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Coca, Conflict, and Rural Income: Evidence from Colombia*

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Coca, Conflict, and Rural Income: Evidence from Colombia

Coca is widely believed to be economically important in Andean nations, though the drug trade is also associated with organized crime and violence, especially by insurgent groups. In this paper, we study the social consequences of a major shift in coca paste production from Peru and Bolivia to Colombia, where most coca is now harvested. This shift arose in response to the disruption of the "air bridge" that previously ferried coca paste into Colombia. We study the consequences of increased coca production for deaths by violence, rural economic conditions, school enrollment, and child labor. We also attempt to distinguish the effects of increased coca production from a secular increase in rural insurgent activity and the Colombian government's temporary ceding of two departments in coca-growing regions. The results suggest rural areas in departments that saw accelerated coca production subsequently became much more violent, initially against a backdrop of generally improving public health and a lull in Guerilla activity. On the economic side, there is some evidence of increased income for self-employed workers and increased labor supply by teenage boys. These effects seem unlikely to have generated a substantial increase in rural living standards.

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I. Introduction

The production of cocaine and opium is concentrated in a small number of countries. Almost all of the cocaine consumed in North America and Europe comes from the Andean nations of Bolivia, Colombia, and Peru, while over 90 percent of the world opium supply originates in Afghanistan and Myanmar (United Nations, 2001). The social costs of illegal drug use in the U.S. and concern with the political consequences of the drug trade, including possible financial links with international terror, have led to policies that make Colombia the third largest recipient of U.S. foreign aid, after Israel and Egypt. American involvement in Colombia extends to significant U.S. military participation in both drug interdiction and to major development programs such as Plan Colombia.

Attempts to disrupt the flow of illegal drugs raise important questions for producer countries, as well as for the United States, which sponsors most of these efforts. Of immediate concern are the social and economic consequences of the drug trade for producer nations, or, equivalently, the consequences of successful disruption or crop eradication programs. Coca and poppy cultivation are a significant source of income for producers, especially in rural areas. The loss of this income can increase poverty and may also contribute to social unrest, as suggested by field accounts emphasizing the economic burden interdiction imposes on peasant-producers (see, e.g., Leons, 1997 and Chauvin, 1999, for Bolivia). On the other hand, the size of the drug economy is hard to assess and widely debated (see, e.g., Steiner, 1998; Thoumi, 2002).[1] Moreover, cultivation *per se* may do little to enrich the cultivators, since – as with the relationship between the farmgate price of coffee and the beans we buy at Starbucks – the price of raw coca leaf makes up a small fraction of the price of cocaine (Alvarez, 1995).

In addition to the economic consequences of the drug trade, policy-makers have long had to contend with the political consequences of both the drug trade and attempts at interdiction. This concern is particularly acute in Colombia, which has repeatedly suffered periods of extraordinarily high levels of violence and civil unrest, most recently in the late 1990s, when violent crime and political killings rose

[1] Steiner (1998) estimates total Colombian income from illegal drugs at 4-6 percent of GDP in the first half of the 1990s.

sharply. This in spite of the fact that Colombia is one of the more robustly democratic countries in Latin America, and has seen substantial economic growth throughout most of the 20th Century. The causal role of the drug trade in Colombia's cycle of violence is widely debated (see, e.g., Cardenas, 2001). While a superficial link at first seems obvious, the historical evidence clearly weighs against this. Marijuana became an important crop only in the 1960s and the cocaine trade began in the 1970s, with significant coca plantings appearing only in the 1990s (see, e.g., Bagley, 1998). On the other hand, violence and civil conflict have been a major factor in Colombian political life since independence. For example, during the period known as 'La Violencia" (1948-57), as many as 200,000 Colombians may have been killed (Winn, 1999). This is part of a history that included eight civil wars between Conservatives and Liberals in Colombia's first century of independence.

Weighing in favor of a link between the drug trade and violence or civil unrest is the fact that some of the killing is carried out by members of drug cartels or individuals operating on their behalf. Thus, homicide rates peaked in the late 1980s and early 1990s, when the cartel leadership rebelled against extradition efforts. Also, the major Colombian Guerilla groups, especially the Colombian Revolutionary Armed Forces (FARC) and the National Liberation Army (ELN), are widely believed to derive substantial income by taxing drug proceeds, as do illegal self-defense groups or paramilitaries (Rangel, 2000; Rabasa and Chalk, 2001). Moreover, illegal economic activity has long been associated with the use of violence as a method of intimidating authorities and enforcing contracts (see, e.g., Miron's 1999 study of U.S. alcohol prohibition).

In this paper, we try to untangle the causal links between drug cultivation, rural violence, and rural economic conditions. We focus on coca production and not the cocaine trade more generally since the impact of the former is likely to be more localized, and is of special concern in light of the recent growth in rural violence. Moreover, a narrow focus allows us to exploit a sharp change in the structure of the Andean drug industry: before 1994, most of the coca paste exported from Colombia was grown and produced in Peru and Bolivia. Beginning in 1994, however, in response to increasingly effective air interdiction by American and local militaries, the so-called air bridge that ferried coca paste from growers to Colombian refiners was disrupted. In response, paste production shifted to Colombia, where it eventually surpassed pre-interdiction levels as Colombia growers became more productive. We use this shift to estimate the consequences of a coca economy for Colombia's rural population, looking at violent death rates, rural labor market outcomes, school enrollment, and child labor.

Although our focus is narrow, the recent Colombian situation should be of intrinsic interest to U.S. policy-makers. If Plan Colombia is successful, coca cultivation is likely to be pushed back into Bolivia and Peru. Moreover, the results reported here may also shed light on a number of broader development issues. The links between economic activity, violence, and institutions and weak state control are of long-standing interest to development economists. A recent literature stimulated by Acemoglu, Johnson, and Robinson (2001) examines the impact of institutions and weak state control on aggregate economic activity using cross-country data. Three recent examples of studies relying on micro and regional data are Miguel, Satyanath, and Sergenti (2004), who link exogenous shocks to economic conditions (via rainfall) to civil conflict; Krueger and Maleckova (2002), who examine the links between poverty and education and terrorism and terrorist sympathies; and Abadie and Gardeazabal (2003), who use a regional control strategy similar to ours to look at the economic consequences of Basque separatist terrorism. In contrast with Miguel, Satyanath, and Sergenti (2004), who find improved economic conditions reduce civil conflict in Africa, and with Krueger and Maleckova (2002), who find that economic conditions are largely unrelated to violence and terrorist activities, our results suggest increased coca production accelerated conflict. On the other hand, the increase in coca production generated few economic benefits, perhaps because of negative externalities (consistent with the results from Abadie and Gardeazabal, 2003), or perhaps because the benefits are expropriated by insurgents, as suggested by Rangel (2000).

Of course, the shift of coca production from Bolivia and Peru to Colombia may be a double-edged sword in the way that many other agricultural shocks, such as the rainfall variation studied by Miguel, Satyanath, and Sergenti (2004), are not. Still, this ambiguity is not unique in the developing world. One important parallel with the mixed blessings of the drug trade is the trade in so-called blood diamonds that appear to fuel conflicts in Angola, Liberia, The Congo, and Sierra Leone. As with drugs in Latin America, mining primary resources also appears linked to a cycle of instability, violence, and poverty in Africa.

The paper is organized as follows. In the next section, we provide additional background, and briefly describe a cross-country analysis. Section III outlines the approach we used to divide Colombia into coca-growing and non-growing regions. Section IV discusses estimates of the effect of coca growing on mortality and section V discusses effects on rural labor markets and rural income. Section VI summarizes the results and offers some conclusions.

II. Institutional and Historical Background

The cocaine industry grew up around thousands of small peasant holdings, mostly in Bolivia and Peru.[2] Harvested coca leaves are dried by farmers and sold to entrepreneurs who make them into coca paste, a simple chemical process that takes a few days. Paste has about one one-hundredth the volume of coca leaves, and the transition from leaf to paste is where most of the weight reduction in cocaine production occurs. The next step in coca processing is to make coca base, a somewhat more complicated process involving additional chemicals. Finally, cocaine hydrochloride is refined from coca base. This chemical process (though not highly sophisticated) typically occurs in urban centers. Street cocaine is made by diluting cocaine hydrochloride with sugar and baking soda, usually in the consuming country.

While Colombia has almost always been the principal exporter of refined cocaine, until fairly recently little coca was grown there. Colombian drug middlemen and exporters operated by importing coca paste (or coca base) from Bolivia and Peru, specializing in refining and distributing cocaine hydrochloride (i.e., cocaine). In the early 1990s, the drug industry changed in response to a change in emphasis in US and producer-country enforcement policies. In April 1992, after Peruvian president Fujimori's so-called self-coup, the Peruvian military began aggressively targeting jungle airstrips and small planes suspected of carrying coca paste, as part of a general process of militarization of the drug war (Zirnite, 1998). Colombia

[2] This section draws on Whynes (1992) and Thoumi (1995).

followed suit with a similar shoot-down policy for planes ferrying paste into the country in 1994. US policy moved in tandem with Presidential Decision Directive 14 in November 1993, which shifted U.S. interdiction away from Caribbean transit zones like Bermuda towards an attempt to stop cocaine production in the Andes. The disruption of the air bridge ferrying coca paste into Colombia, renewed in early 1995 after a brief hiatus in 1994, was a key part of this effort.[3]

The militarization of the drug war and disruption of the air bridge does not appear to have reduced the supply of cocaine (see, e.g., Rabasa and Chalk, 2001). It did, however, lead to a marked shift in the organization of the industry among producer countries. This can be seen in Figure 1a, which uses data from a United Nations (2001) drug report to show the change in the locus of production of dry coca leave from Peru and Bolivia to Colombia. While Bolivian production was flat in the early 1990s, Peruvian production fell sharply from 1992 to 1993, followed by a sharp increase in Colombia of about 50 percent from 1993 to 1994. Part of this increase appears to have come from increased cultivation and part from improved yields. Colombia production continued to grow thereafter, as did the Colombian share of total production. Other figures in the United Nations (2001) report show that by 1997, potential cocaine production in Colombia (i.e., before eradication) exceeded that in Peru.

Cross-country Comparisons

The purpose of this paper is to assess the social and economic consequences – for Colombians – of the shift in coca cultivation and the production of coca leaf and paste to Colombia. A natural starting point for this sort of analysis is a cross-country comparison. Coca is probably not important enough for the

[3] The Peruvian and Colombian shoot-down policies can also be seen as a response to U.S. pressure. Militarization of the drug war began as part of first President Bush's "Andean Strategy" in 1990, with a program of military, economic, and law-enforcement assistance for Andean nations in FY1990-94. Initially, however, this effort met with little sympathy in the region (Washington Office on Latin America, 1991). Late 1992 and 1993 marked the beginning of a period of independent efforts and sharply increased cooperation by producer nations.

fluctuations studied here to turn up in GDP growth rates. It seems more likely that the shift in cultivation would have a visible impact on crime.

By way of a brief cross-country exploration, Figure 1b plots homicide rates by country in Latin America for 1990-2001 or years where data are available. Contrary to the decade of the 1980's which experienced substantial increases in homicide rates (see, e.g., Gaviria, 2000), the 1990s were years of a largely improving homicide picture in Colombia. While rates were also falling in Bolivia (over the brief period for which we have data) and over a longer period in Peru, homicide in Colombia began to decline in 1992, and fell steeply from 1993-94 and from 1994-95, when coca production was skyrocketing. At the same time, the homicide picture in other comparison countries, such as Brazil, Ecuador, and Venezuela was stable or deteriorating. But the early 1990s saw extraordinary violence as Colombian drug lords fought amongst each other and with the government, largely in reaction to pressure from the US for extradition. The death of Pablo Escobar in December 1993 marked the end of what was an unusually violent period, even by Colombian standards. The strong country-specific trends in violence suggest a within-country analysis is likely to be more fruitful.

III. Classification of Regions

Our research design exploits the fact that the change in the drug industry in the early 1990s probably had a disproportionate effect on Colombian departments which, by virtue of climate and soil conditions, were hospitable to the cultivation of coca plants and the production of coca paste. This naturally raises the question of how to classify departments or regions as potential coca-growers and paste-producers. The best candidates for future coca production seem likely to be those departments with a pre-existing coca presence. We identified baseline coca-growing departments using estimates for 1994 reported in Uribe (1997, p. 67). This source collects a number of international observers' estimates of hectares of coca bush under cultivation by Colombian department. The reports summarized in the table are dated October 1994, so the data were presumably collected somewhat earlier. The 9 departments that had at least 1,000 hectares under cultivation are Bolivar, Caqueta, Cauca, Meta, Narino, Putumayo, Guaviare, Vaupes, and Vichada. For the purposes of estimation, we identify these collectively as the "9-department growing region."

In a second coding scheme, we expanded the definition of the growing region to include the five additional departments identified as growing on a satellite map in Perafan (1999, p. 11). This map is also dated 1994. The Perafan map adds the three Northern departments of the Sierra Nevada (Cesar, Magdalena, and La Guajira), and the departments of Norte de Santander and Guainia. These 5 are also listed as growing regions in Uribe (1997), while all in the group of 9 appear as growing on Perafan's (1999) map. We refer to the expanded coding scheme as defining a "14-department growing region."

Our color-coded map, reproduced in the appendix, shows the 9 department growing region to be concentrated in the Southern and Eastern part of the country. Note, however, that not all Southern or Eastern departments are growing. For example, Amazonas, in the Southeast corner, is not coded as growing in either scheme. The group of 9 growing departments includes two, Meta and Caqueta, that were ceded to FARC control from 1998 to 2001 as part of an abortive peace effort. We refer to these two as the demilitarized zone (DMZ) and allow for separate DMZ effects in the empirical work. The other five departments coded as growing are mostly in the Northern part of the country, though one, Guainia, is in the far East.

To establish a "first-stage" relation for our division of Colombian departments into growing and non-growing regions, we regressed the growth in coca cultivation from 1994 to 1999 or 1994 to 2000 on an indicator for growing status in 1994. Growth is measured from 1994 since this is the year used to classify growing regions (as noted earlier, the 1994 data were probably collected earlier). The endpoint years of 1999 and 2000 are used because these are the years for which departmental cultivation figures are available. But the change from 1994 to the end of the decade seems likely to provide a good summary of coca penetration in the relevant period.[4]

[4] The 1999 and 2000 data by department is from Colombia's anti-drug agency, Direccion National de Estupefacientes (DNE, 2002), which was collected through the Illicit Crop Monitoring System (SIMCI- Sistema Integrado de Monitoreo de Cultivos Ilicitos). This system was implemented by the United Nations Office on Drugs and Crime with the logistical support of the Colombian anti-narcotics Police (DIRAN) and in coordination with the DNE. The methodology to collect

The first-stage results, summarized in Table 1, show a strong correlation between coca growth and base-period growing status. The estimates in column 1 indicate that coca cultivation grew by about 7500 more hectares in the 9-department growing region than in the rest of the country. Omission of the two DMZ departments leads to an even larger effect of almost 8500 hectares. With or without the DMZ departments, the growth effect is significantly different from zero. The estimates in column 3 show larger effects when growth is measured through 2000 instead of 1999, with growing regions gaining 8748 (s.e.=3876) hectares over the period.[5] Finally, when growing status is defined using the 14 department scheme, the intercept moves close to zero, indicating essentially no growth outside of these 14 departments. The 14 department growing region also saw substantial growth in cultivation, almost as large as in the more coca-intensive subset of 9 growing departments.

For the empirical work on mortality discussed in the next section, we report estimates using both the 9- and 14-department classification scheme since both support a first stage for the coca expansion. As it turns out, the mortality results are similar under both classifications. Our analysis of other outcomes using rural survey data relies on the 14-department scheme only since the Colombian Rural household survey only covers 5 of the departments in the 9-department growing region.

Descriptive Statistics by Region Type

Not surprisingly, the growing departments are more rural than the rest of the country. This is apparent in the descriptive statistics in Table 2, which compares growing and non-growing regions along a

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the data is based on the analysis of satellite images, complemented with verification flights over coca growing regions. The data for 2000 appear to be more complete than the data for 1999.

[5] Mean growth is about 2800 hectares through 1999 and 2900 through 2000. The 1994 mean for hectares under cultivation is about 2100. In the 9-department growing region, the base mean was 7155 and the in 14-department growing region, the base mean was 4732.

number of dimensions. The comparison between growing and non-growing is affected by the fact that the non-growing region includes the three departments with Colombia's largest cities: the Bogota capital district; Antioquia, which contains Medellin, an especially violent city; and Valle del Cauca, where Cali is located. To improve comparability with growing regions, we also tabulate statistics without these 3 departments. We also drop the Bogota capital district, Antioquia and Valle del Cauca from the mortality analyses in order to avoid confounding the effects of coca production with the secular decline in violence in big cities in the early nineties. Only the Bogota capital district is dropped from the analysis of rural labor markets and rural income.

