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VOLATILITY AND POLITICAL INSTITUTIONS: THEORY AND APPLICATION TO ECONOMIC GROWTH[†]

Abstract

This paper develops a model where an institutional constraint limits incumbent discretion to prevent adverse policy outcomes. We show that, in this framework, executive constraints have an impact on the mean and variance of policy. This allows us to interpret the empirical observation that growth volatility is lower in countries with strong executive constraints. We fit the model to growth data and use our estimates to describe the heterogeneity in performance of weak and strong executive constraints across countries. This is used to illustrate the heterogeneous output response to the adoption of strong executive constraints. We then use the fitted values to consider the benefits of strong executive constraints in income terms.

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1 Introduction

How and whether democratic institutions improve policy making and economic performance has been a central debating point in the political economy literature. To that end, the focus has been on the performance of economies cross-sectionally and before and after transitions. There are two dominant features of the literature to date. First, it has tended to focus on aggregated measures of democracy and/or the consequences of elections. Second, it has tended to look at average performance rather than implications for volatility.

This paper's approach is motivated by a combination of theory and facts. From a theoretical perspective, democratic institutions have two main components. The first, and the primary focus in most models, is the contestability of political office. For example, whether a country uses free and fair elections. The second, is a range of institutions which constrain the use of power once acquired. These include the power of the legislature in passing legislation and the codification of laws that need to be obeyed.[1] Both of these dimensions go into the overall democracy score of a country which has been the variable which has dominated empirical work. Our focus here will be constraints which limit executive discretion. We will develop a model where such constraints affect both the mean and volatility of policy outcomes.

Our main empirical focus is on economic growth. This is motivated by Figure 1 which gives the kernel densities of economic growth from the Penn World Tables when we divide the sample between those countries that have strong and weak executive constraints. The pattern shown here is striking with more upside and downside "risk" associated with low executive constraints. Whether or not this is due to policy rather than other factors, is debatable. However, we will show that a reduction in growth volatility is a feature of countries which make transitions between strong and weak executive constraints where it is more difficult to argue that this will lead to a change in the structure of the economy.

Figure 1 here

The numbers behind Figure 1 are not without consequence when it comes

[1] The separation of power goes back to Montesquieu (1752). John Stuart Mill described executive constraints as a limit to the power of a ruler that can be achieved through *"[...] establishment of constitutional checks, by which the consent of the community, or of a body of some sort, supposed to represent its interests, was made a necessary condition to some of the more important acts of the governing power."* [Mill (1859)]

to looking at the downside. They imply that countries with weak executive constraints have a 50% higher chance of negative growth compared to those with strong constraints, are more than twice as likely to have a growth rate below -5% and are over three times more likely to experience a growth rate below -10%. Of course, this can be counterbalanced by the prospect of good upside performance. But approaches to evaluating institutions which place more weight on downside risk, as in the recent literature on robust control, will tend to focus more heavily on poor performance.

The theoretical approach developed here offers a natural interpretation of Figure 1 where the effect of executive constraints on average growth and its volatility is driven entirely by changes in the policy making process. Our model also offers a way of thinking about both the cross-sectional variation in growth performance and the within-country volatility. Moreover, we show that there is a straightforward way of fitting the model to the data using least squares. The parameter estimates that come out of this exercise give us a quantitative assessment of the heterogeneity which is due to politics.

We use our estimates to make two institutional comparisons. The first of these considers the gains in expected income over a ten year window if a country with weak executive constraints were to move to strong constraints. In the absence of a strong prior on how the new political institutions will perform, we take a robust-control approach where we compare the gains under a pessimistic prior about the performance of strong constraints. We contrast this with the gains based on assuming that a country which adopts strong constraints has the average performance with strong executive constraints. Even our more cautious approach suggests that many countries with weak executive constraints would gain from adopting them using our income criterion. However, these do not include the strong growth performers with weak constraints like China.[2] Our second exercise is to compare institutions "behind the veil of ignorance" where heterogeneity in performance allows us to think about the income gains from strong constraints. This exercise generates gains of around 4-15% in GDP over ten years, with large gains when we focus on the poorly performing countries under both weak and strong executive constraints in the spirit of a "maximin" approach. Whichever part of the performance distribution we look at, the gains from strong executive

[2] An alternative interpretation of China suggested in Besley and Kudamatsu (2009) is that there are internal controls which are similar executive constraints but which are party of the communist party modus operandi rather than being formal executive constraints.

constraints are positive.

The remainder of the paper is organized as follows. In the next section, we discuss some background issues including relevant literature. Section three introduces the model while section four uses it to interpret cross-country growth experiences. Section five concludes.

2 Background

Relationship to the Literature There is now a large empirical literature on the link between democracy and growth such as Barro (1996), Papaioannou and Siourounis (2008), Persson and Tabellini (2009a,b), and Przeworski and Limongi (1993). The empirical findings are somewhat equivocal. Moreover, the links between the empirical approach and theoretical models is limited. By now, it is recognized that there is no simple empirical story to be told and that there could be considerable heterogeneity as discussed in Persson and Tabellini (2009b).

Also relevant to this paper is the literature on economic volatility in emerging market economies. Aguiar and Gopinath (2007), for example, observe that shocks to trend growth—rather than transitory fluctuations around a stable trend—are the primary source of fluctuations in emerging markets. This is consistent with the idea developed here that political factors affect growth trends. Koren and Tenreyro (2007) separate growth volatility at a the country level from sector-specific volatility and find that, as countries develop, changes in the sector composition reduce volatility. The paper is also related to the observation by Calvo (1998) that "sudden stops" in capital flows occur in countries because there is policy flexibility; local governments are more constrained in their policy choices creating less policy risk. The role of institutional factors in volatility in emerging markets is emphasized in Rodrik (1999).

This is not the first paper to note that there is a difference in variance of performance in countries which are democratic – see, for example, Acemoglu et al (2003), Almeida and Ferraira, (2002), Moborak (2005), Rodrik (1997) and Weede (1996). However, we believe that this is the first paper which tries to tie this fact to an underlying theory of how policy making varies with political institutions.[3]

[3] Overbye (1996) discusses some possible theoretical underpinnings for this based on the predictability of policies but does not relate this back to the data.

Theoretical approaches to the relationship between democracy and outcomes follow two main lines. The influential work of Acemoglu and Robinson (2006) focuses on shifts in political control between income groups and how this impacts the economy through redistribution policies. Such models do not have a role for executive constraints with the focus being on how elections affect access to power. This paper uses an agency model of politics of the kind introduced in Barro (1973) and Ferejohn (1986). We supplement the traditional focus of agency models on the external control imposed by voters by considering the behavior of a legislature which can act as an internal control on policy makers.[4]

Our theoretical approach is related to Persson et al (1997). They provide an explanation for why the separation of powers improves the accountability of elected officials. A key condition to make separation of powers work in favor of voters is that no policy can be implemented unilaterally, i.e., without the consent of both the executive and the legislature. This relates more generally to the differences between parliamentary and presidential systems as discussed both theoretically and empirically in Persson and Tabellini (2000).

Executive Constraints The standard approach in much of the empirical literature on democracy is to work on with some kind of aggregate democracy score.[5] This aggregates components which includes constraints on the executive and the process for acquiring power, i.e. whether there are elections. Here we will focus on a specific dimension of democratic institutions – the imposition of constraints on the executive. Such constraints operate by changing the amount of discretion enjoyed by policy makers while holding office. Thus, some policy decisions might be prevented or overruled.

As a measure of strong executive constraints we use the variable "xconst" in the Polity IV dataset which is on a seven point scale. The manual explains the variable's construction as follows:

> "Operationally, this variable refers to the extent of institutionalized constraints on the decision making powers of chief executives, whether individuals or collectivities. Such limitations may

[4] See Besley (2006) for a discussion of the literature and Besley and Kudamatsu (2009) for a model which focuses on a different model of internal controls in the absence of elections.

[5] That said, there are a number of papers which look at executive constraints separately.

be imposed by any "accountability groups." In Western democracies these are usually legislatures. Other kinds of accountability groups are the ruling party in a one-party state; councils of nobles or powerful advisors in monarchies; the military in coup-prone polities; and in many states a strong, independent judiciary. The concern is therefore with the checks and balances between the various parts of the decision-making process." [p. 24, Polity IV Dataset Users' Manual 2010]

We will create a dummy variable which is equal to one when the score is seven which, in a nutshell, corresponds to a political system where there is "Executive Parity or Subordination: Accountability groups have effective authority equal to or greater than the executive in most areas of activity."[6] The checklist for coders in the Polity IV manual states that the highest score of the variable "xconst" is only allocated if important legislation can be initiated by a parliament which holds the executive to account. Indeed, our reading of the country reports is that those coding countries pay a lot of attention to whether the executive relied on support from another organization (this could be, parliament, independent courts or the military) to conduct policy.

Adopting strong executive constraints is much less common than having, for example, open access to power. Thus, only around 20% of country year observations since 1950 have the highest score for executive constraints while just over 50% have the highest score of openness. There are no countries which have strong executive constraints which don't also have the highest level of openness. Over time, the fraction of countries with strong constraints has been increasing.

We believe that there are good reasons for disaggregating democracy and focusing on executive constraints separately. The first argument is theoretical and is developed below – the logic of using internal constraints and external political control through elections is somewhat different. Greater openness and competitiveness through free and fair elections allows citizens

[6] See http://www.systemicpeace.org/ inscr/p4manualv2010.pdf. Examples of evidence used to assign a score of 7 are (i) A legislature, ruling party, or council of nobles initiates much or most important legislation (ii) The executive (president, premier, king, cabinet, council) is chosen by the accountability group and is dependent on its continued support to remain in office (as in most parliamentary systems). (iii) In multi-party democracies, there is chronic "cabinet instability."

to remove poorly performing incumbents and create performance-related retention decisions. Executive constraints can affect policy choices apart from the electoral cycle.

But there is a second empirical argument for the focus. There are a number of countries in the data that are fully open according to polity but do not have strong executive constraints.[7] For example, of the 220 countries in the PolityIV data in 2000, 122 countries have the highest score for openness but only 50 have the highest score for executive constraints. All of these 50 countries have the highest score for openness. So looking at these dimensions separately leads us to classify countries somewhat differently.[8] The fact that all countries which have strong constraints are also open according to PolityIV means that we will build a model where citizens can remove their rulers from office and focus on the consequences of varying executive constraints.

As a final motivation for the focus on executive constraints, it is worth looking at a version of Figure 1 where we look at the way that having open executive recruitment affects the distribution of growth rates. This is given in Figure 2 for the sample of country years where executive constraints are weak. The distribution with full openness shifts to the right and has a higher mean.[9] The reduction in the variance is much less pronounced in this case.

Figure 2 here

Disaggregating Growth Performance We now disaggregate growth variation into its between country and within-country variation differentiated by the strength of executive constraints. As well as providing further understanding of the numbers behind Figure 1, it also allows us to think about how we might interpret the variation that we see in the data using a political economy model. Growth is calculated from real GDP per capita provided by the World Penn Tables 7.1.[10]

Countries spend different amounts of time with high or low executive

[7] Full openness is defined as the variable "xropen" in the PolityIV data taking its maximum possible value of 4.

[8] In 2000, there are 114 countries in the PolityIV data which are classified as democratic based on their aggregate democracy score but which do not have have the highest score for executive constraints.

[9] This difference is statistically significant and robust to controlling for country and year fixed effects.

[10] See the Appendix for more details on the data and sample.

constraints as measured in the PolityIV data. Let $\rho_{\delta c}$ be the proportion of observations in the data where country c has executive constraints $\delta \in \{S, W\}$ where 'S' is strong and 'W' is weak.

Let $\mu_c(\delta)$ be country c's average growth in when it has institutions δ. Then the average growth rate for $\delta \in \{S, W\}$ is:

$$\bar{\mu}(\delta) = \sum_c \rho_{\delta c} \mu_c(\delta).$$

Let $\bar{\mu}$ be the mean growth in the sample as a whole.

Now let $\sigma_c^2(\delta)$ be the variance of growth in country c when it has institutions δ. The effect on the variance of growth from changing from $\delta = W$ to $\delta = S$ is given by

$$\bar{\sigma}^2(S) - \bar{\sigma}^2(W) = \sum_c \left[\rho_{Sc}\sigma_c^2(S) - \rho_{Wc}\sigma_c^2(W)\right]$$
$$+ \sum_c \left[\rho_{Sc}\left[\mu_c(S) - \bar{\mu}\right]^2 - \rho_{Wc}\left[\mu_c(W) - \bar{\mu}\right]^2\right].$$

This decomposes growth into changes in within country volatility in growth and a between country component to the extent that there are differences in the dispersion of growth rates across countries. Figure 1 showed that the overall variance falls when strong executive constraints are adopted but not whether this is primarily a between or within country change.

In fact both within and between country dispersion is lower under strong executive constraints. The easiest way to see is this in by running the following growth regression where the dependent variable is the growth rate in country c with institutions δ in year t:

$$g_{\delta ct} = \alpha_{\delta c} + \alpha_t + \eta_{\delta ct} \tag{1}$$

where α_t are year dummy variables and $\alpha_{\delta c}$ is a country/institution fixed effect that captures mean growth for country c under institution δ. This specification also controls for common global shocks that affect growth. The variance of the residuals $\eta_{\delta ct}$ by country for a period when institutions are δ gives us a measure of within-country growth volatility.

