Crime, Transition, and Growth

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Abstract

This paper analyses whether the effect of crime on growth depends on the structural changes caused by transition. The result of the simple model suggests that when the structure of economy changes, the cost of economically motivated crime will also change; thus, affecting the impact of crime on economic performance. Using data for some of the republics of the former Soviet Union, we find support for this conjecture.

Key words: *growth, crime, transition economies*

JEL Code: P26, P52, O57, O17

1 Introduction

Crime imposes significant costs on the society due to the consumption of illegal products and/or the negative externality associated with illegal activities (Czabanski, 2008). As a result of the significance of the economic costs of crime, over the last three decades an increasing number of studies have focused on this topic. However, despite the growing research in this field, so far no empirical study on the impact of crime examines how the transition from a command economy to a market based economy influences the effects of crime on growth.

In order to address the aforementioned gap in the existing literature, we analyse how the structural changes occurred during transition influence the impact of crime on growth. To guide our empirical analysis, we develop a simple growth model where the criminal activities affect economic outcomes, given the costs associated with the criminal activities. Namely, in the model, we link both the cost of criminal

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activity and the gains from it to the structure of the economy. Based on the analysis of the model, we obtain some insights into how the effect of crime on the economy may change as the structure of the economy changes. We then provide empirical evidence on how the effect of crime on economic growth has changed in some of the former USSR economies during the 1985-2010 transition that had led to a change in the structure of the economy in those countries.

In building our model we employ the reasoning proposed in the extant literature. Specifically, in his influential paper, Becker(1968) provides an economic rationale to criminal activities as well as optimal policies to combat illegal behaviour; that is, the criminals respond to economic incentives in the same way as the law-abiding citizens. The results of the model predict that the law enforcement depends on the probability of detection of a crime and the severity of the punishment. Ehrlich (1973) theoretically models the participation of individuals in illegitimate activities, and tests his model using US state data. He finds that inequalities increase the level of crime, especially crime against property; while, the probability of being caught discourages the crime. We follow Becker (1968) and Ehrlich (1973) in terms of determining the incidence of crime, but also extend their approach by assuming that parameters such as the probability of detection or the cost of criminal activity also depend on the institutional aspects of the economy. In addition, the structural changes in the economy influence criminal activities by altering both the marginal productivity of criminal effort and the costs associated with crime.

In existing empirical studies, the effect of crime on growth has not been found to be unambiguously negative. For example, the World Bank study (2006), based on data from 43 countries for 1975-2000, reports results suggesting a strong negative effect of crime on growth. Càrdenas (2007) also finds a significantly negative association between crime and per-capita output growth in a panel of 65 countries using homicide data for 1971-1999. On the other hand, Mauro and Carmeci (2007) find that crime has a negative impact on income levels but exerts no significant long-run adverse effect on growth rates. Moreover, most of the published literature (Glaeser et al., 1996; Fajnzylber et al., 2002a; 2002b) has focused on the determinants of crime; however, crime, as one of the determinants of economic growth, largely remains neglected in the macroeconomic framework (Detotto and Otranto, 2010). Olavarria-Gambi (2007) estimates an aggregate burden of crime for Chile in 2002 at 2.06 percent of the GDP.

As aforementioned, the relationship between crime and certain economic indicators has been under some empirical scrutiny. One strand of the empirical studies on the effect of crime attempted to explain the difference in economic performance across countries due to the difference in the incidence of crime along with other variables (Sandler and Enders, 2008; Barro, 1996; Gardenas, 2007; Gaibulloev and Sandler, 2008). The other strand of the relevant empirical studies employ time series estimation methods and examines whether there is a causal relationship between crime and certain economic variables (Neanidis and Papadopoulou, 2013; Mauro and Garmeci, 2007; Gardenas, 2007; Habibullah and Baharom, 2009; Detotto and Pulin, 2009; Chen, 2009; Narayan and Smyth , 2004). Along the lines of the latter literature, Detotto and Otranto (2010) address two questions: first, whether the economic effect of crime depends on the level of the crime rate, and second, whether crime affects the economy differently depending on the business cycle. However, as there were no institutional changes in the subject country (Italy) during the examination period, Detotto and Otranto (2010) could not test the effect crime had on growth as a result of changes in the structure of the economy. Given this gap in the existing literature, this paper contributes by analysing and thus providing new insights on the effect of crime on economic growth as a result of structural changes in the economy.

Additionally, there are some shortcomings in the empirical literature stemming from the use of proxies when it comes to crime rather than actual measures of the degree of crime. Some studies (for example, Powell et al., 2010) using cross-country data do not explicitly control for crime but instead use proxy variables such as the "rule of law", "political stability", "civil liberties", "corruption rate", "government leadership", "inequality" amongst other variables. We attempt to address this shortcoming by using a measure of crime calculated based on the actual data of the number of crimes committed in country at a given period of time.

In terms of the broader framework pertaining to the analysis of economic growth, our study is in line with the existing literature. In particular, Barro (1991) considers various determinants of growth and finds that political instability negatively influences economic growth. In his study he uses two variables as measures of political instability, the number of revolutions and coups per year and the number of political assassinations per million of the population per year. He finds that across countries both variables are statistically significant and negatively correlated with growth. In another cross-country analysis of growth, Barro and Sala-i-Martin (1995) find that political instability has a detrimental impact on growth, whereas a stronger rule of law has a positive and significant effect on growth. Additionally, using a sample of 53 developing countries from 1984 to 1995, Poirson (1998) finds that stronger economic security contributed significantly to private investment and growth. Specifically, he finds that in the short run, reductions in expropriation risk and terrorism influence growth positively, while in the long-run, corruption and contract repudiation affect growth negatively in the long run. In view of the aforementioned works, the framework we employ in this study assumes that the general institutional structure significantly influence the effect of crime on economic growth.