Without the 3 big-city departments, the non-growing population is 65 percent urban, in comparison to 50 percent urban in the 9 department region minus the DMZ (growing region A), 66 percent urban in the 5 additional growing departments (growing region B), and 58 percent in the DMZ. Although growing and non-growing departments differ along the urban/rural dimension, they had similar primary school enrollment rates. Secondary school enrollment was somewhat lower in the growing regions, however, consistent with the fact that these regions are more rural.

The early 1990s homicide rates shown in the table were unusually high, even by Colombian standards. For example, the homicide rate reached a remarkable 719 per 100,000 in Antioquia, mostly because of violence in Medellin, and was 272 overall in the non-growing region. These statistics are per 100,000, among men aged 15-59. Without the big-city departments, homicide rates in the non-growing region averaged 141 per 100,000. This can be compared to the rates of 87 in growing region A, 151 in growing region B, and 205 in the DMZ. Thus, homicide rates were of a similar order of magnitude in growing and non-growing regions at the beginning of the decade.

Potential Confounding Factors

A potential complication for our analysis is the fact that many growing departments are now centers of insurgent activity, perhaps for reasons unrelated to the expansion of the coca industry. At the beginning of the decade, however, fewer growing departments were guerilla strongholds. This is suggested by the 1990 distribution of homicides by department (Ministerio de Defensa Nacional, 2001, p. 24). Although homicide is not synonymous with a guerrilla presence, a link is widely drawn (e.g., Cardenas, 2001; Rangel, 2000).[6] In an attempt to separate coca-induced effects, including those related to insurgent activity, from the direct effect of a strong guerilla presence, we estimate models with separate effects for the DMZ, where the FARC presence is likely strongest, and for the rest of the growing region. We also note that the mid-1990s are described by Restrepo, Spagat, Vargas (2003) as something of a lull in Guerilla activity (in particular, a "stagnation period"; p. 17). Beginning in 1997, however, there was clearly an escalation in FARC activity.

Other relevant consideration in the Colombian context are the large number of economic migrants who move to rural areas in search of work (e.g., in the coca fields) and especially the flow of refugees out of the countryside as a consequence of the civil conflict ("poblacion desplazada"). Both types of migration may induce selection bias in an analysis of economic circumstances in rural areas with many in- and/or out-migrants. As a partial check on the first issue, we report analyses of economic outcomes in samples with and without migrants. In practice, the importance of the latter phenomenon is difficult to quantify. It is worth noting, however, that much displacement occurs within departments, though this is likely to be a substantially rural-to-urban movement. Also, according to information from the United Nations High Commission for Refugees (UNHCR, 2002), the largest senders and receivers of displaced populations include both growing and non-growing departments under our classification scheme, and the phenomenon of internal displacement

[6] A study by the Federal Research Division (1988) of the Library of Congress identifies guerilla strongholds in 1988 as falling in the departments of Huila, Caquetá, Tolima, Cauca, Boyacá, Santander, Antioquia, Valle del Cauca, Meta, Cundinamarca and Arauca. Of these, we classify Huila, Tolima, Boyaca, Santander, Antioquia, Valle de Cauca, Cundinamarca, and Arauca as non-growing, Cauca as growing, and Caqueta and Meta as growing, DMZ. See also Figure 4.2 in Rabas and Chalk (2001), which shows the strongest FARC presence in and around the DMZ in 1986-87, though areas of FARC activity subsequently expanded to cover most of the country (Figure 4.3).

long pre-dates the rise in coca production. In any case, we discuss possible implications of population displacement for the results, below.

IV. Coca and Violence

Graphical Analysis

The evolution of violent death rates in the 1990s is described in Figure 2a, which plots death rates per 100,000 for men aged 15-59 by region type. The data underlying this figure defines the growing region using the 14-department scheme.[7] The 1991 death rates were between 100-150 in the non-growing and non-DMZ growing regions, and close to 200 in the DMZ. In 1991, the violent death rate in the DMZ rose to almost 250. Because the death rate in the DMZ is so much higher than the death rates in the other two regions, the figure is not very useful for making fine within-region comparisons. It shows, however, a declining trend from 1992-96 and then an upturn in all three regions. There is also a clear spike in violence in the DMZ in 1998, the year the government ceded control of this area. In contrast to the down-then-up pattern in violence in the mid nineties, Figure 2b shows death rates from disease to have been slightly declining in the non-growing region and declining somewhat more in the growing region (though not in the DMZ).

A clearer pattern of within-region changes emerges after correcting for scale and removing proportional region-effects. This can be seen in Figure 3a, which plots the log of violent death rates, after removing means by department type. The figure shows a similar up-then-down pattern in death rates in all three regions through 1993. While rates continued to fall thereafter in the non-growing and DMZ regions, they stopped falling in the main growing region, and begin an upward trend in 1996. Violent death rates in the DMZ began increasing in 1995, where they continued sharply upwards until their 1998 peak. In contrast with the acceleration in violent death rates, death rates from disease improved steadily in the growing relative

[7] Here and in the rest of this section, the non-growing region omits Antioquia, Valle de Cauca and Bogota, the departments with Colombia's three largest cities. Violent death rates were coded from vital statistics micro data obtained from the Colombian statistical agency, DANE. Violent deaths are defined here as homicides, suicides, deaths from military and insurgent activity (not a distinct category in all years), and a small number of non-accident deaths by external causes not elsewhere classified. The overwhelming majority (over 90%) of deaths in this category are homicides. We code suicides with homicides because the distinction is not always clear in practice.

to the non-growing region beginning in 1992. Death rates in the DMZ also tracked rates in the non-growing region until 1998.[8]

Figures 4a and 4b explore the robustness of regional differences in the evolution of death rates to the definition of the growing region. In particular, these figures repeat Figures 3a and 3b with the growing region defined using the 9-department scheme. Using this definition, the growing region shows a sharper increase relative to the non-growing in 1994 than under the 14-department scheme. It should also be noted, however, that death rates in the 9-department region do not track the 1990-93 violent death rates in the non-growing region quite as well as under the earlier coding. As before, a pattern of relative improvement in disease mortality appears in Figure 4b.

A complication with the analysis of death rates is the quality of the population statistics used for the denominator. We used census-based 5-year estimates and projections published by DANE (1998) for 1990, 1995, and 2000, linearly interpolating statistics for the in-between years. The underlying census was conducted in 1993. As noted above, however, the 1990s were marked by considerable population movement between departments so the population denominator may be inaccurate. An alternative strategy which avoids this problem is to look at violent death rates relative to death rates from other causes. After transformation to log odds, this approach can be motivated by a multinomial logit model for the risk death by cause, where survival is the reference group.

To describe the logit strategy more formally, let v_{jt} denote the number of violent deaths in department j and year t and let n_{jt} denote the number of deaths from all other causes. Let p_{jt} denote the corresponding

[8] Competing risks complicate the interpretation of the decline in disease death rates since some of those who die by violence may have otherwise died of disease. Still, it seems likely that an environment of deteriorating public health would turn up in higher disease death rates (a pattern observed in the DMZ after the government ceded control). The competing risks problem is likely mitigated by the fact that those most likely to die from disease (the very old and very young) are least likely to die by violence.

population statistics. Write the probability of violent and non-violent death as

$$v_{jt}/p_{jt} \equiv exp(\alpha_{jt}(v)) / [1 + exp(\alpha_{jt}(v) + exp(\alpha_{jt}(n)]$$

$$n_{jt}/p_{jt} \equiv exp(\alpha_{jt}(n)) / [1 + exp(\alpha_{jt}(v) + exp(\alpha_{jt}(n)].$$

These are identities that define $\alpha_{jt}(v)$ and $\alpha_{jt}(n)$. Assuming, however, that $\alpha_{jt}(v)$ has a region-year interaction induced by the shift of coca production to Colombia, while $\alpha_{jt}(n)$ does not, we can interpret region-year interaction terms in the empirical logits,

$$ln(v_{jt}/n_{jt}) \equiv \alpha_{jt}(v) - \alpha_{jt}(n),$$

as evidence of a region-specific shock that increased the risk of violent death. To this end, Figure 5a plots the residual from a regression of $ln(v_{jt}/n_{jt})$ on region effects for the 14-department growing region while Figure 5b shows the corresponding plot for the 9-department scheme.

The logit plot for the 14-region growing classification shows a pattern of declining relative logits in the non-growing region, in contrast with stable then increasing death rates in the growing region between 1994 and 1996. This is similar to the pattern for log death rates in Figure 3a. By 1995, the logit death rate exceeded that in the non-growing region, after starting considerably below. Violent logit death rates in the DMZ again turn sharply upwards in 1996. Figure 5b shows an even sharper break in the 9-department growing region in 1994, though again the crossing point is 1995.

Because the pattern of relative death rates is broadly similar in the non-DMZ growing region and in the DMZ (recall the DMZ is also a growing region), we also looked at relative death rates when the entire growing region is pooled. These results, presented in Figures 6a and 6b for log death rates using the 14 region classification, show a strong parallel between the 1990-93 data on violent death rates for the combined growing region and the corresponding data for the non-growing region. Again the regional death rates seem to diverge in 1994, though death rates in the growing region do not begin to increase until 1996. In contrast, the disease death rates tend to decline somewhat more steeply until 1998, when there is a sharp upturn in the growing region. Figures 7a and 7b tell a similar story using the 9-department classification scheme, though in this case the upturn in violent death rates comes in 1994.

On balance, the figures suggest that violent death rates in the non-DMZ growing region beginning between 1994 and 1996 were higher than what might have been expected based on pre-1994 trends. The change in relative death rates by region seems likely to have been a result of the increase in coca production. The pattern is broadly similar in the DMZ, where the FARC presence was strongest, and other growing departments. Moreover, the increase in violent death rates contrasts with a gradually improving disease environment in this period, both nationwide, and in the growing relative to the non-growing region. The contrast in trends for violence and disease mortality weighs against the notion of a secular deterioration in infrastructure or a general social breakdown that caused the increase in violence. On the other hand, as noted earlier, the interpretation of cause-specific rates as being determined primarily by underlying exogenous forces is complicated by competing risks. As a check on the idea that the decline in disease death rates is an artifact of increasing violent death rates, Figure 8 plots mortality rates from all causes for 0-4 year olds, a group for which death by violence is rare. This figure shows a strong declining trend in both growing and non-growing regions until 1998. Like the earlier figures for adult disease mortality, the decline is somewhat steeper in the growing than the non-growing region. The upturn in 1998 may be a recession effect since this is observed in both areas.

Mortality Estimates

To quantify the relative increase in violent death rates in the growing region, we estimated year-region interaction terms using the following equation:

$$ln(v_{ajt}/p_{ajt}) = \mu_a + \beta_j + \delta_t + \Sigma\, \alpha_{0s} g_{js} + \Sigma\, \alpha_{1s} d_{js} + \varepsilon_{ajt}. \qquad (1)$$

The dependent variable, $ln(v_{ajt}/p_{ajt})$, is the log death rate in cells defined by 10-year age groups (indexed by *a*), department, and year. The term μ_a is an age effect, β_j is a department effect, δ_t is a year effect; g_{js} indicates non-DMZ growing departments in year s and d_{js} indicates DMZ departments in year s where s=1993, . . ., 2000; and α_{0s} and α_{1s} are the corresponding year/region-type interaction terms. Some models also include trends for each department type. This amounts to replacing β_j with $\beta_{0j} + \beta_{1j}t$, where β_{1j} takes on 3 values, one for each department type.[9]

The estimates of α_{0s} and α_{1s} using the 14-department scheme are reported in Panel A of Table 3. The unweighted estimates of α_{0s} in column 1 show a significant 12.5 percent increase in mortality in 1994 in the non-DMZ growing region, with no effect in 1993 (a specification check) and no effect in the DMZ in 1994. A DMZ effect appears in 1995 and especially 1996, though the non-DMZ growing region effect is only marginally significant in 1996. When weighted by population size, the growing region interactions outside the DMZ are somewhat larger and more precisely estimated than when unweighted. The flow of refugees out of the growing regions generates concerns about possible biases in these results, particularly for the DMZ. As noted earlier, however, refugees are displaced from both growing and non-growing regions. Moreover, since refugees are probably those most affected by violence, if anything, displacement out of growing regions is likely to impart a downward bias in our estimates of effects on violent deaths.

Unweighted estimates from models with region-specific trends generate less precise estimates for 1994 than models without trends, but the weighted estimates of α_{0s} for 1994-96 remain significant when weighted. For example, the estimate of α_{0s} for 1996 in column 7 is .241 (s.e.=.113). The estimates of α_{1s} show a clear jump in DMZ mortality in 1998 in all specifications, though the higher mortality level is not sustained. Finally, estimates using the 9-region scheme, reported in Panel B of the table, show a sharper break in the unweighted estimates of α_{0s} for 1994, consistent with the figures. Without trends, the weighted estimate of α_{0s} is not significantly different from zero until 1995, but the weighted estimate with trend is a large and precisely estimated .502 (s.e.=.089).

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[9] For purposes of estimation, the sample was expanded slightly to include ages 15-64 to accommodate the 10-year age groups. Data are analyzed for age-specific cells to control for changes in the age distribution due to migration. Standard errors were adjusted for age/department clustering.

The link between coca production and increased death rates may occur through a number of channels, some related to the fact that coca production is an illegal industry. But the importance of organized crime predates widespread coca cultivation, and most of the violence associated with the cocaine trade occurred in large cities (most dramatically, in Medellin). Because coca *production* is a rural activity, the impact of coca production on violence in rural areas may be stronger than the impact on violence in urban areas. Moreover, coca producers are widely believed to be a key part of the economy in guerilla-controlled areas, either through taxation or direct control of production. This also suggests that violence in rural areas should be more sensitive to the spread of coca than violence in cities since the guerilla presence is strongest in the countryside. While the growing region is largely rural, it includes many towns and a few cities. We therefore repeated the earlier analysis of violent death rates separately by urban/rural status of victims.[10]

Estimates by urban/rural status generally point to a stronger link between coca penetration and violent death rates in rural areas when the growing region is defined as including 14 departments. This is documented in Panel A of Table 4, which reports estimates of equation (1) for rural residents in columns 1-4 and for urban residents in columns 5-8.[11] For example, the estimates of α_{0s} in column 1 are .35 (s.e.=.1) for 1995, .36 (s.e.=.12) for 1996, and .4 (s.e.=.12) for 1997 for rural deaths. The corresponding estimates for urban deaths, reported in column 5, are .052 (s.e.=.092), .165 (s.e.=.1), and .11 (s.e.=.1), though it should be

[10] DANE mortality files identify the type of area in which the deceased lived and the location of death. We defined urban/rural status by type of residence since hospitals are mostly found in cities. For the purposes of our analysis, the deceased was identified as urban when residence was coded as “cabecera municipal.” The urban residence variable is available only from 1992.

[11] The urban/rural distinction is used for the numerator but ignored in the population denominator. Since the model is in logs, this model probably provides a reasonable approximation to an analysis of true death rates by urban/rural status. Estimates in Table 4 are unweighted since we do not have population statistics by urban/rural status.

noted that there is a significant 1994 effect of .19 in urban areas, with no 1994 effect in rural areas. Other than the 1994 result, which appears anomalous, the contrast between columns 1 and 5 show much larger effects in rural than urban areas when the growing region is coded using 14 departments. This pattern also persists in models that include trends (compare column 3 and column 7), with some of the effects on rural areas very large (and the corresponding trends large, significant and negative).

The contrast by urban/rural status using the 9-department scheme, reported in Panel B of Table 4, is less clear-cut than when using 14 departments. On one hand, estimates of α_{0s} without region-specific trends are larger in urban than rural areas. Again, however, estimates of α_{1s}, the DMZ interaction terms are mostly larger and more likely to be significant in rural areas before the DMZ was ceded in 1998. Estimates of models with trends also show much larger effects in rural areas in Panel B (compare columns 3 and 7). Finally, it seems reasonable to weight the evidence in Panel A more than that in Panel B heavily, since the figures discussed earlier suggest the 14-region classification scheme leads to a better match of pre-treatment trends between growing and non-growing regions.