Figures 3 and 4 plot the kernel densities of the estimates of $\alpha_{\delta c}$ and $\eta_{\delta ct}$ from running this on our entire sample of countries. Figure 3 plots our estimates of $\eta_{\delta ct}$ for both strong and weak executive constraints. The reduction in the variance of growth within country is once again striking. Figure 4 plots the estimated $\alpha_{\delta c}$. Due to the lack of a time dimension there is a lot less data on which to estimate the between country patterns. But the reduction in between-country variation is also apparent.

Figures 3 and 4 here

Table 1 gives the mean and variance of growth computed from equation (1) for two samples of countries. Panel A provides data for all countries in the sample and shows that there is a fall in mean growth with weak executive constraints from around 2.4% to 2.0%. The within country standard deviation, i.e. the standard deviation of $\eta_{\delta ct}$, increases from 3.52% to 6.86% when a country has weak executive constraints. The between country standard deviation, i.e. the standard deviation of $\alpha_{\delta c}$, rises from 1.01% to 1.82%. Given these standard deviations the mean differences across regimes are not significant.

We can also look at this for countries that switched into or away from strong executive constraints during our sample period. For the purposes of comparing their performance, we will look at those which have spent a minimum of three years with strong and weak executive constraints. In this sample, it is more plausible to argue that changes in volatility are driven, in significant measure, by political factors rather than structural changes in the economy.[11] Results are in Panel B of Table 1. The pattern of changes in the mean and standard deviation of growth is similar to what we found for the full sample. The growth rate falls a little less from 2.31% to 2.13% on average. The within-country standard deviation increases from 3.74% to 5.12% and the between country standard deviation from 1.30% to 1.99%.

3 The Model

This section lays out a framework for thinking about how executive constraints affects policy incentives. The model will show why both the mean and variance of policy outcomes vary with executive constraints.[12]

[11] As an additional test we also derive Table 1 controlling for the level of GDPpc in the regression (1). Results are reported in Table A1 which shows extremely similar patterns.

[12] It is based on Besley (2006, Chapter 3).

3.1 Framework

Policy-Making We use a simple model which citizens delegate policy-making power to a policy maker whom we refer as "the executive". The question is whether such delegated authority is used in the interest of citizens and how this is influenced by institutions.

Time is infinite and is denoted by $t = 1, 2, ...$ In each period, the executive faces a policy challenge and must pick from among three possible actions $e \in \{0, 1, q\}$ where q stands for "status quo". The payoff to voters is:

$$u_t = \begin{cases} \Delta_H & \text{if } e_t = s_t \\ \Delta_0 & \text{if } e_t = q \\ \Delta_L & \text{if } e_t \neq s_t. \end{cases}$$

where $\{\Delta_H, \Delta_0, \Delta_L\}$ are public information and $s_t \in \{0, 1\}$ is observed only by the policy maker. Ex-ante $s_t = 1$ with probability $\frac{1}{2}$. These payoffs satisfy the following restrictions:

$$\Delta_H \geq \Delta_0 \ \geq \Delta_L \text{ and } \frac{\Delta_H + \Delta_L}{2} < \Delta_0.$$

Thus, there is a good policy choice and a bad policy choice with the status quo policy lying between the two. The latter condition says that it is never worthwhile for an uninformed policy maker to randomize over $e \in \{0, 1\}$ rather than choosing q.

The model can be interpreted as representing two broad kinds of policy-making. With *policy activism*, the outcome is $e_t \in \{0, 1\}$. With constrained policy-making $e_t = q$, i.e. the incumbent is compelled to stick with the status quo. Whether policy activism benefits voters depends on matching the action to the state.

The Executive We assume that there is large set of potential policy makers who can be picked to be the executive. These policy makers are of two types. A small fraction π of policy makers always chooses $e = s$. We will refer to this type as good. The remaining $1-\pi$ of policy makers are susceptible to misbehaving, being tempted to pick $e \neq s$ and we model this temptation as drawn each period on $[R_L, R_H]$ with distribution function $G(r)$. We refer to them as opportunistic. We assume that $R_H > 0$ but allow for the possibility that $R_L < 0$ so that temptation can sometimes reinforce doing what voters want. Let μ denote the mean of r and assume that $\mu > 0$ so that on average temptation is counterproductive from a voter perspective. We assume that r is drawn each period and is *iid*. We have assumed for convenience that r is earned only with policy activism. One interpretation is to think of r as earning a rent relative to the status quo.

All agents discount the future with the same discount factor β. Let $e_t \in \{0, 1, q\}$ be the action taken by the incumbent. In what follows, we will focus on the case where π is very small. This corresponds to a somewhat pessimistic view.[13] This will give the least incentive for the legislature to give discretion to the incumbent.

Executive Constraints Every period, voters can choose whether to retain the incumbent executive or replace her with a randomly selected alternative who is good with probability π. This is the standard external control on politicians emphasized throughout the political agency literature as in Barro (1973) and Ferejohn (1986).

We add to this the possibility of an internal control in the form of an executive constraint imposed by a legislature which acts in the interests of voters and hence can help to solve the political agency problem. The role of executive constraints is to curtail some instances of bad policy making in the spirit of the veto players model of Tsebelis (2002). This constraint works ex ante, i.e. before the policy decision has been taken. We measure the strength of executive constraints by a parameter $\xi \in [0, 1]$ and suppose that such constraints are active with probability $1 - \xi$. Hence, a higher value of ξ represents weaker constraints. Let $x_t \in \{0, 1\}$ denote active executive constraints, i.e. whether the legislature can reduce incumbent discretion in period t.

We assume that the legislature can observe r_t but not s_t. The inability of the legislature to observe the state determining optimal policies will mean that it can only work as an imperfect disciplining device. Having observed r_t, we allow the legislature to remove the discretion of the incumbent and impose policy q. An executive constraint is binding whenever $x_t = 1$ and $e_t = q$.

We will allow beliefs of the voter and legislature to update their beliefs about the quality of the executive over time and let Π_t be the "reputation" of the executive at date t, i.e. the belief that the incumbent is good.

[13] It follows a long tradition which goes back at least to Hume (1742). It is also a postulate which Buchanan (1989) has argued strongly in favor of.

Timing Within each period t, the timing is as follows:

1. An incumbent is in place with reputation Π_t.
2. Nature determines $\{r_t, s_t, x_t\}$.
3. If $x_t = 0$ then the incumbent chooses $e_t \in \{0, 1, q\}$
4. If $x_t = 1$ then the legislature can choose between imposing $e_t = q$ and letting the incumbent choose from $e_t \in \{0, 1, q\}$.
5. Payoffs $u_t \in \{\Delta_0, \Delta_L, \Delta_H\}$ are realized and citizens form beliefs about the quality of their incumbent denoted by Π_{t+1}.
6. Citizens choose whether to retain the existing incumbent ($\phi(u_t) = 1$) or pick a new one from the pool ($\phi(u_t) = 0$). The new candidate is good with probability π.

We will look for a stationary perfect Bayesian equilibrium of the game in which citizens optimally make their retention decisions and the executive optimizes its policy choice. If executive constraints are in force, then the legislature optimizes its decision whether to grant discretion to the executive.

We focus on the case where $\pi \to 0$, i.e. almost all policy makers are opportunistic. Having the possibility of good policy makers in the model still plays a role in the equilibrium since it allows us to use Bayes rule on types conditional on seeing a particular outcome. Most importantly, it gives the voters a strict preference for re-appointing any policy maker who has made the right choice if they are granted policy discretion.

3.2 Equilibrium

The equilibrium of the model has three parts which we solve for working backwards. First, we solve for the optimal retention decision made by voters at stage 6. We then solve for the optimal action of the legislature if $x_t = 1$, which is stage 4 above and finally we solve for the behavior of the incumbent if he is granted discretion.

The stationary equilibrium of the model has the following form. There is a value $\hat{r}(\xi)$ such that incumbents who are given discretion choose $e_t = s_t$ for $r_t \leq \hat{r}(\xi)$ and $e_t = 1 - s_t$ otherwise. If executive constraints are in place, the legislature will remove incumbent discretion, i.e. impose policy q, if $r_t > \hat{r}(\xi)$ and allow it otherwise. If voters are given the opportunity, then they remove any incumbent who has misused their discretion, i.e. generated payoff Δ_L. Otherwise the incumbent is retained.

The key behavior in the equilibrium of the model is therefore summarized in

$$\hat{\lambda}(\xi) = G(\hat{r}(\xi))$$

which gives the probability that the bad type incumbents choose the policy which voters want if they have the discretion to do so.

The Behavior of Voters Voters condition their behavior on the observed payoff generated by an incumbent $u_t \in \{\Delta_0, \Delta_L, \Delta_H\}$. In making their decisions, they use Bayes rules to update their beliefs about the incumbent's type. Thus beliefs evolve according to:

$$\Pi_{t+1}(u_t, \Pi_t) = \begin{cases} \frac{\Pi_t}{\Pi_t + (1-\Pi_t)\lambda(\xi)} & \text{if } u_t = \Delta_H \\ \Pi_t & \text{if } u_t = \Delta_0 \\ 0 & \text{if } u_t = \Delta_L. \end{cases}$$

In a voting equilibrium, voters choose to retain an incumbent if the future value of re-election is greater than the value of removing the incumbent based on the expected future stream of policy benefits. The Appendix shows that the voting equilibrium is as follows:

Proposition 1 *In a voting equilibrium,* $\phi(\Delta_L) = 0$ *and* $\phi(\Delta_0) = \phi(\Delta_H) = 1$.

This result makes intuitive sense. Any incumbent that has produced Δ_L must be bad and hence it is worthwhile for voters to return to the pool even if the probability that the new incumbent is good is small. Any incumbent that has produced Δ_H is more likely to be good than a randomly selected incumbent and hence is worth retaining. Nothing is learned about the incumbent's type when Δ_0 is chosen. If the incumbent has generated Δ_H in the past it is strictly better to keep her than return to the pool and, if this is her first term in office, then the voters are indifferent between retaining her and going back to the pool so $\phi(\Delta_0) = 1$ is (weakly) optimal in such cases.

The Behavior of the Legislature We now study the behavior of the legislature and their decision to impose policy q. Suppose that the legislature conjectures that there is a critical value $\hat{r}(\xi) \in [R_L, R_H]$ such that the behavior of the executive is as follows:

$$e_t = \begin{cases} s_t & \text{if } r_t \leq \hat{r}(\xi) \\ 1 - s_t & \text{otherwise.} \end{cases}$$

We will show in the next section that this is indeed the case and characterize $\hat{r}(\xi)$. This implies that an incumbent with discretion chooses the action which gives the voters their largest payoff only if the realization of r_t is low enough.

If $x_t = 0$, then the legislature has no decision to make. If $x_t = 1$, then the legislature can decide after observing r_t whether to impose q or allow the incumbent to choose their preferred policy. Given the conjectured behavior of the executive, the legislature knows that the executive will choose the voter's optimal discretionary policy if r_t is low enough. Otherwise, the wrong policy will be chosen (as $\pi \to 0$). Hence, the status quo policy will be chosen whenever r_t is high. This result, which is proven in the Appendix, is stated as:

Proposition 2 *Suppose that $x_t = 1$, then as $\pi \to 0$, the legislature imposes $e_t = q$ if and only if $r_t > \hat{r}(\xi)$.*

This result shows that, even if constraining the executive is possible, it is not optimal to use that constraint in every case. It makes sense only when the legislature believes that the executive would stray away from the best policy in the event that discretion is granted.

The Behavior of the Executive Finally, we turn to the behavior of the executive given the voting equilibrium in Proposition 1 and behavior of the legislature in Proposition 2. We will characterize the threshold $\hat{r}$ below which the incumbent chooses $e_t = s_t$ if they are granted discretion.

The executive observes s_t and the realization of r_t. If it is given discretion over policy, and succumbs to temptation, it earns r_t but is then removed from office. If it decides to use the discretion to generate Δ_H, then it survives. The value of being retained is given by the expected future rents that it might earn given the likelihood that executive constraints are effective and that it is given discretion. Solving for this value, we can compute the threshold below which discretion is used in the interest of voters. This is given in the following result:

Proposition 3 *There exists a threshold value of temptation denoted by* $\hat{r}(\xi) \in [R_L, R_H]$ *which is increasing in* ξ *and solves*

$$\hat{r}(\xi) = \frac{\beta\xi\left(1 - G\left(\hat{r}(\xi)\right)\right) E\left(r : r \geq \hat{r}(\xi)\right)}{1 - \left[1 - \xi\left(1 - G\left(\hat{r}\right)\right)\right]\beta}$$

below which an incumbent with discretion chooses $e_t = s_t$.

The threshold is increasing in ξ. Thus a greater prospect of discretion (a lower likelihood of executive constraints being imposed) increases the ex ante probability that the executive will choose the voter's preferred policy if she is granted discretion. This is due to the fact that discretion yields the possibility of future rents which increase the incentive for good behavior in the present.

Proposition 3 highlights an interesting side-effect of executive constraints. Executive constraints attempt to improve policy outcomes by restricting the choice of the executive. However, through their impact on future payoffs, executive constraints make the executive behave worse in the present.

