Macro-Economic Instability and Crime

Patrick Guillaumont, Frédéric Puech

CERDI, Etudes et Documents, E 2006.02

Document de travail de la série
Etudes et Documents
E 2006.02

MACRO-ECONOMIC INSTABILITY AND CRIME

Patrick Guillaumont* and Frédéric Puech*

March 2006
25p.

*CERDI, CNRS and Université d'Auvergne

1 Introduction

Relying on samples taken from developing and developed countries, several recent papers, such as those by Fajnzylber et al. (2002), Soares (2004) and Neumayer (2003, 2005), have emphasized the influence of macro-economic variables on crime. Those studies highlight the impact of the average level of income and of its growth rate. But none of them consider the impact of its instability.

This paper argues that the factors corresponding to economic shocks or macro-economic instability have a significant and robust influence on crime. It suggests that this influence comes from disappointed anticipations, formed during periods of rapid increase of income, which, to some extent, generates frustration and possibly crime. It also suggests that illegal activities are used by some agents to compensate their loss of income and, in this way, smooth their consumption. It mainly deals with the direct effect of instability on crime. Nevertheless, since macro instability reduces growth, as it has been largely substantiated in literature, and growth has been found to have a negative impact on crime, it can also be supposed to have an indirect effect on crime through the growth rate.

We tested our hypothesis of a direct effect of macro instability for two kinds of crime: the utmost crime against persons, homicide, and crime against property, robbery. The samples are those used by Neumayer (2003) for homicide and Neumayer (2005) for robbery. Those samples both cover a set of developed and developing countries during the 1980-97 period and are much larger than those previously used by Fajnzylber et al. (2002). Results support the hypothesis that income instability has a significant influence upon crime. They are more outstanding for homicide than for robbery.

The remainder of this paper is as follows. Section 2 presents the conceptual framework for identifying variables usually considered as determinants of crime and for discussing the effects of instability and volatility on crime. Section 3 presents the data and samples and explains how instability indicators are built. Results are analyzed in section 4. Section 5 concludes.

2 Conceptual framework

2.1 "Traditional" variables

According to the economic theory of crime initiated by Becker (1968) and Ehrlich (1973), criminals, like other individuals, are supposed to maximize their expected utility and react to incentives. Crime is seen as a consequence of a rational allocation of time between legal and illegal activities. In other words, each agent compares his or her expected earnings in the legal and illegal sectors, and becomes a criminal if illegal income is higher. This choice is largely influenced by deterrence or, more precisely, by the probability of apprehension and the size of punishment: the number of crimes committed decreases with the importance of deterrence. As a consequence, a large part of the literature dealing with determinants of crime focuses on the effect of deterrence[1].

This literature also tries to identify variables which are considered as "traditional" determinants of crime, even if their effect is not always clear. This is particularly the case for the average level of income. On the one hand, a higher average income results in more opportunities in the legal labor market thus leading to a reduction in crime against property. On the other hand, it also increases opportunities for criminals since there are more goods to steal. Similar arguments also apply to income growth so that the overall effect of these two variables is undetermined. Another hypothesis recently advanced by Neumayer (2005), concerns the effect of income inequality upon crime. Crime against property may be seen as an attempt by the poorest to reduce the gap between their own income and the income of the richer parts of the population. Furthermore, income inequality reduces the opportunity cost of crime, at least for the poor. Finally, relative deprivation induced by inequality generates frustration and increases violence. As a consequence, a positive effect of inequality on crime is expected. However, this effect is not always seen as significant in empirical studies, particularly at a macro-economic level. Several explanations have been given for this result, including a lack of data for a large number of countries and a lack of temporal variation of the variable used (generally, the Gini index).

[1]See Fajnzylber et al. (2000) and Fougère et al. (2005) for a review.

The theoretical model developed by Becker (1968) is possibly not adapted for explaining violent crime without any economic concern since it is unlikely that an individual makes a rational analysis before committing an assault or a murder. Further additional theoretical background is needed to explain this kind of crime. Neumayer (2003) singles out three theories to explain violence. Firstly, the modernization theory suggests that the process of modernization in a given country increases violence because previous social control mechanisms are destroyed, in partly due to urbanization: the process leads to an alienation of individuals (particularly those who were unable to adapt to this new type of society), and to an *anomie* situation (absence of norms), which can lead to an increase of violence. Secondly, the opportunity theory suggests that crime increases if the opportunities for criminals increase: these opportunities can be pecuniary as well as social and demographic, justifying the use of population density or the percentage of young males in the population as "pro-crime" variables. The third theory, quoted by Neumayer (2003), is cultural: crime varies following cultural differences amongst countries (or amongst groups within a country). Hereafter we will refer to this classification when analyzing the impact of instability on crime.

2.2 The effect of macro-economic instability

According to the modernization theory, individuals' propensity to violence can be seen to increase in a changing economic and social environment, firstly, because social control mechanisms are less efficient and secondly because individuals who are incapable of adapting become frustrated. Macro-economic instability can thus influence crime through this channel: instability warps anticipations, especially if it occurs due to macro-economic shocks. If a country benefits from good economic perspectives, agents will have optimistic expectations. Then, if a negative shock occurs, individuals will have to give up their aspirations. Not only are anticipations rendered more difficult, thus generating deception, but, as the newly created needs cannot be satisfied, frustration increases and is more likely to be translated into violence.