V. The Economic Consequences of a Coca Economy

In this section, we turn to an assessment of the economic consequences of the shift in coca production to Colombia´s growing departments. Our empirical strategy is the same as in Section III, though here we use micro data to distinguish between residents and migrants, and report estimates from a more parsimonious specification, as well as a fully interacted specification analogous to equation (1). The data come from the rural component of Colombia's annual household survey and are described in the data appendix. Briefly, the survey provides reasonably large repeated cross-sections, with information on households and individual household members. We limit the analysis to data from 1992 (because of earlier changes in survey design) through 2000 (after which the survey was replaced by a new panel data set). The survey was conducted in 23 of Colombia's 33 departments and the Bogota capital district.[12] Using the 14-department definition of the

[12] The included growing departments are Bolivar, Cauca, Narino in the 9-department region, plus Cesar, La Guajira,

growing region, the rural survey includes households from 7 growing departments plus the two departments in the DMZ. Because only 3 non-DMZ departments from the 9-department growing region were included in the rural survey, we use the 14-department classification scheme.

Our analysis looks separately at samples of adults, school-age boys and girls, and teenage boys who might be in the labor market. The sample of adults includes men and women aged 21-59. This sample is described in the first two columns of Table 5 using data for 1992 and 1997,which provides descriptive statistics of the weighted data. Roughly 30% of the sample are migrants, where migrants are defined as individuals who do not currently live in the county where they were born. Most are married and about half are male. The 14-department growing region contributes from 24 percent of the sample in 1992 to 30 percent of the sample in 1997. The number of respondents from the DMZ also increased, from 1.4 to 3.9 percent. These increases probably reflect migration. Not surprisingly, few of the adults are enrolled in school.

About two-thirds of male adults were employed in 1992 and 1997, though only about 36 percent had positive wage and salary earnings. When restricting the sample to adult men only, 93-95 percent were employed, as can be seen in columns 3 and 4, and 55 percent had positive wage and salary earnings. Between 25 and 26 percent of adult men and women had positive income from self-employment, while between 35 and 37 percent of adult men had positive income from self-employment. Note that self-employment income includes income from individual short-term contracts, from the sale of domestically produced goods and from commercial or family-based agricultural production. Wage and salary earnings and self-employment income are reported in real terms and were constructed using the consumer price index provided by the Department of National Statistics (DANE). These variables are given in 1998 pesos, worth about 1400 to the US dollar. Thus, mean wages range from 52 to 77 dollars per month, and mean self-employment income from 241 to 398

Magdalena, and Norte de Santander, plus Caqueta and Meta in the DMZ. In contrast with the mortality analysis, Antioquia and Valle de Cauca are included in the non-growing sample because the survey is limited to rural households.

dollars per year, in the samples of adults.[13]

Descriptive statistics for the sample of children, reported in columns 5-8, show that most children were enrolled, and enrollment rates increased somewhat between 1992 and 1997. Fewer children than adults are migrants, but the regional distribution of children is broadly similar to that for adults. Employment statistics for children are only asked to those over 10 years of age. About a third of boys between 10 and 16 and 10 percent of girls between 10 and 16 work, showing the importance of child labor. The statistics in columns 9 and 10 show that over half of boys aged 13-20 were working. Hours per month for boys were substantial, though lower than for adults. Boys also have lower earnings. Wages and salary income ranges between 42 and 44 dollars per month, and self-employment income ranges from 44 to 47 dollars per year. From 40-49 percent were still enrolled in school and few were married.

The analysis of rural outcomes begins with estimates of effects on the probability of having self-employment income and the log of self-employment income for those who have some. Because coca production is an agricultural activity, self-employment (either as farmer or other employer, landowner, or contractor) seems likely to be relevant, perhaps more relevant than wage income. The interpretation of results for log self-employment income is potentially complicated by selection bias from endogenous conditioning. As in a wage equation, however, we can make an educated guess as to the likely sign of any selection bias. Since the presumptive effect of being in the growing region after 1994 is to increase the likelihood of self-employment, the conditional-on-positive estimates of effects on log wages will be biased downwards by the fact that, on the margin, those induced to enter self-employment have lower self-employment earnings potential in the absence of treatment (see, e.g., Angrist, 2001).

The first two columns of Table 6a report estimates of the marginal effects of interaction terms analogous to α_{0s} and α_{1s} from a logit specification similar to (1). This model uses micro data instead of cells,

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[13] The self-employment variable reflects a uniform topcode at the 95th percentile of the distribution for each year, where the 95th percentile is calculated including zeros.

and replaces the age effects in (1) with a vector X_i of individual characteristics that includes a full set of age dummies, dummies for marital status, sex (when men and women are pooled), and the size of household. The sample includes adult men and women because women have a reasonably high probability of having self-employment income. The results in column 1 show positive but insignificant effects in 1996-97 and 1999-00. We also report results without migrants to control for potential selection biases from migrants towards growing regions. Results omitting migrants, reported in column 2, are somewhat larger, with a marginally significant positive effect in 1996 (.049, with an s.e. of .03) and a significant effect of .052 in 2000 (s.e.=.022).

Paralleling the results for self-employment probabilities, the results in columns 3 and 4 show some evidence of an increase in (log) self-employment income. In particular, there are large, statistically significant effects on the order of .3-.4 in 1996-98, a period when coca is likely to have had a major impact. For example, the effect in 1996 in the sample including migrants is .362 (s.e.=.131). There are somewhat smaller positive effects in 1994 and 2000, though these are not significant.

In an effort to improve precision, we also estimated models with pooled interaction terms. Linear models with pooled interaction terms can be written

$$y_{ijt} = X_i'\mu + \beta_j + \delta_t$$
$$+ \alpha_{0,94\text{-}97}g_{j,94\text{-}97} + \alpha_{0,98\text{-}00}g_{j,98\text{-}00} + \alpha_{1,94\text{-}97}d_{j,98\text{-}00} + \alpha_{1,98\text{-}00}d_{j,98\text{-}00} + \varepsilon_{ijt}, \qquad (2)$$

where X_i is the vector of individual characteristics referred to above, as well as a migrant dummy, with coefficient vector μ. The interaction variables $g_{j,94\text{-}97}$ and $g_{j,98\text{-}00}$ indicate the non-DMZ growing region in 1994-97 and 1998-2000, with corresponding interaction terms $\alpha_{0,94\text{-}97}$ and $\alpha_{0,98\text{-}00}$. Likewise, the interaction variables $d_{j,94\text{-}97}$ and $d_{j,98\text{-}00}$ indicate the DMZ in 1994-97 and 1998-2000, with corresponding interaction terms $\alpha_{1,94\text{-}97}$ and $\alpha_{1,98\text{-}00}$. When the dependent variable is binary, we estimated a logit version of (2), and report marginal effects. As with equation (1), we also estimated versions of (2) replacing β_j with $\beta_{0j} + \beta_{1j}t$, where β_{0j} is a department fixed effect and β_{1j} is a trend taking on 3 values, one for each department type.

Results from models with pooled interaction terms and no trends are reported in Columns (1) and (3) of Table 6b. These models generate statistically significant estimates of effects on the probability of self-employment and on the log of self-employment income in the non-DMZ growing region. The former effects are small, on the order of 3-4 percentage points, but the latter are large (see, e.g., the column 3 estimate of .25 in 1995-97 with a standard error of .1). Moreover, as noted above, given the positive effect on the probability of having self-employment income, selection bias probably makes this an underestimate.

Estimates of interactions for the DMZ show no effect on the probability of having self-employment income, but even larger (though imprecisely estimated) effects on log self-employment income than in the non-DMZ region. Again, these results may be subject to selection bias as a result of migration, especially in the DMZ. However, the migrant dummy provides a partial control for potential selection biases from economic migration towards coca growing regions. Also, the majority of refugees displaced as a result of the civil conflict are reported to be young and female, so, if there are biases, they are less likely to be of concern in this sample of adults (Codhes, 1996).

The evidence for an effect of coca-growing on the probability of self-employment and self-employment income is clearly weakened by the inclusion of region-specific trends. For example, the estimates in column 2 fall to zero when region-specific trends are added to equation (2). On the other hand, there is still some evidence of an effect in 1995-97 in the sense that the coefficient with a trend is about the same (compare .288 and .251) and close to significant at the .1 level (t=1.47). Interestingly, the trend itself is not significantly different from zero. This suggests that number of cross sections in our sample is not large enough to allow us to clearly distinguish relatively sharp breaks due to the advent of a coca economy from pre-existing region-specific trends.

The remaining estimates in Tables 6a and 6b are for labor supply measures (on all jobs) and the log of monthly wages in a sample of men. We focus on men because male participation rates are considerably higher than female participation rates, especially in the wage sector. The estimated employment effects for men show little evidence of a change in participation in the growing region. Most of the estimated interaction terms are small and none are significantly different from zero. There is some evidence of an increase in log hours though it is not very robust. For example, in the hours equation, the 1996 interaction without migrants is .048 (s.e.=.033) and the 1998 interaction with migrants is .053 (s.e.=.02). In models with pooled interactions, there is stronger evidence for a significant effect in 1998-2000 than in 1995-97, though again the estimates are muddied by inclusion of region-specific trends.

The estimates for the log wage outcome also show something in the later 1998-2000 period, though not the earlier 1995-97 period. In particular, the strongest effects on wages are in 1998 and 1999. For example, yearly interactions in models with and without migrants are a significant 10-11 percent in 1998 and a significant 7 percent in 1999. The increase in relative wages in the growing region in 1998 and 1999 is noteworthy given the high levels of violence in the same period. Effects in the later period but not the earlier may be a return to workers' tenure in the coca industry, or it may signal some other regional trend in the later period such as a response to reduced labor supply in the face of increased violence. Note, however, that because these estimates for a sample of adult males only, they are less likely to be affected by selection biases from out-migration by disproportionately young and female refugees.

Results for Children and Youth

The last set of outcomes is for children and youth.[14] We might expect the increase in coca production (and perhaps the increase in violence that appears to have resulted from this) to have reduced school enrollment and increased child labor.[15] Columns 1 and 2 indeed show statistically significant reductions of .065 and .073 on boys' school enrollment in 1997, but estimates for other years are smaller and none of the estimates in pooled models, with or without trends, are significant. Moreover, while the estimated interaction

[14] To adjust inference for within-HH clustering, estimates for children and youth were averaged up to the household level. For details, see the data appendix.

[15] Edmunds and Pavcnik (2004) recently explore the link between trade flows and child labor. Following their taxonomy, coca can be seen as an unskilled-labor intensive good that is a candidate for production with child labor.

terms without trends are all negative, inclusion of trends causes the signs to flip for boys. Estimates for girls are mainly positive, though not significant. An exception is the DMZ, where effects are negative and marginally significant without trends.

While the overall impression from the enrollment results suggests an absence of effects, the pattern of estimates for boys' labor supply is more complex. Employment effects for 1997 and in the pooled later period are positive in the non-DMZ growing region, but the pooled interaction for the later period is negative (and significant) in the DMZ. The negative significant effect in the DMZ is also robust to the inclusion of trends (though it becomes implausibly large). On the other hand, in models without trends, log hours appear to have increased in both the non-DMZ growing region and the DMZ. For example, the pooled estimate for the earlier period for the non-DMZ area is .112 (s.e.=.048) and many of the yearly interactions in Table 7a are significant. Inclusion of trends wipes out the DMZ effect but leaves the non-DMZ effects essentially unchanged, though no longer significant. Again, however, the trend in the non-DMZ growing region is clearly zero (-.0016, s.e.=.022). On balance, however, Table 7b appears to provide modest support for the notion that coca production increased teen boys' labor supply.

VI. Summary and Conclusions

The disruption of the Andean air bridge provides a unique opportunity to assess the effects of coca on Colombia's rural population and perhaps draw some wider lessons. Of particular interest is the role of the coca industry in fostering violence and civil conflict, as well as the economic impact of coca. Our results strongly suggest that coca production led to an increase in violence. Although we cannot conclusively identify specific channels, differences in effects by urban/rural status are consistent with the notion that coca supports rural insurgents and paramilitary forces. Violence may also be used to enforce contracts in this illegal industry, though here the case for an urban/rural differential is less clear.

On the economic side, we found some evidence for an increase in self-employment income, though not in the likelihood of having income from this source, or work more generally. The increase in income is estimated to be on the order of 25 log points, a fairly substantial gain. There is also some evidence for an effect on boys' labor supply. But evidence for both effects is weakened by our inability to clearly distinguish treatment effects in the growing region from region-specific trends. Moreover, because the gains appear to be fairly narrowly distributed, it seems unlikely that increased coca production raised overall standards of living in growing areas. The weak gains may be due to extortion on the part of insurgents (or paramilitary forces). And of course, the increased violence associated with coca production clearly reduces quality of life in the affected areas. Remarkably, the increase in violence occurred against a backdrop of generally improving public health as measured by death rates from disease and infant mortality. At a minimum, this shows that different quality of life variables reacted very differently to the coca influx.

The question of how broad the lessons from this study are is difficult to resolve. Rural Colombians would be unlikely to have voluntarily traded the sharp increase in violence observed in growing regions for the modest income gains associated with coca production. While the generality of this trade-off is an open question, it seems unlikely to be unique to Colombia. Moreover, the results provide an interesting case study of a situation where increases in income (again, taking the results without trends as definitive) did not lead to a reduction in civil conflict, but rather fueled the fires of unrest. This contrasts with the more optimistic picture in Miguel, Satyanath, and Sergenti (2004), but is more or less in line with journalistic accounts of the role played by blood diamonds in Africa's civil wars and economic theories of insurrection as extraction or extortion (e.g., Collier and Hoeffler, 2001; Grossman, 1991). Finally, we note that the disruption of the Andean air bridge was not the end of the aerial drug war. A recent account describes significant successes in the ongoing effort by US and Colombian forces to eradicate Colombia's coca crops by aerial spraying, and the continued suppression of coca production in Peru (Marquis and Forero, 2004). At the same time, Bolivian production is estimated to have increased 17 percent.

DATA APPENDIX

Mortality Detail Files

We obtained mortality detail files from the Colombian national statistical agency, DANE, for 1990-2001. These files, which are the source for published vital statistics tables (e.g., http://www.dane.gov.co/inf_est/vitales.htm), show individual death records, with basic demographic information on the deceased and cause of death. The 1990 and 1991 files did not include reliable urban/rural codes and are therefore omitted from the sample used to construct Table 4. The 2001 also had some inconsistencies (the file was provisional) and was therefore dropped.

Cause of death

We aggregate detailed causes of death on a consistent basis from year to year into the following larger groups: Homicide and suicide, accident and other non-violent trauma, disease, other causes, other violent deaths. The violent death rate used here is the sum of Homicide and suicide plus other violent deaths. Data after 1997 show separate categories for general external causes not identified as accidents, and deaths due to actions by state and guerilla forces. These two categories appear to correspond to the "other violence category" from previous years.

Location information

Our construction of death rates by department and year is for department of death and not residence. Urban/rural status, however is by area of residence. This is coded somewhat differently from year to year. We established a consistent urban/rural by coding as urban those listed as living in "cabecera municipal" and coding the institutionalized as non-urban. Those with missing urban/rural status (about 1/16 of deaths) are omitted from the analysis used to produce Table 4.

Match to population information

As noted in the text, population statistics for each department-year-age (5 year)-sex category were obtained from DANE (1998) for 1990, 1995, and 2000. The Colombian census used for these data was conducted in 1993, so data for other years are inter-censal estimates and projections. We interpolated using 5-year growths for each cell.

Finally, we aggregated mortality counts to match 5-year age bands, and then matched to the relevant population denominators.

Colombian Rural Household Surveys

We are working with the "Encuesta Rural de Hogares", the rural component of the "Encuesta Nacional de Hogares," which became "Encuesta Continua de Hogares" (panel) in 2001. The rural household survey was first conducted as a pilot in 1988. The survey was conducted again in December 1991 after the sampling methodology was updated and then on a consistent basis every September starting in 1992 until 2000. The survey collects data on a representative sample from four rural regions: Atlantic Region (which includes the departments Atlantico, Cordoba, Magdalena, Sucre, Cesar, La Guajira, and Bolivar); Pacific Region (which includes the departments of Choco, Nariño, Cauca, and Valle del Cauca); the Central Region (which includes the departments of Antioquia, Caldas, Huila, Tolima, Quindío, Risaralda, and Caqueta);

and the Eastern Region (which includes the departments of Norte de Santander, Santander, Boyaca, Cundinamarca, Meta and the surrounding areas of Bogota capital district). This includes 23 departments out of the 33 departments and Bogota capital district, which is excluded from our analysis.