Discussion The model delivers an insight into how executive constraints affect policy. By allowing the possibility of imposing Δ_0 when Δ_L would have been chosen by the bad incumbent reduces some bad outcomes compared to full discretion. However, because $\hat{r}(\xi)$ is lower when there are executive constrains, there is a deterioration in behavior ex ante. Thus, whether executive constraints improves policy making is unclear a priori. It depends on the relevant parameters and the objective function.

The model predicts that institutions affect the mean and volatility of citizens' payoffs. To see this observe that average voter welfare is

$$G\left(\hat{r}(\xi)\right)\Delta_H + \left[1 - G\left(\hat{r}(\xi)\right)\right]\tilde{\Delta}_\xi \tag{2}$$

where $\tilde{\Delta}_\xi = [1-\xi]\Delta_0 + \xi\Delta_L$ and the variance of policy outcomes is

$$G\left(\hat{r}(\xi)\right)\left[1 - G\left(\hat{r}(\xi)\right)\right]\left(\Delta_H - \tilde{\Delta}_\xi\right)^2. \tag{3}$$

Both are functions of ξ. We can get some insight into the trade-offs predicted by the model by differentiating (2) and (3) with respect to ξ. There are basically two effects to consider in each case: the first direct effect comes from the change in $\tilde{\Delta}_\xi$ and the second from the change in $\hat{r}(\xi)$. For both the mean and standard deviation these effects can work against each other making it an empirical question whether the mean and variance of performance increase or decrease with executive constraints.

The effect on the mean from a change in ξ is given by

$$g(\hat{r}(\xi))\left[\Delta_H - \tilde{\Delta}_\xi\right]\frac{\partial \hat{r}(\xi)}{\partial \xi} - [1 - G(\hat{r}(\xi))][\Delta_0 - \Delta_L]. \tag{4}$$

The first term represents the fact that there is better incumbent behavior if there is more discretion, i.e., weaker constraints. This tends to increase the mean outcome. The second term is negative and is due the increased downside risk that having greater discretion imposes.

The effect of an increase in ξ on the variance is given by:

$$\begin{aligned}&\left[g(\hat{r}(\xi))[1 - 2G(\hat{r}(\xi))]\left(\Delta_H - \tilde{\Delta}_\xi\right)^2\right]\frac{\partial \hat{r}(\xi)}{\partial \xi}\\ &-G(\hat{r}(\xi))[1 - G(\hat{r}(\xi))]\,2[\Delta_0 - \Delta_L].\end{aligned} \tag{5}$$

The effect of an increase in discipline on the variance is ambiguous in sign. The second term is always negative. It captures the fact that executive constraints impose a lower downside policy risk, i.e. due to Δ_L being less than Δ_0. Overall, if this difference is large enough or $G(\hat{r}(\xi)) \leq 1/2$, then the variance is unambiguously lower when executive constraints are strengthened. We will show that this is the empirically relevant case.

The theory that we have presented has focused on the effect of executive constraints. It would be straightforward to extend the model to allow for varying degrees of contestability for office. This affects how far the threat of removal of an executive who produces Δ_L is real. If producing bad performance does not lead to removal then this will tend to lower $\hat{\lambda}(\xi)$ for any level of executive constraints. This too will affect the mean and variance of policy outcomes. Changing contestability will generate terms analogous to the first of the two terms in (4) and (5). Reducing contestability will definitely reduce mean performance but has an ambiguous effect on variance depending on whether $\hat{\lambda}(\xi)$ is greater than or less than a half. Hence if we think of an overall democracy index combining executive constraints and contestability, we would not necessarily expect different predictions from contestability. However, the prediction on the mean level of performance should be more clear cut in that case. This is in line with what we found in Figure 2.

4 Application to Economic Growth

In this section, we apply the model to the facts about growth that we discussed above. We will discuss how to fit the model parameters to the data in the case where the policy decisions made by government affect economic growth. We then use this to discuss the comparison of economic performance with and without strong executive constraints.

4.1 Productivity Shocks, Policy and Growth

We work with a growth model where policy making affects labor productivity growth. This allows us to forge a link between the theory and data on the mean and variance of realized growth rates. For the purposes of fitting the model we will focus on two extreme cases: either $\xi = 1$ which correspond to weak executive constraints denoted by $\delta = W$ or $\xi = 0$ which correspond to strong executive constraints, $\delta = S$.

Model Structure Consider an open economy where the aggregate production function in country c at date t is

$$Y_{ct} = (\Gamma_{ct} L_c)^{\alpha} (K_{ct})^{1-\alpha}$$

where Γ_{ct} is labor productivity. The latter is assumed to depend on country-level economic policies along the lines articulated by Aghion and Howitt (2006) and evolves stochastically over time according to the following equation:

$$\Gamma_{ct} = \Gamma_{ct-1} e^{\rho_{ct}(\delta)}$$

where $\rho_{ct}(\delta) = \kappa_c(\delta) + \varepsilon_{ct}$ and $\varepsilon_{ct} \sim N\left(-\frac{1}{2}\sigma^2_{\varepsilon c}(\delta), \sigma^2_{\omega c}(\delta)\right)$ with $\delta \in \{S, W\}$ denoting whether executive constraints are strong or weak. This formulation implies that $E\left(e^{\rho_{ct}(\delta)}\right) = e^{\kappa(\delta)}$, i.e. $E(e^{\varepsilon}) = 1$.

Firms hire capital and labor in competitive factor markets. The labor market is closed with a fixed stock of labor L_c while capital is available on a global capital market at price r. We assume that capital is chosen before ε_{ct} is realized so that risk matters to firms.

Then firms choose their optimal capital stock as follows:

$$\begin{aligned} K^*_{ct}(\delta) &= \arg\max \left\{ E\left(e^{\kappa(\delta)+\varepsilon_{ct}}\right)^{\alpha} (\Gamma_{ct-1} L_c)^{\alpha} K^{1-\alpha} - rK \right\} \\ &= \Gamma_{ct-1} L_c \left(\frac{(1-\alpha)}{r}\right)^{\frac{1}{\alpha}} e^{\kappa(\delta) - \frac{1-\alpha}{2}\sigma^2_{\varepsilon c}(\delta)} \end{aligned}$$

This implies that that the (log of) income per capita, y_{ct}, is given by:

$$\log y_{ct} = [\kappa_c(\delta) + \alpha\varepsilon_{ct} + \log(\Gamma_{ct-1})] - \frac{(1-\alpha)^2}{2}\sigma^2_{\varepsilon c}(\delta) \quad + B_c$$

where B_c is a time-invariant constant. Using this, the growth rate at date t in country c is $g_{ct} = \kappa_c(\delta) + \alpha\varepsilon_{ct} + (1-\alpha)\varepsilon_{ct-1}$.[14] Note that this depends on executive constraints through $\kappa(\delta)$. The implied mean and variance of growth are given by:

$$\mu_c(\delta) = \kappa_c(\delta) - \frac{1}{2}\sigma^2_{\varepsilon c}(\delta) \tag{6}$$

and

$$\sigma^2_{gc}(\delta) = \sigma^2_{\varepsilon c}(\delta). \tag{7}$$

This allows us to map between moments in the growth data and the parameters of the economic model. In particular, we will use the relationship in equations (6) and (7) to calculate country-specific estimates of the productivity growth trend $\kappa_c(\delta)$ and variance $\sigma^2_{\varepsilon c}(\delta)$ from the moments in the growth data. Moreover, these depend on $\delta \in \{S, W\}$.

To map this onto the political model, assume that the productivity growth trend is $\kappa_c(\delta) = \lambda_{\delta c}\Delta_H + (1-\lambda_{\delta c})\tilde{\Delta}_\delta$ where

$$\tilde{\Delta}_\delta = \begin{cases} \Delta_L & \text{if } \delta = W \\ \Delta_0 & \text{if } \delta = S, \end{cases}$$

$\lambda_{Sc} = G_c(\hat{r}(0))$ and $\lambda_{Wc} = G(\hat{r}(1))$. Then if $\Delta_{ct} \in \{\Delta_H, \Delta_L, \Delta_0\}$ is the realized value of Δ in country c at date t, then assume $\varepsilon_{ct} = \Delta_{ct} - \kappa_c(\delta) + \omega_{ct}$ where $\omega_{ct} \sim N\left(-\frac{\sigma^2_{\varepsilon c}(\delta)}{2}, \sigma^2_\omega\right)$ which implies that $\sigma^2_{c\varepsilon}(\delta) = \lambda_{\delta c}(1-\lambda_{\delta c})\left[\Delta_H - \tilde{\Delta}_\xi\right]^2 + \sigma^2_\omega$. Thus the trend growth rate and the standard deviation around the trend vary with executive constraints as the model implies.

Fitting the Model In order to fit the model to the data we will take the following approach. First, we assume a common set of parameters Δ_H, Δ_0 and Δ_L across countries. We then calculate a set of country/institution-specific values of $\lambda_{\delta c}$. Thus the model is applied under the assumption that

[14] Growth is given by $\log y_{ct} - \log y_{ct-1} = [\kappa_c(\delta) + \alpha\varepsilon_{ct} + \log(\Gamma_{ct-2}) + \varepsilon_{ct-1}] - [\kappa_c(\delta) + \alpha\varepsilon_{ct-1} + \log(\Gamma_{ct-2})]$

differences in productivity growth between countries are due to differences in politics as represented by $\lambda_{\delta c}$.

First observe that by the definition of $\kappa_c(\delta)$ we can write

$$\lambda_{\delta c} = \frac{\kappa_c(\delta) - \tilde{\Delta}_\delta}{\Delta_H - \tilde{\Delta}_\delta}. \tag{8}$$

Substituting this into the expression for the variance of growth, we have that

$$\sigma_{gc}^2(\delta) = \left(\kappa_c(\delta) - \tilde{\Delta}_\delta\right)(\Delta_H - \kappa_c(\delta)) + \sigma_\omega^2 \tag{9}$$

where $\kappa_c(\delta) = \mu_c(\delta) + \frac{1}{2}\sigma_{gc}^2(\delta)$. Thus, the variance is a non-linear function of the trend growth rate and the common parameters $\{\Delta_H, \Delta_L, \Delta_0\}$. We can use this to fit the model to the data using non-linear least squares to estimate (9).[15] We run the regression jointly for strong and weak executive constraints imposing the condition from the theory that Δ_H is common across the two samples.[16]

We first estimate $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$ for all countries in the data. Second, we look at only those countries that switched in or out of strong executive constraints during our sample period and which spent at least three years in each regime. The results are shown in Table 2. The point estimates line up as we would expect with $\hat{\Delta}_H > \hat{\Delta}_0 > \hat{\Delta}_L$. This is a key implication of the theory and is a key part of the mechanism behind the lower variance in strong executive constraints. In the restricted sample of switchers we find a significant estimate with $\hat{\Delta}_H = 8.4\%$, a value of $\hat{\Delta}_0 = -1.1\%$ and $\hat{\Delta}_L = -3.2\%$. As we argued in the discussion following Proposition 2, the magnitude of $\Delta_0 - \Delta_L = 2.1\%$ plays an important role since it reduces volatility when strong executive constraints are introduced. In the model that we estimate, this key magnitude is both economically and statistically significant. It underpins the "insurance" effect of strong executive constraints.

Using equation (8), we can now back out country/regime-specific estimates $\hat{\lambda}_{\delta c}$ using our estimates $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$.[17] We interpret heterogeneity in $\hat{\lambda}_{\delta c}$ as a country-specific political equilibrium depending upon whether

[15] In this we treat σ_ω^2 as a country and institution specific error term.

[16] We also used a more flexible specification in which we allowed the Δ_H to be a function of the regime. This exercise confirms that the there are no significant differences in Δ_H between strong and weak executive constraints.

[17] For details and an example see the Appendix B.

executive constraints are strong or weak. Returning to the model, this heterogeneity in country performance could be thought in terms of the model as being due to different distributions $G(\cdot)$ for each country. While this is a stylized way of fitting the model, given that we have imposed common values for $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$, it gives an interpretation of the moments in the growth data entirely through variations in politics.[18]

We can now summarize the fruits of this estimation by looking at the distribution of our estimates of $\hat{\lambda}_{\delta c}$. One way to assess the fit to the model is to see whether the prediction that $\hat{\lambda}_{Wc} > \hat{\lambda}_{Sc}$ (Proposition 3) holds in the data. Figure 5 gives the estimated cumulative distribution function for $\hat{\lambda}_{\delta c}$ for $\delta \in \{S, W\}$. In line with the theory, the distribution of $\hat{\lambda}_{Wc}$ first order stochastically dominates that of $\hat{\lambda}_{Sc}$.[19] In other words, it does look like giving greater incumbent discretion does improve behavior of incumbents in line with the theory.

Figure 5 here

While this does not prove that the model provides a valid way of thinking about differences across countries, it is a non-trivial finding from the data which has a bearing on the model.

More generally, these estimates provide a useful way of thinking about the consequences of adopting strong executive constraints for growth and income levels in terms of how politics responds to institutions. It also provides a method for considering heterogeneity across countries. We will explore this crucial point further in the next section.

