Corruption and Political and Economic Reforms: A Structural Breaks Approach*

Anders Olofsgård† and Zaki Zahran‡

This version: June 1 2007

Abstract

In this paper we look at the impact of broad policy reforms on the levels of corruption. We use a structural break approach to identify country specific time periods in which significant shifts in corruption levels take place. We then correlate these times of change with a set of co-variates with specific focus on the impact of democratization, and trade and equity market liberalization. We find robust support for the hypothesis that episodes of reduction in corruption levels tend to be correlated with democratization and equity market liberalization. [*Keywords: Corruption, panel-data, democracy, economic reforms. JEL codes: D73, D78, C23*]

*We are grateful for comments and suggestions from an anonymous referee, numerous seminar participants, and, in particular, Michael Bailey, Bob Hussey, Dennis Quinn, George Shambaugh and Dan Westbrook.

†*Address:* The Economics Department and Edmund A. Walsh School of Foreign Service, Georgetown University, and SITE, Stockholm School of Economics. *E-mail:* afo2@georgetown.edu.

‡*Address:* The Economics Department, Georgetown University, 37th and O Streets, N.W. Washington DC, 20057. *E-mail:* zz4@georgetown.edu.

1 Introduction

The purpose of this paper is to study the impact of political and economic reforms on the level of corruption. We are far from the first to analyze this question, but we look at the data in a way that has not been done before. Inspired by a recent literature on economic growth, we use a structural break approach to identify episodes in which the corruption level undergoes significant change and then correlate these episodes with the timing of economic and political reforms and other co-variates. Using this approach we find a more robust relationship between instances of democratization and episodes of reductions in corruption, as compared to most typical cross-country regressions. We also find some support for a positive role for economic reforms, in particular equity market liberalizations. Our results thus suggest that political and economic reforms may be more important for reducing corruption than what has previously been argued within the empirical literature.

In a set of recent papers within the empirical growth literature, the authors have set out to look at the data in a novel way (e.g. Hausmann et al (2004), Jones and Olken (2004), Papell and Ben David (1997)). Instead of looking at the determinants of long-run average growth rates, these papers have identified episodes of growth acceleration and tried to explain what causes these growth spurts. The exact definition of an acceleration varies slightly across papers, but it is basically a significant shift in the trend growth rate over some minimal number of years.[1] The motivation behind this approach is mainly threefold. First of all, the approach explicitly looks at variation within countries, which takes care of the potential bias from country-specific time invariant factors in the typical cross-country growth regressions. Furthermore, by focusing on the episodes of change, the approach also accounts for the possibility of non-linear effects of discrete changes in the environment, as can be expected for instance in models with poverty-traps. Finally, the policy discussion is usually centered around the question of what can be done to generate a sustained acceleration in a country's growth rate. Hence, the question is what is needed to initiate a sustainable change, exactly what the growth acceleration approach is focusing on, and the hope is that instruments available to policy makers, such as economic, political or judicial reforms, are part of the answer.

The above mentioned motivation can as readily be applied to the study of corruption, a field in which cross-country regressions are the norm. It has long been argued that corruption is a persistent phenomenon and that countries tend to get stuck in corruption traps that are very hard

[1] Some papers only look at accelerations, whereas others look at significant changes in both directions.

to get out of. Theoretically, this has motivated authors to model the level of corruption as the outcome of games with frequency dependent equilibria, typically giving rise to vicious or virtuous cycles (e.g. Cadot 1987 and Andwig and Moene 1990). In this kind of models, the movement to a new equilibrium with a lower level of corruption is generally a discrete jump caused by some rather drastic change in the underlying environment. Identifying these jumps and finding out what may cause them thus seems like a fruitful approach. Furthermore, fighting corruption has moved to the forefront of the policy discussion on how to spur development in poor countries during the last decade. Identifying what events are correlated with success, or the opposite, may therefore have more than an academic value.

In this first attempt to study corruption with this approach, we focus on two sets of explanatory variables, economic reforms and political liberalization. We do this for two reasons. First, development practitioners have long argued that political accountability and economic openness are keys to reducing corruption, but the typical cross-country regressions have found mixed support for this. Rather, the typical regressions have suggested that history rules.[2] For instance, Treisman (2000), in a widely cited and influential paper, identifies five variables to be robustly correlated with corruption, but only one of these, the income level, tends to vary in the short to medium term. The other four, history of British rule, the percentage of Protestants in the population, being a federal state, and a history of democratic rule for at least 40 years, seem to be more determined by history than any current policy choices.[3] In particular, political and economic reforms seem to have little, if any, impact. It is questionable, though, if cross country regressions is the best approach in this case. Political and economic openness are both highly correlated with income level, which is by far the most significant variable, both in statistical and economic terms, in Treisman's study. Severe problems of multicollinearity are thus likely to be present. It seems like a potentially more fruitful approach would be to focus on what happens within countries as they undergo these reforms.

Furthermore, comparing the short and long run effect of increases in income reveals a somewhat puzzling divergence, which also suggests a potential role for economic and political reforms. Cross-country regressions without exception suggest that richer countries have lower levels of corruption (e.g. Treisman 2000, Fisman and Gatti 2002, Serra 2006). This is also what we find in our data. However, when we instead use fixed effects regressions focusing on the short-run effects of income

[2] This arguments is also supported by some theoretical models. Tirole (1996), for instance, argues that current generations may be doomed into a bad equilibrium by a reputation for corruption inherited from previous generations.

[3] With the exception of being a federal state, these are also the only variables, with the addition of political instability, that are deemed to be robust in an extreme bounds analysis conducted by Serra (2006).

then the result is the opposite, i.e. that corruption goes up as income goes up. This may seem puzzling at first, but there is an abundance of case studies suggesting that the potential to reap rents in economic booms fuel corruption in the short run. See for instance Pei (2006) on China or think of countries benefitting from resource booms, such as Russia (Shleifer and Treisman, 2000). The question though is how to reconcile this difference in the effect of income in the short and long run?

One potential explanation is that with economic development comes stronger institutions, containing the ability of public agents and private actors to collude in corrupt deals without punishment. This would suggest that the response in the level of corruption to economic booms should be smaller in richer countries. However, this cannot in itself explain the pattern in the cross-country data, since this does not suggest that the correlation should turn negative. It must therefore also be the case that the stronger institutions or, more generally, something that is part of the development process, causes discrete jumps in the perceived level of corruption. Hence, our argument suggests that to resolve the puzzle we should focus on episodes of significant change in the perceived level of trend corruption, and see if these changes are associated with discrete changes in the underlying institutions, broadly defined. In this paper we focus attention on the impact of regime type and economic reforms aimed at increasing the level of competition in the economy. Obviously, there are other institutional changes that may also matter, and democratization and economic liberalization may be the cause of some deeper underlying change. There is therefore ample room for additional future work.

The paper is structured as follows. In Section two we offer an overview of the literature. In Section three we discuss the data we use, while we lay out our empirical strategy and present our results in Section four. In Section five we discuss the implications of our findings.

2 Determinants of Corruption

Despite an abundance of research on corruption there is no real consensus on what the consequences are, or why it varies so substantially across countries.[4] As documented by Serra (2006),

[4]It is safe to say that the dominant view is that corruption has a negative effect on the economy, but there are also divergent views. One line of argument claims that corruption can alleviate imperfections in a second best situation. This can be the case in the presenence of politically motivated policy distortions (Leff 1964 or Huntington 1968) or when excessive red tape necessitates "speed money" to get things done (Lui 1985). Another line of argument builds on the incentives for investments that can arise when politicians/bureaucrats guarantee businesses higher rents than would arise on a competitive market in exchange for bribes. South Korea is often mentioned as an example

an abundance of different variables have been shown to be significant determinants of the level of corruption in different cross-country studies, but very few of them are robust to small permutations to the model or the sample applied. Nevertheless, an important line of argument coming out of the literature is that corruption is a persistent phenomenon. These arguments have been backed up by an empirical literature which has found many (more or less) historically determined variables to be important. La Porta et al (1999) and Treisman (2000) find that religion matters. More specifically, countries dominated by what the authors classify as more individualistic religions (Protestantism versus Catholicism and Islam) tend to have lower corruption. La Porta et al (1999) also finds that the legal system matters. The British common law seems superior at fighting corruption relative to the French civil law or socialist law. Treisman (2000), however, finds that common law performs no better (if anything, worse) than civil law once former colonial status is controlled for. He claims that what really matters is legal culture rather than legal code, and that the British colonial rule instilled a sense of obedience to rules rather than to authority, or power, which means that corruption at the highest levels gets prosecuted. Federalism (sometimes referred to as decentralization) has also been found to be important, even though the sign of the effect, both theoretically and empirically, is ambiguous (e.g. Shleifer and Vishny 1993). Treisman (2000) finds that federal governments tend to have higher corruption, which he attributes to a common pool problem associated with having multiple layers of agencies who do not internalize the effect on other agencies of requiring a bribe. On the other hand, Fisman and Gatti (2002), using another definition of federalism and another data set, find that federalism decreases corruption. They state that their results confirm the argument that decentralization increases accountability of government bureaucrats.

