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# Corruption vs reforms: Why do voters prefer the former?

Igor Fedotenkov<sup>1</sup>

## Abstract

In this paper, we address the question of why voters tolerate corrupt politicians. Standard economic techniques such as expected utility maximization under uncertainty are employed. We show that a corrupt politician is less likely to institute reforms which can cause short-term losses for voters during a transitional period or lead with some probability to non-success. Voters' higher risk aversion causes an increased fear of reforms and higher tolerance for corruption. We also show that during an economic crisis the corruptionists' optimal strategy is not to institute reforms, as models with honest politicians predict, but to reduce the level of corruption. Using panel data techniques, we show that such a strategy is in line with the empirical CIS data; however, it follows with a short delay.

**JEL Classification:** D72, D73, E60, I38.

**Keywords:** Corruption; politician; median voter; reforms; risk aversion.

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# 1 Introduction

Corruption affects agents' wellbeing and macroeconomic indicators. It is one of the main obstacles to economic growth (Mauro 1995; Del Monte and Papagni 2001). As a result, the causes and consequences of corruption have attracted much attention from economists, sociologists and political scientists. One of the central questions in studying the phenomenon of corruption is why people elect corrupt politicians. Numerous explanations have been proposed and ideas discussed. We address this question using standard economic techniques, such as utility maximization under uncertainty. We show that if agents are sufficiently risk averse or the intertemporal substitution of consumption is low, agents may not desire reforms, because their effects are uncertain or produce losses in the short run. Therefore, agents often prefer to elect corrupt politicians who steal a part of the agents' endowments, but have fewer incentives for implementing reforms and, therefore, offer stability. Furthermore, we show that corrupt politicians' optimal strategy during an economic crisis is not to activate economic reforms, as predicted in models with honest politicians (Vis 2009; Hollanders and Vis 2013), but to steal less. Using the data of the Commonwealth of Independent States (CIS), we show that such a policy takes place in practice, but adjustments in corruption follow economic growth with a 1-2 year lag.

Many studies emphasize that a higher level of democracy is associated with lower corruption. Political freedom, freedom of speech and fair elections give voters an opportunity to punish corrupt politicians and elect the honest (Goldsmith 1999; Chowdhury 2004; Sung 2004). Nevertheless, corruption exists in democratic countries as well, and democracy enables some forms of corruption, which are not possible under a dictatorship (Moran 2001). So, why do voters in democratic countries continue to elect corrupt politicians? The explanations are multiple.

One hypothesis is that in democratic countries people tend not to elect corrupt politicians; however, information about their corrupt activities may not be public. The government may influence news content by maintaining a "cozy" relationship with the media even in the absence of censorship (Besley and Prat 2006). Therefore, if corruption is uncovered, the ability to attract and hold the public's attention may be limited (Winters and Weitz-Shapiro 2013). Another problem, related to the dissemination of information is that often voters do not believe information about corruption. Despite receiving such information, voters may discard it as not credible (Muñoz, Anduiza, and Gallego 2016) or assign blame incorrectly (Kurer 2002; De Vries and Solaz 2017).

A lack of political competition also contributes to explain voting for corrupt politicians. Based on empirical evidence from 70 countries, Schleiter and Voznaya (2014) showed that greater political competition is associated with lower corruption. The empirical evidence from the European countries shows that there is a U-shaped relationship between the likelihood of corruption voting and the voters' location on the left/right political spectrum. Voters with extreme political preferences are more likely to neglect corruption charges and continue to support their party, while voters in the center more often switch parties due

to a wider choice in this part of the political spectrum or they choose not participate in elections. However, if the number of political parties is large, the U-shape relationship becomes flatter (Charron and Bågenholm 2016). Apart from the absolute number of political parties, their quality also matters. Often voters tend not to punish a corrupt party if they believe that alternative parties are also corrupt (Cordero and Blais 2017).

Another common explanation of why voters choose corrupt politicians is that they create clientelistic networks and deliver public goods to them. They manipulate public goods and resources so that political loyalty is rewarded. Put simply, corrupt officials buy public support (Kurer 2002; Manzetti and Wilson 2007; Pereira and Melo 2015). However, not all studies confirm this explanation. Using data from Greece, Konstantinidis and Xezonakis (2013) found that the clientelistic exchange has negative effects on the public support of a corrupt politician, while the popularity of corrupt politicians increases if they provide collective benefits, such as lower taxes. This argument was also indirectly confirmed by Muñoz et al. (2016) on Catalanian data.

Our paper proposes another motive for voting for corrupt officials. We note that if we introduce corrupt politicians to a model with unpopular reforms, agents may tolerate corruption, because corrupt politicians have fewer incentives to institute reforms. This is so if politicians' benefits from corruption exceed the benefits obtained from economic reforms. To the best of our knowledge, this is the first paper linking the political economy of unpopular reforms with corruption.

Our model relies on the assumption of fear of reforms. This is a quite realistic assumption in Russia and other post-Soviet countries. According to RLMS data, approximately 55 percent of Russians claimed that their lives have worsened since economic reforms started in 1991, with only 23 percent holding the opposite opinion in 2006 (Denisova, Eller, and Zhuravskaya 2010). These results are not surprising. Having analysed post-communist transitions in Eastern European countries, Hellman (1998) found that partial reforms are profitable for small groups of people and create large losses for the rest. Therefore, the optimal winners' strategy is to freeze the economy in a partial reform equilibrium that is profitable to them, while imposing substantial costs on the rest of the population. Such partial reforms were implemented in a number of Eastern European countries, including Russia in the nineties.

Even if economic reforms are complete, they often create losses in the short run: e.g., a switch from a pay-as-you go to a more funded pension scheme (Breyer 1989), capital taxation (Peterman 2013; Fehr and Kindermann 2015), sector-specific labour and capital taxations (Fedotenkov 2018), a switch from VAT to consumption taxes (Sarkar and Zodrow 1993). The advantages of the reforms are also received unevenly by different groups, and some groups become worse off even in the long run (Buccioli et al. 2017). Consequently, even in Western economies, the majority often prefers the status quo (Boeri, Börsch-Supan, and Tabellini 2002; Brooks and Manza 2006; Van Groezen, Kiiver, and Unger 2009).