4.2 Comparing Institutions

We now use the estimated model to gain some insight into the income gains from switching institutions. We will conduct two different exercises which

[18] We show in the appendix Table A2 that controlling for GDP per capita levels does not change the pattern we find. We estimate (9) on a more restrictive sub-samples of countries with at least 5 years in each regime, control for year fixed effects and GDP per capita levels. We always find very similar values $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$ and a (significant) ordering $\Delta_H > \Delta_0 > \Delta_L$.

[19] This is broadly the pattern for the countries that switched as shown in Table A3. However, there are some countries with $\lambda_{Sc} > \lambda_{Wc}$. The way that such anomalous cases could be reconciled with the theory is by supposing that the $G(\cdot)$ also changes due to greater transparency with strong constraints.

take advantage of the fact that we have estimated a wide range of heterogeneity in $\lambda_{\delta c}$.

In the first exercise, we will look at the countries in our data that have weak executive constraints and consider what income gains we would predict from a switch towards strong executive constraints. In the second, we will conduct a comparison of institutions without assuming a starting point of weak executive constraints, taking instead the perspective of a dispassionate constitution designer armed with our model and parameter estimates who is basing the choice on income gains. Following Rawls (1971), we will frame this as choice from "behind the veil of ignorance" where different draws from the $\lambda_{\delta c}$ are possible.

In both of these cases, we will choose two criteria of choice. We consider a standard approach where we take the average performance of each institutional arrangement as the benchmark. The second, is motivated by the literature on robust control. Here, ignorance about the underlying performance can lead to an approach which compares institutions using the worst performing cases in each institutional setting. We will use these to provide quantitative estimates so that we can see how the income gains that we estimate are quantitatively different when we take a more cautious approach.

The Criterion Our criterion for judging institutions will be expected income differences based on expected growth over a ten year time horizon. Using our model, the expected income level in a country with trend production growth $\kappa_c(\delta)$ and variance $\sigma^2_{\varepsilon c}(\delta)$ after T years will be $e^{\left\{\left[\kappa(\delta)-\frac{1}{2}\sigma^2_{\varepsilon c}(\delta)\right]T\right\}}$ times their baseline level of income. Thus the variance and mean of productivity shocks drive such gains. When we compare institutions, the relative expected income gain/loss from strong executive constraints for country c after T years is:

$$B_c(T) = e^{\left(\left[\kappa_c(S)-\frac{1}{2}\sigma^2_{\varepsilon c}(S)\right]-\left[\kappa_c(W)-\frac{1}{2}\sigma^2_{\varepsilon c}(W)\right]\right)T} - 1 \tag{10}$$

When we are comparing a country with and without strong executive constraints through the lens of the model, we use our estimates $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$ together with specific values of $\lambda_{\delta c}$ to form estimates of $\{\kappa_c(\delta), \sigma^2_{\delta c}\}$. The choice of $\lambda_{\delta c}$ embodies our assumption about how politics affects income comparisons. This approach allows us to make comparisons which involve countries which have never adopted strong executive constraints by hypothesizing a value λ_{Sc}. We can then hold the economic environment fixed by fixing $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$ for the purposes of comparisons. The values of $\lambda_{\delta c}$ then do all the work in our estimates of the gain in equation (10).

One way to gauge the value of strong constraints would be to focus on the gains experienced by countries that have made a transition from weak to strong constraints. For example, we might consider the average performance of countries that have switched from weak to strong constraints as a kind of "average treatment effect". Our approach allows to bring in a wider experience of $\lambda_{\delta c}$ to make comparisons since we can use the specific estimates of $\lambda_{\delta c}$ in all countries to have a full range of heterogeneous "treatment" effects.

When we look at the range of experience in Figure 5, we can treat this as a probability distribution for the performance with and without strong executive constraints. Then when a country has weak or strong institutions, we can think of it getting a draw from that distribution. However, it is plausible to argue that attaching probability weights to these outcomes based on the empirical frequency distribution is problematic. For example, if countries select in and out of strong and weak constraints in a way that is correlated with $\lambda_{\delta c}$ it is not clear that the average of experience in $\lambda_{\delta c}$ is what we would want to look at.

In this context, we think that a better way to proceed would be to be agnostic about the probability weights attached to observations introducing ambiguity into the comparisons.[20] As a practical proposal, we will look at the four quartiles of the distribution of $\lambda_{\delta c}$. Following the literature on robust control, we will then focus our attention on performance in the bottom quartile to create "robust" comparisons.[21] That criterion is close in spirit to the maxmin expected utility approach suggested by Gilboa and Schmeider (1989) in a classic contribution to the literature. We regard this to be particularly instructive when we make "behind the veil of ignorance" comparisons below. However, in all cases, we do consider comparisons at the mean of $\lambda_{\delta c}$ where observations are weighted according to the length of the country/institution episodes reported in Tables A2 and A3.

Adopting Strong Constraints We begin by focusing only on those countries which have always had weak executive constraints over our time period. We then ask what we would estimate the income gains (or losses) to be should

[20] See Manski (2011) for discussion of policy in this context.

[21] Robust control ideas originated in macroeconomics to think about model uncertainty – see, for example, Hansen and Sargent (2001).

they adopt strong constraints. For these countries, we take as λ_{Wc} what we have estimated from the data by fitting the country experience to their mean productivity growth. However, for λ_{Sc} there is no direct empirical measure. We consider two cases. In the first, we take the weighted mean of the sample of all countries which have switched to strong executive constraints. In the second, we take the weighted mean in the bottom quartile of the distribution of those countries. We are then interested in countries that would gain from a switch, and by how much, according to our model.

The results are presented graphically in Figure 6 which plots estimates of (10) for all countries that have always had weak executive constraints in the sample. We suppose that these countries keep their value of λ_{Wc} if they stay in weak constraints. The blue dots give the estimate of gain using the mean value of λ_{Sc} for countries which switched to strong constraints to project performance in the case of adopting strong constraints. All but a small set of countries would benefit from making this transition on this basis – these are countries which have strong growth under weak constraints. Quite sensibly, for example, they include China. Given the latter's extremely strong performance and our estimates of $\sigma^2_{\delta c}$, we predict that China will continue to perform better with weak constraints. That of course, assumes that λ_{Wc} stays the same in China as it has in the past, i.e. there is no shock to the political equilibrium for given constraints. But if, for example, there were reasons to believe that the $G(\cdot)$ might change in future then we would be moving more towards the kind of comparison that we perform in the next section.

Our "robust" criterion which uses the bottom quartile of λ_{Sc} does, not surprisingly, offer a more cautious assessment. Now only around one half of the countries in the sample would be predicted to gain from strong constraints. Figure 6 labels a small number of countries in the middle of the distribution of λ_{Wc} to illustrate. Tanzania and Russia, for example, would gain significantly if they had the average λ_{Sc} after switching to strong executive constraints but would lose if they drew the λ_{Sc} in the lowest quartile. However, in some cases, the ten year income gains remain positive even with the more conservative approach. They are, for example, 4% for Venezuela, 7% for Cameroon and 24% for DR Congo over ten years even if they were to be a "lowest quartile" strong executive constraints country.

Figure 6 here

Whichever exercise we perform demonstrates the importance of making heterogeneous comparisons, here based on the different past experiences of each country. The average gain might be misleading for any country in this sample. This message is reminiscent of Persson and Tabellini (2009b) but puts a specific model structure to assess this.

Behind the Veil of Ignorance Our second exercise considers a "Rawlsian" comparison of institutions from behind the veil of ignorance. Rawls (1971) argued for a maximin approach but principally motivated by distributive justice rather than ambiguity. However, Harsanyi (1975) famously argued for a comparison based on considering the average outcome. Rather than taking a stance, here we will compare the two criteria for our practical application.

We look at this comparison by creating estimates of (10) at different points in the distribution of $\lambda_{\delta c}$, $\delta \in \{S, W\}$. We calculate the weighted mean value of $\lambda_{\delta c}$ for four quartiles under both strong and weak executive constraints. We then use these mean values and our $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$ to calculate values of $\{\kappa_c(\delta), \sigma^2_{\delta c}\}$ for each quartile. This allows us to run policy experiments regarding the gain $B_c(T)$ calculated from inserting the quartile values $\{\kappa_c(\delta), \sigma^2_{\delta c}\}$ in equation (10). These values are given in Table 3 which reports results for the full sample and for the sample of countries that switched between strong and weak executive constraints.

As we have already seen in Figure 5, the average value of λ_{Wc} is higher in each quartile. However, trend productivity growth is still lower in the bottom quartile with the implied variance being higher. Going back to equations (4) and (5), this suggests that the effect due to $\Delta_0 > \Delta_L$ in our estimates is the dominant force in making comparisons, i.e. protection from the downside is what matters empirically with strong constraints.

If we look at (10) across the quartiles for the countries that switched over our sample period, then the gain is 14.39% in the bottom quartile, 15.78% is the second quartile, 15.02% in the next quartile and 3.99% in the top quartile. The same broad pattern is found for the full sample. Thus, behind the veil of ignorance, there is a compelling argument for strong executive constraints which is stronger with a focus on the lower performance tail in the distribution of $\lambda_{\delta c}$.

This approach offers a clear insight into the value of strong executive constraints. This might appear surprising given the original statement of the marginal differences in average growth between weak and strong executive constraints illustrated in Figure 1. However, our approach has made use of both the within and across variation of the growth data which is illustrated by Figures 3 and 4. The parameter $\lambda_{\delta c}$ is fitted through (8) to cross-sectional differences in mean growth (strictly speaking trend productivity growth). The variance estimates combine this with $\left\{\hat{\Delta}_H, \hat{\Delta}_L, \hat{\Delta}_0\right\}$ based on equation (9).

5 Concluding Comments

This paper is motivated by the frequently observed fact that countries with weak political institutions generally have more variable economic performance. This is also found when comparing across transitions between strong and weak executive constraints. Moreover, the fall in variance consists of a fall of within-country variance over time as well as lower between-country variance.

We have suggested a simple model where executive constraints affect both the mean and variance of performance and have applied this to economic growth. By attributing variability in growth performance to politics, we can explain the decline in variance as the result of changes in policy-making which are broadly in line with the prediction of the model. This can be used in turn to estimate the gains from strong executive constraints driven by changes in the mean and variance of productivity shocks. These show significant potential gains in the level of income over time from strong executive constraints.

The theoretical model allowed us to think about the political consequences of adopting strong constraints through their impact on the distribution of $\lambda_{\delta c}$. This parameter is a sufficient statistic for the behavior of growth volatility for $\delta \in \{S, W\}$. The cross-sectional pattern of the parameter allows us to think about the between-country variation in politics. Our model also gives us a way of thinking about the heterogeneous growth performance of countries with strong and weak executive constraints getting beyond average effects following Persson and Tabellini (2009a,b). The approach that we have taken is quite simple. However, this has enabled us to focus on specific features of the data in a transparent way and allows us to unpack the heterogeneous effects of institutional differences. This remains an important research program – the average effects are often of little policy relevance.

While our focus here has been on growth, in future work it is important to study a wider range of outcomes and policies. An initial look at the data on life expectancy and infant mortality strongly suggests that the effect on the second moment is not confined to economic growth. In Figures 7 and 8, we plot the within residuals from a regression similar to equation (1) which controls for country fixed effect and year dummy variables. Once again weak executive constraints show a higher within episode standard deviation compared to strong constraints. This could, to some extent, also be a reflection of general macro-economic conditions in the economy but they could also reflect a wider set of policy factors. This merits a closer investigation in future work. However, these Figures are in line with the thrust of the argument developed here.

Figures 7 and 8 about here

Another potentially fruitful line of enquiry involves studying private sector responses to institutions in greater detail. In Besley and Mueller (2014), we investigate how investment flows by foreign firms respond to reductions in macro-economic risk following a switch to strong executive constraints. We argue that this might explain why countries with strong executive constraints appear to attract more investment inflows.

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A Proof of Proposition 1

Proof. Let $u(z) = z\Delta_H + (1-z)\hat{\Delta}(\xi)$ where $\hat{\Delta}(\xi) = \xi\Delta_L + (1-\xi)\Delta_0$. Define voter discounted utility $W(\lambda, \xi, \boldsymbol{\phi}, \pi_n)$ from the recursion:

$$\begin{aligned} W(\lambda, \xi, \boldsymbol{\phi}, \pi_n) &= u(\xi\psi^n + (1-\xi)\lambda) + \psi^n\xi\beta\left[\max_{\phi(\Delta_H)}\{\phi W(\lambda, \xi, \boldsymbol{\phi}, \pi_{n+1}) + (1-\phi)[W(\lambda, \xi, \boldsymbol{\phi}, \pi)]\}\right] \\ &\quad + [1-\psi^n]\xi\beta\left[\max_{\phi(\Delta_L)}\{\phi W(\lambda, \xi, \boldsymbol{\phi}, 0) + (1-\phi)[W(\lambda, \xi, \boldsymbol{\phi}, \pi)]\}\right] \\ &\quad + (1-\xi)\beta\left[\max_{\phi(\Delta_0)}\{\phi W(\lambda, \xi, \boldsymbol{\phi}, \pi_n) + (1-\phi)[W(\lambda, \xi, \boldsymbol{\phi}, \pi)]\}\right] \end{aligned}$$

where $u(\xi\psi^n + (1-\xi)\lambda)$ captures expected utility within the period. Also, we have defined $\pi_{n+1} = \frac{\pi_n}{\pi_n + \lambda(1-\pi_n)}$ and $\psi^n = (\pi_n + (1-\pi_n)\lambda)$ which are both increasing sequences. Here we have used the fact that $\Pi = \pi_n$ if $e_t = q$, i.e. there is no updating of the incumbent's type under executive constraints. We adopt the convention $\pi_1 = \pi$.