Corruption is not fully determined by history, though. As reported in Lederman, Loayza and Soares (2005), the within country variance in corruption is smaller than the cross-country variance in their sample, but the ratio between the two is no smaller than that for many other variables typically used in panel data regressions. Also, there are many cases of successful reductions in corruption levels (see for instance Rose-Ackerman 1999 and Reinikka and Svensson 2004b). Hence, even if self-fulfilling expectations can create corruption traps, there may be ways to get out of them. Therefore, we focus attention in particular on two sets of broad policy reforms that we think can be helpful; reforms aiming at increased political accountability, and reforms aiming at increased economic openness.

of this crony-capitalism. Ades and di Tella (1997) present a model along these lines, suggesting that interventionist industrial policy feeds both investments and corruption.

2.1 Political Accountability

There are basically two risks for politicians of engaging in or accepting the existence of corruption. The first risk is political, the risk of losing power. The second risk is judicial, the risk of being prosecuted.

Elections are widely perceived to increase the political risk of corruption by institutionalizing the ability of citizens to replace an unpopular ruler at a relatively low cost (e.g. Rose-Ackerman 1999).[5] However, the extent to which elections serve as a disciplinary device depends on the extent to which voters are aware of when corruption is taking place. Hence, transparency and access to information is crucial. As shown in case studies of the education sector in Uganda (Reinikka and Svensson 2004a and 2004b), lack of information facilitates corruption, but fortunately successful information campaigns can also help reduce corruption by significant amounts.

Political accountability can also arise through the existence of checks and balances (separation of powers) that introduce an element of monitoring and whistle-blowing within political institutions. The hope is that different government bodies will discipline each other to the benefit of the citizens (Persson et all 1997 and Laffont and Meleu 2001). The courts are of course particularly important, since the independence and honesty of these institutions are crucial for the judicial risk politicians and bureaucrats face when engaging in corruption (e.g. Bond 2004).[6]

So far we have emphasized the disciplinary effects of democracy, but there are also arguments in the opposite direction. Corruption may for instance take the form of electoral campaign contributions in exchange for certain policy decisions. Fierce electoral competition may in this case lead to more rather than less corruption (Rose-Ackerman 1999, Geddes 1997). Periods of democratic transition may also be associated with higher corruption if old norms and institutions are eroded before new norms and institutions are in place. Monitoring and enforcement may be weakened in the turmoil often associated with regime change, and opportunities for bribes may be abundant, in particular if the political transition coincides with an economic transition, as we have witnessed in the post-communist countries in Eastern and Central Europe and the former Soviet Union. Also, even if actual corruption does not increase, people's perceptions of corruption may do, because the emergence of a political opposition and a free and independent media may shed light on what was

[5] Voting may be a nuissance but it is clearly less risky than staging an insurrection against an authoritarian ruler.

[6] Note though that institutionalizing checks and balances that increases the judicial and political risks of engaging in corruption may also be a way for honest politicians to signal their intentions in an adverse selction framework (Desai and Olofsgård, 2006). Institutions may thus be endogenous to the level of corruption.

previously hidden.

The empirical results are mixed. Studies using only cross-sectional data do not usually find a robust correlation between regime type and corruption. Triesman (2000) finds that countries having been democracies for at least 40 years tend to have lower corruption, but current regime type (measured either as a dummy or with Freedom House's rating of political rights), or the number of years as a democracy, were not statistically significant. As mentioned in the Introduction, a major problem with cross-sectional data is of course that regime type is highly correlated with income. Inconclusive results are therefore not surprising.

Lederman et al (2005) and Adsera et al (2003) use panel data, exploiting both the time series and the cross-sectional variation in the data. It is worth noting, though, that none of these papers use fixed effects, so most of the explanatory power still comes from the cross-country variation (since the between variance in the corruption data is higher than the within variance) and likely problems of omitted variable bias from time-invariant country specific factors are not dealt with. Adsera et al (2003), using an OLS estimator with panel-corrected standard errors, find that democracy, measured by Polity III data, tend to have a negative correlation with corruption, but the statistical significance depends on the number of controls. They do find a robust and negative relationship between newspaper circulation and corruption, though, suggesting that public information is important. Lederman et al (2005), using data from the Database of Political Institutions, make a distinction between presidential and parliamentarian democracies and find that only the latter are correlated with lower levels of corruption[7] . They also find that a history of uninterrupted democracy has a separate negative correlation with corruption, lending further support to the findings in Treisman (2000).

2.2 Economic Openness

An important insight from the literature is that corruption is fueled by the presence of potential rents. These rents can arise due to a host of reasons. What we focus on here, though, is the impact of restrictions on competition and other forms of market regulations. When restrictions and regulations lead to the presence of rents, incentives will be in place to expropriate those rents for personal benefit. Ades and Di Tella (1999) show in their paper that policies which aim at

[7] Persson (2004) finds a similar result looking at a broader measure of structural policies including in addition to corruption measures of rule of law, bureaucratic quality, and expropriation risk.

increasing market competitiveness play an important role in controlling corruption. This result is consistent with earlier work that proposes introducing competition as a means of bribe reduction (Rose-Ackerman, 1978). A study by Clarke and Xu (2002), using micro-data from 21 countries in Eastern Europe and Central Asia, shows that bribes to utility companies are lower in countries where these companies are privately owned and where competition in the sector is high. Broadman and Recanatini (2000) also argue along these lines. They find a robust link between the level of corruption and the development of market institutions, in particular barriers to entry of new business, the effectiveness of the legal system, and the efficacy and competitiveness of services provided by infrastructure monopolies.

One important example of how limits to competition causes incentives for corruption comes from the trade literature, which has shown how trade restrictions give rise to rent seeking activities (e.g. Bhagwati 1982). The specific rent seeking activities vary according to the circumstances; from tariff evasion, to seeking bribes for licenses, etc. Gatti (1999) argues that differentiated tariff rates provides incentives for corruption in the interactions between importers and custom officials, and shows some empirical support for this argument. This suggests that eliminating tariffs, or at least using a system of flat taxation, would reduce corruption. Larrain and Tavares (2001) also find a strong and robust link between trade openness and corruption.

Other forms of restrictions and regulations, such as price controls, foreign exchange allocation mechanisms, complex tax systems, and government control of the financial sector also give rise to opportunities for rent-seeking behavior. Dreher and Siemers (2004) examine the relationship between corruption and capital account restrictions. Using panel data they find a significant relationship that cuts both ways: higher levels of corruption leads to stricter restrictions, and more restrictions leads to more corruption. Larrain and Tavares (2004) study the effect of foreign direct investments (FDI), another source of competition, on levels of corruption. They find that FDI as a share of GDP is associated with lower levels of corruption, and that its quantitative impact is of the same order of magnitude as that of per capita GDP. Wei (2000) argues that globalization in the form of trade and investment liberalization and technological advancement can reduce corruption.

3 Data

Corruption has traditionally been seen as something observable but not quantifiable. During the last couple of decades, though, both non-governmental organizations and for-profit firms have developed subjective corruption perception indices, covering a relatively wide range of developed and developing countries. The subjective nature of the data clearly has its limitations (for an in-depth discussion, see Treisman 2000), but authors generally find some comfort in the fact that different measures tend to be very highly correlated. In this study we need to have reasonably long time series in order to capture episodes of change. We have therefore chosen a widely used measure of corruption from the Political Risk Service, the International Country Risk Guide (ICRG). This data allows us to have a twenty year time frame from 1984 to 2003. The ICRG corruption index is measured between 0 and 6, with a higher value implying less corruption. The mean value within our sample is 3.2, with an overall standard deviation of 1.4, and a within country standard deviation of 0.7. Hence, the greatest variation is across countries, but there is still enough variation within countries to motivate a study of structural breaks in the time series.

Our key independent variables are measures of political and economic reform. Based on the motivation behind our approach, we are interested in fundamental changes in policy, rather than gradual incremental change. That is, we want to test the impact of reforms favoured by most development practitioners, such as democratization or opening up of markets for foreign ownership, rather than the effect of piecemeal political liberalization within autocracies or already established democracies, or marginal reductions in trade taxes. We are therefore focusing on binary measures of change in political institutions and economic policy, keeping in mind the fact that this means that we are ignoring some of the variation in other less coarse indicators.

To measure the strength of political accountability we use data from the Polity IV project. We use the Polity2 indicator, which defines countries as autocracies or democracies, and measures the quality of democratic institutions on a scale from -10 to 0 (for autocracies) and from 0 to +10 (for democracies). Hence, the measure permits a gradual scale within the sets of democracies and autocracies, but we are focusing attention on the jumps from negative to positive territory (or the other way around), i.e. on what according to this measure implies a change in regime type. In principle, this change may be part of a gradual piecemeal transition, which may not correspond that well with our concept of a democratization process. However, as pointed out in Giavazzi and

Tabellini (2005), the standard deviation within the sub-sample of observations around 0 is much greater than that of the complete sample. This indicates that regime change tends to induce discrete jumps within this range.