Fear of reforms is the key element of the model developed by Hollanders and

Vis (2013) to study the timing of reforms. Their model includes two politicians who receive benefits (sometimes immaterial) when they implement reforms and the median voter who receives direct losses. If a politician implements a reform, next election cycle, the voter chooses another politician. The voter also attributes the responsibility for economic crises to the government, and if a crisis hits, she then elects a different politician. Therefore, the optimal strategy for a politician in office is to implement reforms only when a crisis hits. We take this model as a starting point, but include possibilities for corruption. We simplify politicians' behavior, which does not affect our main results; however, the behavior of the median voter is more complicated, because now she needs not only to elect a politician, but also make decisions about the upper level of tolerated corruption. If the crisis hits, similarly to Hollanders and Vis, the median voter wishes to punish the politician for bad economic performance. However, the corrupt politician can mitigate the losses of the median voter by reducing the level of corruption and so remain in office. Similar politicians' behaviour was found empirically in the CIS countries.

The remaining part of the paper is designed as follows. In the next section, we develop a theoretical model. Section 3 provides some empirical cross-country estimates, which confirm the main mechanism of the model. In section 4, predictions of the model are validated empirically using panel data technique. Finally, section 5 concludes.

## 2 Model

There are three players in the model living forever: two politicians and one median voter. The total population is clearly larger, so we suppose that its size is equal to  $N$ . In each period, only one politician holds elected office, chosen by the median voter.

There is an infinite set of reforms, and each period, a politician in office may (or may not) implement one of them. For now, we assume that the median voter dislikes reforms. The formal condition, when this is the case, is derived later. If a politician implements a reform, next period, another politician is elected. If the reform is not implemented, the same politician is reelected next period.<sup>2</sup> We suppose that all players have perfect information concerning the other players and their preferences.

### 2.1 Politicians

Each period the politician in office makes one decision:

- He decides whether to institute a reform or not.

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<sup>2</sup>This assumption changes when an economic crisis is introduced.

This action is performed depending on the maximization of his utility function. At time  $t = 0$ , this utility function is given by

$$V_0 = \sum_{i=0}^{\infty} \delta^i v(x_i), \quad (1)$$

where  $\delta$  is a discount rate,  $0 < \delta < 1$ ,  $U(\cdot)$  is a strictly concave instantaneous utility function and  $x_i$  denotes consumption at time  $i$ ,  $v(x_i) > 0$  for  $x_i > 0$  and  $v(x_i) = 0$  when  $x_i = 0$ .

If a politician is not in office his benefit in this period is equal to zero  $w = 0$ , otherwise he receives legal benefits  $w$ ,  $w > 0$ . If he undertakes a reform, he obtains satisfaction from the reform  $r$ ,  $r \geq 0$  (if the reform is not made,  $r = 0$ ). If voters wish, they may allow politicians to steal the amount  $s$  of resources, and the politician does it. In this case, losses from corruption are allocated evenly between agents. The difference between benefits from corruption and lawful benefits is that the former lead to direct losses for the median voter. All benefits received by politicians are consumed in the same period.

Next, we simplify the analysis of Hollanders and Vis by assuming that politicians have perfect information about each other and take this information into account when making their decisions. Having used the sums of geometric sequences, we find that a politician's utility of never reforming and always staying in office is given by  $V_0^n = (1 - \delta)^{-1}v(w + s)$ . If the politician carries out a reform, next period the median voter elects another politician. As the other politician is exactly the same, he likewise implements a reform. Therefore, in this case, politicians assume office every second period. This results in  $V_0^r = (1 - \delta^2)^{-1}v(w + s + r)$ . As all the periods are the same, the politicians never reform if  $V_0^r < V_0^n$ , and always reform otherwise. Denote  $g(s) = v(w + s + r)/v(w + s)$ . The condition of not making reforms simplifies to

$$g(s) < 1 + \delta. \quad (2)$$

Therefore, the behaviour of politicians is summarised as follows:

- Politicians never reform if condition (2) is satisfied.
- Politicians always reform otherwise.

**Proposition 1.** *Under the assumptions about function  $v(\cdot)$ ,  $g(s)$  declines in  $s$ .*

The proof is presented in Appendix 1. Intuitively, this result follows from the fact that if politicians are allowed to steal a larger amount, the marginal increase in utility function from implementing a reform is low; however, a decline in income during the period when the politician is out of office is larger. Proposition 1 implies that a higher amount  $s$  stolen by politicians makes the condition for never reforming more likely to be satisfied. Therefore, it is possible that politicians who decide to institute reforms when  $s = 0$  do not institute them for some  $s > 0$ .

## 2.2 Median voter

In this subsection, we consider the case of the politician who initiates a reform in the absence corruption, and who initiates no reform when corruption is present. The other cases are trivial and will be discussed later.

In each period, the median voter performs two actions:

- Elects a politician;
- Decides whether and how much the politician in office can steal.

We suppose that the median voter's preferences are given by an Epstein-Zin utility function (Epstein and Zin 1989; Epstein and Zin 1991):

$$U_t = [(1 - \beta)C_t^\rho + \beta(EU_{t+1}^\alpha)^\frac{\rho}{\alpha}]^\frac{1}{\rho}. \quad (3)$$

$C_t$  is the median voter's consumption at time  $t$ ,  $\rho$ ,  $\rho < 1$  corresponds to the elasticity of intertemporal substitution of consumption, which is given by  $(1 - \rho)^{-1}$ ,  $\alpha$  corresponds to risk aversion, which is defined as  $1 - \alpha$ , so that higher values of  $\alpha$  correspond to a lower risk aversion,  $\beta$ ,  $0 < \beta < 1$ , is a discount rate.