Rural definition

The survey uses the following criteria to identify the rural population. The rural population includes:

1. The population of the city where the county's government is located if the city has less than 10,000 inhabitants.

2. The population of the city where the county's government is located if the city has more than 10,000 inhabitants and it meets one of the following characteristics:

(a) the percentage of residents in the city does not exceed 50% of the population in the entire county,
(b) the percentage of the active population engaged in agricultural activities exceeds 50%, or
(c) the percentage of housing units without basic services (water, electricity, etc.) exceeds 20%.

3. All population living in towns with less than 10,000 inhabitants.

4. All population not living either in cities or towns.

Sampling methodology

The sample for the survey is taken from the universe of the Census population living in private households. The sampling methodology consists of first generating strata according to geographical location and socioeconomic level; then, randomly drawing 'municipios' (the equivalent of counties in the U.S.) from these strata; next, randomly drawing neighborhoods from these 'municipios'; and, finally, randomly drawing blocks and then households from these neighborhoods. To facilitate the collection of information, households are grouped into 'segments' of 10 households on average. The typical year includes approximately 8,500 households, but the sample has increased over time. In particular, the sample size increased in 1996. The survey collected data from 148 municipios in 1992-1995, but it collected data from 197 municipios in 1996-2000.

In addition, the survey methodology changed as follows in 1996. First, between 1992 and 1995 the sample was drawn from the 1985 Census, while starting in 1996 and until 2000 the sample was drawn from the 1993 Census. Second, starting in 1996, interviewers were required to revisit households, which generated an increase in response rates.

Sample weights

The survey weights include factors of adjustment to account for changes in subsampling and for non-response. So, we use the weighted data in our analysis to take account of the 1996 changes. In particular, the weights are estimated as:

$$W = (1/P) \times S \times (I_s/N_s),$$

where P is the probability of an individual being sampled and S is a weight given to segments. S equals 1 unless the number of households within the segment exceeds 10. The last term is the ratio of the number of households actually interviewed within a segment, I_S, and the number of households selected for interviewing within a segment, N_S, so it captures the response rate within a segment.

Since the average number of children per household is around 3, we generate within household averages for the children's data in order to avoid multiple observations per household. Likewise, since the weights are individual weights, we construct household weights by summing up the individual weights for all children within the household.

Top-coding and imputation

Labor market information is collected from individuals aged 10 and up. We impute zeros for the employment and hours of 8 and 9 year olds in the descriptive statistics in Table 5. Hours are collected from all employed workers, including salaried and wage workers as well as self-employed workers. Wage and salary earnings were collected for all jobs in 1992-1999. In 2000, wage and salary earnings were collected separately for the main job and for secondary jobs, so we add salaries in the two jobs to make the 2000 measure of earnings consistent with earnings data for other years. Yearly self-employment income is collected separately as earnings from business and commercial and family-based agricultural production. In the original data, earnings and self-employed income were top coded only between 1992 and 1995. We impose uniform top-coding by applying a cap at the 95th percentile (including zeros) for each year. In addition, we imputed the mean earnings and self-employment income by department for all those individuals who reported having earnings or self-employed income but did not report an amount.

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Table 1: First Stage for Coca Cultivation

Treatment Group	Parameter	Cultivation Growth 1994 to 1999 (1)	(2)	1994 to 2000 (3)	(4)
		A. With DMZ departments			
9 growing states	Intercept	735		506	
		(1749)		(2024)	
	Slope	7554		8748	
		(3445)		(3876)	
14 growing states	Intercept		207		292
			(2053)		(2348)
	Slope		6100		6127
			(3152)		(3604)
		B. Without DMZ departments			
9 growing states	Intercept	735		506	
		(1845)		(2074)	
	Slope	8434		9533	
		(3883)		(4364)	
14 growing states	Intercept		207		292
			(2115)		(2414)
	Slope		6287		6112
			(3400)		(3879)

Notes: The table reports estimates of the change in cocaine cultivation on 1994 levels for the 33 Colombia Departments (states). The 1994 variable is the average of 4 measures from Thoumi el al (1997). The 1999 and 2000 data are police estimates, reported in Government of Colombia (2002).

Table 2: Descriptive Statistics

Region type	Department	Population in 1993 (1)	% Urban in 1993 (2)	% Primary Enrollment 1995 (3)	% Secondary Enrollment 1995 (4)	Homicide Rate 1990-93 (5)
Non-growing	Santafe de Bogota, DC	4,945,448	99.7	60.8	75.2	179
	Amazonas	37,764	50.4	56.3	33.2	35.3
	Antioquia	4,342,347	72.0	75.1	59.1	719
	Arauca	137,193	63.6	90.0	38.8	226
	Atlantico	1,667,500	93.7	68.2	67.9	65.2
	Boyaca	1,174,031	42.5	65.8	47.4	124
	Caldas	925,358	64.7	66.2	56.3	252
	Casanare	158,149	54.7	77.9	34.5	153
	Choco	338,160	38.5	66.6	32.0	65.6
	Cordoba	1,088,087	48.2	89.5	50.5	66.7
	Cundinamarca	1,658,698	54.7	71.7	55.3	126
	Huila	758,013	60.0	73.9	47.7	133
	Quindio	435,018	83.8	64.7	65.0	173
	Risaralda	744,974	81.3	66.1	59.1	303
	San Andres y Providencia	50,094	70.4	69.7	84.2	44.1
	Santander	1,598,688	68.9	68.9	53.3	193
	Sucre	624,463	67.1	96.6	51.3	38.5
	Tolima	1,150,080	60.7	71.9	55.5	141
	Valle del Cauca	3,333,150	85.3	71.9	62.6	312
	All non-growing	25,167,215	75.5	70.9	59.8	272
	All w/o Bogota, Antioquia, and Valle de Cauca	12,546,270	64.5	72.7	54.0	141
Growing A	Bolivar	1,439,291	68.6	75.4	50.4	41.1
	Cauca	979,231	36.7	73.8	36.3	170
	Guaviare	57,884	36.9	59.3	17.4	131
	Narino	1,274,708	42.9	62.4	33.7	58.7
	Putumayo	204,309	34.6	75.4	28.0	171
	Vaupes	18,235	24.8	74.9	21.4	2.84
	Vichada	36,336	24.1	54.2	16.6	39.3
	All growing A	4,009,994	49.8	70.6	39.4	86.5
Growing B	Cesar	729,634	62.9	82.1	50.7	146
	Guainia	13,491	30.4	43.3	17.1	45.3
	La Guajira	387,773	64.3	72.5	58.5	136
	Magdalena	882,571	64.0	67.7	41.0	70.8
	Norte de Santander	1,046,577	70.8	67.8	42.4	241
	All growing B	3,060,046	66.0	71.7	45.6	151
DMZ	Caqueta	311,464	46.0	76.4	31.7	205
	Meta	561,121	64.0	72.9	52.2	205
	All DMZ	872,585	57.5	74.3	44.3	205
	All Departments	33,109,840	71.0	71.1	55.2	236

Source: *Colombia Estadistica, 1993-1997* and tabulations of vital statistics. Columns 2, 3 - from table 2.1.2. Column 3: % of pop. living in *cabecera* . Columns 4, 5 - from tables 10.2.1 and 10.3.1. Column 4: primary enrollment divided by pop. aged 5-9 plus 60% of the pop. aged 10-14. Column 5: secondary enrollment divided by 40% of the pop. aged 10-14 plus pop. aged 15-19. Homicide rates are for men aged 15-59, per 100,000.

Table 3: Mortality Estimates

	Unweighted				Weighted			
	No trends		With trends		No trends		With trends	
	Growing	DMZ	Growing	DMZ	Growing	DMZ	Growing	DMZ
	1	2	3	4	5	6	7	8
A. 14 Growing Departments								
1993	.023	-.059			-.081	-.100		
	(.086)	(.095)			(.051)	(.074)		
1994	.123	-.078	.133	-.145	.045	-.134	.097	-.105
	(.045)	(.079)	(.100)	(.127)	(.063)	(.075)	(.077)	(.181)
1995	.102	.198	.118	.098	.141	.126	.205	.160
	(.075)	(.135)	(.141)	(.178)	(.068)	(.122)	(.094)	(.220)
1996	.154	.266	.176	.134	.163	.179	.241	.214
	(.103)	(.115)	(.184)	(.208)	(.106)	(.116)	(.113)	(.264)
1997	.230	.402	.259	.237	.179	.260	.269	.298
	(.104)	(.144)	(.217)	(.258)	(.094)	(.127)	(.132)	(.311)
1998	.200	.514	.235	.315	.120	.434	.222	.474
	(.114)	(.142)	(.287)	(.305)	(.083)	(.134)	(.153)	(.358)
1999	.197	.340	.238	.109	.313	.296	.428	.339
	(.075)	(.121)	(.315)	(.373)	(.081)	(.102)	(.174)	(.407)
2000	.284	.142	.337	-.122	.388	.119	.516	.163
	(.079)	(.124)	(.357)	(.411)	(.069)	(.099)	(.195)	(.457)
dept-type			-.006	.033			-.013	-.002
trend			(.042)	(.050)			(.025)	(.030)
B. 9 Growing Departments								
1993	.003	-.069			-.217	-.116		
	(.130)	(.092)			(.052)	(.072)		
1994	.203	-.082	.261	-.138	.058	-.141	.312	-.076
	(.127)	(.074)	(.128)	(.124)	(.078)	(.070)	(.074)	(.089)
1995	.249	.212	.330	.127	.167	.109	.502	.188
	(.102)	(.133)	(.188)	(.176)	(.085)	(.120)	(.089)	(.155)
1996	.290	.268	.396	.155	.152	.150	.567	.243
	(.131)	(.110)	(.275)	(.203)	(.115)	(.106)	(.116)	(.156)
1997	.325	.383	.454	.240	.196	.235	.692	.342
	(.136)	(.140)	(.299)	(.254)	(.104)	(.124)	(.133)	(.201)
1998	.552	.562	.705	.390	.159	.424	.736	.545
	(.145)	(.140)	(.431)	(.301)	(.080)	(.133)	(.171)	(.234)
1999	.230	.312	.406	.111	.322	.249	.979	.384
	(.096)	(.118)	(.478)	(.368)	(.091)	(.098)	(.188)	(.254)
2000	.307	.092	.507	-.138	.327	.044	1.06	.193
	(.102)	(.121)	(.522)	(.403)	(.078)	(.100)	(.200)	(.263)
dept-type			-.024	.029			-.080	-.014
trend			(.063)	(.049)			(.025)	(.029)

Notes: The table reports results of regressions with log violent death rates on left hand side, controlling for year and age effects. The model is estimated using statistics aggregated by department, year, and 10-year age groups, for men aged 15-64. Standard errors adjusted for department-age clustering are in parentheses.

Table 4: Mortality Estimates by Urban/Rural

	Rural				Urban			
	No trends		With trends		No trends		With trends	
	Growing	DMZ	Growing	DMZ	Growing	DMZ	Growing	DMZ
	1	2	3	4	5	6	7	8
				A. 14 Growing Departments				
1994	.038	-.087	.644	.322	.196	-.048	.147	.183
	(.121)	(.144)	(.294)	(.200)	(.090)	(.111)	(.183)	(.175)
1995	.310	.378	1.31	1.06	.052	.100	-.030	.485
	(.100)	(.124)	(.431)	(.380)	(.093)	(.132)	(.269)	(.252)
1996	.356	.580	1.74	1.53	.165	-.040	.051	.498
	(.116)	(.110)	(.583)	(.507)	(.100)	(.159)	(.369)	(.360)
1997	.397	.283	2.17	1.50	.109	.146	-.038	-.838
	(.124)	(.171)	(.760)	(.622)	(.103)	(.160)	(.464)	(.450)
1998	.266	.491	2.43	1.98	.034	.332	-.145	1.18
	(.127)	(.171)	(.903)	(.735)	(.113)	(.145)	(.564)	(.555)
1999	.415	.055	2.96	1.82	.053	.329	-.159	1.33
	(.131)	(.187)	(1.08)	(.884)	(.099)	(.138)	(.678)	(.664)
2000	.506	-.019	3.44	2.01	.080	.115	-.164	1.27
	(.142)	(.150)	(.124)	(.976)	(.091)	(.154)	(.770)	(.770)
dept-type			-.388	-.270			.033	-.155
trend			(.158)	(.128)			(.101)	(.101)
				B. 9 Growing Departments				
1994	.186	-.057	.578	.254	.260	-.065	.240	.178
	(.132)	(.116)	(.308)	(.219)	(.115)	(.106)	(.231)	(.157)
1995	.242	.317	.889	.833	.229	.129	.196	.535
	(.110)	(.122)	(.469)	(.397)	(.121)	(.129)	(.348)	(.278)
1996	.239	.500	1.14	1.22	.359	-.026	.312	.541
	(.127)	(.112)	(.625)	(.520)	(.122)	(.155)	(.495)	(.329)
1997	.196	.177	1.35	1.10	.395	.188	.335	.918
	(.139)	(.173)	(.859)	(.651)	(.110)	(.157)	(.600)	(.407)
1998	.297	.463	1.71	1.59	.409	.440	.335	1.30
	(.120)	(.171)	(1.02)	(.770)	(.135)	(.143)	(.750)	(.507)
1999	.222	-.052	1.89	1.28	.250	.361	.163	1.42
	(.141)	(.185)	(1.22)	(.426)	(.117)	(.133)	(.898)	(.604)
2000	.136	-.184	2.06	1.36	.272	.141	.171	1.36
	(.142)	(.149)	(1.39)	(1.03)	(.102)	(.150)	(1.01)	(.699)
dept-type			-.255	-.205			.013	-.162
trend			(.176)	(.133)			(.133)	(.091)

Notes: The table reports results of regressions with log violent death rates on left hand side, controlling for age and year effects. The model is estimated using statistics aggregated by department, year, and 10-year age groups, for men aged 15-64. Standard errors adjusted for department-age clustering are in parentheses.

Table 5: Descriptive Statistics for Rural Survey

	Sample									
	Adult workers (men and women)		Adult Workers (men)		Boys		Girls		Teenage Workers (boys)	
	1992	1997	1992	1997	1992	1997	1992	1997	1992	1997
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Employed	0.658	0.647	0.950	0.931	0.360	0.283	0.095	0.077	0.600	0.506
	(0.474)	(0.478)	(0.219)	(0.253)	(0.436)	(0.413)	(0.264)	(0.250)	(0.450)	(0.458)
Hours Worked per month	142	132	219	200	65.6	44.9	15.4	11.2	121	94.1
	(117)	(115)	(76.8)	(85.2)	(86.9)	(74.3)	(47.8)	(39.7)	(103)	(96.6)
Monthly Wages	74,098	81,461	115439	123636	-	-	-	-	61038	58921
	(115512)	(127287)	(126002)	(137069)					(78522)	(84989)
Positive Wages	0.362	0.369	0.551	0.555	-	-	-	-	0.418	0.350
SE Income (5% top code)	337712	352969	557381	551260	-	-	-	-	61196	65253
	(815718)	(865459)	(1026941)	(1048327)					(311898)	(291899)
Positive SE Income	0.247	0.259	0.348	0.371	-	-	-	-	0.066	0.08
Enrolled	0.017	0.028	0.014	0.024	0.694	0.779	0.757	0.815	0.397	0.486
Age	36.4	37.0	36.6	37.1	11.9	11.9	11.9	11.9	16.2	16.2
	(10.7)	(10.6)	(10.7)	(10.6)	(2.10)	(2.18)	(2.15)	(2.19)	(1.95)	(1.90)
HH Size	5.60	5.32	5.56	5.31	6.60	6.35	6.66	6.41	6.57	6.35
	(2.56)	(2.49)	(2.60)	(2.51)	(2.36)	(2.41)	(2.36)	(2.43)	(2.48)	(2.57)
Migrant	0.282	0.316	0.280	0.312	0.133	0.161	0.163	0.160	0.161	0.182
Single	0.229	0.221	0.284	0.277	1.00	0.999	0.990	0.981	0.981	0.970
Male	0.496	0.597								
Growing (14-dept)	0.235	0.303	0.234	0.309	0.262	0.332	0.250	0.336	0.238	0.332
Growing (9-depts)	0.137	0.181	0.133	0.180	0.147	0.191	0.138	0.198	0.138	0.197
DMZ	0.014	0.039	0.014	0.039	0.013	0.040	0.014	0.044	0.011	0.034
Max N	13550	19184	6641	9801	2602	3513	2477	3253	2040	2881

Notes: Adult workers include men aged 21-59. Boys and girls are aged 8-16. Employment and hours for boys and girls under 10 years of age are imputed zeros. Teenage workers are boys aged 13-20. Wages and self-employment income are in real (1998) pesos, about 1000 to the US dollar.