To measure economic reforms we use two different binary indicators.[8] The first indicator builds on the well known measure of trade openness first developed by Sachs and Warner (S/W 1995) and later updated by Welch and Wacziarg (2003). The original S/W indicator classifies a country as being closed if it displays at least one of the following characteristics: 1) Average tariff rates of 40 % or more. 2) Non-tariff barriers covering 40 % or more of trade. 3) A black market exchange rate that is depreciated by 20 % or more relative to the official exchange rate, on average, during the 1970's and 1980's. 4) A state monopoly on major exports. 5) A socialist economic system. The update from Walch and Wacziarg (2003) basically follows this set-up with some deviations based on data availability (see their paper for a more detailed discussion). To identify periods of trade reform, we look at episodes in which this measure changes, i.e. when a country changes from closed to open or the other way around.[9]

The second economic indicator builds on a measure of equity market liberalization, developed in Bekaert and Harvey (2002) and Bekaert, Harvey and Lundblad (2005). This indicator takes the value of one in countries in which foreign portfolio investors are allowed to own the equity of a particular market. As with trade openness, equity market liberalizations are likely to be correlated with other macroeconomic, financial and legal reforms. However, as shown in Bekaert, Harvey and Lundblad (2005), the indicator has a robust positive effect on growth even when controlling for other indicators of macroeconomic, financial and legal reforms. Hence, the indicator seems to capture something quite specific to equity markets. Once again, we look at episodes of change in order to identify the role of economic reforms.

We also control for an additional set of right hand side variables. We are focusing on variables

[8] We also tried with a third variable, a binary measure of capital account openness from the IMF's Annual report on Exchange Arrangements and Exchange Restrictions. However, this variable was never close to being statistically significant, with p-values typically above 0.80, and it's inclusion did not influence any of the other results.

[9] The S/W indicator has been widely used but it has also been critisized, in particular by Rodrik and Rodriguez (2000). One line of criticism has been that trade policies are so highly correlated with other macroeconomic policies that it is impossible to identify the effect of trade alone. This criticism is not a great concern for us, since we are not explicitly concerned with the effect of trade reform. Rather the opposite, it may be to our benefit since trade reform is only part of what constitutes a more competitive and transparent market economy, and if it is correlated with other reforms working in that direction then we are more likely to capture what we want. However, the indicator has also been critized for being to much driven by two of its components, the black market premium and the state monopoly on major exports. In particular, Rodrik and Rodriguez (2000) point out that the state monopoly on major export criteria was based on a World Bank study covering only African countries, and that all except one of the Sub-Saharan African countries were classified as closed based on this criterion. They therefore argue that the openness indicator to a great extent boils down to a Sub-Saharan-Africa dummy.

that change over time, since time-invariant variables cannot by construction be correlated with our reform variables. Income is clearly correlated with corruption (even though the short run and long run correlations may differ, as discussed in the Introduction) as well as with regime type and economic openness. We therefore include in our regressions measures of income and income growth. Abundance of natural resources has also been linked to high levels of corruption, as well as lack of democracy and economic openness, so we also include a measure of exports of fuels as percentage of total exports (e.g. Ades and di Tella, 1999, and Leite and Weidmann, 1999). Finally, political instability, which may be correlated with regime type, has been claimed to have a robust impact on the level of corruption (Serra 2006). We therefore include a measure of the average number of changes in executive power during the last ten years calculated from data provided by the Polity IV project. The inclusion of this variable also helps to reduce an alleged problem with the ICRG corruption data, that it measures the impact of corruption on political instability rather than just the level of corruption. It should be emphasized, though, that this view, though sometimes expressed in the literature, has no foundation in the Political Risk Service's own definition of what the corruption measure is supposed to capture. The variables are defined and their sources specified more in detail in the appendix.

4 Empirical Strategy

4.1 Preliminary Regressions

To make sure that any differences between our results and previous studies are not just driven by different data, we first run a regression using the between estimator to capture the cross-sectional variation. The results are presented in Table 1. In the first four columns we introduce our measures of reform separately, including both the democracy dummy and the less coarse Polity score in order to increase comparability with previous studies. In the last two columns we introduce all reform variables together, first using the Polity score and then using the democracy dummy. The latter specifications are motivated by the fact that economic and political reforms may be correlated, which may cause us to over- or under-estimate the impact of particular reforms if introduced separately (Giavazzi and Tabellini, 2005). For instance, democratization may cause a more or less market friendly administration to come to power or economic reforms may empower groups to also call

for political reforms. The results in Table 1 shows that income level, political stability and (less robustly) fuel exports are all significant and with the same sign as found in other cross-sectional studies. However, in accordance with, for instance, Treisman (2000) and Serra (2006) none of our reform variables are statistically significant. Hence, even in this very parsimonious model with none of the many time invariant variables found important in other studies, political and economic reforms seem to have no impact on corruption.

Things change quite dramatically when we instead study the variation over time within countries. In the first six columns of Table 2 we replicate the regressions from Table 1 but now using a two-way fixed effects model. The conventional interpretation is that the Between estimator shows the long run effects whereas the Within estimator shows the short run effects. In this case, since our reform variables are binary, the interpretation of the within regression is also consistent with a difference-in-difference approach, with the countries undergoing reform during the period being the group of treated countries, and the rest being the control (e.g. Blundell and McCurdy, 2000). Either way, our reform variables now become statistically significant at the conventional levels. Democracy and equity market liberalization have the expected signs, even though it should be noted that the estimated effects are quite small. The short term impact of a democratization is estimated at 0.34 (column 6) whereas that of an equity market liberalization is estimated at 0.25 (column 6). Note also that the estimated impact of respective reform is higher when estimated jointly. This suggests that the types of reforms are negatively correlated. The trade reform dummy is also statistically significant, but surprisingly negative. Hence, the results suggest that reforms opening up the economy for foreign competition from exporting firms increase rather than decrease the perceived level of corruption. Finally, note also the sudden shift in the sign of income. Throughout Table 2 per capita GDP is statistically significant at the one percent level and negative, i.e. suggesting that corruption increases as income increases. As discussed in the Introduction, this is quite contrary to the findings in all studies using only (long term) cross-sectional variation but at the same time consistent with many observations of patterns of corruption in rapidly growing economies. The scope for corruption simply increases with economic activity. The opposite effect of income in the long run probably has more to do with incremental institutional change that usually comes with economic development than increased income levels in and off themselves.

The last two columns of Table 2 show the results from a GMM estimation as specified in Arellano and Bond (1991). We test this model for two reasons. Corruption is clearly persistent, so a dynamic

model may better reflect the true data generating process. However, it is well known that dynamic panel-data models generate inconsistent estimates in the presence of time-invariant country specific effects. The GMM model of Arellano and Bond is designed to yield consistent estimates also in this context. Secondly, the GMM model allows us to partially loosen the assumption of strict exogeneity of the right hand side variables by using lagged values of all independent variables as a matrix of instruments. There are many potential sources of endogeneity in the corruption literature and ideally we would be able to identify truly and undoubtedly exogenous instruments. This is very challenging in our context, though, since we are explicitly looking at episodes of change. Hence, we cannot use typical geographic or historical variables as instruments, since they are time-invariant and thus cannot possible be correlated with change in political institutions or economic policies. The GMM model is the best we can do, but the reader should keep in mind that it may not be ideal. The model specified for this set of regressions is:

$$y_{it} = \alpha_1 y_{it-1} + \alpha_2 y_{it-2} + \sum_k \beta_k x_{k,it} + \upsilon_i + \eta_{it} \tag{1}$$

where υ_i is the time-invariant unobserved heterogeneity, which may or may not be correlated with the regressors in the model, and η_{it} is an i.i.d. error term.[10]

The results confirm that corruption is indeed persistent, but the most important result for our purpose is that all our reform variables stay statistically significant at the 1% level, though, as expected, the coefficients decrease somewhat in size. Most notable is that the trade openness dummy now switches sign to become positive, what we initially had anticipated. The bias in the previous regressions thus seems to have had the biggest impact on this variable. Natural resources also come alive, with the expected negative sign.

We now turn to the main innovation of this paper, the study of significant episodes of change in corruption levels. This procedure requires two steps: First of all we identify the episodes of change, and construct a three year window around that year. Second, we look at what correlates with these episodes of change, with a particular focus on the role of political and economic reforms..

[10] Estimation was performed using the Xtabond command in STATA. The output of this command includes a Sargan test for overidentifying restrictions, confirmed in our results, and a test for the serial correlation of the error term. The procedure always generates first-order correlation, but it is important that there is no second-order correlation. This is conformed by our results which firmly reject the hypothesis of second-order correlation. For more details on this method of estimation we refer the reader to Arellano and Bond (1991).

4.2 Determining the Episodes of Change

To determine the episodes of change we use an alghoritm developed by Bai-Perron (1998) for identifying structural breaks in time series data. This methodology has not been used before to analyze breaks in corruption levels, however, it has been used widely to analyze time series data in macroeconomics, international finance and monetary economics. We use the method to search for breaks in the mean level of corruption. The timing of a change in corruption levels is chosen by the year that maximizes the F-statistic for a spline regression, with the timing given by a break at the relevant year. We apply this method to the corruption data for all our 126 countries. For our purpose the structural break model is thus specified as follows

$$\begin{array}{c} y_t = c_1 + u_t, t = 1, ..., T_1, \\ y_t = c_2 + u_t, t = T_1 + 1, ..., T_2, \\ \vdots \\ y_t = c_{m+1} + u_t, t = T_m + 1, ..., T \end{array} \tag{2}$$

where y_t is corruption at time t, c_j $(j = 1, \ldots, m+1)$ is the intercept for the respective intervals of time and u_t is a random disturbance term. The break points $(T_1, \ldots, Tm)$ are treated as unknowns, and are estimated together with the unknown coefficients when T observations are available. The procedure then determines the appropriate number of breaks in the data by a number of different statistics. See Appendix A for details. Given the limited data we have access to for each country, we allow the maximum number of breaks (l) to be 3, with a minimum of 4 years between any two successive breaks. The results of this method to determine the episodes of change are reported in Table 3. The column labeled "Year" identifies the time of change for the given breaks.