While there are number of studies examining the effect of crime on growth in developing economies, no study to date examines the effect of crime on growth in a transitioning economy. It is well-known that in the former Soviet Union countries, there was an expansion of illegal activities during the early years of transition. Shelly (1995) attributes this phenomenon to the insecurity of capital, money laundering, the growth of organised crime and the ineffective policies that were in place to fight crime in Russia and the Commonwealth of Independent States (CIS) countries. The transition caused deep structural changes that might have also affected how the criminal operate in the former USSR countries. For example, the transition affected the structure of property rights significantly due to the large scale of privatisation programs implemented in al of the former USSR countries. In fact, it has been highlighted that in early stages of the post Soviet transition, property rights were quite weak in most of the former Soviet economies (Sonin, 2003; Braguinsky and Myerson, 2007a, 2007b). Although it has been highlighted that such economies develop either a system with weak property rights and rent-seeking or with strong property rights imposed by a dictator (see e.g. Hafer, 2006; Guriev and Sonin, 2009). In light of this, our study attempts to gain new insights into the relationship between crime and growth.

Our analysis yields the following results. The main result is that the private property rights and other structural changes that emerged after the collapse of the command economy played a positive role in decreasing the negative effect of crime on economic growth. Specifically, we find that during the transition, decline in the negative effect of crime can be attributed to the structural changes. This result is indirectly supported by the finding of Detotto and Otranto (2010), who find during recessions there in an increase in the negative effect of crime. Namely, given that during the transition all the former USSR economies experienced an economic recession, the expected increase in the negative effect of crime on growth was lessened by the structural changes in the economy. The main structural changes appear to come in the form of increased productivity of crime (due to stronger organisation of crime) and reduced pool of felonious agents (most likely implemented by a dictatorship-type governance). In addition, unlike Detotto and Otranto (2010), we find that the marginal effect of crime depends on the level of crime. We explain this difference as a result of the structural changes that had occurred during the transition of the economies of the former USSR that we consider in our empirical analysis.

2 Model

There are two types of agents: law-abiding and felonious. Assume that there is a fixed measure of mass of citizens, λ, are potential criminals, while $1-\lambda$ are the law-abiding citizens.

Criminal agent

A fraction $\varepsilon \in (0,1)$ of felonious agents choose to be criminal. Those who are a criminal-type choose the level of their effort, $\phi_t \in (0,1)$, in criminal activities. This implies that the intensity of crime is determined by $\phi_t \varepsilon$. The criminals receive illegal income from each victim, given as $\tau_t = \theta\phi_t$, where θ is the productivity of criminal activities. One way to model this the productivity of criminals is to state it as a function that depends on the wage rate in the economy, as with higher income of the citizens, crime allows to capture more income for any given effort. We assume that $\theta = \theta_0 w_t^{\zeta}$, where θ_0 and $\zeta < 1$ are parameters. There are $n = \frac{1-\lambda}{\varepsilon\lambda}$ victims per a given felonious agent.

The criminals can be detected with probability, p, for their crimes, and incur costs, x_t. The magnitude of this cost depends positively on the extent of the crime and this cost is increasing with the income generated in criminal activities; that is, the worse the crime the higher the cost. For tractibility sake, we assume that this cost can be captured by a quadratic function of the income from criminal activities. In addition, there is externality from the overall criminal rate in the economy. The more agents choose to be criminal the less becomes the cost of criminal activity. Therefore, the cost faced by a felonious agent is given by:

$$x = \eta(1-\varepsilon){\tau_t}^2, \tag{1}$$

where η is an exogenous cost parameter. The probability of detection, p, along with the parameters that drive the costs associated with crime depend on the economy's institutional setting.

We link the cost of crime to the structural changes that take place when an economy transitions from a command driven to a market driven economy. These resulting structural changes give rise to private property rights and protection, altering the cost of running criminal activities, and hence, the effect of crime on economic growth. This conjecture is based on the following analytical findings.

In order to capture the structural differences between the two types of economies, command versus market-based, we use the rationale given in Besley and Ghatak (2010). They argue that in an environment where public ownership of capital is combined with a socialist regime, the wage rate would be set below the incentive-compatible level. In our context, this can be expressed as the optimal wage rate with some level of tax, π. In general, this formulation implies that the tax rate under the command economy regime is higher than under the market economy regime. That is, the effective wage rate for the agent is given as $(1-\pi)w_t$, where w_t is the gross wage rate. However, this does not imply that the effective wage rate is lower under command economy by definition, as the effective wage rate also depends on the gross wage rate, w_t. Therefore, even if π is higher in the command economy, if the gross wage rate, w_t, is high enough, then it is possible that the effective wage, $(1-\pi)w_t$, is higher than in a market economy with lower taxes and gross wage rate.