Moreover, instability reduces the opportunity costs of crime against property by reducing opportunities in the legal sector. The wage the criminal could have earned by working instead of committing a crime is uncertain if there is instability, thus rendering illegal activities relatively less risky than what they would be in a situation without instability. This argument is rather similar to the one used to link unemployment to crime: the fewer opportunities there are in the legal labor market, the more attractive illegal activities become, especially if they become regular (as in organized crime for example), enabling the criminal to smooth his income and consumption. From this point of view, crime can be considered as a kind of diversification of activities in order to protect oneself against climate or price shocks. Even if opportunities for criminals are also more uncertain, it seems reasonable to assume that macro-economic instability increases crime against property since it lowers its opportunity costs.

To some extent, instability can also increase homicides, since it can be seen as an "efficient" way to reallocate resources after a shock. Miguel (2005) discovered that murders of elderly women in rural Tanzania increase after extreme rainfalls (a negative income shock leading to food shortage), the justification for these murders being that these women were witches. In another paper, Miguel et al. (2004) find that income shock (instrumented by rainfall variations) increases violence in Africa by raising the probability of civil war.

We should also keep in mind the indirect effect of instability on crime, through the growth rate. A lot of studies have estimated the impact of export instability (or other exogenous sources of instability) or of growth volatility on average growth in developing countries (see Ramey & Ramey 1995, Guillaumont et al. 1999, Hnatkovska & Loayza 2004, Guillaumont 2005). Indeed, instability by generating risk may increase precautionary savings. But more significantly, it slows down, through several channels, productivity improvement, innovation and finally the growth rate. If average growth (and thus the level of income) has a negative effect upon crime, which is often assumed, then instability, by reducing average growth, also indirectly increases crime. Since in our regressions, where crime is explained by both the average level of income per capita and the growth rate, this effect is already captured, we must not forget that our analysis is focused on direct effects, i.e. those which do not go through the level or the growth of income.

3 The data

3.1 Explained variables

Macro-economic analysis of crime suffered for a long time from the lack of quality data, in particular because the legal definition of crime differed among countries. The United Nations' *World Crime Surveys* (WCS hereafter) filled this void. This dataset is built upon surveys from governments, conducted in several waves by the United Nations since 1970, and deals with the judiciary system as a whole (number of crimes committed, police size, justice organization). However, they are official crime data, well-known to under-estimate the true crime rates as not every crime is reported to the police. Moreover, they are issued from surveys transmitted to governments, which implies firstly, that countries can choose not to answer, and secondly, that the data cannot be verified.

It is therefore better, as much as possible, to use other sources. Firstly, one can use data issued from the World Health Organization (WHO). These data contain, for every country and every year, the number of deceases classified depending on the cause of the death, with a specific category for homicide. Since these data come from the health administration of each country, it is, *a priori*, more reliable than WCS data. Finally, data for crime against persons as well as crime against property can be obtained from Interpol. These data are collected directly from the police, which reduces the risk of manipulation by the government or the likelihood of errors (even if WCS data more than likely come from the same source). Moreover, Interpol data cover a larger number of countries than the WCS and gives a more representative sample.

We used the databases of Neumayer (2003) for homicide and of Neumayer (2005) for robbery[2], which correspond to two panels of developing and developed countries for

[2]The databases are freely available on the website of the *Journal of Peace Research*: `http://www.prio.no/jpr`.

six 3-year periods covering the 1980-97 period. Homicide rates are taken mainly, and in priority, from WHO data, considered as the more reliable source. The sample is completed by Interpol data, where they exist. Robbery rates come exclusively from Interpol. We thus have a sample of 132 countries for homicide and 87 for robbery, of which a large number are developing countries. This is one of the advantages of the dataset used by Neumayer compared to the one used by Fajnzylber et al. (2002), who use WCS data and thus get a sample of only 45 countries for homicide and 34 for robbery. Furthermore, a large part of the observations in their samples covers developed countries.

3.2 Traditional determinants

The baseline model includes economic, social, demographic and deterrence variables in order to take into account the main determinants of violent crime. Economic variables are the level of income, measured by the GDP per capita, the level of inequality (measured by the Gini index) and the GDP growth rate, as in Fajnzylber et al. (2002). Concerning the robbery rate, we are followed Neumayer (2005) and also introduced the squared GDP per capita in order to take into account a possible non-linear relation between average income and crime against property: At first, the number of robberies increases as average income increases (because opportunities increase) but, as everybody gets richer on average (whatever the distribution of wealth), incitation to commit a robbery decreases. In other words, we can assume that there exists a Kuznets curve for robbery.

Social variables in the baseline model are the literacy rate as well as female labor force participation. The latter is introduced as a proxy for the weakness of social linkage; with the underlying assumption that a higher female labor force participation means lower parental control, which tends to reduce social linkage between individuals. According to Neumayer (2003), this variable measures the extent to which the traditional social structure which is dominated by males in numerous countries, remains in place and is thus a way to indirectly measure anomie. Some studies prefer to use the divorce rate and some others, such as Glaeser & Sacerdote (1999), use the percentage of female-headed households.