Among the episodes of change we only consider those that passed the following filters:

- *Significance Filter:* This filter excludes breaks that are not significant at the 1% level. The episodes that do not pass this filter are not considered as episodes of change, and are treated as part of the control group. In total there were 125 episodes of change that passed this filter. They were divided as such: 30 episodes were reductions in the level of corruption, and 95 episodes were increases in the level of corruption. These are the episodes reported in Table 3.

- *Size Filter:* This filter considers changes in the corruption index that have a magnitude of at least one unit (the ICRG index varies from 0-6). This eliminates 53 of the 125 episodes

counted above, so we are left with 72 episodes. The episodes that do not pass this filter are marked with "X" in the column labeled ">1" in Table 3.

- *Sustainability Filter:* A third filter is occasionally used to study the difference between sustained changes in the levels of corruption and changes that are later reversed. Among the 72 episodes 19 were only temporary changes. Hence, we are left with 53 episodes of change when this filter is applied on top of the others. The episodes that do not pass this filter are marked with "X" in the column labeled "Sustained" in Table 3.

Tables 4 and 5 provide a summary of episode statistics and classification. The episodes that are identified are of two types: either improvements or deteriorations in the levels of corruption. We create a variable to identify the timing of the break. Following Hausmann et al (2005), we also allow this variable to include a window around the time of each episode [t-1, t, t+1] to allow for some of the uncertainty in our identification. We classify the windows of breaks according to whether they were improvements or deteriorations in levels of corruption. We thus create a variable "episodes" that takes a value of zero for episodes of increased corruption, a value of 1 for no change, and a value of 2 for reductions in corruption. To study these discrete episodes and correlate them with our variables of interest we need to use a multinomial regression. An ordered probit regression is an ideal place to start.

4.3 The Ordered Probit Model

We use the variable "episodes" created above as our dependent variable for the ordered probit regressions, which enables us to study what correlates with these changes in trend levels of corruption, as defined by our "episodes" variable. Using "episodes" also allows us to run an ordered regression, which would not be possible with the raw corruption data we have because it builds on aggregated yearly averages from monthly data. That is, whenever there is some variation within the year, the average number will not be an integer and the number of potential categories is too high for us to treat the corruption data as ordinal rather than cardinal.

We use right hand side variables measured in first differences since the left hand side is defined as an episode of change in corruption. We are thus mapping changes in the right hand variables on changes in corruption. This implies that our binary reform variables take on the value of one in a year of reform and zero all other years, irrespective of the state of political accountability or

economic openness. We are thus correlating years of actual reform with episodes of change in the level of corruption. With continuous variables such as income and growth, this allows us to look at jumps in income levels and accelerations in growth rates that may spur the occurrence of episodes of change in corruption levels.

The specification used for the latent dependent variable in the ordered probit regression is

$$episodes_{it} = \gamma + \sum_{k} \beta_k x_{kit} + \varepsilon_{it} \tag{3}$$

where x_{kit} are the right hand side variables used in the model and discussed in the data section above, and ε_{it} is the error term.

The results of the ordered probit regressions give us the probability of observing the discrete events taking place, that is, the probability of observing a deterioration or improvement in corruption levels for a given set of characteristics given by the right hand side variables in the regressions. See Appendix B for more details on ordered probit regressions, including how to interpret the regression coefficients.

The results of these regressions are reported in Table 6 for all episodes of change, and Table 7 for only sustained episodes of change. As can be seen, both indicators of democracy are positive and significant at the 1% level in both tables, reinforcing the results from Table 2. The impact of economic reforms is more mixed. Equity market liberalization comes out consistently significant, suggesting that episodes of financial market reforms, as episodes of political reforms, are likely to be episodes of reductions in corruption. Trade reform, on the other hand, always carry the expected sign, but it is not statistically significant.[11] The size of the estimated effects are quite moderate, but far from negligible. Using column 5 in Table 6, and looking at the average of the marginal effect (rather than the marginal effect at the average value of the independent variable), we find that a democratization reduces the probability of experiencing an increase in corruption by around eleven percent, and increases the probability of experiencing a reduction in corruption by around six percent. Doing the same thing for equity market liberalization we find that a reform decreases the risk of an increase in corruption by around seven percent, and increases the chances of a reduction in corruption by around four percent.

The control variables also loose some of their significance. This is not that surprising, considering

[11] We also tried with a measure of taxes on international trade over total exports plus imports from The World Bank, but this measure was also never statistically significant.

that these measure gradual changes in continuos variables whereas the left hand side is a discrete event. Note also that there is very little difference between the results in the two tables.

4.4 Fixed-Effects Ordered Probit Model

In Tables 1 and 2 we saw that time-invariant country specific factors may influence the results quite dramatically. This may of course be true also for our ordered probit regressions. We therefore next turn to estimating a fixed effects ordered probit model to check the robustness of the results reported above. This is complicated by the fact that the conventional approach to first differencing the right hand side variables to eliminate the heterogeneity between the different cross sections leads the maximum likelihood estimator to become inconsistent (Chamerblain, 1980). Ferrer-i-Carbonell and Frijters (2004) therefore suggest, based on Chamberlain (1980) and Mundlak (1978), that averages of the right hand side variables should be used to instrument for the unobserved heterogeneity. This gives us an error structure given by $\varepsilon_{it} = \alpha_i + \eta_{it}$, where the time-invariant unobserved heterogeneity, α_i, can be captured by $\alpha_i = \sum_k \delta_k \overline{x}_{k,i} + \upsilon_i$. It is assumed that η_{it} and υ_i are both normal with $E[\upsilon] = E[\eta] = 0$. Using this specification of the error structure, the model we estimate becomes

$$episodes_{it} = \gamma + \sum_k \beta_k x_{k,it} + \sum_k \delta_k \overline{x}_{k,i} + \mu_{it}, \tag{4}$$

where μ_{it} is the sum of two stochastic variables drawn from normal distributions with mean zero (and thus itself normal with mean zero). We estimate the model for all episodes of change and then repeat it again only for sustained episodes of change.

The results of the random effects ordered probit, reported in tables 8 and 9, are largely consistent with those in Tables 6 and 7. Democratization stays significant at the 1% level throughout. Equity market liberalization also stays significant, though only at the 10% level in the case of sustained reforms. The openness dummy is still insignificant while the GDP variable now becomes significant in most regressions. Note also that we are reporting the effect of the average GDP level, one of the variables used as an instrument for the time-invariant heterogeneity in the sample. We only report this variable because all other instruments were insignificant. The negative sign means that countries with a higher average GDP are less likely to experience an improvement in corruption levels, and more likely to experience a deterioration, during the time of our sample. This may seem

surprising at first but actually makes sense, since most countries in the sample with high income already have high corruption scores (i.e. low corruption levels) Hence, there is not much potential to increase the score (which is capped at 6), but a lot of potential to drop. A word of caution when interpreting the results is needed, though. As discussed in section 4.1., it is very challenging to come up with appropriate time-variant instruments for our reform variables. We can thus not for sure rule out problems of simultaneity bias. The lack of significant differences between the fixed effects OLS regressions and those using the GMM estimator of Arellano and Bond in Table 2, does indicate, though, that this may not be a severe problem.

5 Implications

Corruption has recently emerged in the forefront of the discussion of impediments to economic development, both within academia and within policy circles. This is, for instance, apparent within international financial institutions such as the World Bank and the IMF, and it is also a critical part of the philosophy behind the Millennium Challenge Account. This raises the natural question of what can be done in the short to medium term to significantly reduce corruption in countries struggling with the twin burden of lack of economic development and poor governance. Within the policy arena, the benefits of political accountability and transparency, as well as economic openness and competition, have been hailed. This hope has been partly supported by theoretical academic work, but most empirical studies on the determinants of corruption have assigned little, or no, role for economic or political reforms. Instead, the somewhat somber conclusion is that history rules, and that governments have few instruments available that can make any difference except promoting rapid economic development that leads to higher per capita incomes. Unfortunately this is easier said than done, in particular in the presence of high levels of corruption. Governments find themselves in something of a Catch 22; to promote development they need to reduce corruption, but to reduce corruption they need to achieve development (or turn back the time and convince Britain to come and colonize the country before the French or the Spaniards arrive).

What we argue in this paper, though, is that to estimate the effects of political and economic reforms, long-term cross-country regressions may not be the way to go. What we suggest instead is to focus on what happens within countries as these reforms are implemented. Obviously the full effects of the reforms may take time to materialize, so the short-run within-country response

in corruption may seem small. However, the short-run effect will probably be measured with more precision than the long-run effect since countries which are politically open and economically competitive also tend to be rich, educated, and all the other things that come with modernization and economic development, and which also influence corruption levels. Also, the gradual process towards democracy and open markets in Europe looked quite differently from what has been going on in the developing world during the last couple of decades. Therefore, to measure the impact of the current process, looking at what happens within countries currently democratizing and opening up their markets makes more sense than trying to learn something about the impact of politics and economics by comparing Sweden with Zimbabwe.