Table 6a: Adult Labor Market Outcomes - Yearly Interactions, Pooled Growing & DMZ

	Male and Female Workers				Men Only					
	Positive SE Income		Log SE Income		Employed		Log Hours (All Jobs)		Log Monthly Wage and Salary Earnings	
Interaction Terms	All (1)	w/o Migrants (2)	All (3)	w/o Migrants (4)	All (5)	w/o Migrants (6)	All (7)	w/o Migrants (8)	All (9)	w/o Migrants (10)
1994	-0.035	-0.046	-0.025	0.080	-0.014	-0.019	-0.026	-0.031	0.014	0.027
	(0.023)	(0.024)	(0.175)	(0.161)	(0.013)	(0.016)	(0.023)	(0.025)	(0.036)	(0.038)
1995	0.0094	0.0016	0.159	0.190	-0.0025	-0.0084	0.0044	0.0056	-0.011	-0.0080
	(0.024)	(0.023)	(0.153)	(0.155)	(0.012)	(0.012)	(0.024)	(0.029)	(0.037)	(0.038)
1996	0.042	0.049	0.362	0.414	0.0034	-0.010	0.034	0.048	-0.0083	0.0020
	(0.030)	(0.030)	(0.131)	(0.141)	(0.014)	(0.015)	(0.028)	(0.033)	(0.041)	(0.049)
1997	0.025	0.035	0.270	0.292	-0.0051	-0.013	-0.0005	0.0017	0.010	0.028
	(0.020)	(0.019)	(0.122)	(0.116)	(0.014)	(0.018)	(0.030)	(0.036)	(0.041)	(0.046)
1998	-0.020	-0.0090	0.302	0.291	0.0004	-0.012	0.053	0.035	0.103	0.107
	(0.025)	(0.023)	(0.162)	(0.183)	(0.012)	(0.014)	(0.020)	(0.021)	(0.056)	(0.058)
1999	0.0072	0.016	0.205	0.150	0.015	0.0072	0.0063	0.0052	0.069	0.067
	(0.022)	(0.021)	(0.133)	(0.136)	(0.010)	(0.012)	(0.021)	(0.023)	(0.038)	(0.039)
2000	0.044	0.052	0.255	0.230	-0.0031	-0.012	0.065	0.085	-	-
	(0.023)	(0.022)	(0.145)	(0.155)	(0.011)	(0.013)	(0.020)	(0.022)		
N	147833	100284	40338	28912	74781	50914	69144	46770	34451	22257

Notes: The table reports coefficients for growing region/year interactions. Standard errors adjusted for department-year clustering are reported in parentheses.

Table 6b: Adult Labor Market Outcomes with Pooled Interaction Terms

	Male and Female Workers						Men Only			
	Positive SE Income		Log SE Income		Employed		Log Hours (All Jobs)		Log Monthly Wage and Salary Earnings	
Interaction Terms	No Trends (1)	w/Trends (2)	No Trends (3)	w/Trends (4)	No Trends (5)	w/Trends (6)	No Trends (7)	w/Trends (8)	No Trends (9)	w/Trends (10)
Panel A: Growing Effects (non-DMZ)										
1995-1997	0.039	0.0056	0.251	0.288	0.0045	0.0079	0.020	0.013	-0.0051	-0.035
	(0.017)	(0.031)	(0.100)	(0.196)	(0.0092)	(0.015)	(0.019)	(0.028)	(0.028)	(0.052)
1998-2000	0.031	-0.036	0.260	0.333	0.013	0.020	0.044	0.030	0.079	0.026
	(0.017)	(0.049)	(0.106)	(0.340)	(0.0080)	(0.029)	(0.015)	(0.051)	(0.034)	(0.099)
Trends	-	0.011	-	-0.012	-	-0.0011	-	0.0024	-	0.0098
		(0.0080)		(0.053)		(0.0043)		(0.0080)		(0.016)
Panel B: DMZ Effects										
1995-1997	0.0016	-0.028	0.625	0.383	-0.020	0.058	0.050	0.057	-0.047	-0.067
	(0.035)	(0.071)	(0.299)	(0.359)	(0.031)	(0.052)	(0.034)	(0.075)	(0.050)	(0.116)
1998-2000	-0.098	-0.155	0.349	-0.129	-0.039	0.108	0.126	0.138	0.058	0.024
	(0.037)	(0.133)	(0.296)	(0.634)	(0.030)	(0.079)	(0.036)	(0.127)	(0.063)	(0.191)
Trends	-	0.0094	-	0.077	-	-0.025	-	-0.0020	-	0.0064
		(0.021)		(0.107)		(0.012)		(0.020)		(0.029)
N	147833				74781		69144		34451	

Notes: The table reports coefficients for pooled growing region/year interactions terms estimated using equation (2) in the text. Standard errors adjusted for department-year clustering are reported in parentheses.

Table 7a: Outcomes for Children - Yearly Interactions, Pooled Growing & DMZ

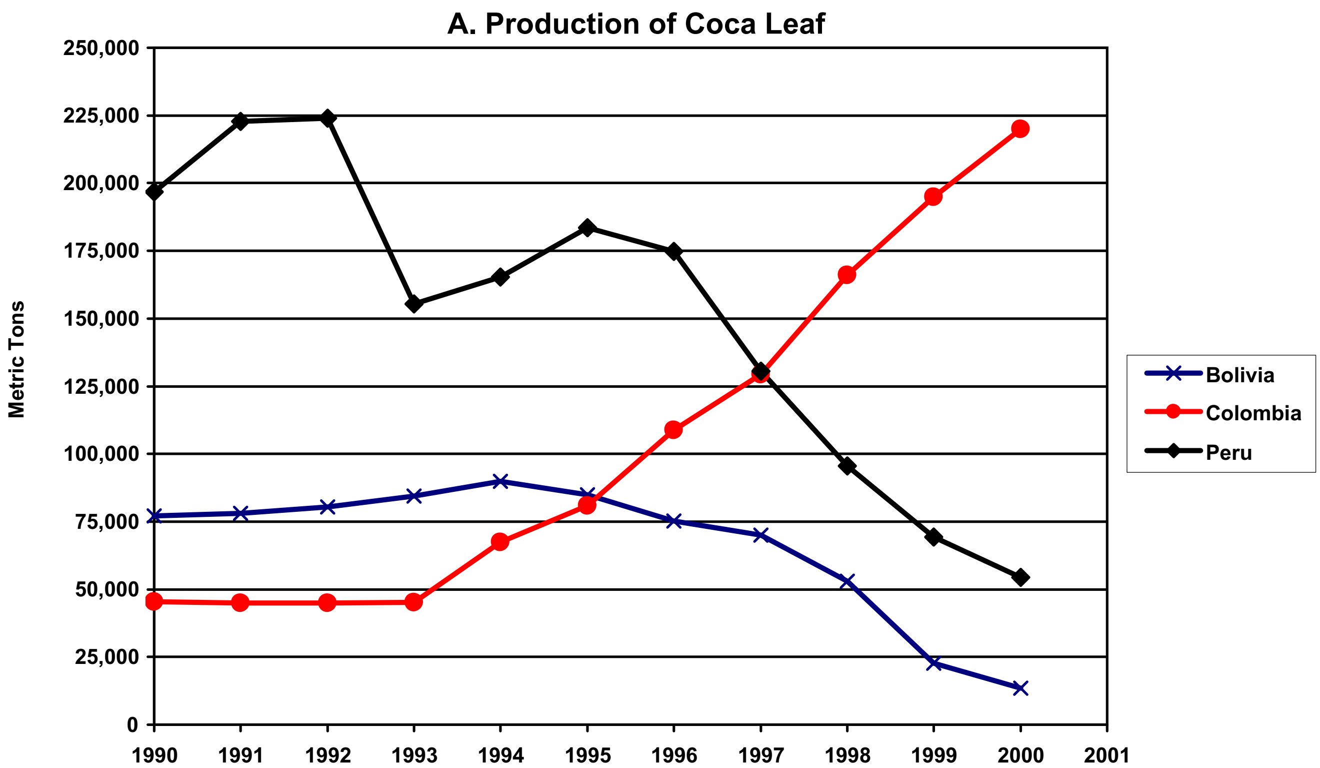
	Enrollment				Labor Market (Teenage Boys)			
	Boys		Girls		Employment		Log Hours (All Jobs)	
Interaction Terms	All (1)	w/o Migrants (2)	All (3)	w/o Migrants (4)	All (5)	w/o Migrants (6)	All (7)	w/o Migrants (8)
1994	-0.0039	-0.042	0.054	0.044	0.021	0.025	-0.028	-0.040
	(0.039)	(0.044)	(0.028)	(0.032)	(0.055)	(0.063)	(0.071)	(0.089)
1995	-0.011	-0.012	0.061	0.049	-0.037	-0.048	0.069	0.074
	(0.037)	(0.040)	(0.048)	(0.046)	(0.040)	(0.039)	(0.078)	(0.083)
1996	-0.0055	0.0010	0.025	0.023	0.033	0.034	0.187	0.173
	(0.032)	(0.031)	(0.026)	(0.028)	(0.043)	(0.049)	(0.071)	(0.072)
1997	-0.065	-0.073	0.031	0.025	0.078	0.092	0.081	0.041
	(0.033)	(0.032)	(0.036)	(0.040)	(0.033)	(0.035)	(0.059)	(0.065)
1998	-0.020	-0.042	0.036	0.042	0.011	0.0009	0.228	0.243
	(0.034)	(0.036)	(0.048)	(0.056)	(0.043)	(0.051)	(0.059)	(0.062)
1999	-0.055	-0.052	0.017	0.0094	0.099	0.123	0.180	0.160
	(0.031)	(0.034)	(0.034)	(0.040)	(0.038)	(0.042)	(0.054)	(0.061)
2000	-0.054	-0.059	0.034	0.017	0.078	0.072	0.272	0.253
	(0.036)	(0.040)	(0.034)	(0.036)	(0.050)	(0.053)	(0.047)	(0.053)
N	27382	22695	25771	21259	22365	18319	12528	10104

Notes: The table reports coefficients for growing region/year interactions. Standard errors adjusted for department-year clustering are reported in parentheses.

Table 7b: Outcomes for Children with Pooled Interaction Terms

Interaction Terms	Enrollment				Labor Market (Teenage Boys)			
	Boys		Girls		Employment		Log Hours (All Jobs)	
	No Trends (1)	w/Trends (2)	No Trends (3)	w/Trends (4)	No Trends (5)	w/Trends (6)	No Trends (7)	w/Trends (8)
Panel A: Growing Effects (non-DMZ)								
1995-1997	-0.0099	0.040	0.035	0.024	0.016	-0.087	0.112	0.117
	(0.024)	(0.046)	(0.024)	(0.051)	(0.030)	(0.060)	(0.048)	(0.089)
1998-2000	-0.028	0.069	0.027	0.0059	0.073	-0.132	0.236	0.246
	(0.025)	(0.077)	(0.027)	(0.095)	(0.032)	(0.096)	(0.040)	(0.143)
Trends	-	-0.016	-	0.0035	-	0.034	-	-0.0016
		(0.012)		(0.014)		(0.015)		(0.022)
N	27382	27382	25771	25771	22365	22365	12528	12528
Panel B: DMZ Effects								
1995-1997	-0.103	0.174	-0.115	-0.197	-0.032	-0.248	0.238	-0.0041
	(0.083)	(0.097)	(0.069)	(0.145)	(0.074)	(0.196)	(0.095)	(0.183)
1998-2000	-0.079	0.436	-0.138	-0.293	-0.213	-0.612	0.232	-0.216
	(0.085)	(0.142)	(0.072)	(0.223)	(0.088)	(0.377)	(0.093)	(0.332)
Trends	-	-0.087	-	0.025	-	0.066	-	0.071
		(0.021)		(0.030)		(0.053)		(0.048)
N	27382		25771		22365		12528	

Notes: The table reports coefficients for pooled growing region/year interactions terms estimated using equation (2) in the text. Standard errors adjusted for department-year clustering are reported in parentheses.



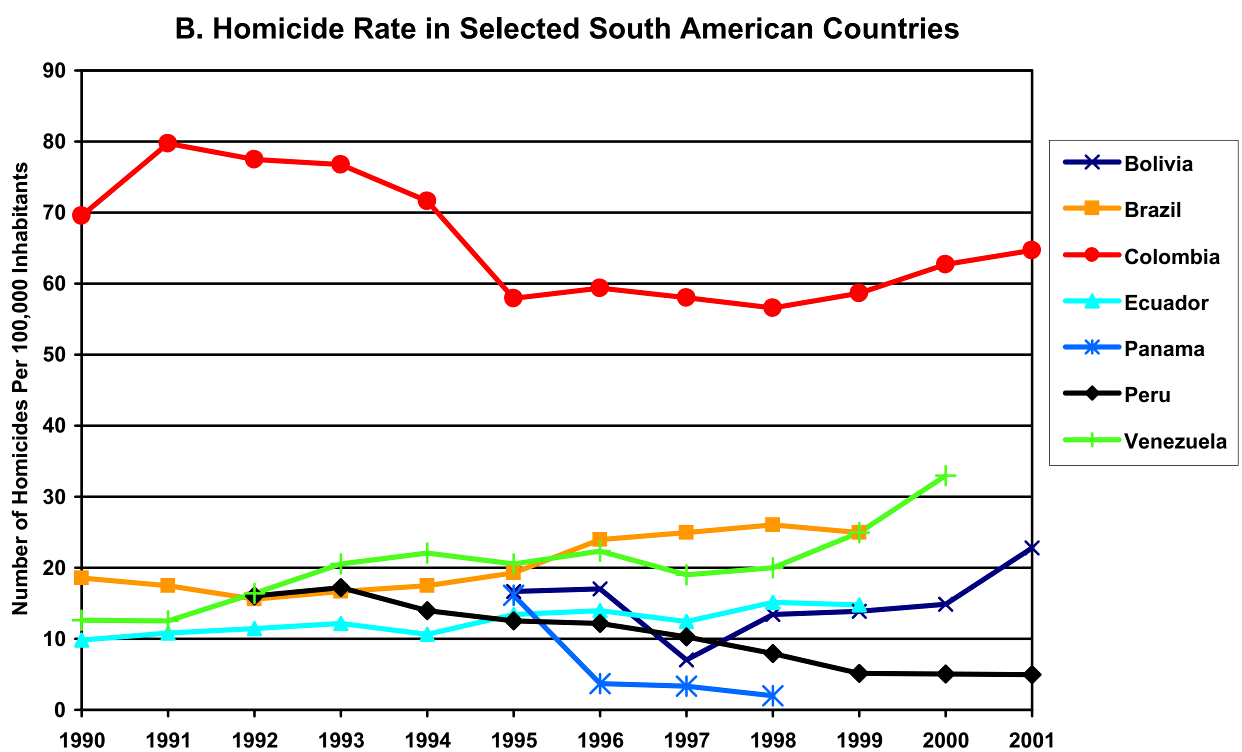


Figure 1. Coca Production and Homicide Rates in the 1990s
For sources, see text.