The two demographic variables most often used are the percentage of young males in the population and the urban rate. Young males are perceived as having a higher tendency to be violent than the rest of population. However, we must remark that, unless we assume there is a significant difference between male and female populations, this variable measures in fact the youth of the population. The urban rate is expected to have a positive impact on both homicide and robbery rates for three reasons, emphasized by Glaeser & Sacerdote (1999). Firstly, urbanization goes hand in hand with a high population density, which means more possibilities for criminals to hide. Secondly, the number of policemen per capita is smaller in cities, reducing the probability of apprehension. Lastly, concerning crime against property specifically, the high population density due to urbanization means a lot of opportunities (and high potential of spoils) as well as a low cost of crime (especially in terms of the distance to be covered).

Finally, we introduced a dummy variable indicating whether the death penalty exists in each country and for each period in order to take into account the effect of deterrence on crime. Variables generally used to measure deterrence, such as the number of policemen per capita or the amount of police expenditure, suffer from an endogenous bias. If it is possible to efficiently and elegantly overcome this problem when working on micro-data (as carried out by Levitt Levitt 1997), it is much more difficult to find an exogenous source of variation for that kind of variable at the macro-economic level. This is why we chose to use the death penalty, which is, a priori, the more exogenous police variable at this level: the existence of the death penalty in a country is mainly the consequence of a political choice and is relatively independent from crime. Furthermore, the use of this variable seems particularly relevant in the case of homicide, since it is generally used to punish that kind of crime. Finally, this variable also has the advantage of not suffering from any measurement error since the existence of the death penalty in a country is clearly known.

3.3 Macro-economic instability variables

We distinguished two kinds of variables. The first one tried to measure exogenous sources of macro-economic instability. The second one dealt with growth rate volatility, which depends both on structural factors and on economic policy.

We considered two kinds of exogenous shocks which can lead to macro-economic instability. The first one comes from external trade fluctuations and is measured by calculating the instability of exports in constant dollars, weighted by the share of exports in GDP. The second one is bound to climate and is measured by the instability of agricultural added value in constant dollars (also weighted by the share of agriculture in GDP). The use of these variables seems relevant since our sample is taken from a lot of developing countries, which are particularly vulnerable to these kinds of shocks. It should be recalled that these two instabilities (not weighted) are among the components of the economic vulnerability index (EVI) used by the United Nations for identifying the least developed countries (United Nations 2000). We also built a similar indicator for the instability of GDP per capita.

These instability measures are calculated as indices of the deviation of each variable from a mixed trend, both deterministic and stochastic. We began by running the following regression:

$$y_{i,t} = \alpha t + \beta y_{i,t-1} + c + \epsilon_{i,t} \tag{1}$$

where $y_{i,t}$ is the variable considered (agricultural value added, exports or GDP per capita) for each country i and each year t. In this equation, we considered a ten-year trend. We then computed the instability index as follows:

$$INS_{i,t} = 100.\sqrt{\frac{\sum_t^T \left(\frac{y_{i,t}-\hat{y}_{i,t}}{\hat{y}_{i,t}}\right)^2}{N}} \tag{2}$$

where $\hat{y}_{i,t}$ is the value of $y_{i,t}$ as predicted by equation 1, T is the length of the period considered and N is the number of observations for the period. The indices are computed for the last year of each three-year period covered by the sample (1982, 1985, 1988, 1991, 1994 and 1997). In order to find which is the most relevant length of the period of instability leading to crime, several indices were computed, referring to instability respectively during the four, five, six, eight and ten years preceding each year considered: we assume the relevant length can be different for homicide and for robbery.

To check whether our results are sensitive to the instability measurement, we also built, for each of the three variables used, an instability index with regards to a trend measured by the Hodrick & Prescott (1997) filter. Instead of smoothing each variable with a simple linear regression (like the one proposed in equation 1), we used this method, which allows for a better smoothing of the series. We then computed an instability index following the formula presented in equation 2 where $\hat{y}_{i,t}$ corresponds to the smoothed variable (what Hodrick & Prescott call the growth of the variable) and $(y_{i,t}-\hat{y}_{i,t})$ corresponds to "cyclical" variations.

We also computed a variable measuring growth volatility, which is, as used by Ramey & Ramey (1995), the variance of the growth rate of GDP. Similarly to our work on instability, this variance was computed for the last year of each three-year period on the four, five, six, eight and ten preceding years.

Finally, the effect of instability may of course differ according to the institutional environment and be a stronger effect the weaker institutions are. Similarly, it may be expected to be lower in the OECD than in developing countries. Since this hypothesis can only be tested using an OECD dummy variable, and since regressions are estimated by using fixed effects, this dummy variable is introduced only as a multiplicative factor of instability. In order to test more specifically the hypothesis that the quality of institutions has an impact, we also introduced in regressions the composite international country risk guide (ICRG) index, both additively and as a multiplicative factor of instability.