We need to show that for all λ, ξ it is optimal to remove the incumbent whenever $\Pi = 0$ and to re-elect her if she has always produced Δ_H if she has had discretion. Note that

$$\begin{aligned} \phi(\Delta_L) &= \arg\max_{\phi}\{\phi W(\lambda, \xi, \boldsymbol{\phi}, 0) + (1-\phi)[W(\lambda, \xi, \boldsymbol{\phi}, \pi)]\} \\ \phi(\Delta_H) &= \phi(\Delta_0) = \arg\max_{\phi}\{\phi W(\lambda, \xi, \boldsymbol{\phi}, \pi_n) + (1-\phi)[W(\lambda, \xi, \boldsymbol{\phi}, \pi)]\} \text{ for } n \geq 2. \end{aligned}$$

Suppose that $\phi(\Delta_H) = \phi(\Delta_0) = 1$. We will show that $\phi(\Delta_L) = 0$. If $\phi(\Delta_L) = 0$, then $W(\lambda, \xi, \boldsymbol{\phi}, 0) < W(\lambda, \xi, \boldsymbol{\phi}, \pi)$. Suppose not, then $\phi(\Delta_L) = 1$ and:

$$W(\lambda, \xi, \boldsymbol{\phi}, 0) = \frac{u(\lambda)}{1-\beta}. \tag{11}$$

For this to be a voting equilibrium, we require that $W(\lambda, \xi, \boldsymbol{\phi}, 0) \geq W(\lambda, \xi, \boldsymbol{\phi}, \pi)$. Then,

$$\begin{aligned} W(\lambda, \xi, \boldsymbol{\phi}, \pi) &= \delta\left(\xi\psi^1 + (1-\xi)\lambda\right) + \psi^1\xi\beta[\max\{W(\lambda, \xi, \boldsymbol{\phi}, \pi), W(\lambda, \xi, \boldsymbol{\phi}, \pi_2)\}] \\ &\quad + \left[1-\psi^1\right]\xi\beta W(\lambda, \xi, \boldsymbol{\phi}, 0) + (1-\xi)W(\lambda, \xi, \boldsymbol{\phi}, \pi) \\ &\geq \delta\left(\xi\psi^1 + (1-\xi)\lambda\right) + \left[\xi\psi^1 + (1-\xi)\right]\beta W(\lambda, \xi, \boldsymbol{\phi}, \pi) \\ &\quad + \left(1-\psi^1\right)\beta\xi W(\lambda, \xi, \boldsymbol{\phi}, 0) \end{aligned}$$

which implies that

$$\begin{aligned}\left(1-\beta\left[\xi\psi^1+(1-\xi)\right]\right)W(\lambda,\xi,\boldsymbol{\phi},\pi) &\geq \delta\left(\xi\psi^1+(1-\xi)\lambda\right)+\left(1-\psi^1\right)\xi\beta W(\lambda,\xi,\boldsymbol{\phi},0)\\ &> \delta(\lambda)+\left(1-\psi^1\right)\beta\xi W(\lambda,\xi,\boldsymbol{\phi},0)\\ &= W(\lambda,\xi,\boldsymbol{\phi},0)\left(1-\beta\left[\xi\psi^1+(1-\xi)\right]\right)\end{aligned}$$

using (11), a contradiction. So $W(\lambda,\xi,\boldsymbol{\phi},0)<W(\lambda,\xi,\boldsymbol{\phi},\pi)$ and $\phi(\Delta_L)=0$ as claimed.

Suppose then that $\phi(\Delta_L)=0$ and $\phi(\Delta_0)=1$. We will show that, beginning with an incumbent with reputation π, $\phi(\Delta_H)=1$. Suppose not. For $\phi(\Delta_H)=0$, we require that $W(\lambda,\xi,\boldsymbol{\phi},\pi_2)\leq W(\lambda,\xi,\boldsymbol{\phi},\pi)$. This implies that

$$W(\lambda,\xi,\boldsymbol{\phi},\pi)=\frac{u\left(\xi\psi^1+(1-\xi)\lambda\right)}{1-\beta}.$$

Now observe that if the incumbent were retained, then

$$\begin{aligned}W(\lambda,\xi,\boldsymbol{\phi},\pi_2) &= u\left(\xi\psi^2+(1-\xi)\lambda\right)+\psi^2\beta\xi\max\left\{W(\lambda,\xi,\boldsymbol{\phi},\pi_3),W(\lambda,\xi,\boldsymbol{\phi},\pi)\right\}\\ &\quad+\left(1-\psi^2\right)\xi\beta W(\lambda,\xi,\boldsymbol{\phi},\pi)+(1-\xi)\beta W(\lambda,\xi,\boldsymbol{\phi},\pi_2).\\ &\geq u\left(\xi\psi^2+(1-\xi)\lambda\right)+\xi\beta W(\lambda,\xi,\boldsymbol{\phi},\pi)+(1-\xi)\beta W(\lambda,\xi,\boldsymbol{\phi},\pi_2)\end{aligned}$$

which implies that:

$$\begin{aligned}\left[1-\beta(1-\xi)\right]W(\lambda,\xi,\boldsymbol{\phi},\pi_2) &\geq u\left(\xi\psi^2+(1-\xi)\lambda\right)+\beta\xi W(\lambda,\xi,\boldsymbol{\phi},\pi)\\ &> u\left(\xi\psi^1+(1-\xi)\lambda\right)+\beta\xi W(\lambda,\xi,\boldsymbol{\phi},\pi)\end{aligned}$$

which implies that $W(\lambda,\xi,\boldsymbol{\phi},\pi_2)>W(\lambda,\xi,\boldsymbol{\phi},\pi)$ – a contradiction so that $\phi(\Delta_H)=1$ as claimed.

To complete the proof, we need to show that $W(\lambda,\xi,\boldsymbol{\phi},\pi_n)>W(\lambda,\xi,\boldsymbol{\phi},\pi)$ implies that $W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1})>W(\lambda,\xi,\boldsymbol{\phi},\pi)$ for all $n\geq 1$. Suppose not. Then $W(\lambda,\xi,\boldsymbol{\phi},\pi_n)>W(\lambda,\xi,\boldsymbol{\phi},\pi)\geq W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1})$. This implies that

$$\begin{aligned}W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1}) &= u\left(\xi\psi^{n+1}+(1-\xi)\lambda\right)+\beta\psi^{n+1}\xi\max\left\{W(\lambda,\xi,\boldsymbol{\phi},\pi),W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+2})\right\}\\ &\quad+\left[1-\psi^{n+1}\right]\xi\beta W(\lambda,\xi,\boldsymbol{\phi},\pi)+(1-\xi)\beta W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1})\\ &\geq u\left(\xi\psi^{n+1}+(1-\xi)\lambda\right)+\beta\xi W(\lambda,\xi,\boldsymbol{\phi},\pi)+(1-\xi)\beta W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1}).\end{aligned}$$

or

$$\left[1-(1-\xi)\beta\right]W(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1})\geq\delta\left(\xi\psi^{n+1}+(1-\xi)\lambda\right)+\beta\xi W(\lambda,\xi,\boldsymbol{\phi},\pi).$$

It also implies that

$$
\begin{aligned}
W\left(\lambda,\xi,\boldsymbol{\phi},\pi_n\right) &= u\left(\xi\psi^n+(1-\xi)\lambda\right)+\beta\xi\psi^n\max\left\{W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right),W\left(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1}\right)\right\} \\
&\quad +\left(1-\psi^n\right)\xi\beta W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right)+(1-\xi)\beta W\left(\lambda,\xi,\boldsymbol{\phi},\pi_n\right) \\
&= u\left(\xi\psi^n+(1-\xi)\lambda\right)+\beta\xi W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right)+(1-\xi)\beta W\left(\lambda,\xi,\boldsymbol{\phi},\pi_n\right)
\end{aligned}
$$

or

$$
\left[1-(1-\xi)\beta\right]W\left(\lambda,\xi,\boldsymbol{\phi},\pi_n\right)=u\left(\xi\psi^n+(1-\xi)\lambda\right)+\beta\xi W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right).
$$

Hence:

$$
\begin{aligned}
u\left(\xi\psi^n+(1-\xi)\lambda\right)+\beta\xi W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right) &> W\left(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1}\right) \\
&\geq u\left(\xi\psi^{n+1}+(1-\xi)\lambda\right)+\beta\xi W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right)
\end{aligned}
$$

which is a contradiction since

$$
u\left(\xi\psi^{n+1}+(1-\xi)\lambda\right)>u\left(\xi\psi^n+(1-\xi)\lambda\right).
$$

using Bayes rule. So we must have $W\left(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1}\right)>W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right)$. Then the result holds by induction for all $n>1$. Finally note that the last step also implies that $\phi\left(\Delta_0\right)=1$. For this to be the case, we need that $W\left(\lambda,\xi,\boldsymbol{\phi},\pi_{n+1}\right)\geq W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right)$ which we have already shown holds. ■

B Proof of Proposition 2

Proof. Suppose now that $x_t=1$. There are two cases, suppose that $r_t\leq\hat{r}(\xi)$, then all incumbents will generate Δ_H and the given a reputation Π, this yields

$$
\Delta_H+\beta W\left(\lambda,\xi,\boldsymbol{\phi},\Pi\right)
$$

since nothing is learned about the type. Imposing the status quo yields a payoff of

$$
\Delta_0+\beta W\left(\lambda,\xi,\boldsymbol{\phi},\Pi\right)
$$

since nothing is learned about the incumbent's type in this case either. Hence allowing discretion is optimal.

Now consider the case where $r_t>\hat{r}(\boldsymbol{\xi})$. Then the expected payoff from allowing discretion is

$$
\Pi\Delta_H+(1-\Pi)\Delta_L+\beta\left[\Pi W\left(\lambda,\xi,\boldsymbol{\phi},1\right)+(1-\Pi)W\left(\lambda,\xi,\boldsymbol{\phi},\pi\right)\right].
$$

If no discretion is offered, then the payoff is

$$\Delta_0 + \beta W(\lambda, \xi, \boldsymbol{\phi}, \Pi).$$

Thus discretion is offered if and only if:

$$\begin{aligned} & \Pi\Delta_H + (1-\Pi)\Delta_L - \Delta_0 \\ \geq \quad & \beta\left[W(\lambda, \xi, \boldsymbol{\phi}, \Pi) - \Pi W(\lambda, \xi, \boldsymbol{\phi}, 1) - (1-\Pi) W(\lambda, \xi, \boldsymbol{\phi}, \pi)\right] \end{aligned} \tag{12}$$

Now note that $W(\lambda, \xi, \boldsymbol{\phi}, \Pi) \geq W(\lambda, \xi, \boldsymbol{\phi}, \pi)$ and as $\pi \to 0$ we have $\Pi \to 0$ so that the right-hand-side is positive. Moreover $\Delta_L - \Delta_0 < 0$. Hence (12) cannot hold and discretion is never offered in this case, as claimed. ■

C Proof of Proposition 3

Proof. Given ξ let

$$V(\hat{r}; \xi) = \xi \int_{\hat{r}}^{R_H} r dG(r) + [1 - \xi(1 - G(\hat{r}))] \beta V(\hat{r}; \boldsymbol{\phi}, \xi)$$

where $1 - \xi(1 - G(\hat{r}))$ is the probability that the incumbent stays in office. Then the incumbent is indifferent between taking r and continuing at

$$\hat{r} = \beta V(\hat{r}; \xi)$$

and solving this yields (**??**). Now let:

$$H(x, \xi) = \frac{\beta\xi \int_x^R r dG(r)}{1 - \beta(1 - \xi + \xi G(x))}.$$

Observe that

$$H_x(x, \xi) = \frac{\beta\xi[H(x, \xi) - x] g(x)}{1 - \beta(1 - \xi + \xi G(x))}.$$

Note that $H(R_L, \xi) > 0$ by assumption and $H(R_H, \xi) = 0 < R_H$. Thus there exists $\hat{r}(\xi) \in (R_L, R_H)$ such that $H(\hat{r}(\xi), \xi) = \hat{r}(\xi)$. Moreover $H_x(\hat{r}(\xi), \xi) = 0$ so that $H_x(x, \xi) < 0$ for all $x > \hat{r}$. Finally, note that

$$H_\xi(x, \xi) = \frac{[1-\beta]\beta \int_x^R r dG(r)}{1 - \beta(1 - \xi + \xi G(x))} > 0.$$

Observe that for $\xi' > \xi$.

$$H(r, \xi) < H(r, \xi').$$

Now let

$$H(\hat{r}(\xi), \xi) = \hat{r}(\xi)$$

and suppose that $\hat{r}(\xi) < \hat{r}(\xi')$. Now this implies that $H(\hat{r}(\xi), \xi') < H(\hat{r}(\xi), \xi)$ since $H(\hat{r}(\xi), \xi')$ is increasing for $\hat{r}(\xi) < \hat{r}(\xi')$. This is a contradiction so $\hat{r}(\xi) \geq \hat{r}(\xi')$ as claimed. ■

Table 1: Across and Within Regime Performance

Panel A: Growth in percent (entire sample)

	strong executive constraints	weak executive constraints
mean	2.41	2
within sd	3.52	6.86
across sd	1.01	1.82

Panel B: Growth in percent (sample of switchers)

	strong executive constraints	weak executive constraints
mean	2.34	2.13
within sd	3.74	5.12
across sd	1.3	1.99

Note: Growth is real GDP pc growth from 1952-2010. Entire sample are 128 countries as described in the appendix. Switchers are countries with at least three years under both strong and weak executive constraints. Within sd is the standard deviation of growth within country/institution episodes. Across sd is the standard deviation of growth across countries. For details see the discussion of equation (1) in the main text.