Our empirical strategy isolates episodes of significant change in the time series of corruption, and then identifies the effects of democratization and economic reforms by studying whether these episodes also are likely to be episodes of change in these variables. Our results suggest that this is the case. In particular, we have identified a robust relationship between reductions in corruption and democratizations as well as equity market liberalizations, while there is little support for a positive effect of trade reforms. Hence, contrary to the cross-country literature we find robust support for a positive role of political reforms and at least some economic reforms. Political accountability and transparency and economic openness and competition may thus indeed be crucial components to reduce corruption levels and help the development process of currently poor countries.

References

[1] Ades, A. and R. Di Tella (1999), "Rents, Competition and Corruption", *American Economic Review*, 89, 982-993.

[2] Adsera, A., C. Boix and M. Payne (2003), "Are you Being Served? Political Accountability and Quality of Government", *The Journal of Law, Economics and Organization,* 19, 445-490.

[3] Andwig, Jens Christopher and Karl Moene (1990), "How Corruption may Corrupt", *Journal of Economic Behaviour and Organization*, 13, 63-76.

[4] Arellano, Manuel, and Stephen Bond (1991), "Some Tests of Specification for Panel Data:Monte Carlo Evidence and an Application to Employment Equations," *The Review of Economic Studies*, 58, 277-297.

[5] Bai, Jushan, and Pierre Perron (1998), "Estimating and Testing Linear Models with Multiple Structural Changes," *Econometrica*, 66, 47-78.

[6] Bai, Jushan, and Pierre Perron (2003), "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics*, 18, 1-22.

[7] Bardhan, Pranab (1997), "Corruption and Development: A Review of Issues", *Journal of Economic Literature*, 35, 1320-1346.

[8] Bekaert, Geert, and Campbell Harvey (2002), "Chronology of Important Financial, Economic and Political events in Emerging Markets", mimeo, Duke University.

[9] Bekaert, Geert, Campbell Harvey, and Christian Lundblad (2005), "Does Financial Liberalization Spur Growth?" *Journal of Financial Economics* 77, 3-55.

[10] Bhagwati, J.N. (1982) "Directly Unproductive, Profit-seeking (DUP) Activities," *Journal of Political Economy,* 90, 988-1002.

[11] Bond, Philip (2004), "Contracting in the Presence of Judicial Agency", mimeo University of Pennsylvania.

[12] Broadman, Harry G. and Francesca Recanatini (2000), "Seeds of Corruption: Do Market Institutions Matter?" Policy Research Working Paper Series, The World Bank, 2368.

[13] Chamberlain, Gary (1980), "Analysis of Covariance with Qualitative Data," *The Review of Economic Studies,* 47, 225-238..

[14] Clarke, Goerge R. G. and Lixin Colin Xu (2002), "Privatization, Competition and Corruption: How Characteristics of Bribe Takers and Payer Affect Bribe Payments to Utilities," World Bank.

[15] Desai, R and A Olofsgård (2006), "Support for Reform: Constitutionalism and Credibility in Post-Communist Economies", *Economics of Transition*, 14, 479-504.

[16] Dreher, Axel and Lars-H.R. Siemers (2004), "The Intriguing Nexus between Corruption and Capital Account Restrictions," Economics Working Paper Archive, WUSTL, Development and Comp Systems, No. 0306004.

[17] Ferrer-i-Carbonell, Ada, and Paul Frijters (2004), "How Important is Methodology for the Estimates of the Determinants of Happiness?" *The Economic Journal*, 114, 641-659.

[18] Gatti, Roberta (1999), "Corruption and Trade Tariffs, or a Case of Uniform Tariffs," Policy Research Working Paper Series, No. 2216, The World Bank.

[19] Gatti, Roberta and Raymond Fisman, (2002), "Decentralization and Corruption: Evidence Across Countries", *Journal of Public Economics*, 83, 325-345.

[20] Geddes, B. (1997), "The Political Uses of Corruption and Privatization", APSA Conference paper, Washington DC.

[21] Giavazzi, F. and G Tabellini (2005), "Economic and Political Liberalizations", *Journal of Monetary Economics*, 52, 1297-1330.

[22] Greene, William (1993), "*Econometric Analysis*", 5th edition Prentice Hall.

[23] Hausmann, Ricardo, Lant Pritchett, and Dani Rodrik (2005), "Growth Accelerations", *Journal of Economic Growth*, 10, 303-329.

[24] Huntington, Samuel (1968), "*Political Order in Changing Societies*", Yale University Press, New Haven.

[25] Klitgaard, Robert (1988), "*Controlling Corruption*", University of California Press, Berkeley.

[26] La Porta, R., F. Lopez-de-Silanes, A. Shleifer, R. W. Vishny (1999), "The Quality of Government", *Journal of Law, Economics and Organization*, 15, 222-279.

[27] Larraín, Felipe, and Jose Tavares (2001), "Can Openness Deter Corruption?", UCLA, mimeo.

[28] Larraín, Felipe, and Jose Tavares (2004), "Does Foreign Direct Investment Decrease Corruption?", Cuadernos de Economia, 41, 199-215.

[29] Lederman, L., N. Loayza and R. Soares (2005), "Accountability and Corruption: Political Institutions Matter", *Economics and Politics*, 17, 1-35.

[30] Leite, Carlos, and Jens Weidmann (1999), "Does Mother Nature Corrupt? Natural Resources, Corruption, and Economic Growth," IMF Working Paper 99/85.

[31] Leff, Nathaniel (1964), "Economic Development through Bureaucratic Corruption", *The American Behavioral Scientist*, 8, 8-14.

[32] Lui, Francis (1985), "An Equilibrium Queuing Model of Bribery", *Journal of Political Economy*, 93, 760-81.

[33] Mundlak, Yair (1978), "On the Pooling of Time Series and Cross Section Data," *Econometrica*, 46, 69-85.

[34] Pei, Minxin (2006), "The dark Side of China's rise", *Foreign Affairs*, March/April.

[35] Persson, Torsten, Gerard Roland and Guido Tabellini (1997) "Separation of Powers and Political Accountability", *Quarterly Journal of Economics*, 112, 1163-1202.

[36] Reinikka, R. and J. Svensson (2004a), "Local Capture: Evidence from a Central Government Transfer Program in Uganda", *Quarterly Journal of Economics*, 119, 679-705.

[37] Reinikka, R. and J. Svensson (2004b), "Fighting Corruption to Improve Schooling: Evidence from a Newspaper Campaign in Uganda", *Journal of the European Economic Association*, 3, 259-267

[38] Rose-Ackerman, Susan (1978). "*Corruption: A Study in Political Economy*", New York: Academic Press.

[39] Rose-Ackerman, Susan (1999), "*Corruption and Government*", Cambridge University Press, Cambridge.

[40] Shleifer, A. and R. W. Vishny (1993), "Corruption", *Quarterly Journal of Economics*, 108, 599-617.

[41] Tirole, Jean (1996), "A Theory of Collective Reputations", *Review of Economic Studies*, 63, 1-22.

[42] Treisman, Daniel (2000), "The Causes of Corruption: a Cross-National study", *Journal of Public Economics*, 76, 399-457.

[43] Wacziarg, Romain, and Karen Horn Welch (2003), "Trade Liberalization and Growth: New Evidence," NBER Working Paper #10152.

[44] Wei, Shang-Jin (2000), "Natural Openness and Good Government," NBER Working Papers, No. 7765.

Appendix A: The Bai-Perron Algorithm

The BP method considers the following linear regression model, with m breaks (m+1 regimes):

$$\begin{aligned} y_t &= x_t'\beta + z_t'\delta_1 + u_t, t = 1, ..., T_1, \\ y_t &= x_t'\beta + z_t'\delta_2 + u_t, t = T_1 + 1, ..., T_2, \\ &\vdots \\ y_t &= x_t'\beta + z_t'\delta_{m+1} + u_t, t = T_m + 1, ..., T \end{aligned}$$

Where y_t is the observed dependant variable at time t; x_t has dimensions $p \times 1$ and z_t has dimensions $q \times 1$, and β and δ_j $(j = 1, \ldots, m+1)$ are the corresponding vectors of coefficients; and u_t is the disturbance term at time t. The break points $(T1, \ldots, Tm)$ are treated as unknown, and are estimated together with the unknown coefficients when T observations are available. In the terminology of BP, this is a partial structural change model, in the sense that β does not change, and is effectively estimated using the entire sample. If $p = 0$, this becomes a pure structural change model where all coefficients are subject to change.

The procedure for detecting structural breaks, suggested by BP, is the following: First, calculate the UDMAX and WDMAX statistics. These are double maximum tests, where the null hypothesis of no structural breaks is tested against the alternative of an unknown number of breaks given some upper bound M. The first is an equal weighted version defined by $UD\ max\ F_T(M, q) = \max_{1 \leq m \leq M} F_T(\hat{\lambda}_1, ..., \hat{\lambda}_m; q)$, where $\hat{\lambda}_j = \hat{T}_j/T$ $(j = 1, ..., m)$ are the estimates of the break points obtained using the global minimization of the sum of squared residuals. The second test applies weights to the individual tests such that the marginal p-values are equal across values of m and is denoted by $WD\ max\ F_T(M, q)$. Details are available in Bai and Perron (1998). These tests are used to determine if at least one structural break is present.