If an agent is engaged in criminal activities, then he or she can work in the official sector. This does not look far fetched. However, given that part of their time is dedicated to criminal activities, the time spent working in the legal sector should decrease. In light of this discussion, the income of the felonious-type agent is given by

$$\begin{cases} (1-\pi)w_t + r_t k_{1t} & \text{with prob. } (1-\varepsilon) \\ (1-\phi)(1-\pi)w_t + r_t k_{1t} + \phi[n\tau_t - px_t] & \text{with prob. } \varepsilon \end{cases}$$

where r_t is the rate of return to capital and k_t is the stock of capital per worker.

Given this, the felonious-type agent solves the following problem:

$$\max_{c,\phi,\varepsilon} U = \int_0^\infty \ln(c_{1t}) e^{-\rho t} dt, \tag{2}$$

s.t.

$$\dot{k}_{1t} = (1-\pi)w_t(1-\varepsilon\phi_t) + r_t k_{1t} + \phi(n\tau_t - px_t), \tag{3}$$

$$\tau_t = \theta\phi_t, \tag{4}$$

$$x_t = \eta(1-\varepsilon){\tau_t}^2. \tag{5}$$

To solve this problem, we construct a present-value Hamiltonian:

$$H = \ln(c_{1t})e^{-\rho t} + v_1[(1-\pi)w_t(1-\phi_t\varepsilon) + r_t k_{1t} + \varepsilon(n\tau_t - px_t)]. \tag{6}$$

The first-order conditions with regard to choice and state variables yield the following:

$$\frac{\partial H}{\partial c_{1t}} = \frac{e^{-\rho t}}{c_{1t}} - v_1 = 0. \tag{7}$$

$$\frac{\partial H}{\partial \phi} = v_1 \left[-(1-\pi)w_t\varepsilon + \varepsilon\left(n\theta - 2p\eta(1-\varepsilon)\theta^2\phi_t\right)\right] = 0. \tag{8}$$

$$\frac{\partial H}{\partial \varepsilon} = v_1 \left[-(1-\pi)w_t\phi + \varepsilon\left(p\eta(\theta\phi_t)^2\right)\right] = 0. \tag{9}$$

$$-\dot{v}_1 = \frac{\partial H}{\partial k_{1t}} \Rightarrow \dot{v}_1 = -v_1 r_t. \tag{10}$$

From (8) we obtain the equilibrium share of criminal agents:

$$-(1-\pi)w + (n\theta - 2p\eta(1-\varepsilon)\theta\phi) = 0.$$

Solving this for ε,

$$\varepsilon_t^* = 1 - \frac{(1-\pi)w_t - \eta\theta}{2p\eta\phi\theta}. \tag{11}$$

Solving (9), we write:

$$\varepsilon^* = \frac{(1-\pi)w}{p\eta\phi\theta^2} \tag{12}$$

Equalising (11) and (12) we write:

$$1 - \frac{(1-\pi)w_t - \eta\theta}{2p\eta\phi\theta} = \frac{(1-\pi)w}{p\eta\phi\theta^2}. \tag{13}$$

Solving (13) for ϕ we obtain:

$$\phi^* = \frac{(1-\pi)w(2+\theta) + n\theta^2}{2p\eta\theta^2}. \tag{14}$$

By analysing (14) and accounting for $\theta = \theta_0 w_t^{\zeta}$, we can state the following.

Lemma 2.1 *Criminal effort, ϕ, increases together with the wage rate if $\zeta < 1/2$ and de-*

creases if otherwise. An increase in the cost of criminal activities or the probability of detection, reduces criminal effort.

By substituting for ϕ in (12) we obtain:

$$\varepsilon^* = \frac{2(1-\pi)w}{(1-\pi)w(2+\theta)+n\theta^2}. \tag{15}$$

Now, using (15), we state the following.

Lemma 2.2 *The incidence of crime, ε, decreases together with the wage rate. An increase in the spread of crime (lower n), increases the incidence of crime.*

Accounting for $\theta = \theta_0 w_t^{\zeta}$ and using (14) and (15), we write that the optimal intensity of crime, $\phi^*\varepsilon^*$, as follows:

$$\phi^*\varepsilon^* = \frac{(1-\pi)w^{1-2\zeta}}{p\eta\theta_0^2} \tag{16}$$

Analysing the equilibrium value of the criminal intensity given above, we can state the following:

Proposition 2.3 *The criminal intensity decreases with the productivity of crime stemming from institutional setting,(θ_0), tax burden , (π), the probability of detection (p), and the cost associated with the crime (η). On the other hand, the criminal intensity increases with the wage rate, w, if $\zeta < 1/2$, and decreases if $\zeta > 1/2$.*

Proof The result is straightforward by considering the comparative statics of (16).

The above result indicates that a transition to a market economy as a result of an increase in the effective wage rate raises both the opportunity cost of crime and its productivity. However, which effect dominates is determined on whether the marginal elasticity of productivity of crime is higher than a certain threshold or not; that is, if $\zeta > 1/2$ holds or not. Apparently, the productivity of crime depends on the institutional environment. Thus, if the institutional setting is not facilitating for criminal activities then rising wage rates result in falling criminal intensity. In addition to the above, other changes are possible as well; for example, the productivity associated with the criminal activities may rise due to a increase the value of parameter θ_0. The value of θ_0 may increase by weakened property rights and growth of organised crime (Shelly, 1995; Sonin, 2003; Braguinsky and Myerson, 2007a, 2007b), or it may decrease if the form of governance turns into a dictatorship type (Guriev and Sonin, 2009). Whether these effects of structural changes actually take place is, of course, an empirical question, which we will deal with in section 3.