Table 2: Delta Parameter Estimates

	(1)	(2)
VARIABLES	entire sample	sample of switchers
delta 0	0.0118***	-0.0107
	(0.00425)	(0.0101)
delta L	-0.0181	-0.0321**
	(0.0113)	(0.0150)
delta H	0.154***	0.0842***
	(0.0424)	(0.0182)
Observations	172	76

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Table shows the fit of a non-linear least squares regression of productivity growth variances on productivity growth means at the country/regime level (equation (9) in the main text). Observations are weighted by episode length. Entire sample are 128 countries as described in the appendix. Switchers are countries with at least three years under both strong and weak executive constraints.

Table 3: Summary of Lambda Estimates

Panel A: sample of switchers

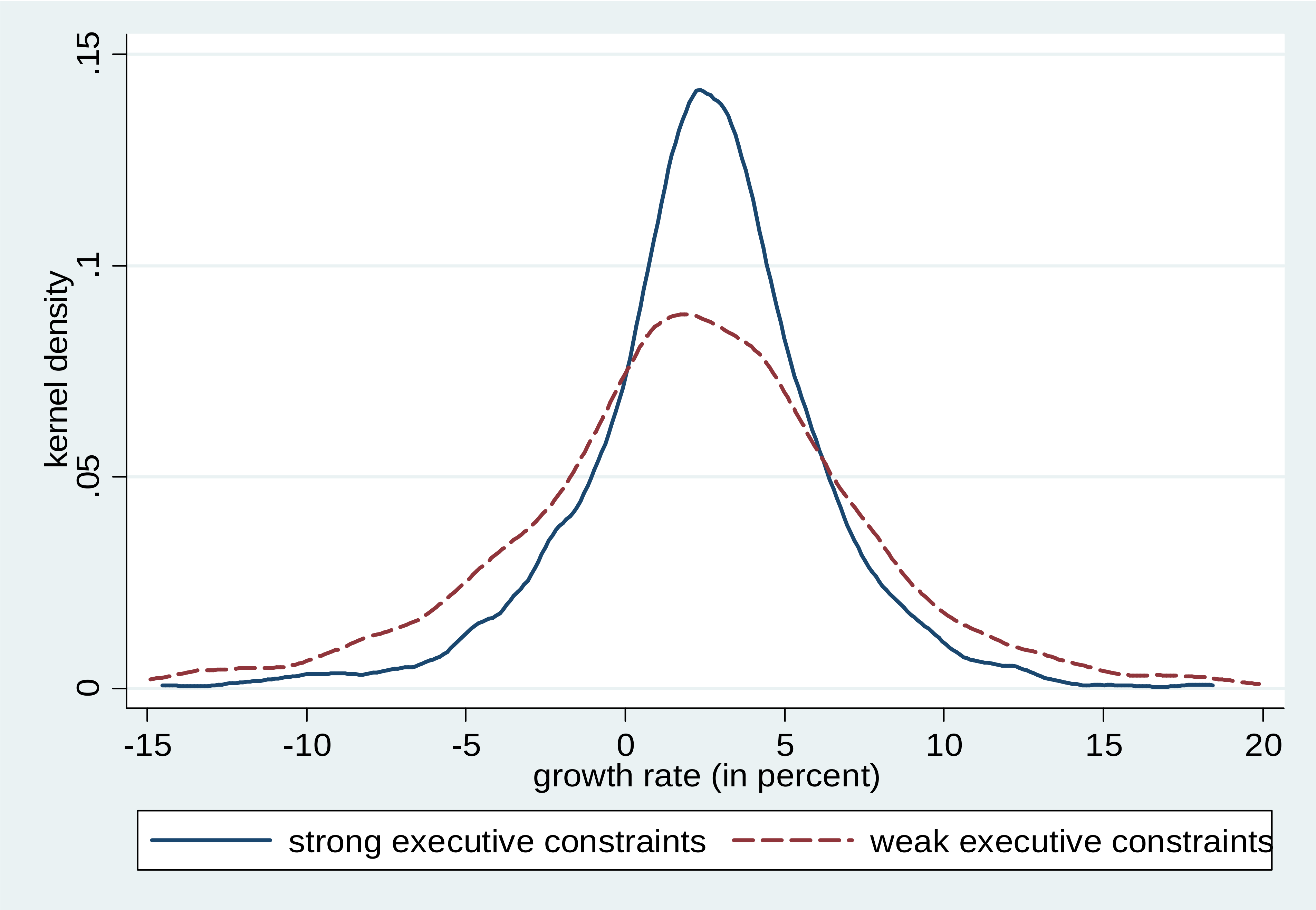
weak executive constraints				*strong executive constraints*				
lambda quartiles	mean lambda	implied mean productivity growth	implied productivity variance	lambda quartiles	mean lambda	implied mean productivity growth	implied productivity variance	output gain from switching
1	0.2766	-0.0088	0.0027	1	0.1737	0.0039	0.0013	14.39%
2	0.4192	0.0032	0.0033	2	0.3312	0.0172	0.0020	15.78%
3	0.5109	0.0109	0.0034	3	0.4158	0.0243	0.0022	15.02%
4	0.7343	0.0297	0.0026	4	0.5241	0.0334	0.0022	3.99%

Panel B: entire sample

weak executive constraints				*strong executive constraints*				
lambda quartiles	mean lambda	implied mean productivity growth	implied productivity variance	lambda quartiles	mean lambda	implied mean productivity growth	implied productivity variance	output gain from switching
1	0.2936	-0.0074	0.0028	1	0.2199	0.0078	0.0015	17.16%
2	0.4137	0.0027	0.0033	2	0.3379	0.0177	0.0020	16.95%
3	0.4919	0.0093	0.0034	3	0.4242	0.0250	0.0022	17.70%
4	0.6787	0.0250	0.0029	4	0.5163	0.0328	0.0022	8.42%

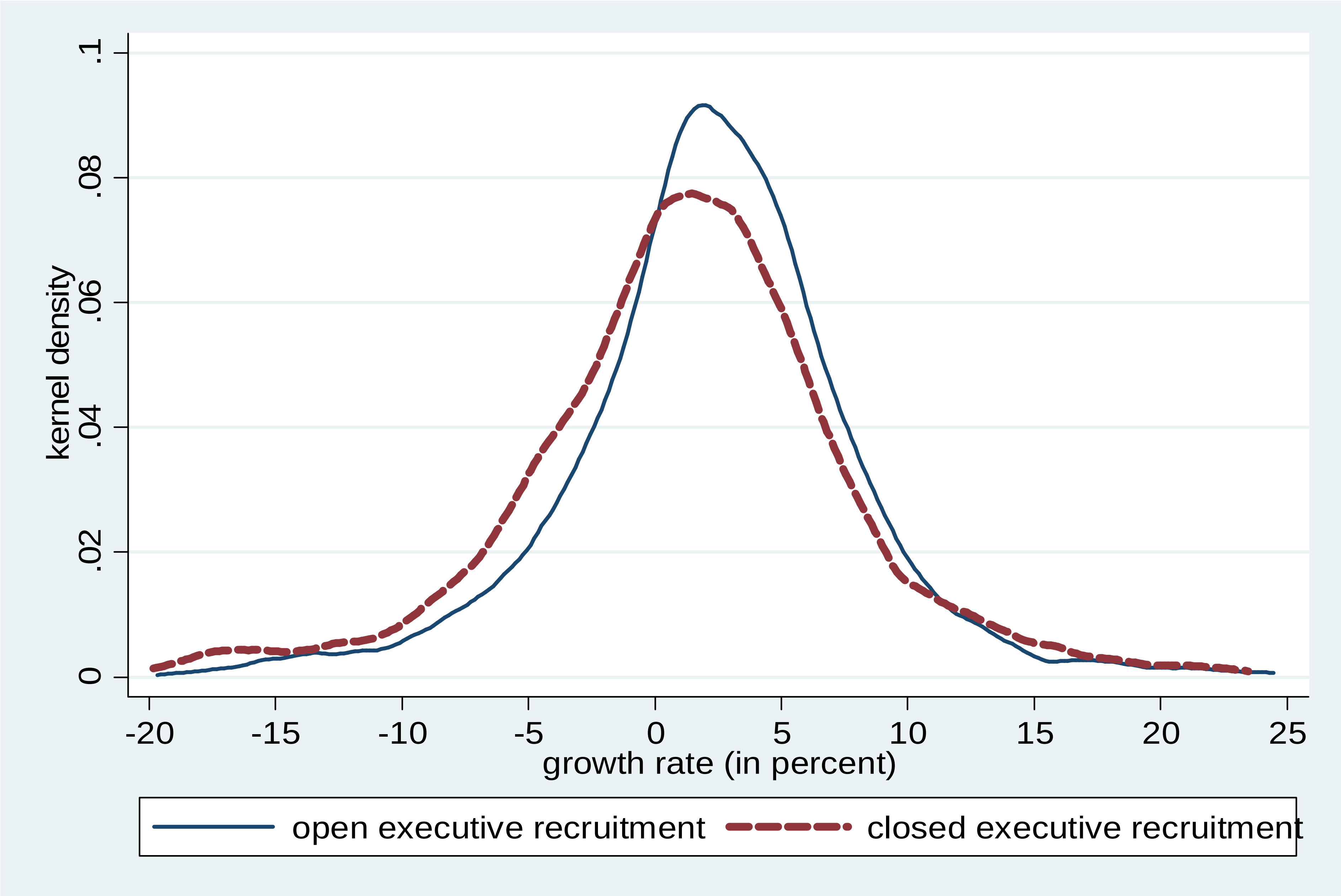
Note: The entire sample are 128 countries as described in the appendix. Switchers are countries with at least three years under both strong and weak executive constraints. Lambdas are calculated from equation (8) in the main text and are reported in appendix Tables A2 and A3. Lambda means use weights by length of the country/institution episode. Mean and variance of productivity growth are calculated using delta estimates from Table (2), column (2). For details see the main text. We set lambda=0 if lambda<0 and lambda=1 if lambda>1. This affects 2 countries in quartile 1 in Panel A under strong executive constraints and 1 country in quartile 4 in Panel B under weak executive constraints.

Figure 1: Growth Rates and Executive Constraints



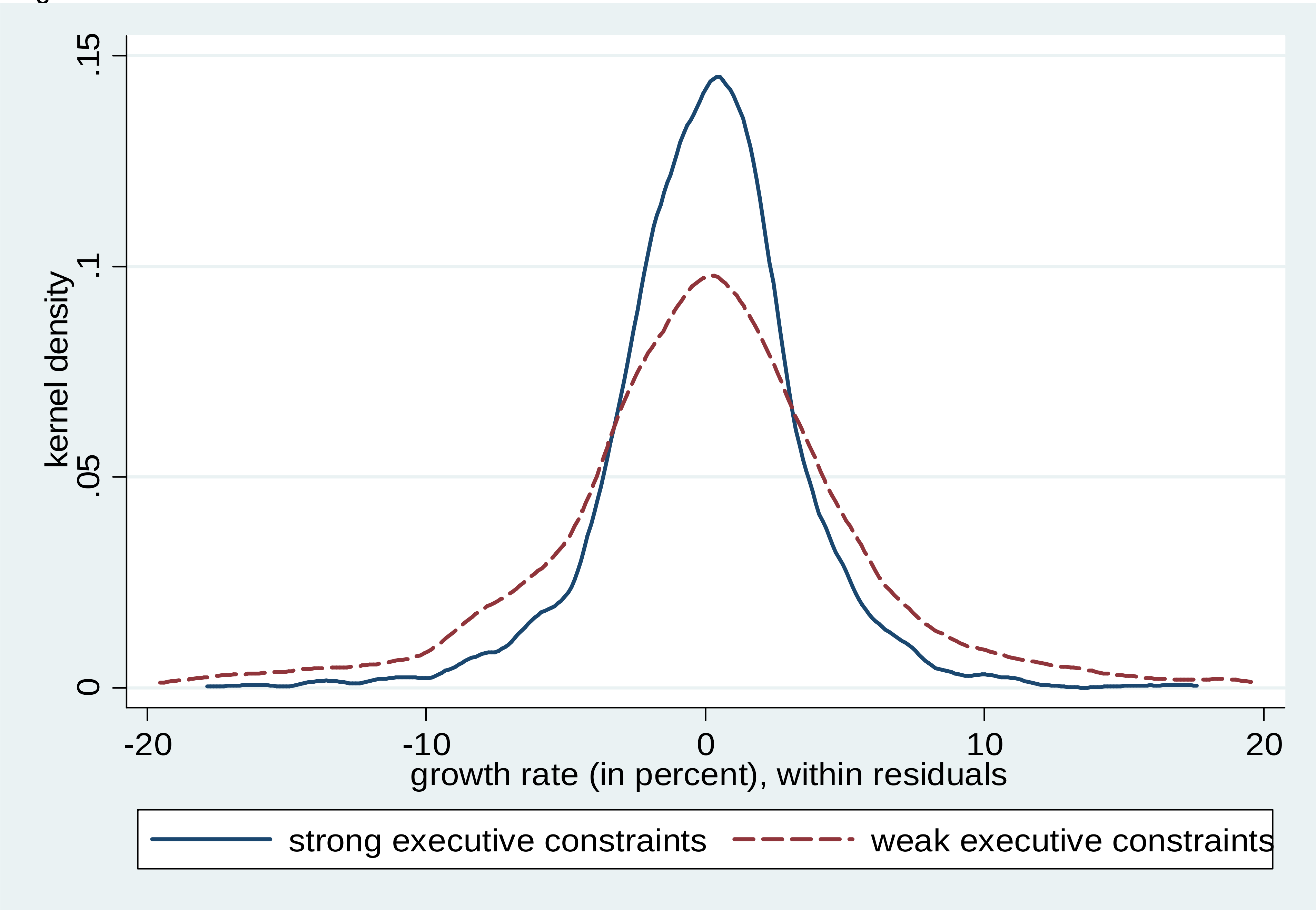
Note: Growth data is from 1952-2010 calculated using real GDP per capita from the Penn World Tables 7.1

