)	(0.121)	(0.053)	(0.146)	(0.147)	(0.125)	(0.928)	(0.083)
Observations	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356	1,356
R-squared	0.113	0.085	0.127	0.012	0.556	0.536	0.100	0.011	0.122	0.284	0.046	0.007	0.065	0.070	0.014	0.012	0.060
Second tertile of drug related homicides																	
ATT: time*treated	-0.075	-0.127	-0.005	-0.180**	0.174	0.155	-0.139	0.014	0.032	-0.006	-0.045	0.048	-0.168	-0.196	0.116	0.003	-0.003
	(0.193)	(0.232)	(0.059)	(0.076)	(0.171)	(0.177)	(0.153)	(0.052)	(0.108)	(0.164)	(0.091)	(0.037)	(0.561)	(0.786)	(0.159)	(0.055)	(0.169)
Observations	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370
R-squared	0.087	0.064	0.143	0.012	0.441	0.449	0.086	0.005	0.125	0.232	0.052	0.004	0.090	0.089	0.029	0.001	0.031
First tertile of drug related homicides																	
ATT: time*treated	-0.159	-0.134	-0.060	-0.055	0.065	0.088	0.018	-0.034	0.284	0.075	0.184	0.007	0.280	0.304	0.250*	-0.116	0.096
	(0.160)	(0.206)	(0.110)	(0.064)	(0.134)	(0.159)	(0.097)	(0.058)	(0.214)	(0.184)	(0.146)	(0.082)	(0.394)	(0.392)	(0.136)	(0.083)	(0.132)
Observations	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386	1,386
R-squared	0.108	0.087	0.067	0.024	0.518	0.505	0.166	0.016	0.095	0.229	0.085	0.013	0.049	0.047	0.042	0.010	0.055

*Controls used in all specifications: Poor-relief subsidies per capita, growth in annual remittances and state's unemployment rate, all lagged for two years. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10*

Table A.12
Placebo test using 1990-2000 as pre-treatment and 2001-2005 as post-treatment

	Treated vs. controls						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Food poverty	Capability poverty	Patrimony poverty	Gini	Total population	Aged 6-14 out of school	Aged 15+ without primary
Panel A: Cartels without drug related homicides							
ATT: time*treated	0.209	0.214	0.223	0.005	0.006	-0.044	-0.032
	(0.134)	(0.137)	(0.147)	(0.109)	(0.022)	(0.081)	(0.029)
Observations	881	881	881	881	881	881	879
R-squared	0.164	0.134	0.071	0.389	0.048	0.636	0.896
Panel B: Drug related homicides							
Areas with at least one drug related homicide	0.069	0.060	0.020	0.012	0.043	0.022	-0.009
ATT: time*treated	(0.063)	(0.067)	(0.083)	(0.086)	(0.039)	(0.047)	(0.017)
	2,301	2,301	2,301	2,301	2,301	2,301	2,301
Observations	0.284	0.229	0.069	0.411	0.038	0.718	0.902
R-squared							
Top 10 decile of drug related homicides							
ATT: time*treated	0.022	0.005	-0.037	0.258	-0.018	-0.132	-0.061
	(0.163)	(0.158)	(0.147)	(0.203)	(0.015)	(0.137)	(0.040)
Observations	635	635	635	635	635	635	635
R-squared	0.253	0.188	0.018	0.632	0.164	0.444	0.850
Third tertile of drug related homicides							
ATT: time*treated	-0.038	-0.048	-0.073	-0.083	0.010	-0.005	0.022
	(0.066)	(0.072)	(0.090)	(0.090)	(0.038)	(0.056)	(0.022)
Observations	1,354	1,354	1,354	1,354	1,354	1,354	1,352
R-squared	0.256	0.197	0.044	0.433	0.010	0.680	0.863
Second tertile of drug related homicides							
ATT: time*treated	-0.003	-0.013	-0.055	-0.038	0.039	-0.007	-0.005
	(0.072)	(0.076)	(0.091)	(0.095)	(0.030)	(0.046)	(0.019)
Observations	1,090	1,090	1,090	1,090	1,090	1,090	1,088
R-squared	0.237	0.191	0.058	0.318	0.021	0.776	0.925
First tertile of drug related homicides							
ATT: time*treated	0.153	0.148	0.117	-0.142	0.034	0.095	0.019
	(0.127)	(0.135)	(0.149)	(0.114)	(0.039)	(0.072)	(0.023)
Observations	705	705	705	705	705	705	705
R-squared	0.349	0.303	0.159	0.357	0.112	0.795	0.941

Controls used in all specifications: Poor-relief subsidies per capita and state's unemployment rate, all lagged for two years.

Conclusions

Persistent inequality and the peculiar balance between high levels of inequality and weak redistributive systems in Latin America are at some extent explained by social dynamics and institutions that have been developed historically in the region. This dissertation addressed three recent phenomena that are fundamental to understand development outcomes in the region: the consequences of educational expansion on social mobility; the incidence of corruption on public support for redistribution; and the effects of drug-related violence on poverty and inequality.