4 Results

Basic results are presented in Table 1 for homicide and Table 2 for robbery. We followed Neumayer (2003, 2005) and used the fixed-effects estimator. We did not use the GMM estimator (used by Fajnzylber et al. 2002), even though it makes it possible to take into account criminal inertia because it is not adapted to the structure and availability of our data: this estimator actually requires the presence, for each country, of at least three consecutive periods, but the analysis of data reveals that only the developed countries and some intermediary-level income countries (most of them from Latin America) meet this requirement. Using GMM would lead to a significant loss of information and a type of selection bias as only the countries which have a reliable and efficient statistical system (as well as a sufficient political control to make the government publish the statistics) would be included in the sample. Moreover, in each and every regressions, we corrected, using a bootstrap technique, the standard errors associated with instability variables since they are generated variables leading to bias in the second-step estimation.

We carried out similar work for the two kinds of crime: column (1) of each table is the baseline model, without any instability or volatility variable. This estimate includes both the Gini index and literacy rate, which are further dropped because these two variables do not have any significant effect and generate an important loss of observations. The Gini index, which comes from the WIDER database, is a very incomplete series (especially for developing countries) and has a small time variation. It is thus likely that the effect of this variable will be taken into account by the cross-section fixed-effects or that unobservable factors will have a simultaneous impact on both income inequality and crime, as suggested by Bourguignon (2001). For this reason, Neumayer (2005) argues that the macro-economic level may not be the most relevant one to study the link between inequality and crime. Literacy rate, taken from the *World Development Indicators* of the World Bank has the inverse bias since indicators for this variable do not contain any data for developed countries and also evidence slow variations over time. Therefore, we decided to drop these two variables in the following regressions.

<Table 1 here>

<Table 2 here>

According to column (2) of Table 1, GDP per capita level and growth rate have significant negative effects on the homicide rate and the percentage of young males in the population has a significant positive effect, as expected. However, the other control variables do not have any significant effect and the overall explanation power of the model is rather weak (R2 around 0.15). This result, which suggests that most homicides remain unexplained, is relatively frequent in literature (Fajnzylber et al. 2000): even if violence has some objective determinants, it remains mostly a random phenomenon. This argument is confirmed by the fact that the model is much more efficient for explaining the robbery rate (column (2) of Table 2). As we expected, the death penalty is the only insignificant variable, since it is normally not a sentence for robbery, and also because this variable does not vary enough over time to have any effect. It should also be noted that the urbanization rate has a surprisingly negative effect on robbery. Two explanations can be brought forward. Firstly, in a study of crime in Madagascar, Fafchamps & Moser (2003) found that it mainly occurs in the rural parts of the country and consists of cattle theft. Even if this study deals with only one country with specific characteristics, its results suggest the presence of a specific rural insecurity in developing countries. Furthermore, during the period considered (1980-97), countries with the highest urbanization level relatively to income were the developed ones, which also have smaller crime rates than developing countries.

The following columns show the results of estimates including instability variables. Columns (3) and (4) include the instability of agricultural added value and the instability of exports for each kind of crime, column (4) presents results where instability is computed when the trend is measured using the Hodrick & Prescott filter. These regressions were run on a limited sample due to the lower number of observations for these two kinds of instability. Finally, columns (5) to (7) include the instability of GDP per capita and the growth rate volatility.

Column (3) of Table 1 suggests a significantly positive and equally important effect of both agricultural added value and exports instabilities, even if it is rather small: a 1% increase in agricultural added value instability increases the homicide rate by 0.107%

(0.11% for exports instability). Table 1 also shows a significantly positive effect of both instability of GDP per capita and volatility of growth. If we turn to table 2, we can see that these two variables also have a significantly positive effect on robbery, which is not the case for the instability of agricultural added value and of exports. It seems that instability of income and growth volatility are more likely to be a factor of income smoothing (in an illegal manner) than exogenous shocks.

Let us now consider the evolution of the coefficients associated with instability when the period over which instability is taken into account varies. Results are presented in Table 3 for homicide and 4 for robbery. Coefficients of instability variables presented in these tables come from regressions identical to those presented in tables 1 and 2 respectively, with the "length" of instability varying. As such, coefficients presented in tables 3 and 4 when instability is computed on 8 years are identical to those presented in tables 1 and 2. Table 3 suggests that the effect of instability on homicide, however it is measured, decreases with the length of instability considered, even if it is always significant. Table 4 suggests the opposite behavior for the elasticity of robbery due to instability, namely this elasticity increases when the period considered for measuring instability decreases, though it is always insignificant for the agricultural added value and export instability. In other words, robbery is more an immediate response to instability, suggesting that it is actually used by some people to compensate for their income loss due to negative shocks and therefore as a mean of smoothing their consumption. Homicide, on the other hand, is a response to both short-term and long-term instability, which is consistent with the hypothesis of a frustration effect. Moreover, higher coefficients associated with long-term instability suggest that instability creates more anomie in the long run than in the short run.

<Table 3 here>

<Table 4 here>

We finally tested whether the effect of instability on crime depends on the macro institutional environment. Firstly, tables 5 and 6 showcase results of estimates where a dummy variable indicating whether a given country belongs to the OECD, for homicide and robbery respectively. As we have already pointed it out, this dummy variable can be introduced only as a multiplicative factor of instability since we used a fixed-effects estimator. Both tables show higher coefficients associated with instability variables on their own, suggesting a higher effect of instability on crime in non-OECD countries. Since we already controlled for the effect of the level of income (and its growth rate) on crime in each regression, the OECD dummy variable can be assumed to mainly measure differences of institutional environment between the two groups of countries. However, this variable has several limitations; firstly, it is a very indirect measure of institutional quality. Secondly, since it cannot be introduced additively, we are unable to estimate its direct effect.