In addition, the $\sup F(0|l)$ is a series of Wald tests for the hypothesis of 0 breaks vs. l breaks. In this paper the maximum number of breaks (l) is chosen to be 3, with a minimum of 4 years between any two successive breaks. If these tests show evidence of at least one structural break, then the number of breaks can be determined by the $\sup F(l+1|l)$. If this test is significant at the 10, 5, 2.5, and 1 percent level, then $l+1$ breaks are chosen. Finally, the number of breaks can also be chosen by the Bayesian Information Criteria (BIC). The method suggested by BP is based on the sequential application of the $\sup F_T(l+1|l)$ test using the sequential estimates of the breaks. Bai and Perron (2003) has a discussion of when the BIC is appropriate to use.

Appendix B: Ordered Probit Regression

As shown in Greene (1993) the probability of any of these events taking place are given as

$$Prob(y = 0|x) = \Phi(-x\prime\beta)$$

$$Prob(y = 1|x) = \Phi(\mu_1 - x\prime\beta) - \Phi(-x\prime\beta)$$

$$Prob(y = 2|x) = \Phi(\mu_2 - x\prime\beta) - \Phi(\mu_1 - x\prime\beta)$$

where x is the matrix of regressors chosen in our model, and Φ is the normal cumulative distribution function. For the model estimated here the latent variable $change_{it}$ replaces $(-x'\beta)$ in the specification above. The probabilities calculated from the model are positive, when $0 < \mu_1 < \mu_2$, where μ_1 and μ_2 are unknown parameters to be determined jointly with the β's. They are the constants of the regressions in the ordered probit.

The marginal effects of the regressors are as usual not equal to the coefficients evaluated by the regression, but rather are given by:

$$\partial Prob(y = 0|x)/\partial x = -\varphi(x\prime\beta)\beta$$

$$\partial Prob(y = 1|x)/\partial x = [\varphi(-x\prime\beta) - \varphi(\mu_1 - x\prime\beta)]\beta$$

$$\partial Prob(y = 2|x)/\partial x = [\varphi(\mu_1 - x\prime\beta) - \varphi(\mu_2 - x\prime\beta)]\beta$$

where φ is the normal probability distribution function.

When a particular β is positive, the derivative of $Prob(y = 0|x)$ must decline, since it has the opposite sign, as shown above. Hence with a positive β the marginal effect is negative, and for a negative β the marginal effect is positive. On the other hand the change in $Prob(y = 2|x)$ will have the same sign as β. So a positive β will indicate a positive marginal effect for $Prob(y = 2|x)$, and negative β indicates a negative marginal effect. The sign for the change in $Prob(y = 1|x)$ will however be ambiguous. Fortunately we are concerned with the changes in probabilities that are unambiguous. We are interested in the marginal effect on $Prob(y = 0|x)$ and $Prob(y = 2|x)$.

Appendix C: Variables Definitions and Sources

Corruption: The subjective perception of corruption as reported by the Political Risk Service's International Country Risk Guide, covering a period of twenty years from 1984 to 2003. The measure ranges from 0-6, where higher values indicate less corruption.

Democratization: Based on the Polity2 indicator, which measures the quality of democratic institutions on a scale from -10 to +10. A democratization is defined to have taken place when this

measure jumps from the negative to the positive range. From the Polity IV Project, University of Maryland.

Trade Openness: A binary measure of trade openness first developed by Sachs and Warner (S/W 1995) and later updated by Welch and Wacziarg (2003). From Sachs, J. and A. Warner (1995), "Economic Convergence and Economic Policies," Brookings Papers on Economic Activities, Eds. William Brainard and George Perry, 1: 1995, 1-95, 108-118, and Wacziarg, Romain, and Karen Horn Welch (2003), "Trade Liberalization and Growth: New Evidence," NBER Working Paper #10152.

Equity Market Liberalization: This indicator takes the value of one after a change that makes it possible for foreign portfolio investors to own the equity of a particular market. From Bekaert, Geert, Campbell Harvey, and Christian Lundblad (2005), "Does Financial Liberalization Spur Growth?" *Journal of Financial Economics* 77, 3-55.

Income: GDP per capita measured in US dollars PPP. From the World Development Indicators, World Bank.

Income Growth: Annual growth of GDP per capita. From the World Development Indicators, World Bank.

Fuel Exports: A measure of exports of fuels as a percentage of total exports. From the World Development Indicators, World Bank.

Political Instability: A measure of the average number of changes in executive power during the last ten years calculated from data provided by the Polity IV project.

TABLE1: Between Estimation

	(1) Corr	(2) Corr	(3) Corr	(4) Corr	(5) Corr	(6) Corr
Polity2	0.0206				0.0135	
	(0.0146)				(0.0206)	
Pol2dum		0.3209				0.1894
		(0.2486)				(0.3369)
Openness			-0.0329		-0.0610	-0.0743
			(0.1875)		(0.2727)	(0.2666)
Equity Markets				-0.0465	-0.0758	-0.0540
				(0.2675)	(0.3092)	(0.3066)
GDP	0.1260***	0.1382***	0.1254***	0.1210***	0.1298***	0.1402***
	(0.0141)	(0.0134)	(0.0118)	(0.0129)	(0.0204)	(0.0150)
Growth	-0.0183	-0.0104	-0.0324	-0.0869	-0.1150**	-0.1098**
	(0.0266)	(0.0320)	(0.0284)	(0.0523)	(0.0518)	(0.0515)
Fuel Exports	-0.0056*	-0.0072**	-0.0044	-0.0097***	-0.0070*	-0.0071*
	(0.0032)	(0.0031)	(0.0030)	(0.0032)	(0.0037)	(0.0037)
Political Stability	-1.4771**	-1.8424***	-1.3654*	-2.5776**	-2.9618***	-2.8670**
	(0.5714)	(0.6037)	(0.7494)	(1.0244)	(1.0146)	(1.1489)
Observations	1145	1115	1361	1150	884	875
Number of Countries	111	108	106	78	72	72
R-Squared	0.63	0.62	0.66	0.72	0.74	0.74

(*)indicates significance at the 10% level; (**)indicates significance at the 5% level; (***)indicates significance at the 1% level

TABLE 2: Fixed-Effect Estimation

							AB GMM Estimation	
	(1) Corr	(2) Corr	(3) Corr	(4) Corr	(5) Corr	(6) Corr	(7) Corr	(8) Corr
Corr(1st Lag)							0.9355***	0.9474***
							(0.0029)	(0.0028)
Corr (2nd Lag)							-0.2926***	-0.2907***
							(0.0018)	(0.0018)
Polity2	0.0379***				0.0449***		0.0118***	
	(0.0072)				(0.0082)		(0.0011)	
Pol2dum		0.2916***				0.3416***		0.1164***
		(0.0890)				(0.0968)		(0.0084)
Openness			-0.1624**		-0.2725***	-0.3066***	0.0468***	0.0584***
			(0.0713)		(0.0784)	(0.0800)	(0.0068)	(0.0064)
Equity Markets				0.1381**	0.2484***	0.2532***	0.1753***	0.1822***
				(0.0655)	(0.0683)	(0.0699)	(0.0050)	(0.0041)
GDP	-0.0692***	-0.0792***	-0.0988***	-0.0808***	-0.0737***	-0.0875***	0.0024***	-0.0033**
	(0.0118)	(0.0119)	(0.0096)	(0.0096)	(0.0143)	(0.0142)	(0.0009)	(0.0015)
Growth	-0.0007	-0.0010	-0.0001	0.0006	0.0027	0.0025	0.0004***	0.0001
	(0.0037)	(0.0038)	(0.0040)	(0.0040)	(0.0043)	(0.0044)	(0.0001)	(0.0002)
Fuel Exports	-0.0001	0.0004	-0.0018	0.0023	-0.0020	-0.0003	-0.0024***	-0.0020***
	(0.0020)	(0.0021)	(0.0029)	(0.0022)	(0.0038)	(0.0038)	(0.0005)	(0.0004)
Political Stability	-1.2478***	-1.0152***	-1.0957***	-1.1580***	-1.4501***	-1.2384***	-0.7909***	-0.7566***
	(0.2318)	(0.2293)	(0.2130)	(0.2194)	(0.2510)	(0.2490)	(0.0400)	(0.0304)
Observations	1145	1115	1361	1150	884	875	676	666
Number of Countries	111	108	106	78	72	72	70	69
R-Squared	0.16	0.15	0.20	0.20	0.20	0.19		
Speicification tests (p-values reported)								
Over Identification Test							0.9951	0.9830
Serial Correlation								
First Order							0.0002	0.0002
Second Order							0.2295	0.2683

(*)indicates significance at the 10% level; (**)indicates significance at the 5% level; (***)indicates significance at the 1% level