We suppose that for each period, in the absence of political reforms and corruption, the median voter obtains an endowment  $c$  of goods and these goods are consumed within the same period. In the presence of corruption, she will have losses of size  $\tau$ ,  $0 < \tau < 1$ . Therefore, her consumptions are equal to  $C_t = (1 - \tau)c$ ,  $t = 0, 1, 2, \dots$ , implying that

$$U_t^C = (1 - \tau)c, \quad \forall t \leq 1. \quad (4)$$

If reforms are implemented at time  $t = 0$ , they create short run losses  $\mu$ ,  $\leq \mu < 1$ . Therefore,  $C_0 = (1 - \mu)c$ . In case of a successful reform, median voters' consumption in the next periods rises permanently by  $\gamma_s$ ,  $\gamma_s > 0$ :  $C_t = (1 + \gamma_s)c$ ,  $t \geq 1$ . In case of failure, it declines by  $\gamma_f$ ,  $0 \leq \gamma_f < 1$ :  $C_t = (1 - \gamma_f)c$ ,  $t \geq 1$ . The probability of success is  $p$ . Due to constant returns to scale,  $U(const \cdot c) = const \cdot U(c)$ . Therefore,  $U_1 = (1 + \gamma_s)U_0$  or  $U_1 = (1 - \gamma_f)U_0$ , depending on whether the reform was successful or not. Therefore, if reforms are implemented:

$$U_0^R = [(1 - \beta)(c(1 - \mu))^\rho + \beta(p((1 + \gamma_s)U_0^R)^\alpha + (1 - p)((1 - \gamma_f)U_0^R)^\alpha)^\frac{\rho}{\alpha}]^\frac{1}{\rho}. \quad (5)$$

Having rearranged this equation, we get:

$$U_0^R = \frac{(1 - \beta)^\frac{1}{\rho}(1 - \mu)c}{[1 - \beta(p(1 + \gamma_s)^\alpha + (1 - p)(1 - \gamma_f)^\alpha)^\frac{\rho}{\alpha}]^\frac{1}{\rho}}. \quad (6)$$

The median voter dislikes reforms at  $t = 0$  if  $U_0^R < U_0^C$ . Inserting expressions (4) and (6) into this inequality and dividing it by  $c$ , we find that the inequality is satisfied when  $\tau < \tau_{max}$ , where

$$\tau_{max} = \max(\phi(\cdot), 0). \quad (7)$$

$$\phi(\cdot) = 1 - \frac{1 - \mu}{\left[ \frac{1}{1-\beta} - \frac{\beta}{1-\beta} (p(1 + \gamma_s)^\alpha + (1-p)(1 - \gamma_f)^\alpha)^{\frac{\rho}{\alpha}} \right]^{\frac{1}{\rho}}}. \quad (8)$$

We assume that  $p(1 + \gamma_s)^\alpha + (1-p)(1 - \gamma_f)^\alpha > 1$  (expected benefits of the reform exceed their losses), and  $1 - \beta \left( (p(1 + \gamma_s)^\alpha + (1-p)(1 - \gamma_f)^\alpha)^{\frac{\rho}{\alpha}} \right) > 0$  (median voter's utility is finite).  $\phi(\cdot)$  can obtain positive or negative values depending on the parameter values. If  $\phi(\cdot) \leq 0$ , agents do not tolerate corruption ( $s = \tau = 0$ ), and prefer reforms. If  $\phi(\cdot) > 0$ , then  $\tau_{max} > 0$ . I.e. agents dislike reforms and tolerate corruption, if corruption leads to losses lower than  $\tau_{max}$ . We assume that  $\phi(\cdot) > 0$ .

The higher the  $\phi(\cdot)$  is, the higher the maximal level of corruption  $\tau_{max}$  tolerated by the median voter, and larger are the benefits from corruption that politicians may receive.  $\phi(\cdot)$  is increasing in  $\mu$  and  $\gamma_f$ , and declining in  $\gamma_s$ ,  $p$ ,  $\alpha$ ,  $\rho$ . The effects of  $\alpha$  and  $\rho$  are not easily seen; therefore, we show them in the following proposition:

**Proposition 2.** *Under the assumptions of the model,  $\phi(\cdot)$  declines in  $\alpha$  and  $\rho$ , when  $\alpha, \rho \neq 0$ .*

The proposition is proved in Appendix 2. From the functional form of  $\tau_{max}$  it can be seen that even a low probability of unsuccessful reform results in tolerance for corruption, if risk aversion is high enough. Similarly, a low elasticity of intertemporal substitution increases the tolerance for corruption.

The median voter's problem was considered for period  $t = 0$ . However, changes in consumption due to reforms are permanent. Therefore, if the reform is implemented, the new consumption level in period  $t = 1$  can be denoted as  $c$ , leading to exactly the same median voter's optimization problem at  $t = 1$ . Then the process is telescopic for  $t = 2, 3, 4, \dots$ . Therefore, if the median voter dislikes reforms in the period  $t = 0$ , she always dislikes them.

## 2.3 Equilibrium

In our model, the median voter decides whether and how much she allows the politicians to steal. Suppose that the costs of corruption are distributed evenly in the population:  $s = Nc\tau$ . Multiple equilibria are possible.

- If  $g(Nc\tau_{max}) \geq 1 + \delta$ , politicians' benefits from reforms are so large that even if they are allowed to steal the amount  $Nc\tau_{max}$ , they prefer to reform. In this case, the median voter has no incentives to tolerate corruption. Therefore, she sets  $\tau = s = 0$ . As politicians always reform, the median voter elects another politician at each period.
- If  $g(0) \leq 1 + \delta$ , the politicians do not make reforms even if benefits from corruption are equal to zero. In this case, there is no need for the median voter to tolerate corruption because she achieves the desired result with no losses caused by corruption. In this case, there is no corruption, and the politician in office does not change.



- If  $g(0) > 1 + \delta > g(Nc\tau_{max})$ , then in the case of no corruption, politicians institute reforms, and if corruption is allowed, do not. Therefore, in this case, the median voter tolerates corruption at size  $\tau = N^{-1}g^{-1}(1 + \delta)$ . This is the minimal corruption level sufficient for politicians not to implement reforms. In this case, one politician remains in office forever.

These political equilibria are based on the assumption that the median voter dislikes reforms, i.e.  $\tau_{max} > 0$ . If this assumption is not satisfied, then there is no need for the median voter to tolerate corruption.

## 2.4 Economic crisis

In this subsection we suppose that the equilibrium with corruption and no reforms holds at the time, when in period 0 an unexpected temporal exogenous crisis hits. During the crisis, the median voter's consumption endowment declines by the amount  $z$ :  $c(1 - z)$ .

Following Hollanders and Vis (2013), we assume that if the median voter's consumption declines in comparison to normal times, she blames the politician in office for this decline, and to punish him elects another politician in the next period. Such voter behaviour has vast empirical confirmation (see Hibbs (1979), Lewis-Beck and Stegmaier (2000) and Singer (2013), for example). In the no corruption model, politicians implement reforms, because they know that in next period they will not be reelected, and get benefits  $r$ . However, in the model with corruption, the politician may remain in office.