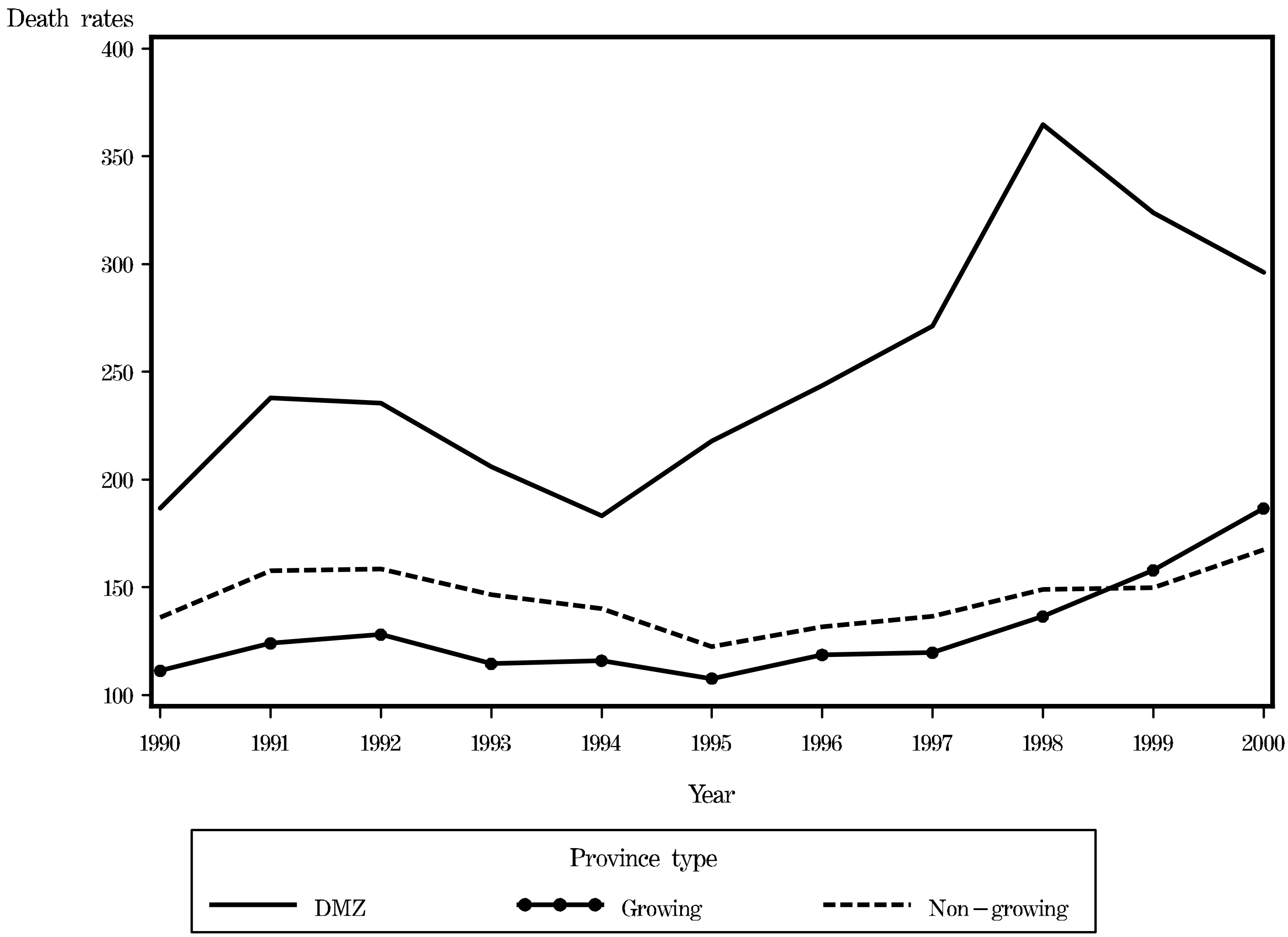


Figure 2a. Death rates by violence for men, aged 15−59, split by 14 provinces growing.
Non−growing omits Antioquia, Valle, and Bogota DC.

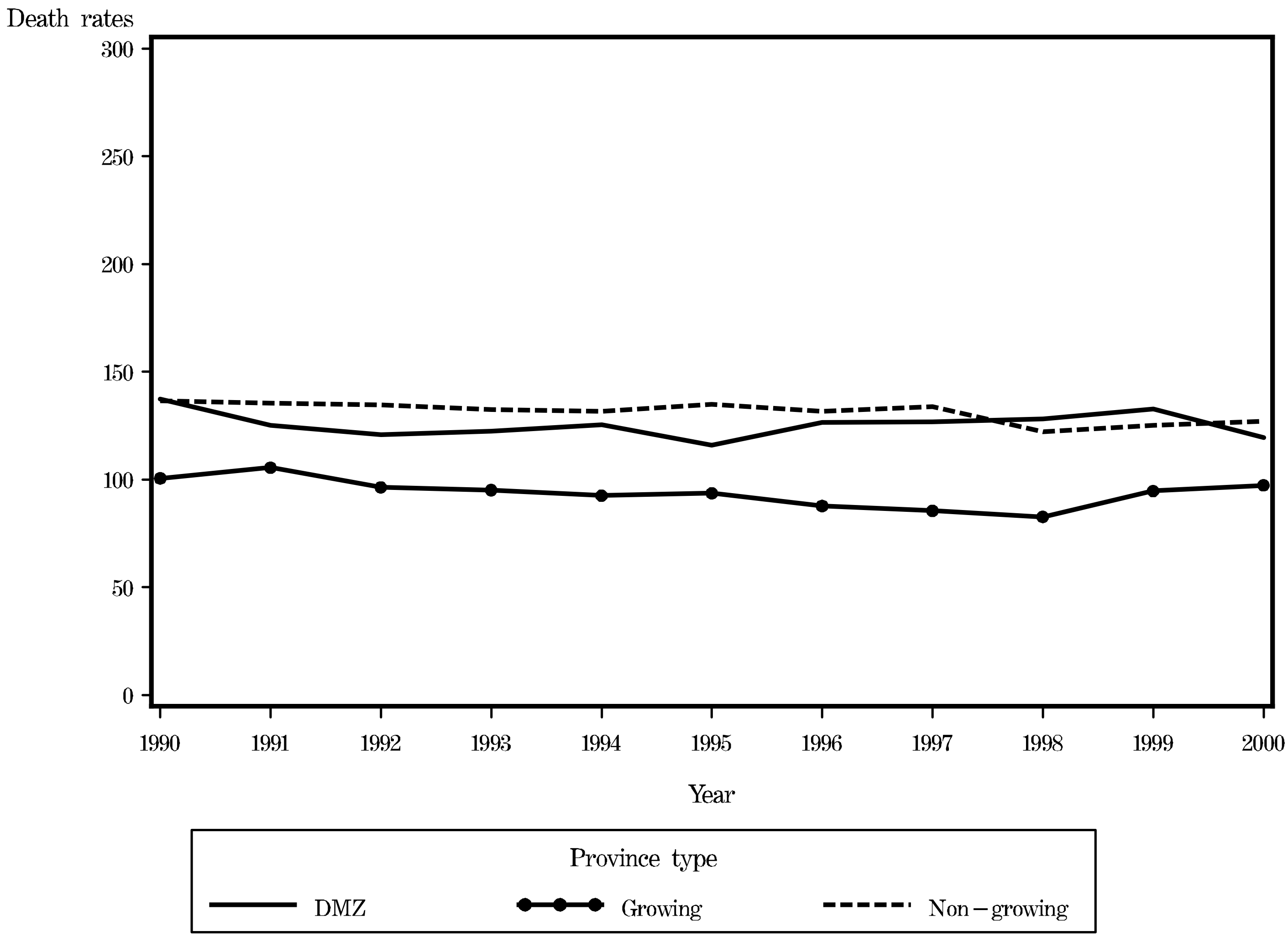


Figure 2b. Death rates by disease for men, aged 15−59, split by 14 provinces growing,
Non−growing omits Antioquia, Valle, and Bogota DC.

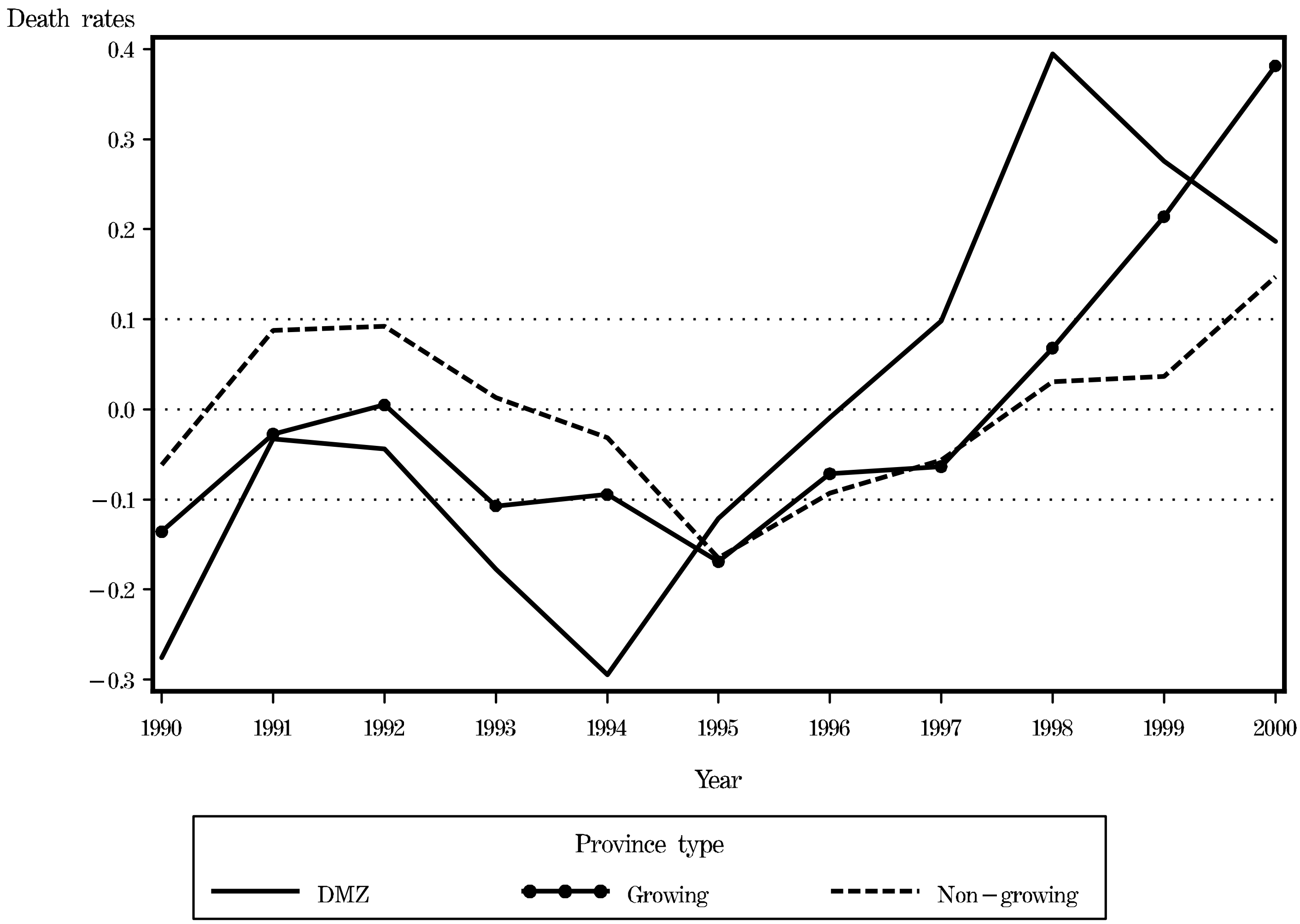


Figure 3a. Death rates by violence for men 15−59, split by 14 provinces growing.
Log rates, relative to average by province type;
Non−growing omits Antioquia, Valle, and Bogota DC.

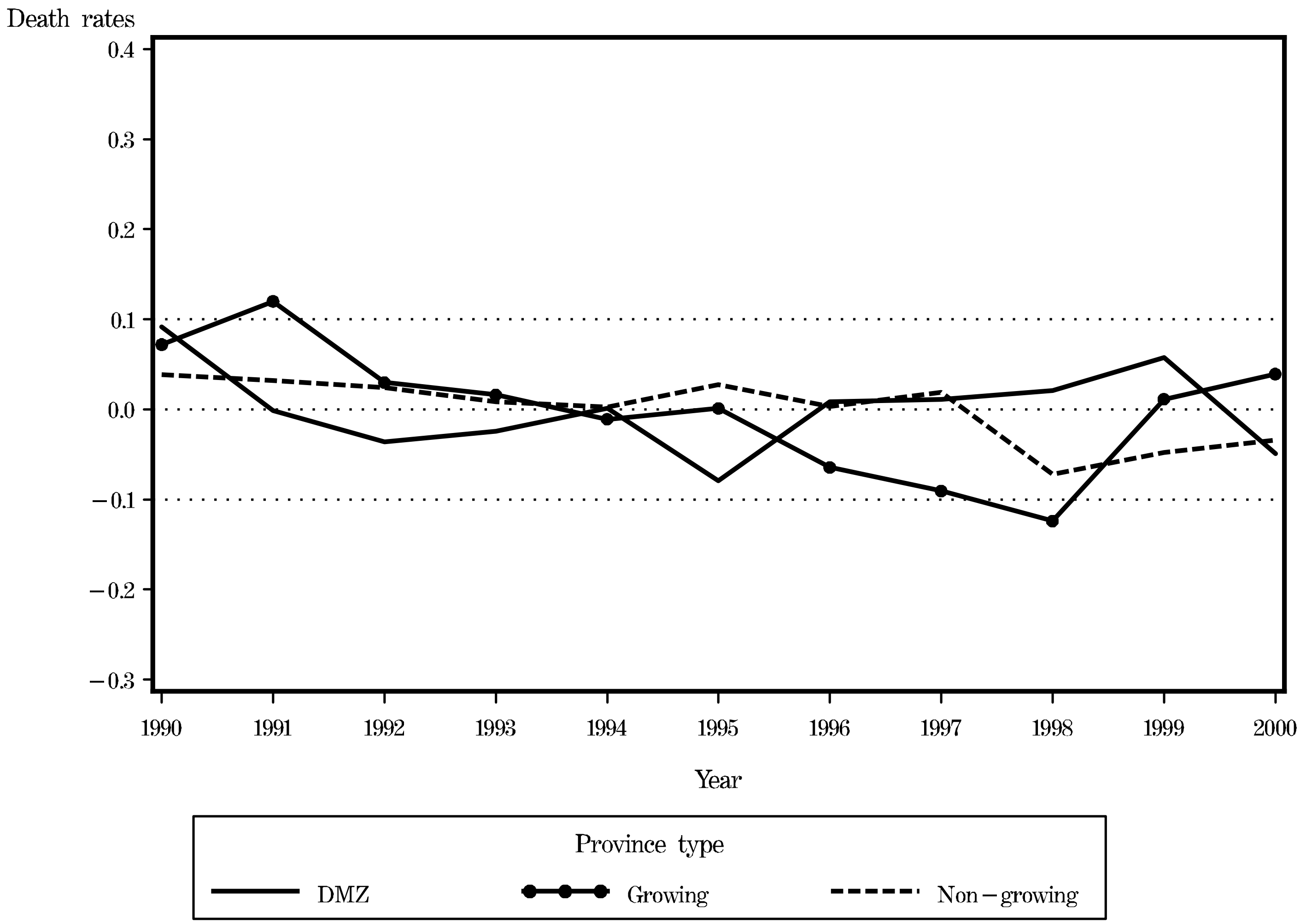


Figure 3b. Death rates by disease for men 15−59, split by 14 provinces growing,
Log rates, relative to average by province type;
Non−growing omits Antioquia, Valle, and Bogota DC.