<Table 5 here>

<Table 6 here>

In order to bypass these issues, we turned to another, more direct and more accurate measurement of institutional quality, by using the composite ICRG index. However, since the ICRG database only began in 1984, the introduction of this variable involves the suppression of the first period covered and a drop in the number of observations. Results are presented in tables 7 and 8 for homicide and robbery respectively. The coefficients associated with the variable of interaction between instability and the ICRG composite index tend to have the expected negative sign even if they are not always significant: the weaker the institutions are, the stronger the effect of instability on crime. Furthermore, the direct effect of instability variables is normally less significant than in the preceding estimates. It suggests that once the direct effect of institutional quality on crime is taken into account, the effect of instability is weaker, supporting the hypothesis that the impact of instability on crime depends on the institutional environment. Finally, in most of the regressions, the ICRG composite index has no direct significant effect on crime.

We also remarked that the elasticities of homicide to the instability of income and to growth volatility are similar, while the level of the elasticities of robbery to instability of income is about twice the level of its elasticities to growth volatility. Since instability of income is measured with regards to a mixed trend which already captures permanent shocks through the lagged variable, while growth volatility reflects both permanent and transitory shocks, we can consider that homicide does not react differently to transitory and permanent shocks, while robbery reacts more to transitory than to permanent ones. This is consistent with our hypothesis that instability influences robbery through the need to smooth income, which is relatively more sensitive to transitory shocks than the instability-induced frustration which is assumed to influence homicide.

<Table 7 here>

<Table 8 here>

5 Conclusion

This paper has considered the impact of macro-economic instability and volatility on crime in an international perspective. Using a panel of developed and developing countries for a maximum of six three-year periods from 1980 to 1997, estimates of the determinants of crime suggest a positive effect of previous macro-economic instability (or growth volatility) on homicide, assumed to be the result of frustration generated by instability, through inaccurate expectations. Instability also leads to increases in robbery, which can be seen as an illegal way of smoothing income. However, this impact of instability is significant only in non-OECD countries, suggesting that the effect of instability on property crime depends on the institutional environment. Of course, the instability variables considered in this paper, as well as other economic variables examined in literature, can only explain a fraction of crime committed.

These results evidence a negative effect of macro-economic instability, which, as far as we know, has yet to be studied. They supplement arguments in favor of policies which aim to reduce macro vulnerability to shocks in developing countries.

Table 1: Determinants of homicide rate: simple model (fixed effects) of the impact of instability

	(1)	(2)	(3)	(4) HP	(5)	(6) HP	(7)
ln(GDP per capita)	-0.491	-0.379	-0.159	-0.186	-0.293	-0.303	-0.287
	(2.65)***	(4.29)***	(1.10)	(1.28)	(2.59)***	(2.69)***	(2.60)***
GDP growth rate	-0.013	-0.007	-0.010	-0.009	-0.004	-0.006	-0.004
	(2.06)**	(2.50)**	(2.02)**	(1.81)*	(1.18)	(1.46)	(1.04)
Death penalty	0.054	0.031	-0.016	-0.010	-0.025	-0.037	-0.047
	(0.28)	(0.38)	(0.16)	(0.10)	(0.26)	(0.39)	(0.50)
Gini index	-0.013						
	(1.66)						
Literacy rate	-0.008						
	(0.45)						
Urbanization rate	0.014	-0.004	0.009	0.011	0.000	0.000	-0.000
	(1.04)	(0.66)	(1.36)	(1.50)	(0.02)	(0.05)	(0.01)
Male 15-64 year-old	-0.000	0.046	0.031	0.031	0.049	0.069	0.049
	(0.01)	(2.24)**	(0.95)	(0.96)	(2.25)**	(2.83)***	(2.26)**
Female labor force participation	0.002	0.003	0.021	0.023	0.012	0.010	0.014
	(0.07)	(0.30)	(1.89)*	(1.98)**	(1.21)	(0.93)	(1.34)
ln(AVA instability)			0.107	0.101			
			(2.43)**	(1.96)**			
ln(Exports instability)			0.110	0.107			
			(2.80)***	(3.02)***			
ln(GDP per capita instability)					0.078	0.106	
					(2.14)**	(2.96)***	
ln(Growth volatility)							0.073
							(3.76)***
Observations	169	596	400	399	525	523	525
Countries	63	137	105	105	132	132	132
R^2	0.31	0.15	0.16	0.14	0.11	0.13	0.13

Dependent variable in logs. AVA: agricultural value added. HP: Hodrick-Prescott.
The length of instability and volatility is 8 years.
Robust t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2: Determinants of robbery rate: simple model (fixed effects) of the impact of instability