Suppose that during normal times the corrupt politician steals share  $\tau$ ,  $0 < \tau < \tau_{max}$  of the median voter's consumption  $c$ , and the median voter will choose to punish him if her consumption declines further. Then, the median voter does not feel the consequences of the crisis if  $c(1 - \tau_z)(1 - z) = c(1 - \tau)$ .  $\tau_z, \tau_z \geq 0$  denotes the amount stolen by the politician during the crisis. Note also that the stolen amount cannot be negative. Therefore, the median voter's losses due to corruption during the crisis shall not exceed:

$$\tau_z = \max\left(\frac{\tau - z}{1 - z}, 0\right). \quad (9)$$

In case of a small crisis ( $z \leq \tau$ ), the politician may reduce the amount stolen to remain in office; however, if the crisis is severe  $z > \tau$ , the costs of the crisis cannot be reimbursed by a lower level of corruption, and another politician is elected. As  $\tau$  tolerated by agents increases with the increasing risk aversion and declining intertemporal substitution of consumption, higher fear of reforms allows the corrupt politician to remain in office during a more severe crisis.

Similarly, if there is unexpected economic growth (negative  $z$ ), the politician in office may increase the amount he steals. The fact that voters are concerned about corruption during economic declines and are more tolerant of it during periods of economic growth was already confirmed empirically (Choi and Woo 2010; Zechmeister and Zizumbo-Colunga 2013). Our key argument is, to remain

Table 1: Dependent variable: control of corruption. Cross-country, 2013.

regressors	OLS		MM-estimator	
	Gains	Losses	Gains	Losses
Intercept	-11.285*** (1.1490)	-10.8483*** (1.1170)	-11.2477*** (1.2102)	-10.6666*** (1.1241)
Risk premia	-1.6709*** (0.6205)	-1.4140*** (0.4396)	-1.7556*** (0.6536)	-1.5966*** (0.4423)
log(GDP/capita PPP)	1.2995*** (0.1244)	1.2042*** (0.1110)	1.3040*** (0.1284)	1.1987*** (0.1117)
$R^2$	0.6965	0.7123	0.6969	0.7127

\*\*\*  $p < 0.01$

in office, the politician may react to economic developments by adjusting his level of corruption.

### 3 Risk aversion and corruption

In the previous section, we showed that higher agents' risk aversion should lead to a higher tolerance of corruption. In this section we check if this assertion can be observed empirically.

Rieger et al. (2014) performed experiments in 53 countries around the world to estimate risk premia that agents require for uncertain outcomes. Agents were given a number of lotteries, with a certain probability of success and asked about what price they would pay to participate in such a lottery. The difference between the expected value of the lottery and the average price agents were willing to pay for a lottery gives an estimate of the risk premia. So that results were independent of currencies, the authors divided them by the expected value of the lottery premia.

The authors also experimented with a lottery with losses (how much would agents pay to avoid the lottery). The country-averaged results are presented in the above-mentioned paper, table 2, columns 1-2. In gain lotteries, positive values correspond to greater risk aversion, and in loss lotteries higher values correspond to lower risk aversion; therefore, we multiplied the former by -1. As a result, in our case, higher values always correspond to greater risk aversion. The other factors used in this section are control of corruption (higher values correspond to lower corruption) and the natural logarithm of the GDP per capita at purchasing power parity (PPP) for 2013, which were obtained from the Worldwide Governance Indicators and World Bank Development Indicators.

If we regress the control of corruption on the country-specific risk premia, having controlled for other variables, we do not find statistically significant coefficients. However, as noted by Rieger et al. (2014), risk premia depends on the level of the countries' economic development, which is likely to affect the control of corruption as well. Therefore, in table 1, we control for a logarithm

of GDP per capita PPP, which reflects the level of the countries' economic development. We present OLS estimates, and check robustness using a robust MM-estimator. The results are very similar. A higher risk premia corresponds to a lower control of corruption and all the estimates are statistically significant at the 0.01 significance level. This result is in line with our theoretical model; however, the resulting estimates may suffer from various endogeneity problems. For example, both risk premia and control of corruption may be affected by country-specific historical development, culture and traditions. Unfortunately, the existing data on risk aversion does not offer a solution to these problems. Nevertheless, in the next section, we assess the predictions of our model using fixed-effects panel model techniques, which solve the endogeneity problems resulting from the time-invariant omitted variables.

## 4 Economic growth and corruption

In this section, we present a number of empirical models to verify whether adjustments to the level of corruption as a response to changes in economic development takes place in practice.

### 4.1 Data and preliminary analysis

We analyse the data of CIS countries; namely: Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Uzbekistan. Georgia, Ukraine and Turkmenistan are not considered as CIS countries, because Ukraine and Turkmenistan have never been full members, and Georgia withdrew in 2008. We analyse the CIS countries because the corruption level in these countries is high enough to give corrupt politicians some space to adjust the level of corruption in response to economic shocks. The data range is 2002-2016. The range of explanatory variables, taken with lags, was extended to 2000-2016.

Our main variables of interest are the control of corruption and GDP growth in constant 2010 prices. We also control for a number of factors - common control variables in the literature: the size of the state measured as government revenue as percentage of GDP, rule of law, voice and accountability, regulatory quality.<sup>3</sup>

We combined data from several sources. Control of corruption, rule of law, voice & accountability and regulatory quality were taken from the World Bank (W.B.) Worldwide Governance Indicators. GDP growth was calculated from the GDP per capita in 2010 prices, obtained from the W.B. World Development Indicators. Government revenue as a percentage of GDP was obtained from the IMF World Economic Outlook Database, (April 2018). Table 2 presents descriptive statistics of these variables. In Appendix 3, their correlation matrix is presented.

By definition, control of corruption “reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private

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<sup>3</sup>Most of these factors were discussed by Rose-Ackerman (2007).