Table 3: Episodes of Change in Corruption Levels Significant at the 1% Level

[X] indicates not passing the filter

Country Name	Code	Region	Income Group	Time	Avg. Before	Avg. After	Direction	Year	>1	Sustained
Angola	AGO	AFR	Low Income	13	3	2.047	↓	1996	X	
Albania	ALB	ECA	Lower Middle Income	12	3.92	2.29	↓	1995		
United Arab Emirates	ARE	MNA	High Income	8	3	2	↓	1991		
Argentina	ARG	LAC	Upper Middle Income	10	3.89	2.5	↓	1993		
Australia	AUS	INL	High Income	16	5	4.729	↓	1999	X	
Austria	AUT	INL	High Income	13	5.006	4.417	↓	1996	X	
Belgium	BEL	INL	High Income	4	5.708	4.917	↓	1987	X	
				13	4.917	3.488	↓	1996		
Burkina Faso	BFA	AFR	Low Income	7	4	2.917	↓	1991		
				13	2.917	2	↓	1997	X	
Bangladesh	BGD	SAS	Low Income	7	0.0119	1.05	↑	1990		
Bulgaria	BGR	ECA	Lower Middle Income	16	3.932	2.3125	↓	1999		
Bahrain	BHR	MNA	High Income	16	3.32	2.4063	↓	1999	X	
Bahamas	BHS	LAC	High Income	9	0.1204	3.9318	↓	1992		
Bolivia	BOL	LAC	Lower Middle Income	4	1.0833	2	↑	1987	X	
				10	2	2.783	↑	1994	X	
Brazil	BRA	LAC	Lower Middle Income	10	3.9167	3.003	↓	1993	X	
Brunei	BRN	EAP	High Income	10	5	4.0416	↓	1993	X	
				14	4.0416	2.875	↓	1997		
Botswana	BWA	AFR	Upper Middle Income	8	4.1458	3.0416	↓	1991		
Canada	CAN	INL	High Income	16	6	5.0833	↓	1999	X	
Switzerland	CHE	INL	High Income	13	5.9615	4.839	↓	1996		
Chile	CHL	LAC	Upper Middle Income	12	3.0278	3.9167	↑	1995	X	
China	CHN	EAP	Lower Middle Income	12	3.941	2	↓	1995		
				16	2	1.145	↓	1999	X	
Cote d'Ivoire	CIV	AFR	Low Income	7	2.89	3.805	↑	1990	X	X
				13	3.805	2.44	↓	1996		X
Colombia	COL	LAC	Lower Middle Income	12	3	2.135	↓	1995	X	
Costa Rica	CRI	LAC	Upper Middle Income	16	5	3.739	↓	1999		
Cuba	CUB	LAC	Lower Middle Income	14	2.97	2.215	↓	1997	X	
Cyprus	CYP	INL	High Income	8	2.948	4.905	↑	1991		X
				15	4.905	4	↓	1998	X	X
Denmark	DNK	INL	High Income	16	6	5.604	↓	1999	X	
Algeria	DZA	MNA	Lower Middle Income	9	3.824	3	↓	1992	X	
				13	3	1.922	↓	1996		
Ethiopia	ETH	AFR	Low Income	8	3.104	1.98	↓	1991		
France	FRA	INL	High Income	11	5.56	4	↓	1994		
				15	4	3.05	↓	1998	X	
Gabon	GAB	AFR	Upper Middle Income	7	2.0595	1.025	↓	1990		
U.K.	GBR	INL	High Income	5	5.9	4.888	↓	1988		
Ghana	GHA	AFR	Low Income	5	1.933	3.2685	↑	1988		X
				14	3.2685	2.33	↓	1997	X	X
Guatemala	GTM	LAC	Lower Middle Income	12	2	3.27	↑	1995		
Guyana	GUY	LAC	Lower Middle Income	10	1.008	2.966	↑	1993		
Hong Kong	HKG	EAP	High Income	14	4.96	3.25	↓	1997		
Haiti	HTI	LAC	Low Income	11	0.803	1.879	↑	1994		
Indonesia	IDN	EAP	Low Income	7	0.3809	2.726	↑	1990		X
				14	2.726	1.208	↓	1997		X
Ireland	IRL	INL	High Income	13	5	2.86	↓	1996		
Iraq	IRQ	MNA	Lower Middle Income	7	2.702	1.012	↓	1990		
Iceland	ISL	INL	High Income	16	6	5.458	↓	1999	X	
Israel	ISR	INL	High Income	13	5	3.142	↓	1996		
Italy	ITA	INL	High Income	9	4	3.1212	↓	1992	X	
Japan	JPN	EAP	High Income	14	4.958	2.88	↓	1997		
Kenya	KEN	AFR	Low Income	14	2.904	2.23	↓	1997	X	
South Korea	KOR	EAP	High Income	8	2.198	4.714	↑	1991		X
				15	4.714	2.716	↓	1998		X
Kuwait	KWT	MNA	High Income	16	2.911	2	↓	1999	X	
Lebanon	LBN	MNA	Upper Middle Income	12	2.611	1.093	↓	1995		
Liberia	LBR	AFR	Low Income	16	0.687	2.437	↑	1999		
Sri Lanka	LKA	SAS	Lower Middle Income	12	3	3.677	↑	1995	X	
Luxembourg	LUX	INL	High Income	13	6	5.02	↓	1996	X	
Morocco	MAR	MNA	Lower Middle Income	4	2	3	↑	1987		
Mexico	MEX	LAC	Upper Middle Income	12	3	2.52	↓	1995	X	

[X] indicates not passing the filter

Table 3 (cont.): Episodes of Change in Corruption Levels Significant at the 1% Level

[X] indicates not passing the filter

Country Name	Code	Region	Income Group	Time	Avg. Before	Avg. After	Direction	Year	>1	Sustained
Mali	MLI	AFR	Low Income	9	1.25	2.93	↑	1992		X
				14	2.93	2.22	↓	1997	X	X
Malta	MLT	INL	High Income	5	3	3.983	↑	1990	X	X
				15	3.983	3.166	↓	2000	X	X
Myanmar	MMR	EAP	Low Income	13	1.987	1	↓	1995	X	
Mongolia	MNG	EAP	Low Income	13	4	2.616	↓	1997		
Mozambique	MOZ	AFR	Low Income	16	4	1.833	↓	1999		
Malawi	MWI	AFR	Low Income	8	3.9375	2.829	↓	1991		
Malaysia	MYS	EAP	Upper Middle Income	4	4.583	3.977	↓	1987	X	
				15	3.977	2.733	↓	1998		
Namibia	NAM	AFR	Low Income	8	4.229	2.9167	↓	1997		
				12	2.9167	1.5416	↓	2001		
Niger	NER	AFR	Low Income	6	3.9305	2.9305	↓	1990		
				12	2.9305	0.5714	↓	1996		
Nigeria	NGA	AFR	Low Income	14	1.9762	1.0833	↓	1997	X	
Nicaragua	NIC	LAC	Low Income	13	4.7948	3.5416	↓	1996		
Netherlands	NLD	INL	High Income	16	6	5.458	↓	1999	X	
Norway	NOR	INL	High Income	12	6	5.0625	↓	1995	X	
New Zealand	NZL	INL	High Income	12	6	5.1979	↓	1995	X	
Oman	OMN	MNA	Upper Middle Income	16	3	2.6875	↓	1999	X	
Philippines	PHL	EAP	Lower Middle Income	4	0.9166	2.5156	↑	1987		
Papua New Guinea	PNG	EAP	Low Income	16	3.104	1.3125	↓	1999		
Poland	POL	ECA	Upper Middle Income	6	3.8333	4.8583	↑	1989		X
				16	4.8583	2.4375	↓	1999		X
North Korea	PRK	EAP	Low Income	7	4.9285	2.9	↓	1991		
				12	2.9	2	↓	1996	X	
				16	2	1.11	↓	2000	X	
Paraguay	PRY	LAC	Lower Middle Income	8	0.4791	1.9167	↑	1991		
Romania	ROM	ECA	Lower Middle Income	6	2	3.9166	↑	1989		X
				12	3.9166	2.7395	↓	1995		X
Saudi Arabia	SAU	MNA	Upper Middle Income	4	3.0833	2	↓	1987		
Sudan	SDN	AFR	Low Income	13	1.942	1	↓	1996	X	
Senegal	SEN	AFR	Low Income	16	3	2.75	↓	1999	X	
Singapore	SGP	EAP	High Income	16	5.8	4.0722	↓	1999		
Sierra Leone	SLE	AFR	Low Income	7	1.964	1.0667	↓	1991	X	X
				12	1.0667	2.8928	↑	1996		X
El Salvador	SLV	LAC	Lower Middle Income	9	2.0185	3.3106	↑	1992		
Somalia	SOM	AFR	Low Income	8	4	1.0486	↓	1991		
Suriname	SUR	LAC	Lower Middle Income	5	2.0833	3	↑	1989	X	X
				16	3	2.277	↓	2000	X	X
Sweden	SWE	INL	High Income	16	6	5.729	↓	1999	X	
Syria	SYR	MNA	Lower Middle Income	8	1.927	3.875	↑	1991		X
				16	3.875	2.2083	↓	1999		X
Thailand	THA	EAP	Lower Middle Income	14	2.994	1.9027	↓	1997		
Trinidad & Tobago	TTO	LAC	Upper Middle Income	4	2.0208	2.9115	↑	1987	X	
Tunisia	TUN	MNA	Lower Middle Income	16	3	2.4792	↓	1999	X	
Taiwan	TWN	EAP	High Income	13	4	2.75	↓	1996		
Tanzania	TZA	AFR	Low Income	5	2.91966	3.7315	↑	1988	X	X
				14	3.7315	2	↓	1997		X
U.S.	USA	INL	High Income	13	5.0256	4	↓	1996		
Venezuela	VEN	LAC	Upper Middle Income	16	2.9635	2.25	↓	1999	X	
Vietnam	VNM	EAP	Low Income	4	2.0833	2.9333	↑	1987	X	X
				14	2.9333	1.7778	↓	1997		X
Yemen, Rep.	YEM	MNA	Low Income	11	3	2.111	↓	2000	X	
Yugoslavia	YUG	ECA	Lower Middle Income	15	2.9555	1	↓	1998		
South Africa	ZAF	AFR	Lower Middle Income	4	5.833	5	↓	1987	X	
				14	5	2.9375	↓	1997		
Congo, Dem. Rep.	ZAR	AFR	Low Income	13	0	1.1071	↑	1996		
Zambia	ZMB	AFR	Low Income	8	1.927	3.333	↑	1991		X
				16	3.333	2.1666	↓	1999		X
Zimbabwe	ZWE	AFR	Low Income	16	3.104	0.3125	↓	1999		