	(1)	(2)	(3)	(4) HP	(5)	(6) HP	(7)
ln(GDP per capita)	10.423	5.283	6.656	6.869	5.902	5.994	6.022
	(3.32)***	(3.55)***	(3.92)***	(4.16)***	(3.89)***	(3.93)***	(3.93)***
ln(GDP per capita)^2	-0.618	-0.314	-0.373	-0.384	-0.335	-0.342	-0.348
	(3.20)***	(3.60)***	(3.73)***	(3.93)***	(3.79)***	(3.86)***	(3.90)***
GDP growth rate	-0.011	-0.018	-0.014	-0.014	-0.024	-0.021	-0.021
	(0.66)	(2.12)**	(1.15)	(1.16)	(2.46)**	(2.22)**	(2.16)**
Death penalty	0.226	-0.248	-0.463	-0.470	-0.160	-0.143	-0.192
	(0.38)	(1.02)	(1.49)	(1.52)	(0.65)	(0.57)	(0.78)
Gini index	0.008						
	(0.50)						
Literacy rate	-0.066						
	(1.54)						
Urbanization rate	-0.004	-0.028	-0.016	-0.018	-0.027	-0.027	-0.028
	(0.12)	(1.94)*	(0.97)	(1.09)	(1.90)*	(1.85)*	(1.90)*
Male 15-64 year-old	0.024	0.113	-0.033	-0.020	0.104	0.103	0.103
	(0.19)	(2.19)**	(0.48)	(0.29)	(2.04)**	(2.01)**	(2.00)**
Female labor force participation	-0.011	0.057	0.054	0.054	0.065	0.068	0.064
	(0.15)	(2.14)**	(1.67)*	(1.68)*	(2.43)**	(2.50)**	(2.37)**
ln(AVA instability)			-0.008	0.007			
			(0.07)	(0.05)			
ln(Exports instability)			0.018	0.006			
			(0.14)	(0.06)			
ln(GDP per capita instability)					0.197	0.192	
					(1.73)*	(1.67)*	
ln(Growth volatility)							0.091
							(1.81)*
Observations	130	274	234	233	269	269	269
Countries	53	88	76	76	87	87	87
R^2	0.42	0.37	0.42	0.43	0.39	0.39	0.38

Dependent variable in logs. AVA: agricultural value added. HP: Hodrick-Prescott.
The length of instability and volatility is 8 years.
Robust t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Elasticity of homicide rate to instability depends on the length of instability

Number of years	AVA instability		Exports instability		GDP per capita instability		Growth volatility
	EE	HP	EE	HP	EE	HP	
10	0.126**	0.135**	0.106**	0.105**	0.079**	0.105***	0.090***
8	0.106**	0.101*	0.110***	0.107***	0.078**	0.106***	0.073***
6	0.082***	0.081**	0.118***	0.105***	0.066**	0.084***	0.048***
5	0.085***	0.096***	0.098***	0.094***	0.057**	0.065**	0.039***
4	0.089***	0.094***	0.090***	0.084***	0.059**	0.071***	0.033**

Dependent variable in logs. AVA: agricultural value added. EE: econometric estimation. HP: Hodrick-Prescott.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Elasticity of robbery rate to instability depends on the length of instability

Number of years	AVA instability		Exports instability		GDP per capita instability		Growth volatility
	EE	HP	EE	HP	EE	HP	
10	-0.016	0.034	0.022	0.023	0.122	0.127	0.021
8	-0.008	0.007	0.018	0.006	0.197*	0.192	0.091*
6	-0.049	-0.044	0.001	-0.004	0.206**	0.203**	0.099**
5	-0.045	-0.041	-0.013	-0.003	0.228**	0.219**	0.086**
4	-0.026	-0.021	0.030	0.032	0.194**	0.217**	0.078***

Dependent variable in logs. AVA: agricultural value added. EE: econometric estimation. HP: Hodrick-Prescott.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Impact of instability on homicide rate in OECD and non OECD countries

	(1)	(2) HP	(3)	(4) HP	(5)
ln(GDP per capita)	-0.188	-0.220	-0.289	-0.280	-0.278
	(1.29)	(1.49)	(2.56)**	(2.47)**	(2.51)**
GDP growth rate	-0.010	-0.009	-0.004	-0.005	-0.004
	(1.96)*	(1.81)*	(1.15)	(1.43)	(1.00)
Death penalty	-0.044	-0.046	-0.034	-0.072	-0.064
	(0.43)	(0.45)	(0.35)	(0.75)	(0.66)
Urbanization rate	0.009	0.010	0.000	0.000	0.001
	(1.29)	(1.43)	(0.04)	(0.03)	(0.11)
Male 15-64 year-old	0.036	0.035	0.048	0.063	0.046
	(1.11)	(1.08)	(2.17)**	(2.57)**	(2.11)**
Female labor force participation	0.019	0.021	0.012	0.009	0.012
	(1.64)	(1.78)*	(1.15)	(0.85)	(1.21)
ln(AVA instability)	0.118	0.105			
	(1.98)**	(1.57)			
ln(Exports instability)	0.128	0.136			
	(2.42)**	(2.73)***			
ln(GDP per capita instability)			0.084	0.131	
			(1.99)**	(3.08)***	
ln(Growth volatility)					0.083
					(3.87)***
ln(AVA instability)*OECD	-0.075	-0.035			
	(0.90)	(0.38)			
ln(Exports instability)*OECD	-0.073	-0.117			
	(1.21)	(2.00)**			
ln(GDP per capita instability)*OECD			-0.054	-0.154	
			(0.89)	(2.42)**	
ln(Growth volatility)*OECD					-0.056
					(1.07)
Observations	400	399	525	523	525
Countries	105	105	132	132	132
R^2	0.17	0.15	0.11	0.13	0.13