Table 2: Descriptive statistics

regressors	Mean	S. D.	Min	Max	Source
Control of corruption	-0.9452	0.2495	-1.37	-0.29	WB Worldwide Governance Indicators
GDP/capita growth	6.2364	5.4875	-14.15	34.50	WB World Development Indicators
Gov. income %GDP	30.8072	8.2593	13.60	50.76	IMF World Economic Outlook Database
Rule of law	-0.8300	0.3670	-1.48	-0.11	WB Worldwide Governance Indicators
Voice & Account.	-1.0965	0.5245	-2.12	0.05	WB Worldwide Governance Indicators
Regulatory Quality	-0.7017	0.4750	-1.71	0.02	WB Worldwide Governance Indicators

interests". It takes values in the  $[-2.5, 2.5]$  interval, higher values corresponding to a better control of corruption. Rule of law, Voice & Accountability and Regulatory Quality take values in the same range, higher values reflecting better performance.

Figure 1 presents some preliminary analysis of the dependence between economic growth and corruption in the countries under analysis. In all countries except Russia, there is a negative correlation between these two factors: local authorities reduce corruption as a response to lower economic growth, and increase it during the periods of economic growth. In Kyrgyzstan, Moldova and Tajikistan this correlation is rather weak, but in Belarus and Kazakhstan the negative dependence is strong. Such behaviour is in line with the predictions of our theoretical model. On the contrary, in Russia, the correlation between GDP growth and control of corruption is positive. Perhaps Russian authorities rely upon other methods to remain in office during periods of economic decline. Further, a more detailed analysis is implemented.

## 4.2 Results

In practice, the actions of corrupt governments are not implemented immediately after a crisis starts. The governments first need to understand that the crisis has taken a place. Second, they need to consider possible measures to remain in office, taking different scenarios into account. When a decision is reached, central authorities must signal officials at the lower levels. Therefore, considering the regression of control of corruption on economic growth, it is more logical to take economic growth with a lag. We include economic growth with a one and two year lag.

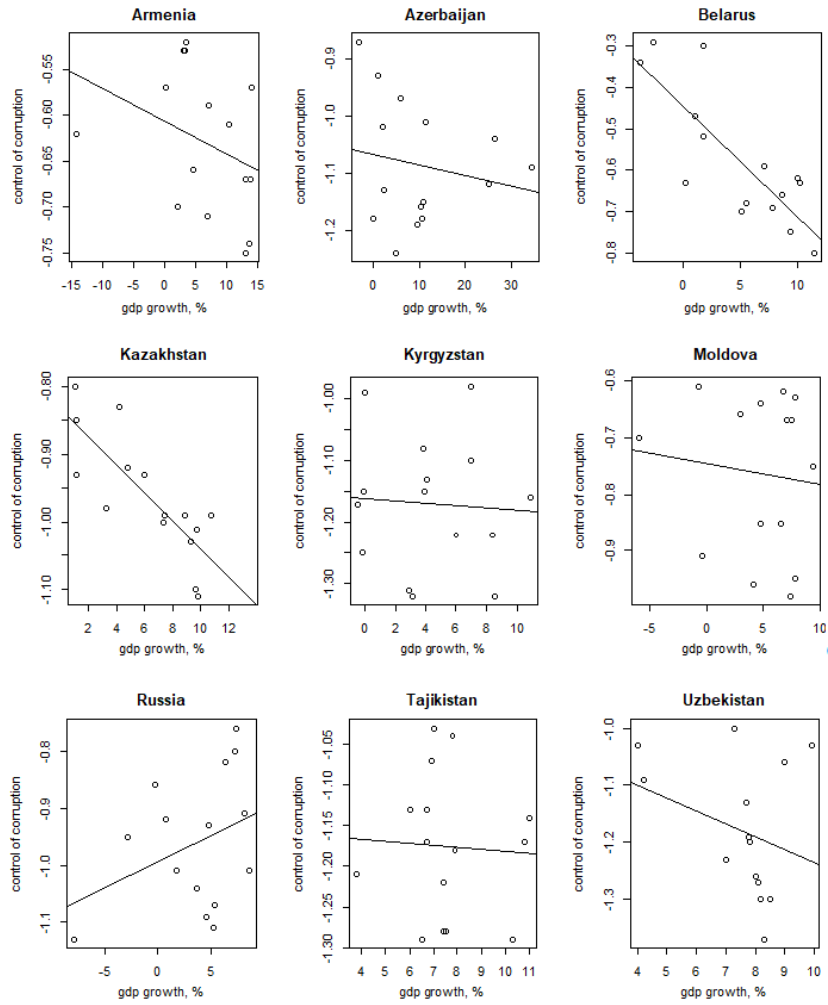
### 4.2.1 Static panel models

We regress control of corruption on GDP per capita growth, taken with one and two year lags, and other control variables. Fixed country-specific and time effects are used. The model has the following analytical expression:

$$CoC_{c,t} = f_c + f_t + a'X_{c,t} + \epsilon_{c,t}, \quad (10)$$

where index  $c$  - denotes a country,  $t$ - time,  $CoC_{c,t}$ - control of corruption,  $f_c$  - fixed country effect,  $f_t$  - fixed time effects,  $X_{c,t}$  - a matrix of explanatory variables (including lagged growths of the GDP per capita),  $a$  - a vector of

Figure 1: GDP growth vs. control of corruption in CIS countries



Source: W.B. Development Indicators & W. B. Worldwide Governance Indicators.

Table 3: Dependent variable: Control of corruption: Static panel, fixed individual and time effects

regressors	1	2	3	4	5	6
GDP/capita growth (lag=1)	-0.0069** (0.0031)	-0.0042* (0.0024)	-0.0042* (0.0024)	-0.0036* (0.0022)	-0.0040* (0.0020)	-0.0041** (0.0020)
GDP/capita growth (lag=2)		-0.0051*** (0.0018)	-0.0051** (0.0021)	-0.0051*** (0.0015)	-0.0055*** (0.0015)	-0.0051*** (0.0014)
Gov. income %GDP			-0.0001 (0.0036)	0.0038 (0.0033)	0.0038 (0.0031)	0.0032 (0.0031)
Rule of law				0.4289*** (0.0978)	0.4246*** (0.0969)	0.3797*** (0.1037)
Voice& Account.					0.1137** (0.0473)	0.0817** (0.0378)
Regulatory Quality						0.1501 (0.11137)
$R^2$	0.0776	0.1105	0.1106	0.3138	0.3448	0.3787
N	135	126	126	126	126	126

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$  significance level

parameters,  $\epsilon_{c,t}$  - residuals of the model. The inclusion of country-fixed effects solves many endogeneity problems, which result from time-invariant economic factors, not considered in our model, i.e., diverse history, culture and mentality.