Figure 2: Growth Rates and Openness of Executive Recruitment



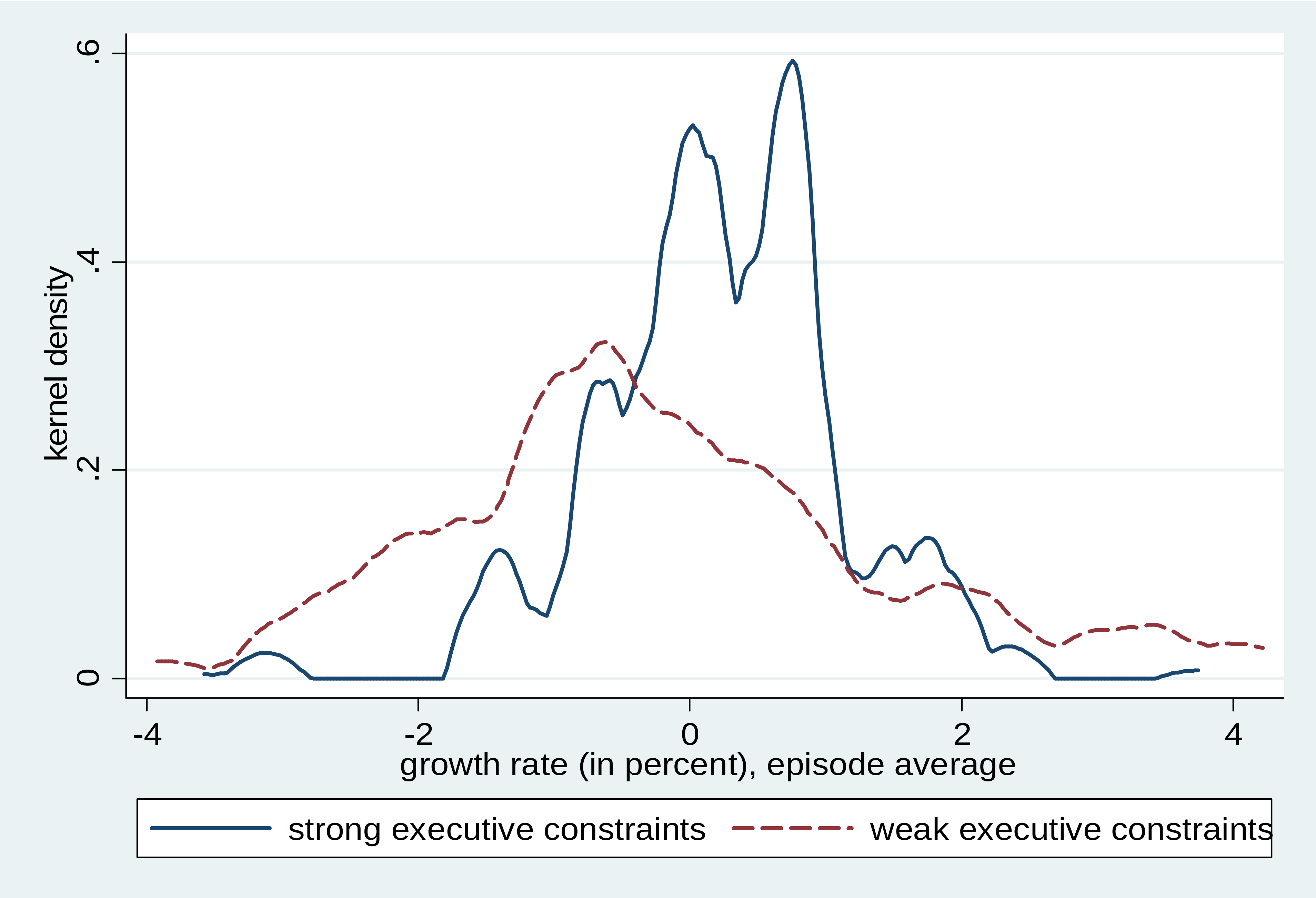
Note: Growth data is from 1952-2010 calculated using real GDP per capita from the Penn World Tables 7.1. The Figure excludes episodes with strong executive constraints.

Figure 3: Within Residuals of the Growth Rate



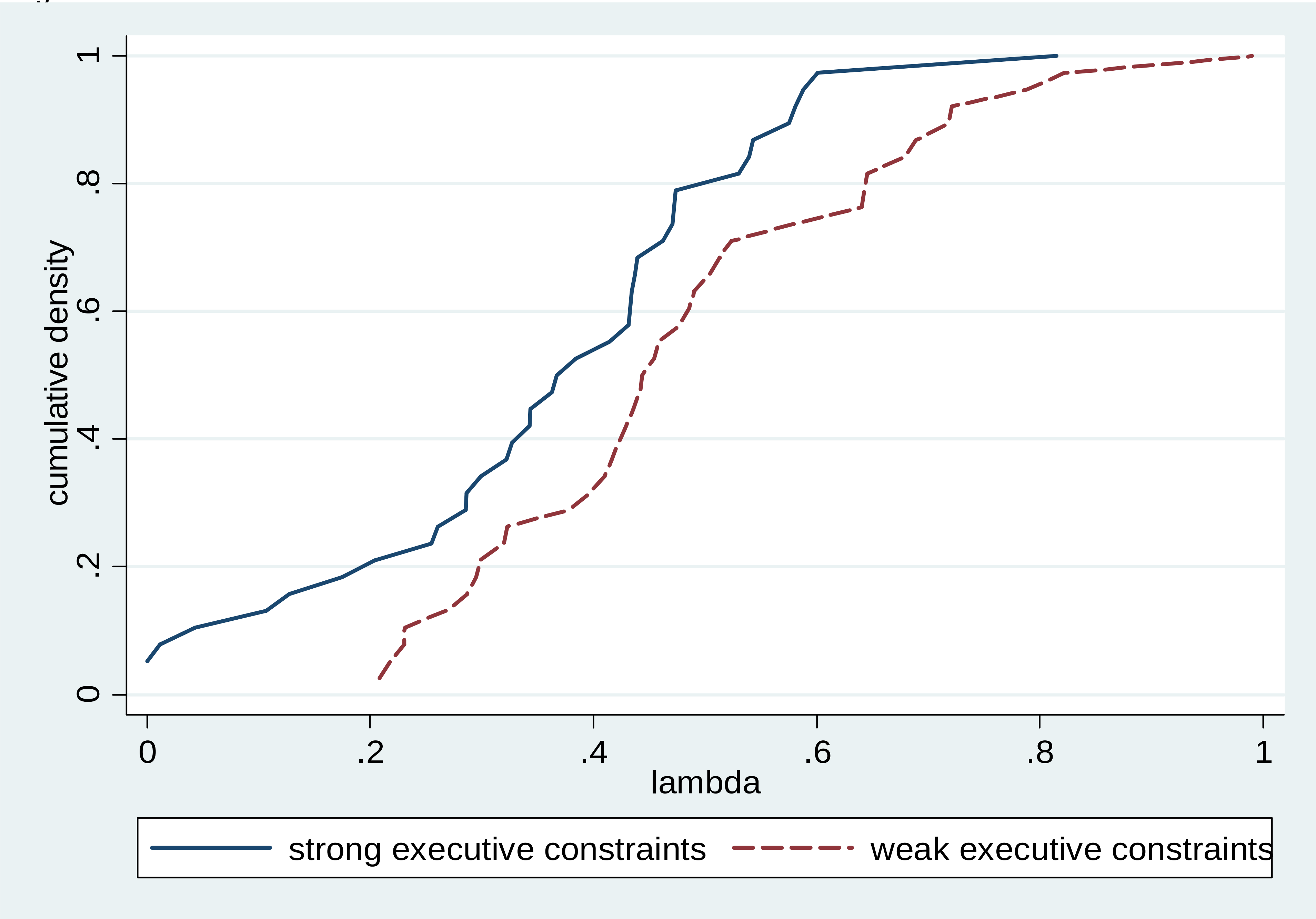
Note: The graph reports within country/institution residuals calculated from equation (1).

Figure 4: Episode Average Growth Rates



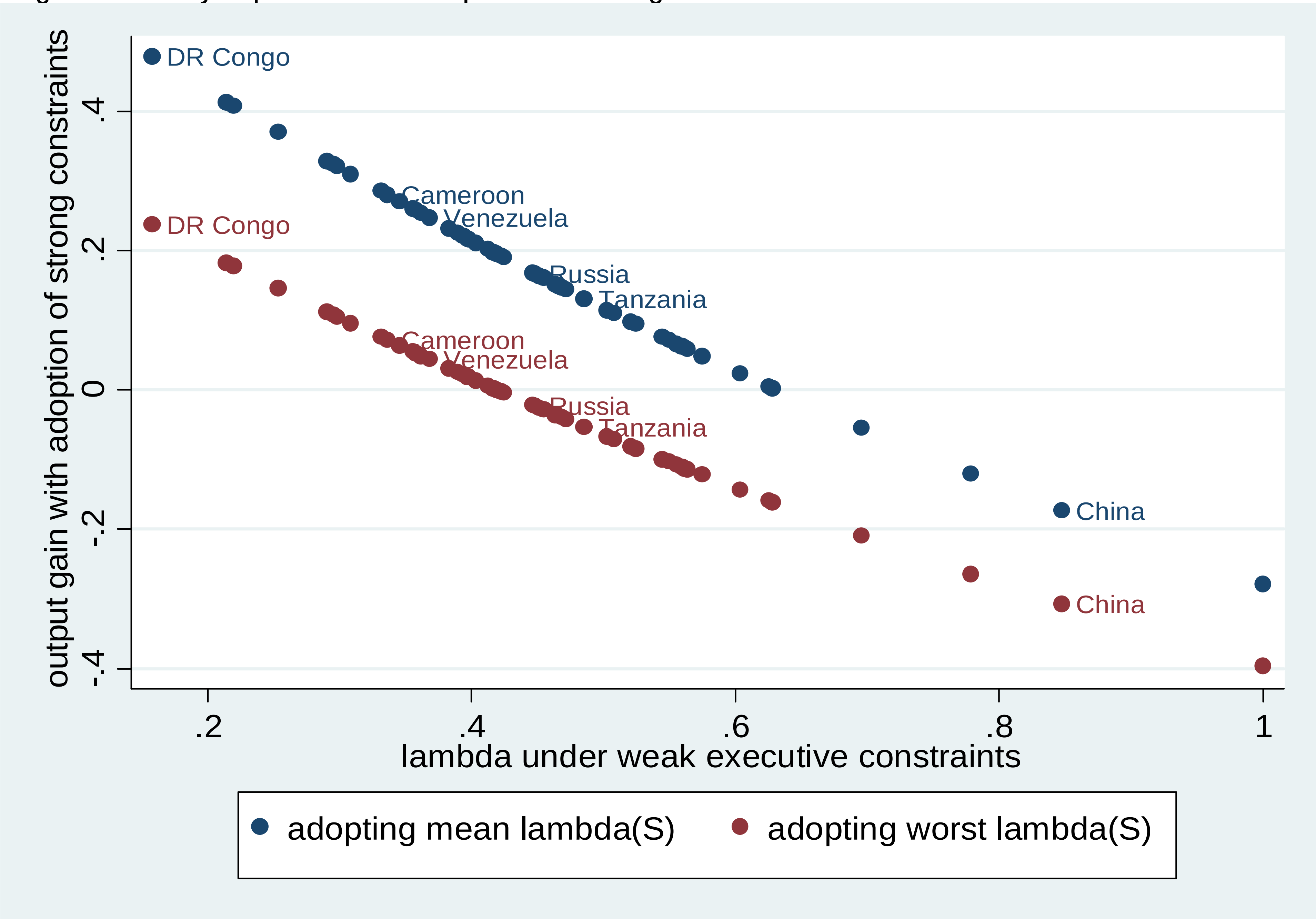
Note: The graph reports across growth averages for each country/institution episode calculated from equation (1).