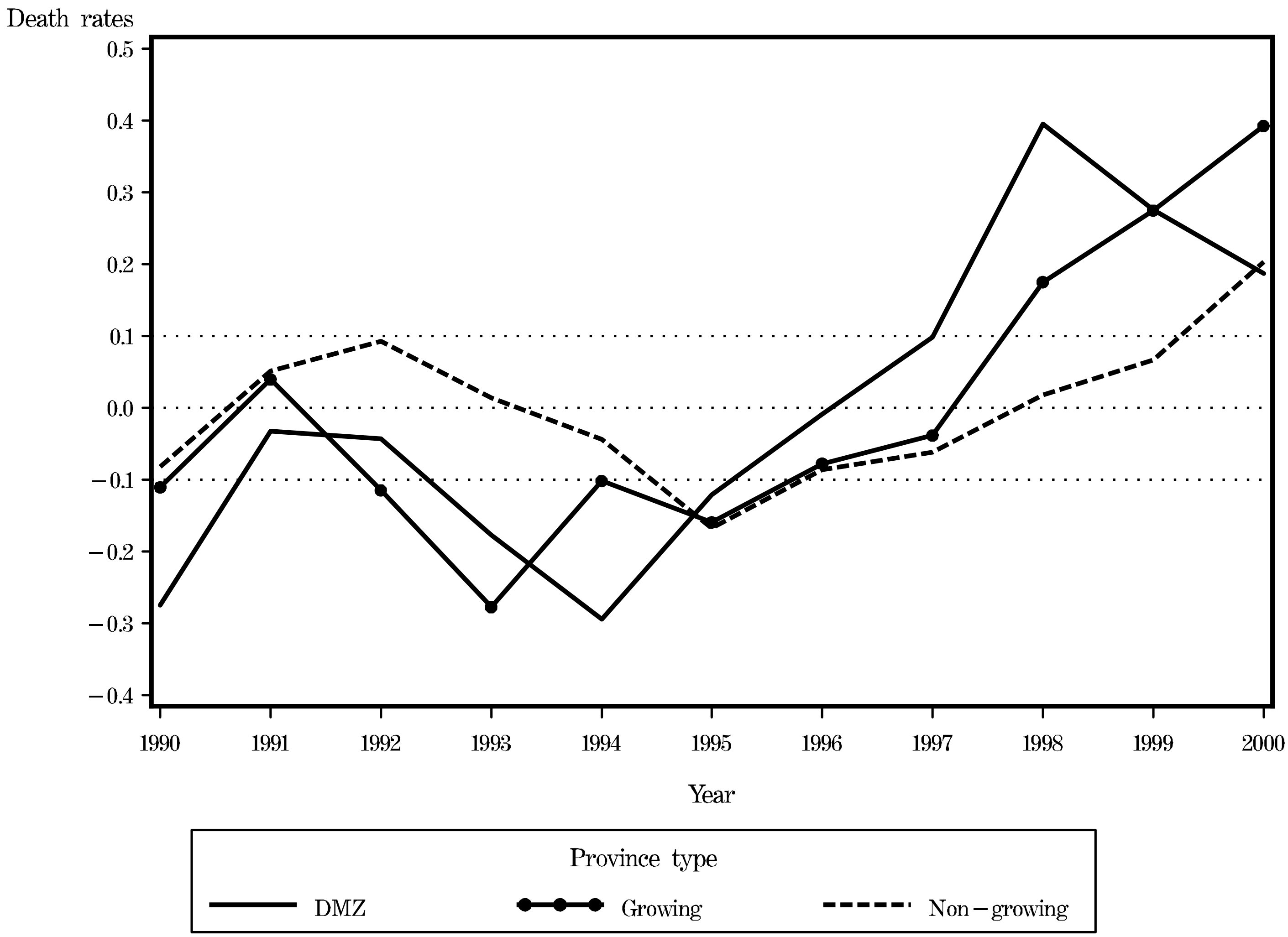


Figure 4a. Death rates by violence for men, aged 15−59, split by 9 provinces growing.
Log rates, relative to average by province type

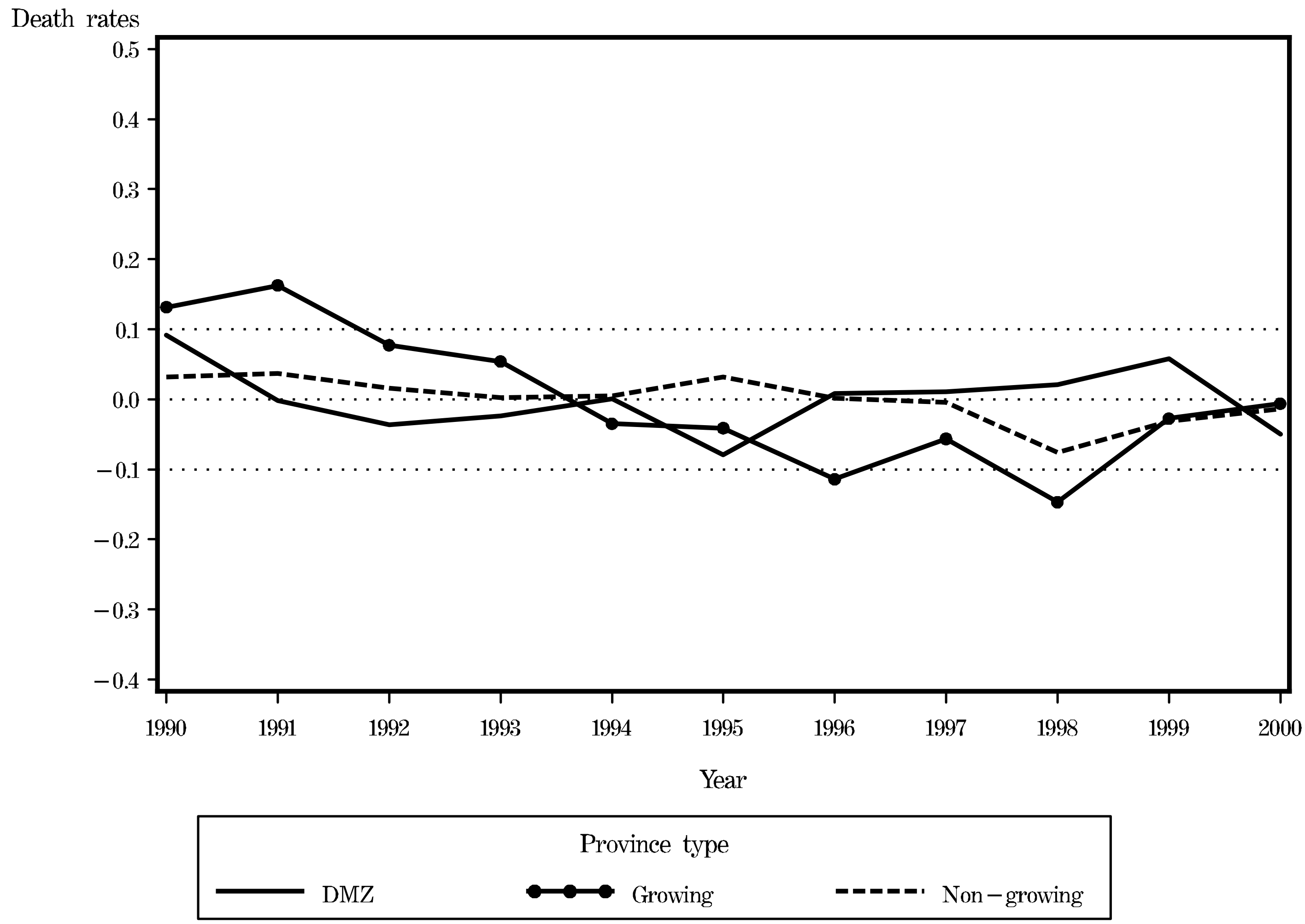


Figure 4b. Death rates by disease for men, aged 15−59, split by 9 provinces growing,
Log rates, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.

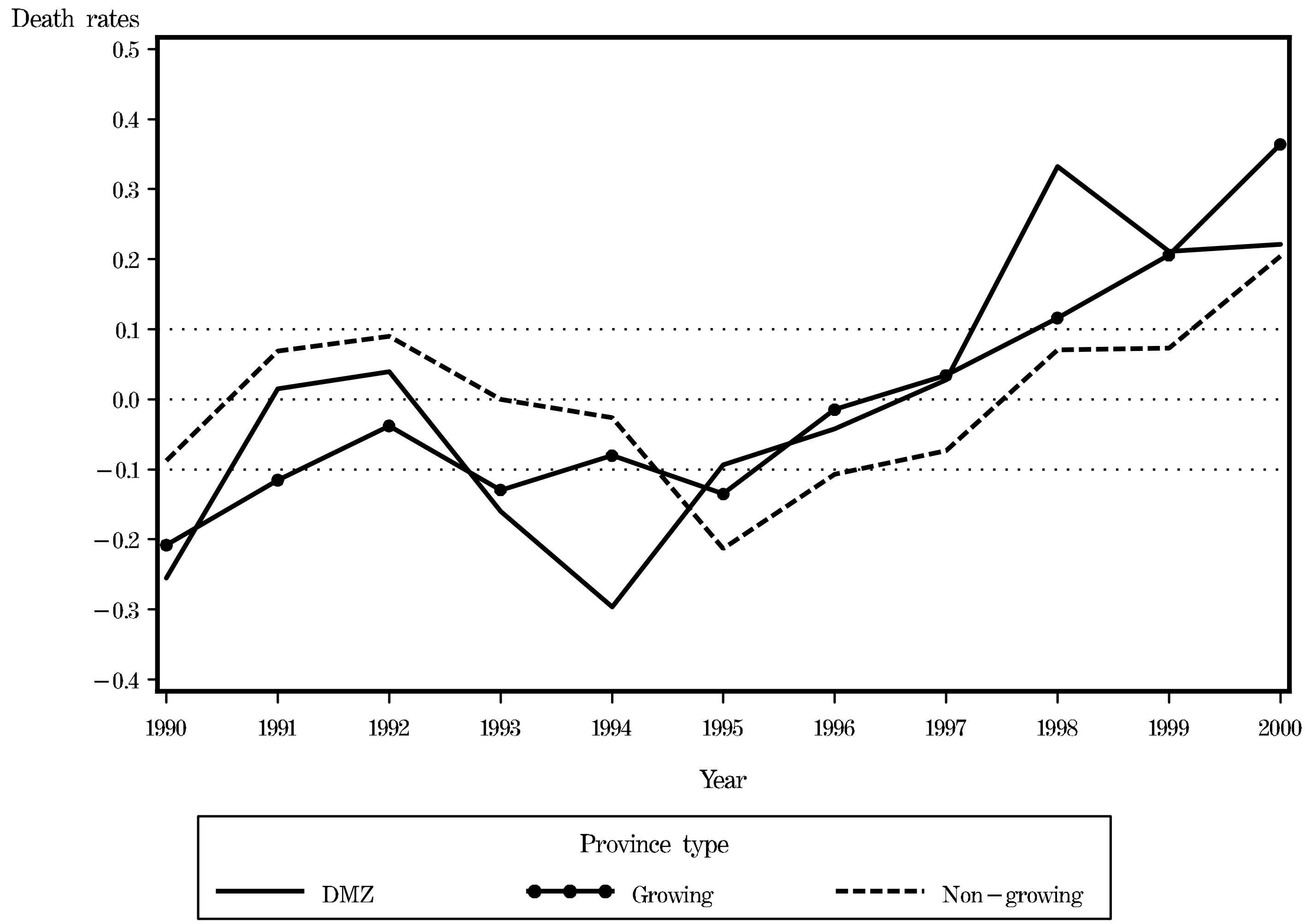


Figure 5a. Death rates by violence for men, aged 15−59, split by 14 provinces growing.
Logits, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.

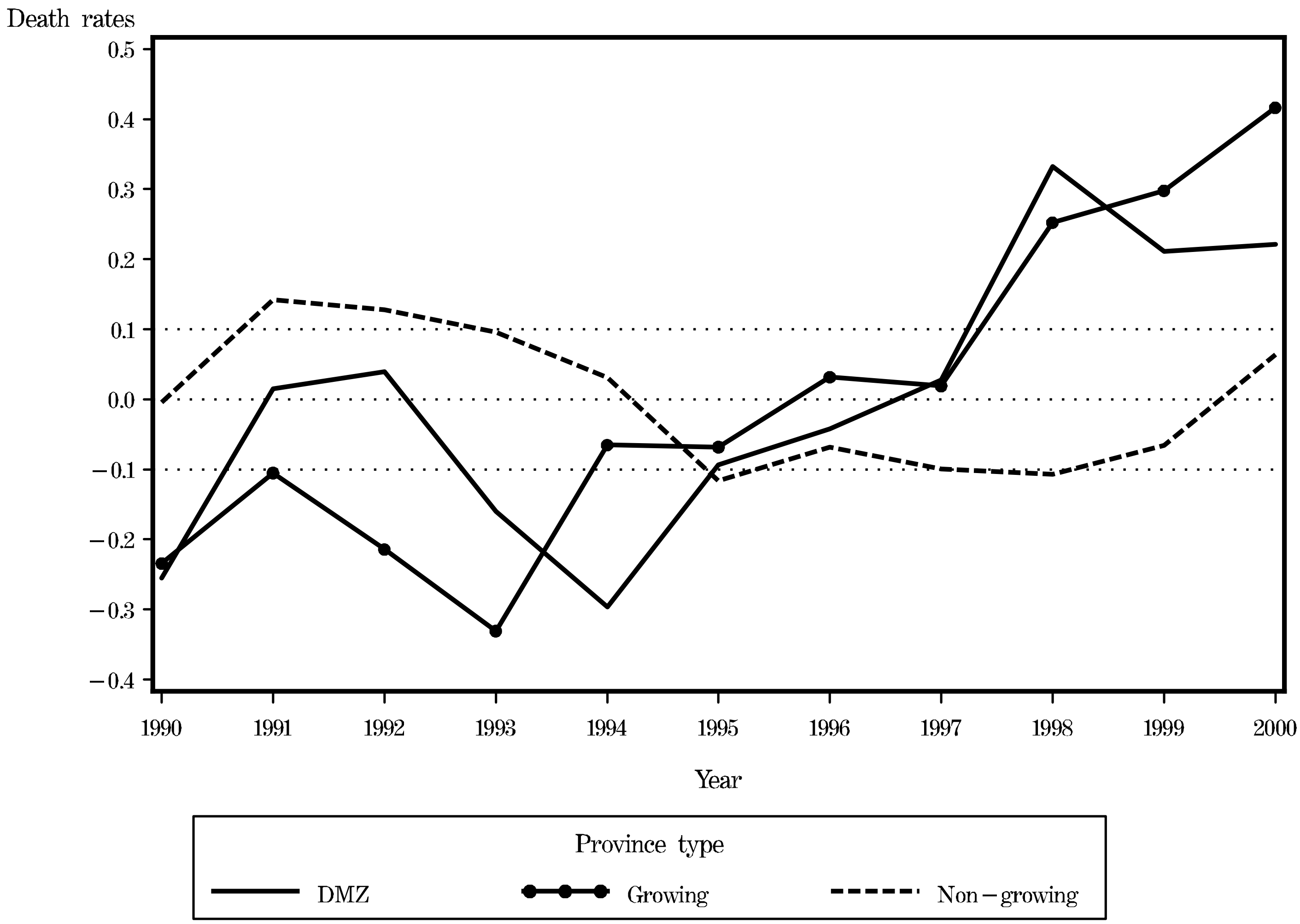


Figure 5b. Death rates by violence for men, aged 15−59, split by 9 provinces growing.
Logits, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.

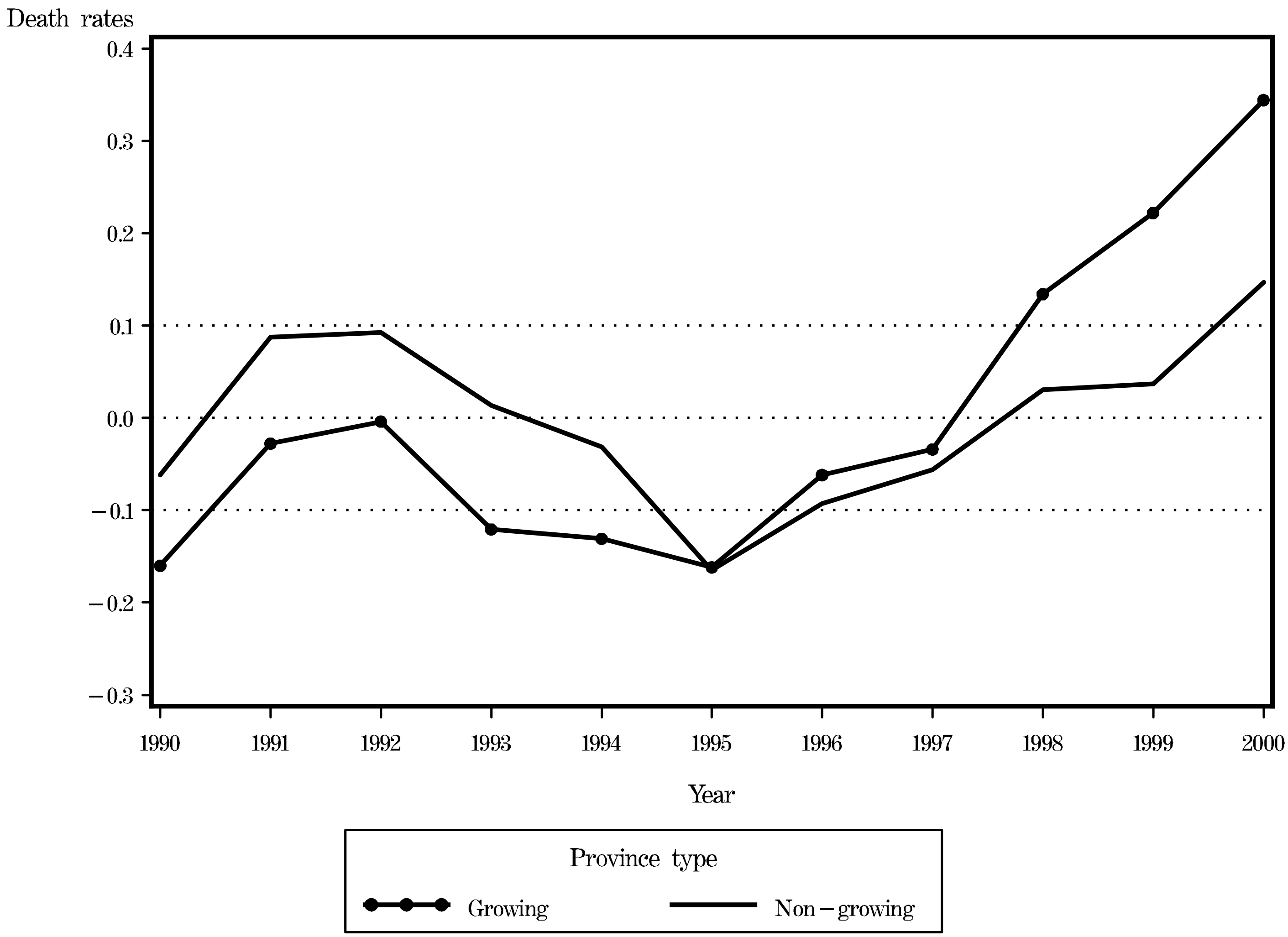


Figure 6a. Death rates by violence for men, aged 15−59, split by 14 provinces growing. Log rates, relative to average by province type