Dependent variable in logs. AVA: agricultural value added. HP: Hodrick-Prescott.
The length of instability and volatility is 8 years.
Robust t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Impact of instability on robbery rate in OECD and non OECD countries

	(1)	(2) HP	(3)	(4) HP	(5)
ln(GDP per capita)	7.291	7.683	6.453	6.151	6.370
	(3.85)***	(4.07)***	(4.21)***	(4.02)***	(4.13)***
ln(GDP per capita)^2	-0.415	-0.435	-0.362	-0.349	-0.367
	(3.73)***	(3.91)***	(4.08)***	(3.93)***	(4.10)***
GDP growth rate	-0.013	-0.011	-0.027	-0.022	-0.022
	(1.02)	(0.91)	(2.77)***	(2.33)**	(2.32)**
Death penalty	-0.563	-0.560	-0.225	-0.196	-0.222
	(1.78)*	(1.79)*	(0.91)	(0.77)	(0.90)
Urbanization rate	-0.019	-0.022	-0.030	-0.029	-0.028
	(1.17)	(1.28)	(2.11)**	(1.97)*	(1.91)*
Male 15-64 year-old	-0.020	-0.008	0.102	0.104	0.100
	(0.30)	(0.12)	(2.01)**	(2.01)**	(1.94)*
Female labor force participation	0.054	0.056	0.059	0.063	0.055
	(1.68)*	(1.75)*	(2.20)**	(2.31)**	(2.03)**
ln(AVA instability)	0.048	0.093			
	(0.25)	(0.42)			
ln(Exports instability)	0.122	0.126			
	(0.51)	(0.57)			
ln(GDP per capita instability)			0.356	0.278	
			(1.87)*	(1.46)	
ln(Growth volatility)					0.168
					(2.43)**
ln(AVA instability)*OECD	-0.147	-0.184			
	(0.67)	(0.70)			
ln(Exports instability)*OECD	-0.248	-0.237			
	(0.89)	(0.95)			
ln(GDP per capita instability)*OECD			-0.336	-0.182	
			(1.49)	(0.78)	
ln(Growth volatility)*OECD					-0.164
					(1.62)
Observations	234	233	269	269	269
Countries	76	76	87	87	87
R^2	0.43	0.44	0.40	0.39	0.39

Dependent variable in logs. AVA: agricultural value added. HP: Hodrick-Prescott.
The length of instability and volatility is 8 years.
Robust t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Elasticity of homicide rate to instability depending on the quality of institutions (ICRG composite index)

	(1)	(2) HP	(3)	(4) HP	(5)
ln(GDP per capita)	-0.402	-0.452	-0.237	-0.290	-0.270
	(2.09)**	(2.32)**	(1.40)	(1.70)*	(1.61)
GDP growth rate	-0.007	-0.006	0.001	-0.000	0.002
	(1.06)	(0.84)	(0.14)	(0.01)	(0.31)
Death penalty	-0.030	-0.026	-0.069	-0.072	-0.078
	(0.22)	(0.19)	(0.49)	(0.51)	(0.57)
Urbanization rate	0.009	0.011	0.013	0.012	0.013
	(0.94)	(1.16)	(1.51)	(1.35)	(1.50)
Male 15-64 year-old	-0.000	0.001	0.034	0.054	0.022
	(0.01)	(0.02)	(1.22)	(1.66)*	(0.76)
Female labor force participation	0.025	0.029	0.021	0.013	0.019
	(1.41)	(1.58)	(1.27)	(0.78)	(1.18)
ICRG	-0.015	-0.018	0.003	0.000	0.015
	(1.44)	(1.63)	(0.58)	(0.04)	(2.50)**
ln(AVA instability)	0.497	0.473			
	(1.87)*	(1.61)			
ln(Exports instability)	0.108	0.187			
	(0.37)	(0.62)			
ln(GDP per capita instability)			0.235	0.370	
			(0.83)	(1.30)	
ln(Growth volatility)					0.261
					(2.34)**
ln(AVA instability)*ICRG	-0.007	-0.006			
	(1.80)*	(1.62)			
ln(Exports instability)*ICRG	0.000	-0.001			
	(0.03)	(0.27)			
ln(GDP per capita instability)*ICRG			-0.003	-0.005	
			(0.75)	(1.31)	
ln(Growth volatility)*ICRG					-0.003
					(1.99)**
Observations	312	312	385	383	385
Countries	87	87	106	106	106
R^2	0.16	0.15	0.08	0.08	0.09

Dependent variable in logs. AVA: agricultural value added. HP: Hodrick-Prescott.
The length of instability and volatility is 8 years.
Robust t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Elasticity of robbery rate to instability depending on the quality of institutions (ICRG composite index)