Law-abiding agent

The law-abiding agent works full time at the firm and rents out all his capital to the firm. If this agent falls victim to a criminal act with the probability of q, the agent will incur a loss of his or her income, given by τ. The agent solves the following problem:

$$\max_{c} U_1 = \int_{0}^{\infty} \ln(c_{2t}) e^{-\rho t} dt, \tag{17}$$

s.t.

$$\dot{k}_{2t} = (1-\pi) w_t + r_t k_{2t} - q\tau, \tag{18}$$

$$q = \frac{\varepsilon(1-\lambda)}{\lambda}. \tag{19}$$

It can be verified that the optimisation problem faced by this type of agent leads to a similar consumption growth rate as that of the felonious agent. That is,

$$\frac{\dot{c}_{2t}}{c_{2t}} = r - \rho. \tag{20}$$

The firm

Due to constant returns to scale we can assume that there is only one firm in the economy, which operates based on the following technology:

$$Y_t = A K_t{}^{\alpha} (L_t(1-\phi\varepsilon))^{1-\alpha}, \tag{21}$$

where A is the productivity coefficient, K_t is the aggregate stock of capital, L_t is total labour, $0 < \alpha < 1$ is the output elasticity of capital . In per capita terms, we can write

$$y_t = Ak^{\alpha}(1-\phi\varepsilon)^{1-\alpha}. \tag{22}$$

We assume that the productivity coefficient $A = A(\phi\varepsilon)$ is such that $A'_{\phi\varepsilon} < 0$, $A''_{\phi\varepsilon} < 0$. The firm maximises its profits according to the following:

$$\max_k \Pi = Ak_t^{\alpha}(1-\phi\varepsilon)^{1-\alpha} - (1-\pi)w_t(1-\phi\varepsilon\lambda) - rk_t. \tag{23}$$

The solution to this problem is given as:

$$\frac{\partial \Pi}{\partial k} = 0 \Rightarrow r_t = A\alpha k_t^{\alpha-1}(1-\phi\varepsilon)^{1-\alpha}. \tag{24}$$

The growth rate

Let us consider the effect of crime on the growth rate defined by equation (20). This analysis leads to the following proposition.

Proposition 2.4 *If the intensity of crime is falling in the wage rate ($\zeta > 1/2$), the negative effect of crime on economy's growth is declining with further growth. However, this also implies that if the intensity of crime is rising in the wage rate ($\zeta < 1/2$), then the negative feedback from crime to economic growth can limit growth rates and create a trap.*

Proof Combining (17) and (24) we can write the growth rate of the economy as:

$$g = \frac{\dot{c}_t}{c_t} = A\alpha k_t^{\alpha-1}(1-\phi\varepsilon)^{1-\alpha} - \rho.$$

It can be verified that $\frac{\partial g}{\partial(\phi\varepsilon)} < 0$. Therefore, if economic growth that leads to higher effective wage rates, $(1-\pi)w$, also reduces the intensity of crime (i.e. $\frac{\partial(\phi\varepsilon)}{\partial w} < 0$), then both crime levels and its effect on economic growth decline. On the other hand, if economic growth leads to a higher intensity of crime due to the condition $\frac{\partial(\phi\varepsilon)}{\partial w} > 0$ holding, then this negative feedback would limit the rate of economic growth due to $\frac{\partial g}{\partial(\phi\varepsilon)} < 0$. ■

3 The Empirical Framework

We derive the empirical model from the above theoretical findings using the methodology employed by Mankiw et al (1992), MRW hereafter. Let us denote

$$\hat{k}_t = \frac{K_t}{AL_t}, \tag{25}$$

$$\hat{y}_t = \frac{Y_t}{AL_t} = \hat{k}^{\alpha}(1-\phi_{\varepsilon})^{1-\alpha}. \tag{26}$$

The capital accumulation equation can be written as,

$$\dot{\hat{k}}_t = i_t\hat{y}_t - (n+\delta)\hat{k}_t, \tag{27}$$

where i_t is the share of investment in total output, n is the rate of population growth, δ is the depreciation rate of capital. Following MRW, we consider the steady-state growth rate, where $\dot{\hat{k}}_t = 0$. Then from (27) we find the capital stock per unit of effective worker

$$\bar{\hat{k}}_t = \left(\frac{i_t}{n+\delta}\right)^{\frac{1}{1-\alpha}}(1-\phi_t\varepsilon). \tag{28}$$

By inserting the above expression for the steady state value of capital back into (26) and taking logs, the steady state value of income per capita is derived as:

$$\log\hat{y}_t^* = \frac{\alpha}{1-\alpha}\log i_t - \frac{\alpha}{1-\alpha}\log(n+\delta) + \log(1-\phi_t\varepsilon). \tag{29}$$

This is the well-known empirical growth equation used by Mankiw et al. (1992). This approach has been extended by Islam (1995) who demonstrates that the model can be adjusted for panel data by approximating the pace of convergence around the state level of output, y^*. This gives us a dynamic model where the adjustment process towards the state is given by:

$$ln\hat{y}_t = (1-e^{-\pi})ln\hat{y}^* + e^{-\pi}ln\hat{y}_{t-1},$$

where $\pi = (n+\delta)(1-\alpha)$. After rearranging and substituting for y^* from (29), we arrive at:

$$ln\hat{y}_t - ln\hat{y}_{t-1} = \left(1-e^{-\pi}\right)\left[\frac{\alpha}{1-\alpha}\ln i - \frac{\alpha}{1-\alpha}ln\left(n+\delta\right) + \log(1-\phi_t\varepsilon) - ln\hat{y}_{t-1}\right] \tag{30}$$