Table 3 presents estimates of a static panel model. The robust standard Arellano type errors (Arellano 1987) are presented in parentheses, as the residuals are autocorrelated.<sup>4</sup> The use of Arellano-type standard errors also takes possible heteroscedasticity into account. The Shapiro-Wilk normality test (Shapiro and Wilk 1965) does not reject the hypothesis that the residuals are normal. The corresponding p-values are in the range: [0.5995-0.8746].

We include one and two years lags of economic growth and gradually add other control variables into the model. These factors are included in the model with no lags.

In all models, GDP per capita growth with one-year lag is negative and significant at the 10% significance level. The coefficient of the second year lag is also negative and larger in absolute size compared to the one-year lag; its standard deviation is lower, resulting in a very high statistical significance. This negative relation between control of corruption and economic growth is in line with our theoretical predictions. However, the quantitative impact is moderate. For example, if in 2014 and 2015 economic growth in Belarus had been 5% higher, its world rank in the control of corruption index would have declined from 108 to 115 in 2016. The other two factors which make a statistically significant impact are the rule of law (1% significance level) and voice and accountability (5% significance level). Both variables have positive coefficients, implying that the vigorous rule of law, and a higher level of democracy are associated with better control of corruption. Government income as a percentage of GDP and

<sup>4</sup>Wooldridge's test for serial correlation results in p-values in the range  $[2.2 \cdot 10^{-16} - 9.2 \cdot 10^{-10}]$  (Wooldridge 2010, pp. 310-312); the p-values corresponding to the Breusch-Godfrey test (Breusch 1978; Godfrey 1978) are in the range  $[5.612 \cdot 10^{-8} - 1.026 \cdot 10^{-3}]$ .

regulatory quality make no statistically significant impact.

Despite controlling for a number of factors, our models can still carry a number of endogeneity problems. For example, reduced control of corruption may suppress GDP growth; a number of studies analysed this reverse link in detail (see Mauro (1995), Ehrlich and Lui (1999) and Mo (2001), for example). Using GDP growth with lags allows us to consider Granger causality. However, we recognize that we cannot solve this endogeneity problem completely. Nevertheless, it is possible to note that the reverse link, implies a positive dependence between the growth of GDP per capita and control of corruption. Therefore, our estimates of the coefficients are likely to be biased upwards, and the negative link between economic growth and control of corruption is underestimated. Similarly, there can be a bilateral dependence between the control of corruption and the rule of law, and/or other explanatory variables. In general, such a reverse causality may affect our estimates for economic growth. Nevertheless, the gradual inclusion of the control variables does not cause an essential change in our estimates or in their significance. This implies that our results are robust to these endogeneity problems.

As the values of control of corruption are limited by the interval  $[-2.5, 2.5]$ , it is logical to consider their transformation similar to the logit. In Appendix 4, we present estimates for the models with transformed dependent variables, using such a transformation. The results are very similar to those presented in table 3. Furthermore, as an additional robustness check, in Appendix 5, we also present estimates with an alternative measure of GDP growth. Instead of using GDP growth in constant prices, we used the growth of GDP PPP in constant prices. The results are very similar, though the coefficient corresponding to the regulatory quality became significant at the 5% significance level.

#### 4.2.2 Dynamic panel models

In a recent work, Engler (2016) argued that agents get used to certain levels of corruption, and their satisfaction is affected not by the level of corruption itself, but by deviations from its previous levels. In order to take these findings into account, we add dynamic terms of the endogenous variable into the model. Its functional form becomes

$$CoC_{c,t} = \alpha CoC_{c,t-1} + f_c + b'X_{c,t} + \varepsilon_{c,t}, \quad (11)$$

where  $\alpha$  is a parameter,  $b$  - a vector of parameters,  $\varepsilon_{c,t}$  - residuals of the model. We do not include time-fixed effects, because they result in singularity problems. In all models, we used six lags of the dependent variable as instruments.

The estimates of equation (11) are presented in table 4. In general, the coefficients of economic growth are estimated to be lower in absolute terms than the corresponding coefficients in the static model. In the dynamic model, the two-year lags of economic growth are always negative and significant at some reasonable significance levels. At the same time, economic growth with a one year lag has a negative sign, but it is statistically significant in models 1-3 only. When we add the rule of law to the model, the coefficient corresponding to GDP

Table 4: Dependent variable: Control of corruption: Dynamic panel, fixed individual effects

regressors	1	2	3	4	5	6
Dep. variable (lag=1)	0.5951*** (0.0751)	0.5920*** (0.0787)	0.5867*** (0.0774)	0.4759*** (0.0762)	0.4893*** (0.0720)	0.5368 *** (0.0680)
GDP/capita growth (lag=1)	-0.0024** (0.0012)	-0.0017* (0.0009)	-0.0017* (0.0009)	-0.0002 (0.0005)	-0.0002 (0.0006)	-0.0003 (0.0007)
GDP/capita growth (lag=2)		-0.0028*** (0.0007)	-0.0027*** (0.0008)	-0.0012* (0.0006)	-0.0013* (0.0007)	-0.0017** (0.0008)
Gov. income %GDP			-0.0015 (0.0014)	-0.0019 (0.0017)	-0.0023 (0.0019)	-0.0011 (0.0021)
Rule of law				0.2286*** (0.0849)	0.2361*** (0.0854)	0.2652*** (0.0954)
Voice& Account.					-0.0515 (0.0641)	-0.0497 (0.0684)
Regulatory Quality						-0.1311 (0.1152)
Sargent (p-value)	1	1	1	1	1	1
AR(1) (p-value)	0.0056	0.0063	0.0061	0.0064	0.0058	0.0049
AR(2) (p-value)	0.2176	0.2624	0.2714	0.2622	0.2289	0.1478
N	117	117	117	117	117	117

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$  significance level

per capita with a one year lag sharply declines in the absolute size and loses its significance, but the negative sign remains. Moreover, inclusion of the rule of law reduces the absolute size of the coefficient corresponding to the two-year lag of GDP growth. These estimates, combined with a negative correlation between GDP growth and the rule of law (see Appendix 3), imply that a decline in GDP growth motivates governments to strengthen the rule of law, thus affecting the control of corruption. This indirect effect of economic growth on the control of corruption accounts for a large portion of the total effect.