The first paper aimed at establishing the effects of policy changes intended to strengthen university autonomy and increase the coverage of education in Colombia, which resulted in a pronounced expansion of the private supply of tertiary level degrees. It attempts to answer two questions: (1) did supply expansion improve probabilities of enrolment and holding a higher education degree? And (2) which students benefited most from higher education supply expansion? Particularly, the paper has two main purposes: (1) analyse the extent in which the expansion, in terms of new institutions and new degree programs, contributed to increase the individual probability of attending higher education and achieving a higher education degree, and (2) establish potential distributional effects by determining which individuals benefited the most by considering heterogeneous effects relative to their family background (parental education). A difference in difference approach was used to compare educational attainment of individuals with similar characteristics before and after the enactment of the reform. The differential expansion of supply at regional level was the source of variability used to understand the relationship between the availability of new undergraduate degree programs and new institutions and the probability of attending and/or completing a higher education degree.

The second paper sheds light on the puzzling effects of corruption on preferences for redistribution. It delved into research which has established that perceived corruption shapes individuals' preferences for redistribution in three different manners: (1) corruption undermines trust in government, which in turn reduces support for redistribution. (2) Corruption creates uneven opportunities to obtain benefits from state intervention and it may consequently increase support for redistribution as an opportunistic desire to capture rents. (3) Corruption subverts equality of opportunity, which may consequently increase support for redistribution as a demand for fairness.

The main aims of the second paper were to estimate the effect of perceptions of corruption on the probability of supporting state intervention to reduce economic inequality and to explore the three pathways outlined above that may mediate this effect. As the causal link between beliefs and preferences runs in both directions —beliefs not only shape public policies, but are also influenced by policies and institutional environment—, the concern for potential endogeneity of perceptions of corruption was addressed through a simultaneous equation model using the level of bribery victimization as exclusion restriction.

The third paper was set to estimate the impact of drug cartels and drug-related homicides on poverty and inequality considering municipal differences during the periods before (2000-2006) and after (2006 or afterwards) cartels settled for the first time. It also aimed at identifying the mechanisms that explain the effects of violence on development. It thus explored the changes in internal migration, education drop out, economic activity, and the number of employers, employees, remunerations and investment across various industries. A difference-in-difference estimator combined with a propensity score matching approach was used to overcome the problem of simply comparing areas that experienced drug-related violence and those that did not, which would ignore that drug cartels might be more active in certain areas given their underlying characteristics, and that some areas might suffer changes not necessarily because of the drug violence, but perhaps due to unobserved characteristics.

The findings from this dissertation make several contributions to the current literature on development in Latin-America.

The first paper provided evidence that the expansion of tertiary education supply in Colombia had a positive effect on equality of opportunity in higher education attainment as it increased the probabilities of enrolment for individuals of less well-off backgrounds. This was especially important for the private offer resulting from policy changes. Nevertheless, this effect is limited in two different ways. First, the positive effect was driven mostly by the increasing supply in the non-university system, which suggests a process of diversion, in which less advantaged students were channelled to educational opportunities considered of lower status in the Colombian context. Second, the supply of public institutions mostly benefited individuals from the most advantaged backgrounds and the positive effect of new public degrees tended to be proportional to the educational attainment of the parents, which signals that there is indeed a trade-off between efficiency and equality, even in the public sector.

These results speak to a vast literature that studies enrolment expansion and questions its potential to act as a 'great leveller' that promotes intergenerational mobility. It does so by analysing the effect of expansion from the supply side as characteristics of such expansion may have consequences in terms of achieving greater participation of students from different socioeconomic groups. Consequently, it refocuses the relevant question by moving a step before when asking whether the expansion of educational supply, and the way it has occurred, reduces inequality by providing more opportunities to individuals from disadvantaged families, or conversely whether it magnifies inequality by expanding opportunities disproportionately for those who are already privileged.

The selection of the Colombian case enabled a deep understanding of the impact and unexpected outcomes of reforming University regulation institutions. The paper puts together data for higher education supply at the department level between 1992 and 2002 and uses individual level information from the National living standards survey in order to provide a rich description of the dynamics of higher education after the most important reform undertaken until now in the country.

Recent discussions on system reform have generated controversy on the role of the private sector on education provision. While some fear that market deregulation leads to augment inequality in educational attainment, the other side argues that higher private supply, including for-profit institutions, increases not only the availability of educational resources in under-served regions, but will also have a levelling effect by reducing the costs and responding more efficiently to market demand for human capital. This paper contributes to the debate by providing evidence that increased supply, and especially private supply did increase probability of enrolment for students from the least well-off backgrounds, but that this positive effect is not enough to ensure equality of opportunity. The reason for this limitation is that the effect is driven primarily by the non-university sector, which in the Colombian case is characterised by lower quality and lower market remuneration than university level. This perpetuates economic inequality because even if the less privileged complete their higher education, they are still in a disadvantaged position as compared to those students from well-off families in the labour market.