By noting that $ln\hat{y}_t = lny_t - lnA$, where $y_t = Y_t/L_t$, (30) is transformed into the following form:

$$lny_t = \left(1-e^{-\pi}\right)\left[\frac{\alpha}{1-\alpha}\ln i - \frac{\alpha}{1-\alpha}ln\left(n+\delta\right) + \log(1-\phi_t\varepsilon)\right] - e^{-\pi}\left(lny_{t-1} + lnA\right). \tag{31}$$

The panel-data empirical model based on the above equation can be expressed in a conventional form as follows:

$$y_{jt} = \gamma y_{j,t-1} + \sum_{m=1}^{3}\left(\beta_j X_{jt}^{m} + \mu_j + \nu_{jt}\right), \tag{32}$$

where $y_{jt} = \ln y_t$, $y_{j,t-1} = \ln y_{j,t-1}$, $\gamma = -e^{-\pi}$, $\beta_1 = (1-e^{-\pi})\left(\frac{\alpha}{1-\alpha}\right)$, $\beta_2 = -(1-e^{-\pi})\left(\frac{\alpha}{1-\alpha}\right)$, $\beta_3 = 1-e^{-\pi}$, $x_{jt}^1 = \ln i_{jt}$, $x_{jt}^2 = \ln(n_{jt}+\delta)$, $x_{jt}^3 = \ln(1-\phi_{jt}\varepsilon_j)$, and $\mu_j = -e^{-\pi}lnA$. The stochastic disturbance terms are assumed to satisfy the following: $E[\mu_j] = E[\nu_{jt}] = E[\mu_j\nu_{jt}] = 0$.

Since, the intensity of crime, $\phi\varepsilon$ is not directly observed, we use the crime rate as a proxy. Hence, instead of $\ln(1-\phi\varepsilon)$, we use $\ln(Crime)$. To determine the conditions under which crime affects growth, we modify the basic empirical model (32) by taking into account that the TFP, A, is a function of the crime rate. Specifically, we postulate that the dependence between productivity and crime may change as a result of the structural changes in the economy. In the empirical model, we implement this rationale by adding an interaction term between a dummy variable (equal to 1 for post-Soviet period) and the crime rate. This dummy variable captures the structural changes that take place during the transition period. The robustness of the results is verified using the property rights indicator defined as the share of the private sector in GDP.

4 Data and Estimation

Several sources of data have been utilized in this study. The annual GDP series and Population figures are collected from the Maddison dataset (Bolt & van Zanden, 2013). Net capital formation (investment) series are from the Official Statistics of the Countries of the Commonwealth of Independent States (CISStat, 2013).[1] As aforementioned, the crime rate is used as a proxy for criminal intensity and is obtained from CISstat for the entire period. The crime rate is calculated per 100,000 population (that is, Total number of Crimes/Population x 100,000) and includes crimes such as first degree/premeditated murder (including attempted), grave bodily injuries, thefts, robbery, bribery and crimes associated with narcotics. Crimes related to hooliganism and rape have been excluded as these crimes are not necessarily driven by economic incentives.

Using a total number of criminal acts as a measure of crime might be questioned on the grounds that the different types of crime can have different prevalence and economic consequences. However, when one is focused only on the incidence of crime but not its nature (as soon as it has some economic consequence), using the total numbers of criminal acts should be fine. As for the structural changes in criminal activity, we intend to gauge that through estimating its impact on overall income measured by GDP. For estimation purposes, all series are transformed into logarithmic form. Following other studies in this area (see, for example, Schündeln, 2013) the depreciation rate is set at a constant rate of 10 per cent for all countries. As a result of the scarcity of data for some countries, the sample contains the following 10 countries: Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine and Uzbekistan. The dataset contains 260 observations and covers the following time period, 1985-2010. Table 1 presents the summary statistics of all the model variables.

Figure 1 exhibits the pattern of the crime rate and GDP per capita for the countries in the sample from 1985 to 2010. It is interesting to note that the crime rate

[1] The official statistics for net capital formation divided into two periods: pre- and post USSR period. Pre USSR dataset had some overlapping years with post Soviet Union dataset. We had to adjust pre Soviet Union figures based on the overlapping years accordingly for investment series.

Table 1: Summary Statistics

Variable name	*Variable*	Obs	Period	Mean	Std. Dev.	Min	Max
GDP per capita	y	260	1985-2010	4851.2	2520.8	824.6	13658.5
Investment per capita	i	260	1985-2010	1321.6	955.6	49.9	5631.7
Population Growth	n	260	1985-2010	1.005	0.011	0.946	1.032
Crime Rate	*Crime*	260	1985-2010	7.066	5.092	1.475	26.873
Property Rights	*Prop*	260	1985-2010	37.71	24.70	5.00	75.0

(dashed line) has been increasing in all of the CIS countries prior to the collapse of the USSR. After the USSR collapse, a sharp decline can only be observed in Azerbaijan (1993-2000), in Tajikistan (1993-2008) and in Uzbekistan (1993-1995). It is also evident that in all countries, with the exception of Tajikistan and Uzbekistan, the post USSR crime rate on average is higher than the crime rate that prevailed during the USSR.