The control of corruption at time  $t - 1$ , has a positive and highly significant impact on the control of corruption at time  $t$ . The coefficients corresponding to the rule of law remained positive and highly significant as in the static model; however, voice and accountability became insignificant. The coefficients corresponding to other control variables were also insignificant.

The Arellano-Bond statistics AR(1) and AR(2) (Arellano and Bond 1991) show that the errors in the first difference regression exhibit first order correlation (it should be so due to the lagged dependent variable in the model), but there is no second-order correlation. This indicates that the instruments are selected properly. However, the Shapiro-Wilk normality test rejects the hypothesis of the normality of residuals at the 5% significance level in models 1, 4, 5 and 6; the corresponding p-values are in the [0.0255, 0.0409] interval. Although the t-test is rather robust, standard errors of the coefficients may be slightly underestimated in these models.

In appendix 5, we present estimates of the model with GDP per capita PPP growth taken as a measure of economic growth. In general, the results are very similar to those presented in table 4.



Therefore, we can conclude that the empirical data on CIS countries are in line with the theoretical predictions of our model; however, corruption adjusts to economic development with a 1-2 year delay.

## 5 Conclusions

In this paper, we developed a model which shows that corrupt politicians have few incentives to implement unpopular reforms. Consequently, agents who prefer the status quo have incentives to tolerate corruption. Even a low probability of unsuccessful reforms results in tolerance of corruption if the agents' risk aversion is high enough. Similarly, great future benefits of reforms, may not compensate short-run losses if the elasticity of intertemporal substitution is low. In such cases, agents prefer stability even if it implies some losses due to corruption.

In contrast to models with no corruption, which predict that the politician in office shall be replaced during the periods of economic hardship, our model allows for corrupt politicians to remain in office. In this case, corrupt politicians can mitigate agents' losses due to economic decline by reducing the amount they steal. The predicted negative relation between control of corruption and economic growth was revealed empirically in the CIS countries for the 2002-2016 period, but changes in the control of corruption follow with a 1-2 year delay.

Our model also predicts that if a corrupt politician in office behaves optimally, he may fall from power during a serious crisis. The extent of such a crisis depends on the voters' risk aversion and the elasticity of intertemporal substitution. The more risk averse the voters and the lower the elasticity of intertemporal substitution, the less likely it is that the politician in office changes.

One indirect consequence of our analysis is that policymakers who wish to implement a new reform, should take agents' risk aversion into account. It is essential to explain the short and long-run effects of reforms, so that agents might better understand their mechanisms and so that their effects would seem more deterministic from the agents' point of view. Limiting uncertainty, would go a long way to increase agents' tolerance of reforms. Failure to do so, may create an opening for corrupt populists to take office, with the likelihood that they will remain in office for a long time.

## Conflict of interest

The author declares that he has not received any grant, honorarium or financial support (apart from the official salary). The author declares that he has no conflict of interest.

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## Appendix 1

*Proof.* Differentiate  $g(s)$  with respect to  $s$ :

$$\frac{\partial g(s)}{\partial s} = \frac{v'(w+s+r)v(w+s) - v(w+s+r)v'(w+s)}{v(w+s)^2} \quad (12)$$

Derivative  $\partial g(s)/\partial s$  is negative when  $v'(w+s+r)v(w+s) - v(w+s+r)v'(w+s) < 0$ . This is the case, when  $\psi(s) = v'(w+s+r)/v(w+s+r)$  is a decreasing function of  $s$ .

$$\frac{\partial \psi(s)}{\partial s} = \frac{v''(w+s+r)v(w+s) - v'(w+s+r)^2}{v(w+s+r)^2} \quad (13)$$

As function  $v(\cdot)$  is concave,  $v''(w+s+r) < 0$ , furthermore,  $v(w+s) > 0$  for  $w+s > 0$ , therefore,  $\partial \psi(s)/\partial s < 0$ . This implies that  $\partial g(s)/\partial s < 0$ .  $\square$

## Appendix 2

*Proof.* First, consider a function of the following form:

$$g(D) = (ax_1^D + (1-a)x_2^D)^{\frac{S}{D}} \quad (14)$$

where  $a, x_1, x_2 > 0$  and  $S > D$ . Define a function  $f(x) := x^{\frac{S}{D}}$ . This function is strictly concave. Therefore, according to Jensen's inequality:

$$g(D) < af(x_1^D) + (1-a)f(x_2^D) = ax_1^S + (1-a)x_2^S, \quad 0 < a < 1. \quad (15)$$

and

$$g(D) > af(x_1^D) + (1-a)f(x_2^D) = ax_1^S + (1-a)x_2^S, \quad a > 1. \quad (16)$$

These inequalities are visualised in Figure 2 in case  $0 < D < S$ . Raising inequalities (15) and (16) into the power  $1/S$ , we get

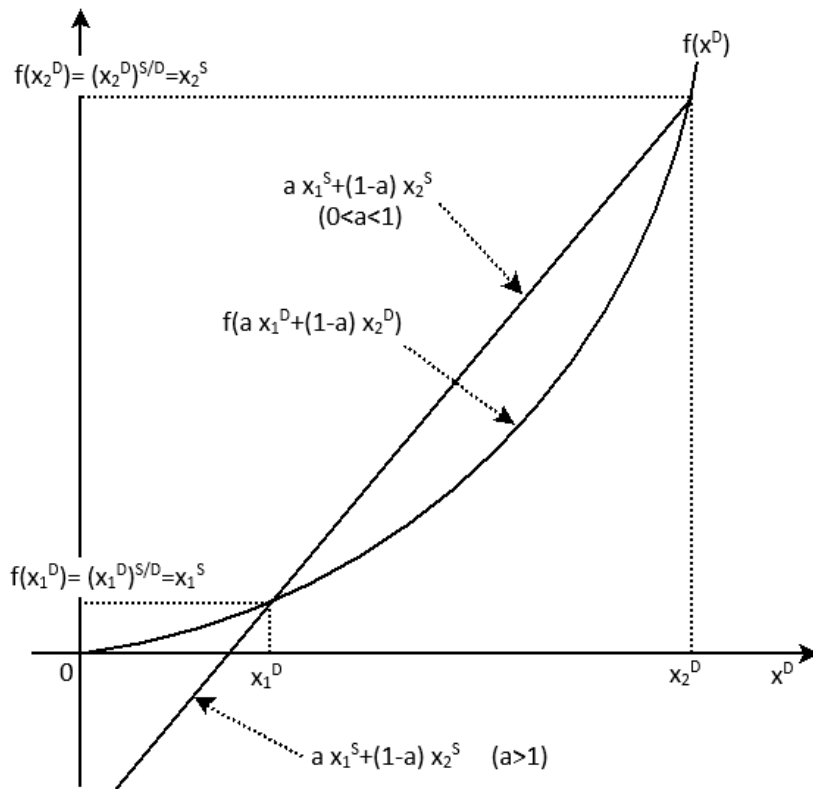
$$(ax_1^D + (1-a)x_2^D)^{\frac{1}{D}} < (ax_1^S + (1-a)x_2^S)^{\frac{1}{S}}, \quad 0 < a < 1. \quad (17)$$