On the other side, defending public education as the unique leveller for its inherently social function is not well-grounded as the evidence has shown that its expansion has privileged mostly students from well-off families. The reason for this is that access to public education is often more academically demanding in the Colombian case. This implies that guaranteeing equality of opportunity at the tertiary level requires

overcoming inequalities in previous educational stages, particularly in terms of the quality of the education.

Further research on the stratification effects at tertiary level and the implications of differences in the quality rather than the quantity of education will move forward our knowledge on the levelling function of education and will better inform educational reform. The difficulties in this direction lie in using quality assessments capable of disentangling the added value of higher education institutions from the students' prior educational background, which determines the starting inequalities.

In the second paper, it was possible to substantiate the expectation that perceiving corruption in the public sector increases people's support for redistribution. The paper provides preliminary evidence for the mechanisms that explain the relationship between perceived corruption and support for redistribution. In line with related findings, there is evidence for a non-linear relationship between political trust and perceived corruption. Consistent with the proposed premise, the findings also suggest that about one sixth of the effect of perceived corruption on support for redistribution is accounted for by political trust. Regarding the second mechanism, the findings suggest that rent seeking has only a direct effect on support for redistribution. This effect is independent from, or additional to the effect of perceived corruption as the estimated impact of perceived corruption on support for redistribution is not altered by the inclusion of rent seeking variables in the empirical model. The third mechanism explaining support for redistribution as a result of fairness motives could not be properly addressed with the available data and this is the main weakness of the paper. However, comparing different sources suggests a positive relationship between the perception that corruption is very common and that income distribution is unfair, and this is consequently taken as a most likely explanation for the obtained results.

Empirical evidence on support for redistribution has been directed at studying the two welfare systems represented by West European welfare regimes and the United States' model. Literature on preferences for redistribution in contexts of high economic inequality, poverty and political conflict are still scarce. This paper contributes to this literature by providing evidence within the background of corruption and by using the experience of Latin America, which is the epitome of the failure of theories predicting that more inequality leads to more redistribution.

Why redistribution in the region is not greater than what is actually observed is a broad question that implies determinants from both the public policy side and the demand

side. This paper focused on the latter and provided evidence that the persistence of inequality in the region may be related to some extent with a perverse equilibrium in which redistribution policies not only benefit those who are in need but also those who have the capacity for rent-seeking. This has important policy implications as this perverse equilibrium leads to a situation in which the policies intended to reduce inequality or increase fairness may cause even more opportunities for corruption, higher efficiency losses and less fair outcomes.

In order to extend this research, future work should focus in understanding opportunistic motives and fairness concerns as these two channels not only are directly related to demand for redistribution but potentially explain an important part of the relationship between perceived corruption and support for redistribution. Further research is also needed in the double-way causality between beliefs and policies as it entails potential dynamic learning failures, namely, incorrect policy choices can become self-sustaining because they generate behaviours and outcomes that confirm the original beliefs. This could help to explain not only the existence of multiple equilibria in the levels of inequality and the extent of redistribution, but also the persistence of an equilibrium of high inequality and low levels of redistribution.

Finally, the third paper identified different impacts of drug cartels and drug related homicides on development in Mexico. The findings show that inequality declined in areas where drug cartels were active without drug related homicides and there were no other impacts in terms of poverty, human capital or population size relative to their control group.

On the contrary, areas suffering drug related homicides had negative effects on poverty, employment and human capital. Poverty increased in those areas that experienced both the highest and lowest rates of drug related homicides. The number of employers, and jobs in some industries declined in the areas affected by drug violence. Furthermore, despite no visible decline in the number of schools or teachers per pupil population, school dropout was high in these areas. This could consequently be explained by rises in poverty, or engagement in drug trafficking and drug dependency. All these results refer to short-term impacts, but following poverty traps models, some of them could persist in the long-run.

Empirical assessments of the economic effects of violence generally adopt a macroeconomic approach and are aimed at estimating its overall cost in terms of economic growth. In social terms, the usual approach is to analyse crime as a consequence of poverty,

inequality and lack of human capital. This paper contributes to the literature on the effects of violence and crime in different ways, as the Mexican dramatic experience provides a scenario to analyse an alternative approach: the effects of crime and violence on socio-economic development from a microeconomic perspective. In order to do so, a rich dataset on official records, national and international media reports, and specialized blogs was gathered and matched with data from population and economic censuses. The results provide a rich framework to analyse the effects of drug cartels on development, especially by considering differences in their engagement in violence.

The results of this paper have a big potential for generalising beyond the Mexican case, as drug trafficking and drug-related violence has spread beyond Latin America. Even though policy implications as to whether and how to regulate drug markets are not obvious from the results, this paper has contributed to the debate on the priorities to diminish the negative effects of drug trafficking and violence.