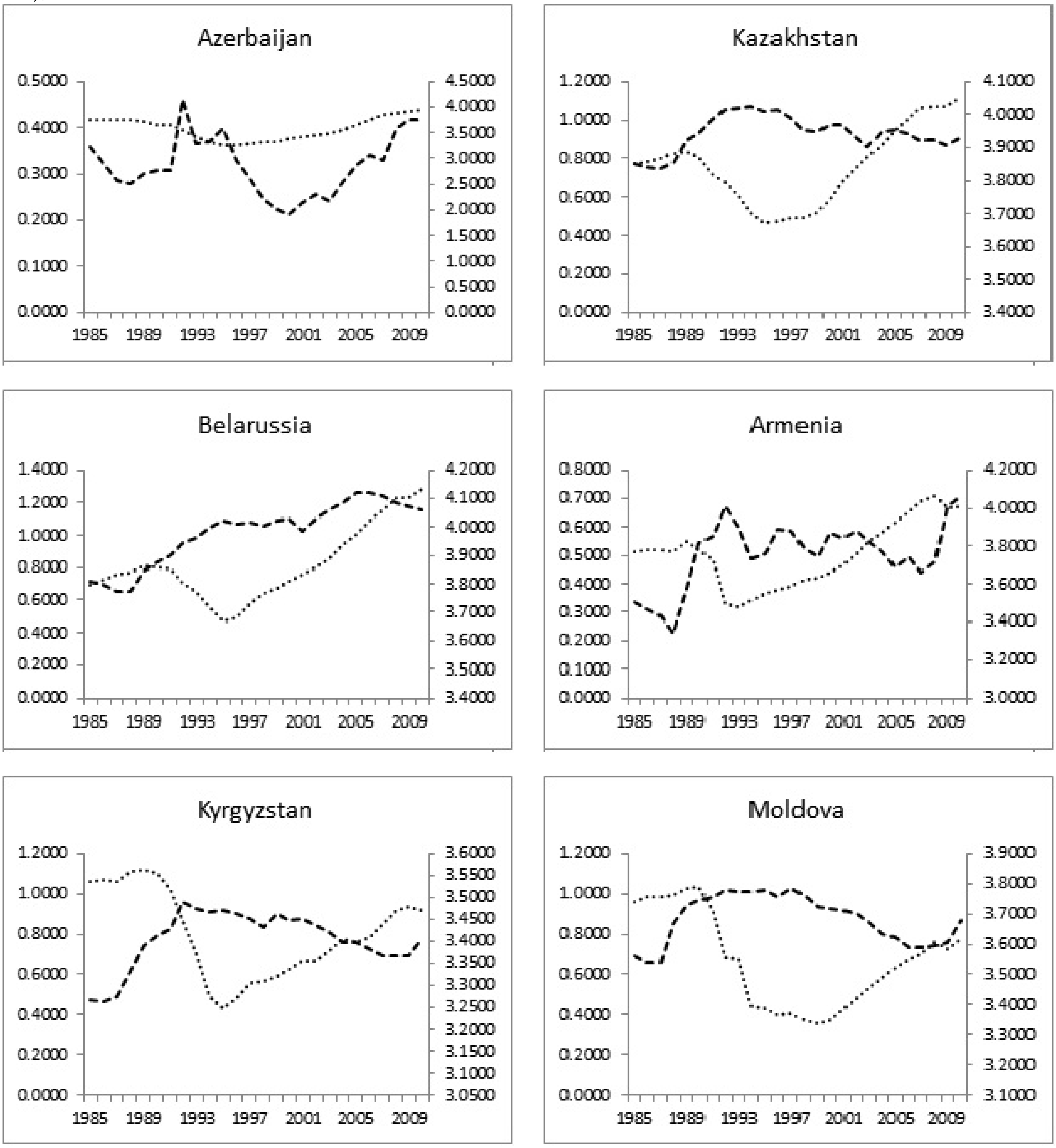
In terms of economic growth, almost all countries experienced a decline during the first few years of the transition. Some of the countries recovered from the problems of high inflation, low manufacturing, chaotic budget structures and declining trade, by the mid 1990s; whereas sin countries such as Russia, Moldova and the Ukraine, stagnation was observed up until 1998. Following the recovery from the Russian financial crisis of 1998, robust economic growth was observed in all of the CIS countries. The average growth rate between 2000 and 2008 was over 6 per cent. This was a result of macroeconomic stability, high foreign investment, a decline in government expenditures, fiscal discipline and tax reforms, rising energy exports, structural reforms in manufacturing, agricultural and service sectors, as well as the liberalization of trade in the major the CIS countries. The effects of the Global Financial Crisis on the CIS countries were minimal as the financial institutions were not exposed directly to US credit markets. The CIS countries have been mostly affected by the falling commodity prices, as a result of the global slow down in demand for exports from these economies.