	(1)	(2) HP	(3)	(4) HP	(5)
ln(GDP per capita)	2.796	2.986	3.184	2.885	3.053
	(1.70)*	(1.81)*	(1.94)*	(1.72)*	(1.83)*
ln(GDP per capita)^2	-0.167	-0.181	-0.191	-0.177	-0.190
	(1.76)*	(1.89)*	(2.05)**	(1.86)*	(2.02)**
GDP growth rate	-0.031	-0.028	-0.025	-0.018	-0.016
	(2.52)**	(2.34)**	(2.20)**	(1.56)	(1.42)
Death penalty	-0.525	-0.523	-0.034	-0.065	-0.072
	(2.08)**	(2.09)**	(0.14)	(0.26)	(0.30)
Urbanization rate	-0.009	-0.010	-0.022	-0.023	-0.019
	(0.46)	(0.49)	(1.33)	(1.36)	(1.12)
Male 15-64 year-old	-0.115	-0.101	0.072	0.075	0.066
	(1.72)*	(1.53)	(1.43)	(1.43)	(1.26)
Female labor force participation	0.014	0.017	0.045	0.046	0.045
	(0.45)	(0.54)	(1.47)	(1.46)	(1.42)
ICRG	-0.016	-0.027	-0.022	-0.017	-0.003
	(0.75)	(1.14)	(2.47)**	(1.95)*	(0.35)
ln(AVA instability)	0.462	0.550			
	(1.08)	(1.20)			
ln(Exports instability)	-0.126	0.077			
	(0.31)	(0.18)			
ln(GDP per capita instability)			0.816	0.519	
			(1.40)	(0.83)	
ln(Growth volatility)					0.404
					(1.79)*
ln(AVA instability)*ICRG	-0.006	-0.007			
	(1.08)	(1.20)			
ln(Exports instability)*ICRG	0.001	-0.002			
	(0.21)	(0.31)			
ln(GDP per capita instability)*ICRG			-0.008	-0.005	
			(1.14)	(0.64)	
ln(Growth volatility)*ICRG					-0.004
					(1.36)
Observations	196	195	217	217	217
Countries	65	65	71	71	71
R^2	0.41	0.41	0.33	0.30	0.31

Dependent variable in logs. AVA: agricultural value added. HP: Hodrick-Prescott.
The length of instability and volatility is 8 years.
Robust t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

References

Becker, G. (1968), ‘Crime and Punishment: an Economic Approach’, *Journal of Political Economy* **76**, 169–217.

Bourguignon, F. (2001), Crime as a Social Cost of Poverty and Inequality: A Review Focusing on Developing Countries, *in* S. Yusuf, S. Evenett & W. Wu, eds, ‘Facets of Globalization. International and Local Dimensions of Development’, World Bank.

Ehrlich, I. (1973), ‘Participation in Illegitimate Activities: a Theoretical and Empirical Investigation’, *Journal of Political Economy* **81**, 521–565.

Fafchamps, M. & Moser, C. (2003), ‘Crime, Isolation, and Law Enforcement’, *Journal of African Economies* **12**(4), 625–671.

Fajnzylber, P., Lederman, D. & Loayza, N. (2000), ‘Crime and Victimization: an Economic Perspective’, *Economia* **1**(1), 219–302.

Fajnzylber, P., Lederman, D. & Loayza, N. (2002), ‘What Causes Violent Crime?’, *European Economic Review* **46**, 1323–1357.

Fougère, D., Kramatz, F. & Pouget, J. (2005), ‘L’analyse économétrique de la délinquance. Une synthèse de résultats récents’, *Revue Française d’Economie* **19**(3), 3–55.

Glaeser, E. & Sacerdote, B. (1999), ‘Why Is There More Crime in Cities?’, *Journal of Political Economy* **107**(6), 225–258.

Guillaumont, P. (2005), ‘Macroeconomic Vulnerability and Aid Response’, ABCDE Europe Conference, Armsterdam.

Guillaumont, P., Guillaumont Jeanneney, S. & Brun, J.-F. (1999), ‘How Instability Lowers African Growth’, *Journal of African Economies* **8**(1), 87–107.

Hnatkovska, V. & Loayza, N. (2004), Volatility and Growth, World Bank Policy Research Working Paper WPS3184.

Hodrick, R. & Prescott, E. (1997), 'Postwar U.S. Business Cycles: An Empirical Investigation', *Journal of Money, Credit and Banking* **29**(1), 1–16.

Levitt, S. (1997), 'Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime', *American Economic Review* **87**(3), 270–290.

Miguel, E. (2005), 'Poverty and Witch Killing', *Review of Economic Studies* .

Miguel, E., Satyanath, S. & Sergenti, E. (2004), 'Economic Shocks and Civil Conflict: an Instrumental Variables Approach', *Journal of Political Economy* **112**(4), 725–753.

Neumayer, E. (2003), 'Good Policy Can Lower Violent Crime: Evidence from a Cross-National Panel of Homicide Rates, 1980-97', *Journal of Peace Research* **40**(6), 619–640.

Neumayer, E. (2005), 'Inequality and Violent Crime: Evidence from Data on Robbery and Violent Theft', *Journal of Peace Research* **42**(1), 101–112.

Ramey, G. & Ramey, V. (1995), 'Cross-Country Evidence on the Link Between Volatility and Growth', *American Economic Review* **85**(5), 1138–1151.

Soares, R. (2004), 'Development, Crime and Punishment: Accounting for the International Differences in Crime Rates', *Journal of Development Economics* **73**, 155–184.

United Nations (2000), 'Poverty Amidst Riches: The Need for Change', Report of the Committee for Development Policy on the Second Session.