[X] indicates not passing the filter

Table 4: Frequency of Change Episodes by Region

	Region								
	Asia	Africa	MENA	Latin Amer.	E. Europe & C. Asia	W. Europe +	Total %	Episodes	Observations
All	3.44%	3.62%	3.69%	2.65%	1.21%	3.21%	3.01%	125	4159
Improvements	0.79%	0.85%	0.53%	1.32%	0.34%	0.27%	0.72%	30	4159
Deteriorations	2.65%	2.77%	3.17%	1.32%	0.86%	2.94%	2.28%	95	4159

*Number of growth episodes divided by number of data points in that region

Table 5: Frequency of Change Episodes by Income Group

	Income Group						
	High Income	Upper Middle Income	Lower Middle Income	Low Income	Total %	Episodes	Observations
All	3.15%	2.22%	2.83%	3.44%	3.01%	125	4159
Improvements	0.26%	0.44%	1.13%	0.94%	0.72%	30	4159
Deteriorations	2.88%	1.78%	1.70%	2.50%	2.28%	95	4159

*Number of growth episodes divided by number of data points in that income group

Table 6: Ordered Probit Estimation on All Episodes of Change

	(1) Episodes	(2) Episodes	(3) Episodes	(4) Episodes	(5) Episodes	(6) Episodes
Pol2dum	1.1448***				1.2995***	
	(0.3501)				(0.3661)	
Polity2		0.1133***				0.1460***
		(0.0321)				(0.0338)
Openness			0.5283**		0.5050	0.5098
			(0.2672)		(0.3331)	(0.3432)
Equity Markets				0.9242***	0.8376***	0.8396***
				(0.2829)	(0.2767)	(0.2752)
GDP	0.0986	0.1039	-0.0294	0.0845	0.1292	0.1453
	(0.1183)	(0.1168)	(0.1034)	(0.1083)	(0.1598)	(0.1631)
Growth	0.0171**	0.0176**	0.0129	0.0107	0.0164*	0.0171**
	(0.0076)	(0.0078)	(0.0089)	(0.0092)	(0.0085)	(0.0087)
Fuel Exports	0.0006	0.0008	-0.0105	-0.0049	0.0014	0.0012
	(0.0060)	(0.0061)	(0.0093)	(0.0073)	(0.0116)	(0.0117)
Political Stability	-1.2382	-1.8857	1.0528	0.3662	-0.3657	-1.1833
	(2.1557)	(2.1565)	(1.8684)	(2.2079)	(2.2469)	(2.2677)
Observations	1034	1061	1280	1057	795	805

Robust std errors reported in parentheses;

(*)indicates significance at the 10% level; (**)indicates significance at the 5% level; (***)indicates significance at the 1% level

Table 7: Ordered Probit Estimation on Sustained Episodes of Change

	(1) SEpisodes	(2) SEpisodes	(3) SEpisodes	(4) SEpisodes	(5) SEpisodes	(6) SEpisodes
Pol2dum		1.2967***			1.4392***	
		(0.3626)			(0.3803)	
Polity2	0.1411***					0.1710***
	(0.0329)					(0.0351)
Openness			0.6168*		0.5925	0.6056
			(0.3276)		(0.3757)	(0.3910)
Equity Markets				0.8098***	0.7133**	0.7251***
				(0.3058)	(0.2770)	(0.2763)
GDP	-0.0334	-0.0391	-0.1402	-0.0152	-0.0149	-0.0049
	(0.1315)	(0.1317)	(0.1124)	(0.1158)	(0.1661)	(0.1701)
Growth	0.0171**	0.0167**	0.0137	0.0111	0.0143*	0.0150*
	(0.0079)	(0.0078)	(0.0090)	(0.0088)	(0.0086)	(0.0088)
Fuel Exports	-0.0011	-0.0012	-0.0039	0.0025	-0.0004	-0.0011
	(0.0048)	(0.0047)	(0.0067)	(0.0043)	(0.0086)	(0.0086)
Political Stability	-2.2518	-1.4091	0.2046	-0.3388	-1.2925	-2.2550
	(2.4701)	(2.4662)	(2.2255)	(2.5761)	(2.4949)	(2.5364)
Observations	1061	1034	1280	1057	795	805

Robust std errors reported in parentheses;

(*)indicates significance at the 10% level; (**)indicates significance at the 5% level; (***)indicates significance at the 1% level

Table 8: Random-Effects Ordered Probit Estimation on All Episodes of Change with Mundlak Averages

	(1) Episodes	(2) Episodes	(3) Episodes	(4) Episodes	(5) Episodes	(6) Episodes
Pol2dum		1.0843***				1.2081***
		(0.4061)				(0.4537)
Polity2	0.1023***				0.1306***	
	(0.0370)				(0.0436)	
Openness			0.5251		0.5218	0.5210
			(0.3938)		(0.4409)	(0.4406)
Equity Markets				0.9795***	0.8428**	0.8438**
				(0.3398)	(0.3567)	(0.3616)
GDP	0.3477**	0.3556**	0.1185	0.4098**	0.6261***	0.6199***
	(0.1508)	(0.1519)	(0.1364)	(0.1636)	(0.2088)	(0.2090)
Growth	0.0187*	0.0182*	0.0123	0.0061	0.0146	0.0141
	(0.0102)	(0.0102)	(0.0107)	(0.0120)	(0.0115)	(0.0116)
Fuel Exports	0.0042	0.0039	-0.0110	-0.0034	0.0113	0.0115
	(0.0165)	(0.0165)	(0.0164)	(0.0148)	(0.0227)	(0.0229)
Political Stability	-0.5397	0.0379	1.8813	1.3608	0.1725	0.9414
	(2.0963)	(2.0897)	(1.6842)	(1.9987)	(2.2280)	(2.2222)
Average GDP	-0.0318**	-0.0339**	-0.0191	-0.0355***	-0.0519***	-0.0529***
	(0.0144)	(0.0147)	(0.0127)	(0.0134)	(0.0159)	(0.0161)
Observations	1061	1034	1280	1057	805	795

(*)indicates significance at the 10% level; (**)indicates significance at the 5% level; (***)indicates significance at the 1% level

Table 9: Random-Effects Ordered Probit Estimation on Sustained Episodes of Change with Mundlak Averages

	(1) SEpisodes	(2) SEpisodes	(3) SEpisodes	(4) SEpisodes	(5) SEpisodes	(6) SEpisodes
Pol2dum		1.2997***				1.3741***
		(0.4627)				(0.5020)
Polity2	0.1462***				0.1679***	
	(0.0431)				(0.0501)	
Openness			0.6514		0.6836	0.6580
			(0.4849)		(0.5083)	(0.5046)
Equity Markets				1.0114**	0.8077*	0.8109*
				(0.4498)	(0.4543)	(0.4572)
GDP	0.3652*	0.3687**	0.1298	0.4685**	0.5272**	0.5205**
	(0.1870)	(0.1870)	(0.1601)	(0.2011)	(0.2359)	(0.2352)
Growth	0.0178	0.0173	0.0124	0.0057	0.0127	0.0124
	(0.0134)	(0.0133)	(0.0139)	(0.0156)	(0.0146)	(0.0146)
Fuel Exports	0.0023	0.0018	-0.0085	0.0068	0.0096	0.0097
	(0.0242)	(0.0236)	(0.0241)	(0.0225)	(0.0301)	(0.0300)
Political Stability	-0.5804	0.1571	1.5375	0.9324	-0.5424	0.3015
	(2.5170)	(2.5076)	(2.1652)	(2.3945)	(2.5604)	(2.5532)
Average GDP	-0.0530**	-0.0555**	-0.0412**	-0.0589***	-0.0649***	-0.0659***
	(0.0216)	(0.0219)	(0.0198)	(0.0212)	(0.0223)	(0.0225)
Observations	1061	1034	1280	1057	805	795

(*)indicates significance at the 10% level; (**)indicates significance at the 5% level; (***)indicates significance at the 1% level