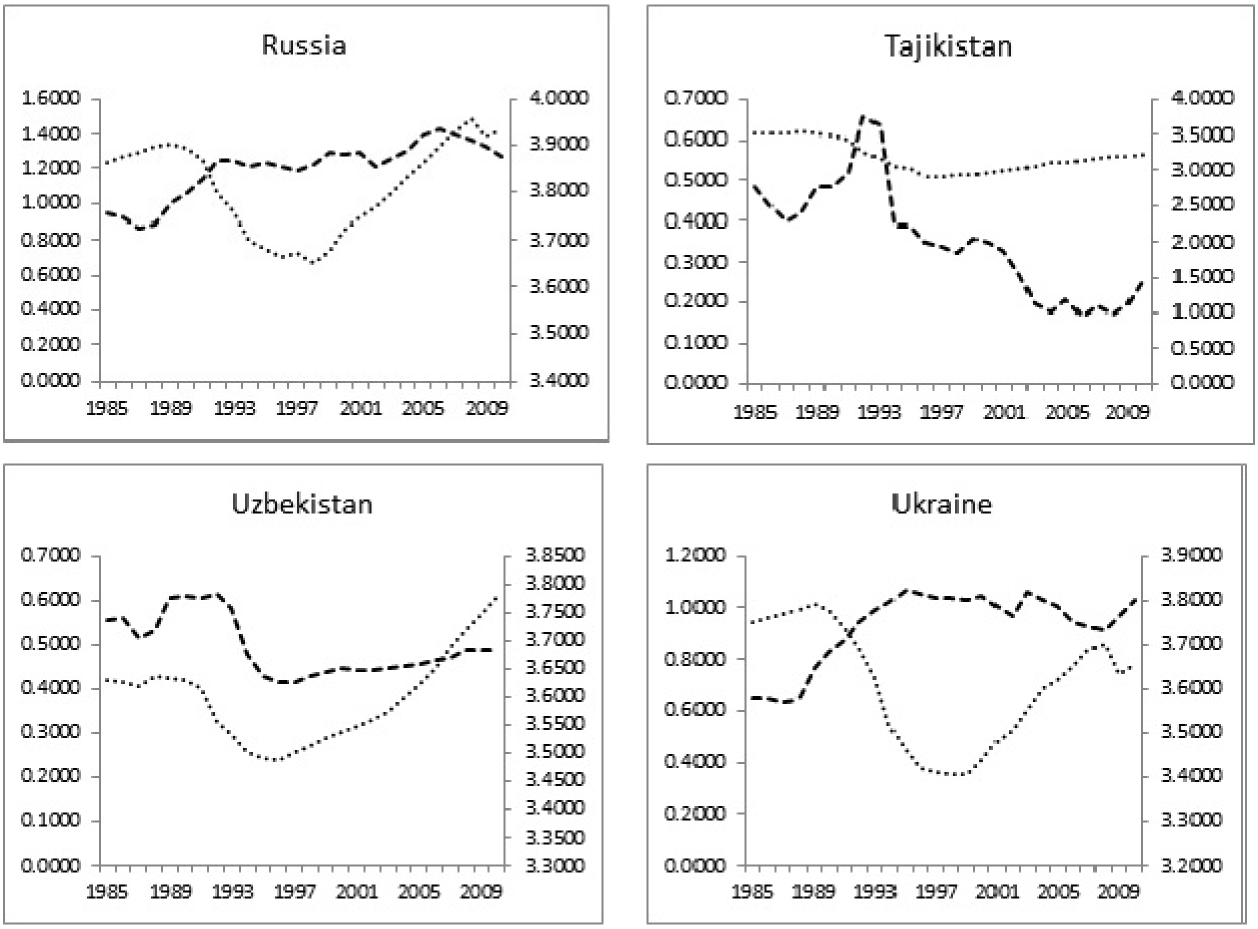
In Table 2 are the results of all the model specifications. In columns 1 to 4 are the conventional OLS estimates. In the case of the OLS estimates, we estimate Eq. (27) using the fixed (FE) and the random effects (RE) estimator without the USSR dummy, column 1 and 2, respectively; and, with the post-USSR dummy (1 for years after 1991, and 0 otherwise), column 3 and 4, respectively. In order to address the problem associated with country specific effects and the regressors, as highlighted by Baltagi (1995) and Roodman (2009), we conduct a Hausman test. The result of the Hausman test (Davidson and MacKinnon, 1982, 1993) shows that the country-specific effects are correlated with the regressors in our model at least at the 5 per cent significance level. Thus, the RE estimator is rejected in favour of the FE estimator. However, due to the presence of the lagged growth variable, the FE is inconsistent (Baltagi, 1995).

Given the inconsistency of the FE estimator, in the presence of a lagged endogenous variable, the potential endogeneity of other regressors and the number of instruments, we employ the system Generalized Method of Moments (GMM) estimator for dynamic panel data.[2] We use the GMM estimator, following Arellano and Bover (1995) and Blundell and Bond (1998), as it allows us to obtain consistent and efficient estimates, given the aforementioned problems associated with dynamic models, as discussed by Baltagi (1995) and Roomond 1998). To confirm that the GMM estimator is appropriate, we test for the hypothesis that the average autocorrelation in the GMM residuals of order 1 and 2 is equal to 0. According to our results, in all three GMM model specifications (without the post USSR dummy, with the post USSR dummy, and the inclusion of property rights indicator, columns 5, 6 and 7 respectively of Table 2), the first and second-order autocorrelation are not violated and are at zero at the 5 per cent significance level. Additionally, the validity of the moment conditions implied by the model is tested using the Sargan (1958) and Hansen (1982) tests of overidentifying restrictions. Both tests confirm the choice of the instruments in our model.