and

$$(ax_1^D + (1-a)x_2^D)^{\frac{1}{D}} > (ax_1^S + (1-a)x_2^S)^{\frac{1}{S}}, \quad a > 1. \quad (18)$$

Therefore, if  $0 < a < 1$ , function  $g(D)$  is strictly increasing in  $D$ , and if  $a > 1$ , function  $g(D)$  is strictly decreasing in  $D$ . Returning to equation (8), the effects of  $\alpha$  on  $\phi(\cdot)$  corresponds to the case  $0 < a < 1$ , with  $a = p$ . The effect of  $\rho$  can be seen, if  $\frac{1}{1-\beta}$  in the denominator of the right hand side of equation (8) is multiplied by  $1^\rho$ , with  $a = \frac{1}{1-\beta}$ ,  $a > 1$ .  $\square$

Figure 2: Inequalities (15) and (16), when  $0 < D < S$ .



## Appendix 3

Table 5: Correlation matrix

regressors	[1]	[2]	[3]	[4]	[5]	[6]
[1] Control of corruption	1					
[2] GDP/capita growth	-0.2093	1				
[3] Gov. income % GDP	0.0625	-0.1693	1			
[4] Rule of law	0.4670	-0.0678	-0.1164	1		
[5] Voice& Account.	0.3194	-0.1098	-0.1733	0.5907	1	
[6] Regulatory Quality	0.0893	-0.1534	-0.0486	0.6116	0.7297	1

## Appendix 4

In this appendix we present a static panel model with individual time and fixed effects when the control of corruption is transformed using a transformation similar to the logit:

$$Y = \log \left( \frac{CoC + 2.5}{2.5 - CoC} \right). \quad (19)$$

Table 6: Dependent variable: transformed control of corruption. Static panel, fixed individual and time effects

regressors	1	2	3	4	5	6
GDP/capita growth (lag=1)	-0.0065** (0.0029)	-0.0039* (0.0022)	-0.0039* (0.0022)	-0.0033 (0.0021)	-0.0037* (0.0019)	-0.0038** (0.0019)
GDP/capita growth (lag=2)		-0.0049*** (0.0017)	-0.0049** (0.0019)	-0.0050*** (0.014)	-0.0053*** (0.0014)	-0.0049*** (0.0013)
Gov. income %GDP			-0.0001 (0.0033)	0.0035 (0.0031)	0.0035 (0.0029)	0.0030 (0.0029)
Rule of law				0.4033*** (0.0817)	0.3996*** (0.0821)	0.3578*** (0.0895)
Voice& Account.					0.0998** (0.0399)	0.0701** (0.0308)
Regulatory Quality						0.1392 (0.1024)
$R^2$	0.0788	0.1142	0.1142	0.3212	0.3488	0.3824
N	135	126	126	126	126	126

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$  significance level

## Appendix 5

In this appendix, GDP per capita growth in 2010 prices was substituted for GDP PPP per capita growth in 2011 prices.

Table 7: Dependent variable: Control of corruption. Static panel, fixed individual and time effects

regressors	1	2	3	4	5	6
GDP/capita PPP growth (lag=1)	-0.0071** (0.0030)	-0.0050** (0.0025)	-0.0051** (0.0025)	-0.0043* (0.0022)	-0.0045** (0.0021)	-0.0042** (0.0018)
GDP/capita PPP growth (lag=2)		-0.0045*** (0.0016)	-0.0045** (0.0020)	-0.0041*** (0.0016)	-0.0045*** (0.0017)	-0.0040*** (0.0014)
Gov. income %GDP			-0.0003 (0.0036)	0.0038 (0.0033)	0.0034 (0.0032)	0.0028 (0.0031)
Rule of law				0.4444*** (0.0891)	0.4432*** (0.0894)	0.3466*** (0.1091)
Voice& Account.					0.1079** (0.0478)	0.0659** (0.0187)
Regulatory Quality						0.2645*** (0.0737)
$R^2$	0.0798	0.1056	0.1057	0.3345	0.3634	0.4515
N	135	135	135	135	135	135

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$  significance level

Table 8: Dependent variable: Control of corruption. Dynamic panel, fixed individual effects

regressors	1	2	3	4	5	6
Dep. variable (lag=1)	0.5878*** (0.0751)	0.5765*** (0.0628)	0.5726*** (0.0599)	0.4908*** (0.0646)	0.4895*** (0.0614)	0.5043 *** (0.0621)
GDP/capita PPP growth (lag=1)	-0.0021** (0.0010)	-0.0011 (0.0008)	-0.0013* (0.0008)	-0.0001 (0.0005)	-0.0001 (0.0005)	-0.0002 (0.0005)
GDP/capita PPP growth (lag=2)		-0.0026*** (0.0005)	-0.0026*** (0.0006)	-0.0010* (0.0005)	-0.0010* (0.0006)	-0.0012* (0.0006)
Gov. income %GDP			-0.0016 (0.0015)	-0.0017 (0.0018)	-0.0020 (0.0019)	-0.0011 (0.0020)
Rule of law				0.2182*** (0.0814)	0.2281*** (0.0852)	0.2501*** (0.0893)
Voice& Account.					-0.0395 (0.0628)	-0.0339 (0.0683)
Regulatory Quality						-0.0825 (0.0936)
Sargent (p-value)	1	1	1	1	1	1
AR(1) (p-value)	0.0056	0.0071	0.0071	0.0075	0.0067	0.0064
AR(2) (p-value)	0.2296	0.2756	0.2923	0.2989	0.2675	0.2550
N	117	117	117	117	117	117

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$  significance level