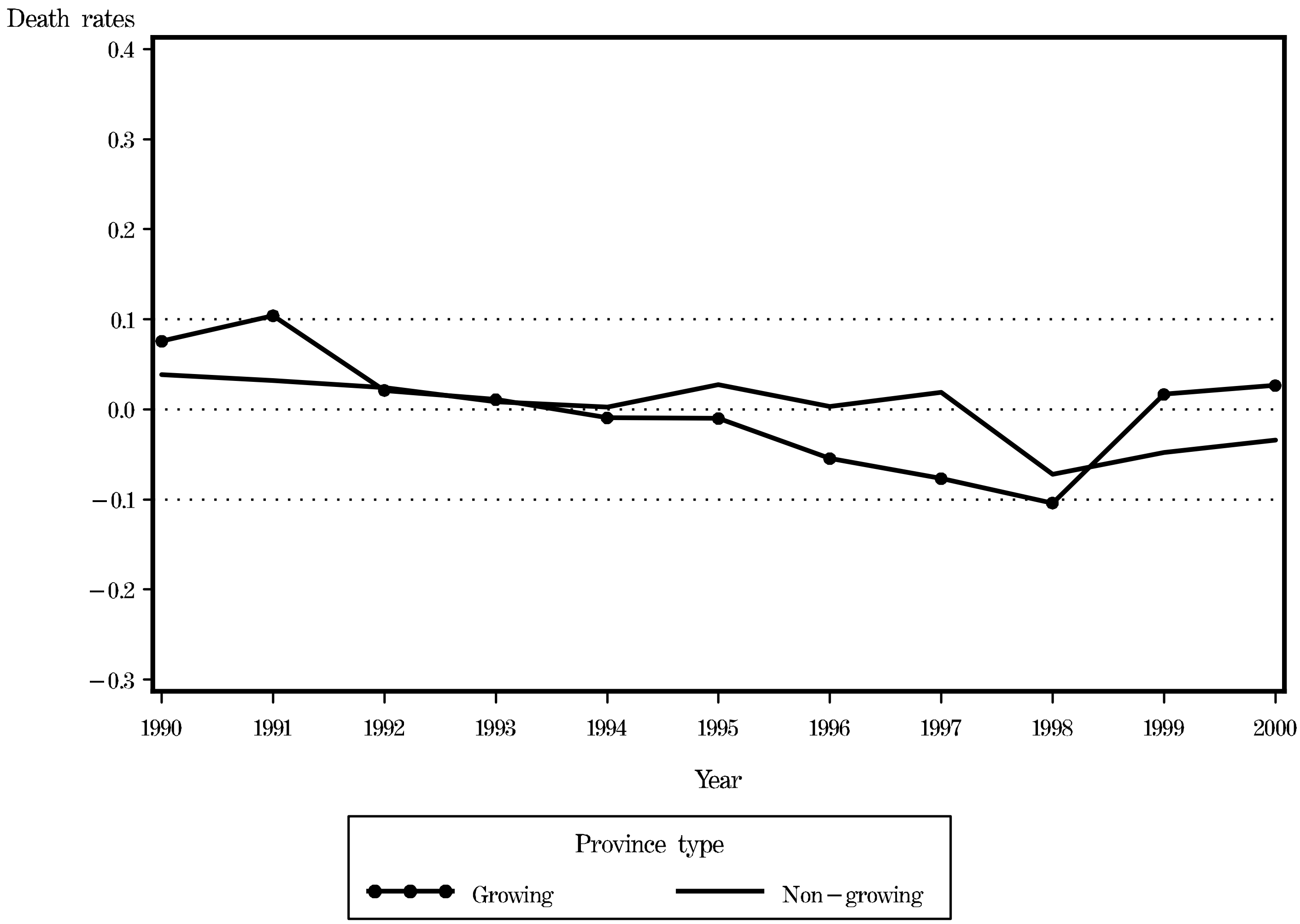


Figure 6b. Death rates by disease for men, aged 15−59, split by 14 provinces growing,
Log rates, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.

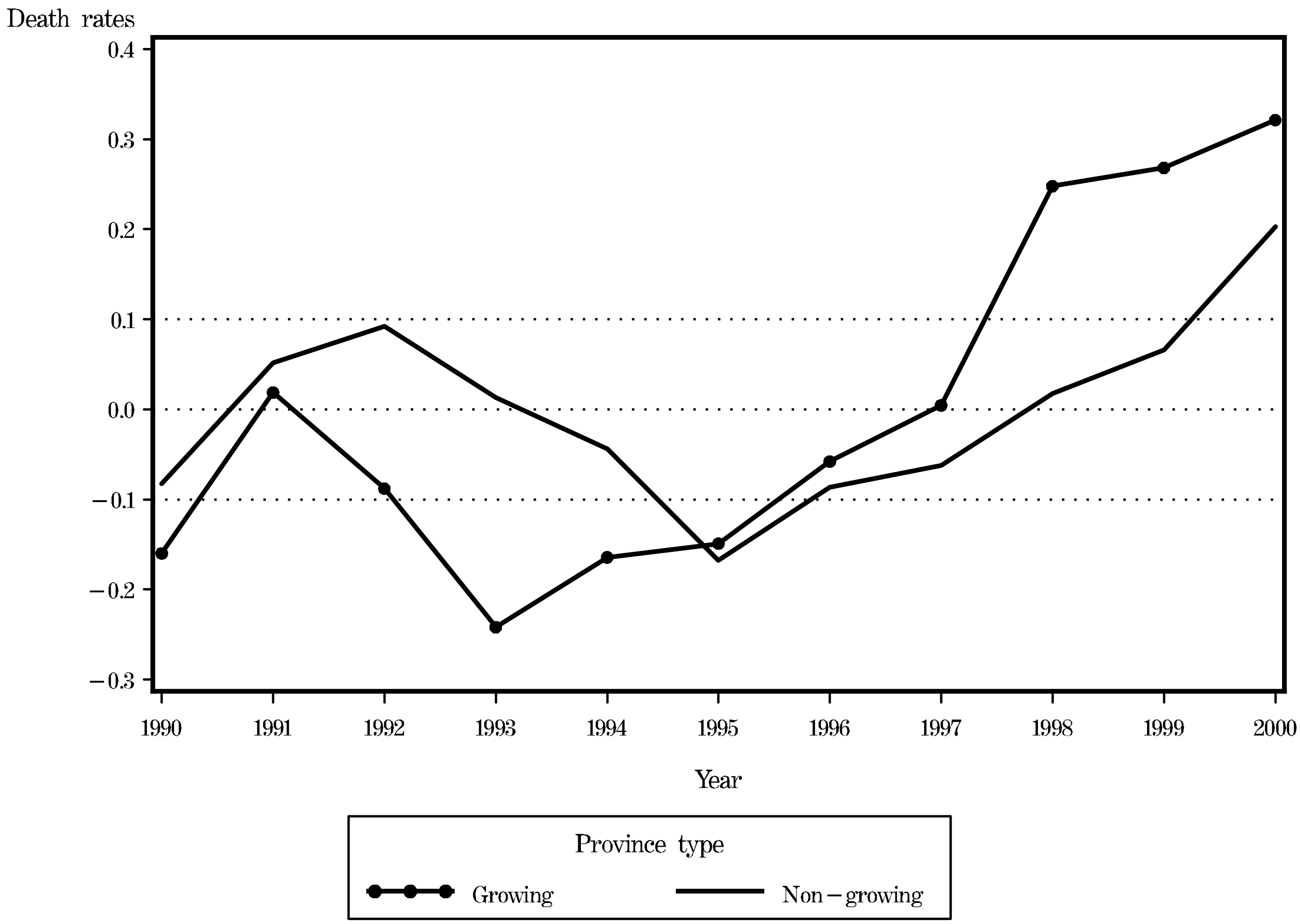


Figure 7a. Death rates by violence for men, aged 15−59, split by 9 provinces growing.
Log rates, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.

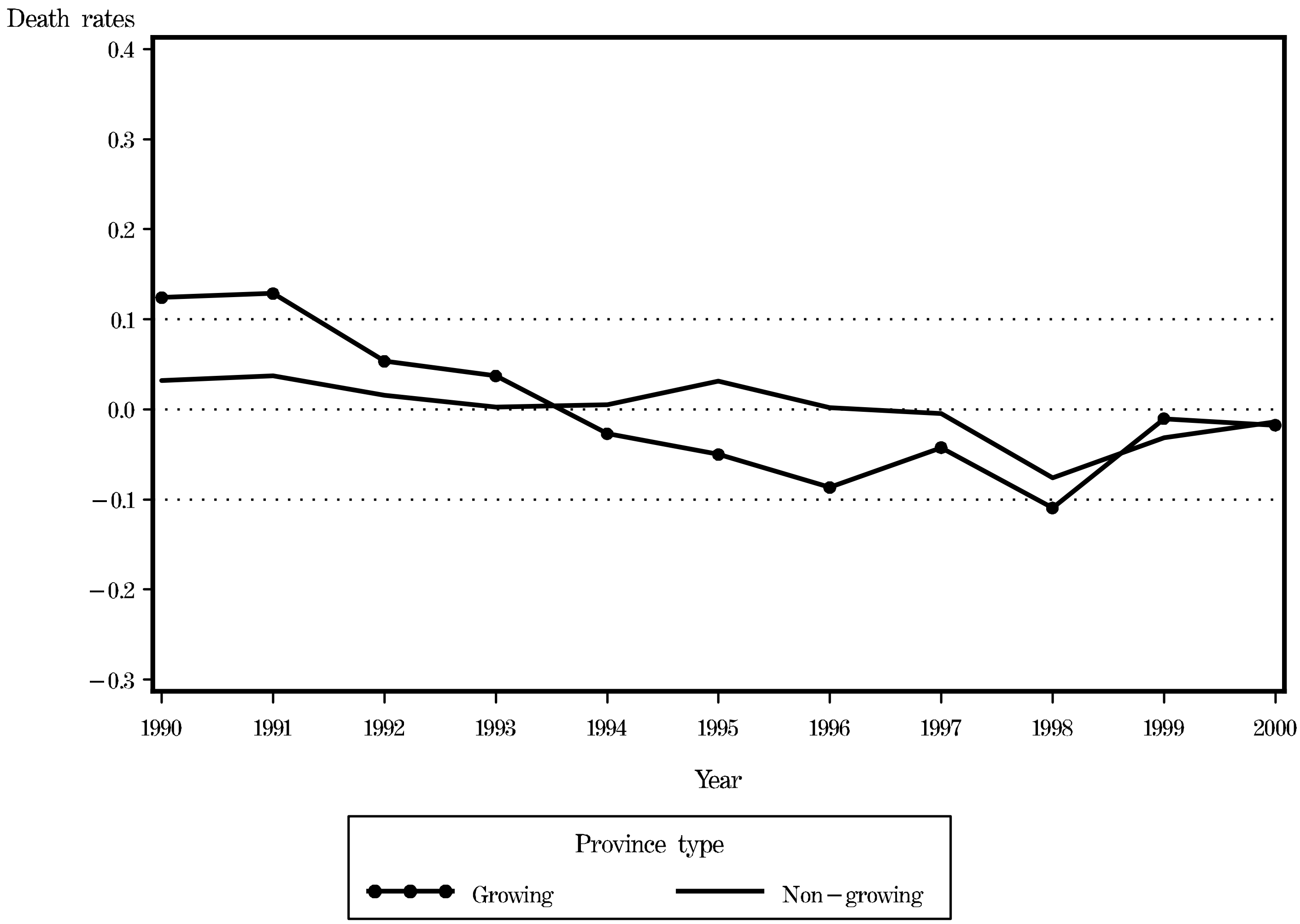


Figure 7b. Death rates by disease for men, aged 15−59, split by 9 provinces growing,
Log rates, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.

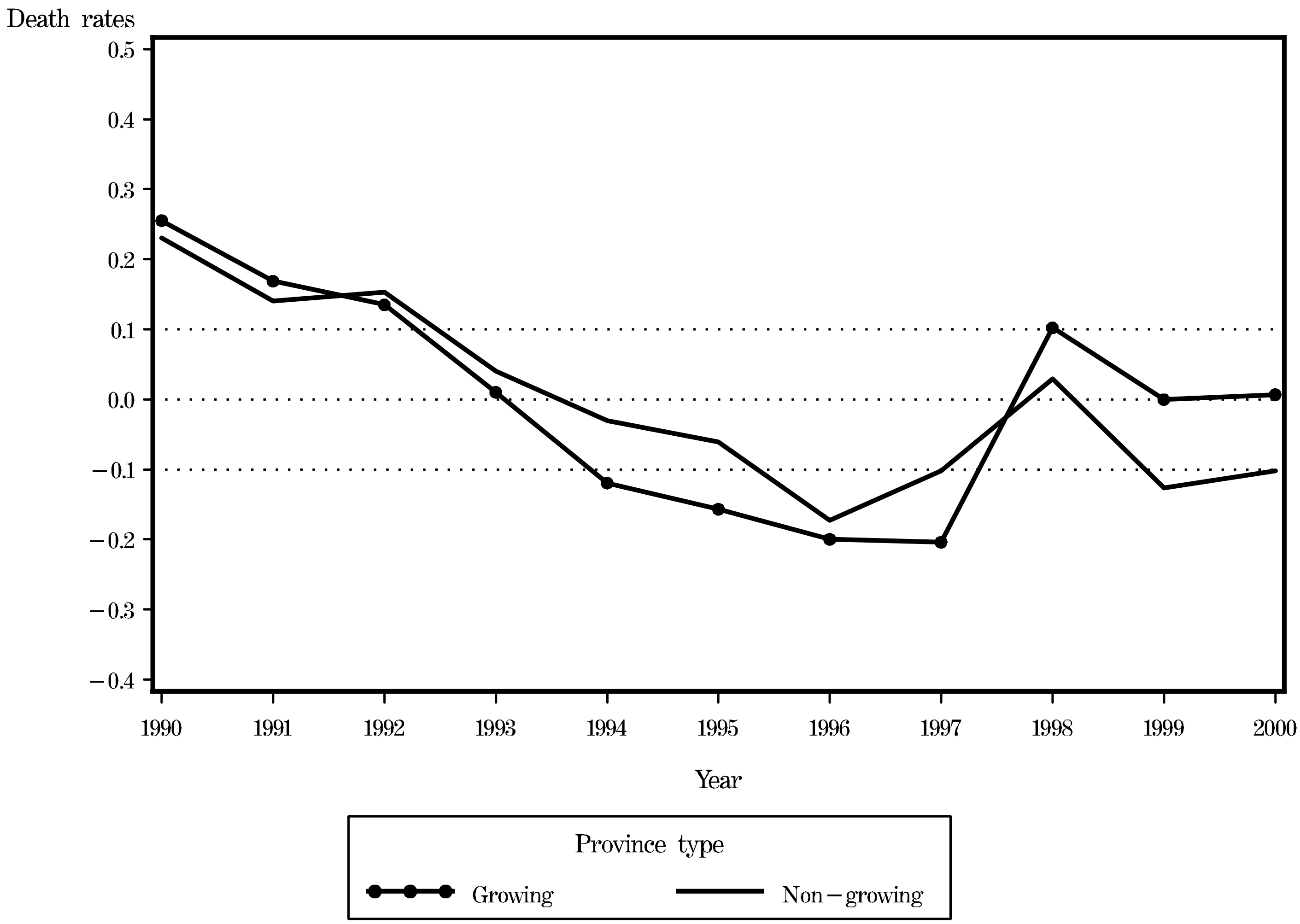


Figure 8. Child mortality (ages 1−4), 14 provinces growing.
Log levels, relative to average by province type
Non−growing omits Antioquia, Valle, and Bogota DC.