[2] For further details on the GMM estimator, refer to Holtz-Eakin et al. (1998) and Arellano and Bond (1991).

Figure 1: Crime rate (left axis, dashed line) and GDP per capita (right axis, dotted line), 1985-2010 in the FSU countries





In all model specifications, the lagged growth variable is positive and statistically significant at the conventional significance levels. The investment variable is significant in FE and RE models with the expected sign but not significant in the GMM estimations. The population and depreciation variables were found to be significant at the 10 per cent level only with a negative sign in the RE and FE models without the post USSR dummy but insignificant in all other models. It is worth noting that population was shrinking rather than increasing in some of the CIS countries partly related due to ageing and death related illnesses. The crime rate was found to be statistically significant in all our models at the 1 per cent level and had the expected negative sign. The dummy variable for the post-USSR period indicates that the negative effect of crime on economic growth has actually reduced due to the structural changes after the collapse of the USSR. This result can be interpreted from two perspectives: (i) the productivity of crime driven by rising income levels reduces crime effort, and hence, might mitigate its negative impact; (ii) as it was indicated in Guriev and Sonin (2009), developing a dictatorship-type governance may strengthen property rights, which, in turn, result in a positive impact on growth. The robustness of the results is confirmed using the property rights indicator (Property) defined as the share of the private sector in GDP, which is significant at the 1 per cent level.

5 CONCLUSION

In this study we set out to find whether the transition from a command-driven economy to a market-based economy influences the effect of crime on economic growth. First, we consider a simple model where some agents were felonious and commit crime. By allowing for a structural difference between the two types of economies, the results of the analysis demonstrate that the transition to a market economy may reduce the negative effect of crime on economic performance. Especially, it would be true if such a transition lead to a stronger property right protection. We tested this conjecture empirically using data for 10 former Soviet Union economies from 1985 to 2010; the results of the empirical exercise confirm the theoretical findings. However, in light of Guriev and Sonin (2009) arguments, stronger property rights might also imply a more dictatorship-type governance emerging in those countries.

Table 2: Growth and crime regressions using panel methods

Variables	FE with post USSR dummy	RE with post USSR dummy	GMM Two-step	GMM Two-step with post-USSR dummy	GMM Two-step with Property rights & crime	GMM Two-step crime IV	GMM HF property rights and crime
$\ln(y_{j,t-1})$	0.880*** (0.027)	0.900*** (0.021)	1.458*** (0.167)	1.494*** (0.217)	1.377*** (0.389)	1.519*** (0.187)	1.387*** (0.165)
$\ln(i_{j,t})$	0.096*** (0.014)	0.100*** (0.014)	-0.125 (0.107)	-0.145 (0.129)	-0.111 (0.086)	-0.162 (0.11)	-0.109 (0.088)
$\ln(n_{j,t}+\delta)$	-0.692 (0.888)	-0.943 (0.629)	-0.601 (0.983)	0.171 (0.914)	0.292 (0.706)	0.63 (1.08)	0.409 (0.914)
$\ln(Crime_{j,t})$	-0.130*** (0.029)	-0.047*** (0.014)	-0.104*** (0.029)	-0.201*** (0.064)	-0.259*** (0.054)	-0.170** (0.076)	-0.192*** (0.042)
$Dummy * Crime_{j,t}$	0.031*** (0.01)	0.021** (0.009)		0.059*** (0.022)		0.046* (0.027)	
$Property_{j,t} * Crime_{j,t}$					0.037*** (0.009)		0.002*** (0.0005)
R2	0.935	0.976					
Number of Instruments			*8*	*9*	*9*	*9*	*9*
Hausman Test	χ^2=20.30 Prob> χ^2=0.001						
Sargan Test			$\chi^2(3)$=1.56 Prob> χ^2=0.669	$\chi^2(3)$=1.29 Prob> χ^2=0.730	$\chi^2(3)$=6.82 Prob> χ^2=0.078	$\chi^2(3)$=0.73 Prob> χ^2=0.865	$\chi^2(3)$=3.38 Prob> χ^2=0.337
Hansen J-Test			$\chi^2(3)$=2.36 Prob> χ^2=0.502	$\chi^2(3)$=4.08 Prob> χ^2=0.253	$\chi^2(3)$=6.74 Prob> χ^2=0.081	$\chi^2(3)$=3.00 Prob> χ^2=0.391	$\chi^2(3)$=5.17 Prob> χ^2=0.159
A&B acov res 1st			*z=-1.84* *Prob>z=0.065*	*z=-1.74* *Prob>z=0.082*	*z=-1.86* *Prob>z=0.063*	*z=-1.72* *Prob>z=0.085*	*z=-2.31* *Prob>z=0.021*
A&B acov res 2nd			*z=-0.89* *Prob>z=0.371*	*z=-0.97* *Prob>z=0.33*	*z=-0.56* *Prob>z=0.574*	z=0.95 *Prob>z=0.342*	*z=-0.53* *Prob>z=0.599*

Note: The dependent variable is GDP per capita. Standard errors are in parentheses. R-squared is the within R-squared for the fixed effects (FE) model and the overall R-squared for random effects (RE). A&B acov res 1st and 2nd is the Arellano?Bond test that average autocovariance in residuals of order 1 and 2; *, **, *** stands for significance at 10%, 5% and 1% levels. To reduce the number of instruments, the number of lags in GMM is restricted to 2 to 4 and collapsed.

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