Figure 5: Estimated Lambda Distributions



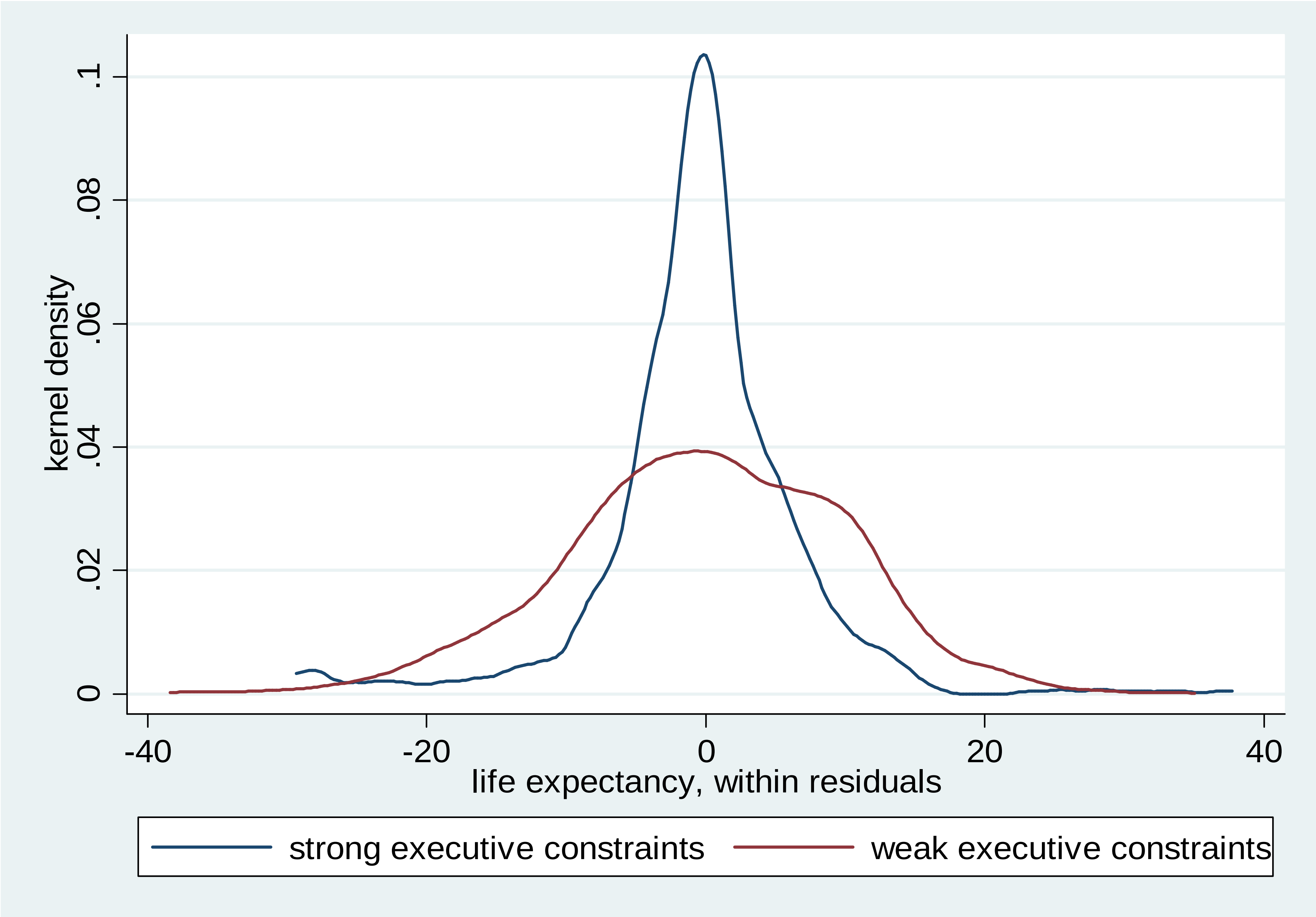
Note: Lambda values are from Table A2, i.e. countries that spent at least 3 years in weak and strong executive constraints.

Figure 6: Policy Experiment – Adoption of Strong Executive Constraints



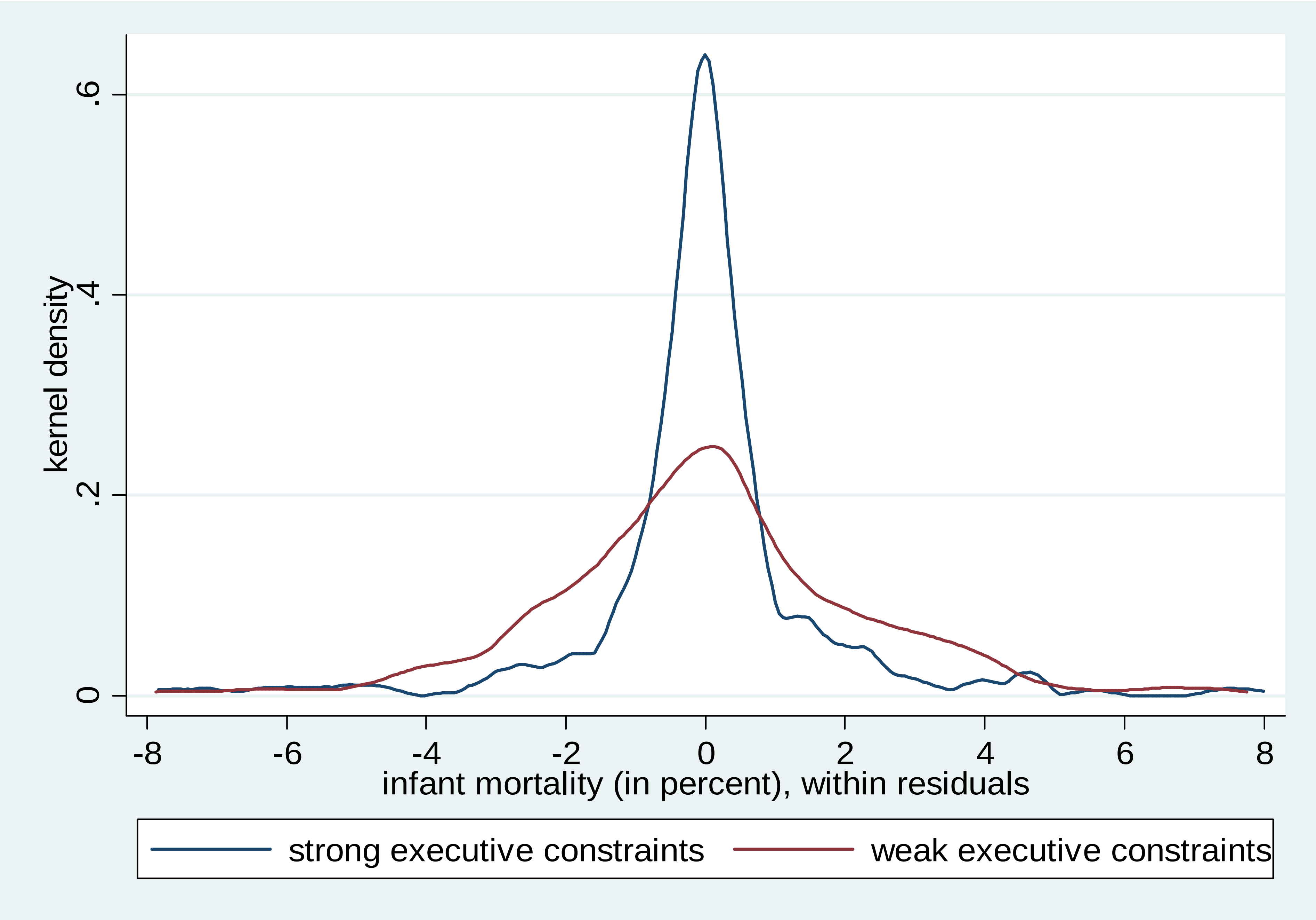
Note: The output gain is calculated using equation (10) and estimates in Table 2, column (2) and Table A4.

Figure 7: Within Residuals of Life Expectancy and Executive Constraints



Note: Life expectancy data is from 1960-2010 from the World Development Indicators 2012.

Figure 8: Within Residuals of Infant Mortality and Executive Constraints



Note: Infant mortality data is from 1960-2010 from the World Development Indicators 2012.

Volatility and Political Institutions: Theory and Application to Economic Growth

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Appendix

A Data Description

A.1 Political Institutions

The data on political institutions come from the Polity IV data base whose manual is available at

$$http://www.systemicpeace.org/inscr/p4manualv2010.pdf$$

from which the following descriptions are taken.

The executive constraints variable that we use is *xconst* available on a seven point scale. It takes a value of one where there is unlimited authority in which there are no regular limitations on the executive's actions (as distinct from irregular limitations such as the threat or actuality of coups and assassinations) and category seven is executive parity or subordination where accountability groups have effective authority equal to or greater than the executive in most areas of activity. The share of countries with a score of xconst equal to 7 went from around 0.25 in the 1980s to over 0.35 in 2010.

Openness of executive recruitment is the variable *xropen* which is intended to capture the extent to which the politically active population has an opportunity to attain the position through a regularized process. This is on a four point scale. At one extreme a value of one denotes the most closed possibility where chief executives are determined by hereditary succession and includes kings, emperors, beys, emirs, etc. A score of four (maximal openness) denotes the case where chief executives are chosen by elite designation, competitive election, or transitional arrangements that fall between designation and election.

A.2 Growth and Mortality Data

Growth is calculated from real GDP per capita data from the Penn World Tables version 7.1 and is based on the *rgdpl* variable. Growth is the percentage point increase from one year to the next.

Infant mortality and life expectancy are from the World Development Indicators 2012. Life expectancy is estimated at birth and given in years. Infant mortality is given per 1000 life births.

A.3 Sample Description

We drop countries with less than 1 million inhabitants and the Lebanon as it is an extreme outlier in terms of productivity growth variance. For a detailed discussion see Besley, Timothy and Hannes Mueller, [2014], "Volatility, Institutions and Investment". This leaves us with an imbalanced panel of 128 countries with data on both executive constraints and GDP per capita growth in the period 1952-2010. The sample of switchers includes just countries which are in both weak and strong executive constraints for at least three years.

After matching the World Development Indicators 2012 to the Polity IV data we an unbalanced sample of 127 countries from 1960 to 2010.

B Appendix Tables Description

Table A1 uses the regression

$$g_{\delta ct} = \alpha_{\delta c} + \alpha_t + \beta Y_{ct} + \eta_{\delta ct} \tag{1}$$

where Y_{ct} is the level of real GDP per capita. We report the standard deviation of the within residuals $\eta_{\delta ct}$ and across variation $\alpha_{\delta c}$ in the Table.

In Table A2 we offer robustness checks for our main estimates of Δ_H, Δ_0 and Δ_L parameters provided in Table 2, column (2). We always follow the same method of calculating $\sigma^2_{\varepsilon c}(\delta) = \sigma^2_{gc}(\delta)$ and $\kappa_c(\delta) = \mu_c(\delta) + \frac{1}{2}\sigma^2_{gc}(\delta)$ first and then using the regression equation

$$\sigma^2_{gc}(\delta) = \left(\kappa_c(\delta) - \tilde{\Delta}_\delta\right)(\Delta_H - \kappa_c(\delta)) + \sigma^2_{\omega c} \tag{2}$$

to estimate Δ_H, Δ_0 and Δ_L. Column (1) in Table A2 reports the results in Table 2, column (2). These are from the sample of countries that were at least three years under both weak and strong executive constraints. In column (2) we restrict the sample to countries that were in each regime for at least 5 years (we lose 5 countries, 10 episodes). In column (3) we use residuals from the growth equations in equation (1) in the main text. In column (4) we use the residuals from equation (1) above. For both cases we set $\mu_c(\delta) = \alpha_{\delta c}$ and $\sigma^2_{gc}(\delta) = var(\eta_{\delta ct})$.

The lambda values in Table A3 and A4 are calculated as follows. First we use the mean country/institution episode growth $\mu_c(\delta)$ and the growth variance $\sigma^2_{gc}(\delta)$ in each country/institution episode to calculate productivity variance

$$\sigma^2_{\varepsilon c}(\delta) = \sigma^2_{gc}(\delta) \tag{3}$$

and trend growth

$$\kappa_c(\delta) = \mu_c(\delta) + \frac{1}{2}\sigma^2_{\varepsilon c}(\delta) \tag{4}$$

which is then used to calculate a country/institution specific value $\lambda_{\delta c}$ from

$$\lambda_{\delta c} = \frac{\kappa_c(\delta) - \tilde{\Delta}_\delta}{\Delta_H - \tilde{\Delta}_\delta} \tag{5}$$

where we use the estimates from Table 2, column (2) so that

$$\begin{aligned} \hat{\Delta}_0 &= -0.0107 \\ \hat{\Delta}_L &= -0.0321 \\ \hat{\Delta}_H &= 0.0842. \end{aligned}$$

Take as an example Albania which had

$$\begin{aligned}\hat{\sigma}^2_{gc}(W) &= 0.0055651\\ \hat{\sigma}^2_{gc}(S) &= 0.0028882\end{aligned}$$

and

$$\begin{aligned}\hat{\mu}_c(W) &= 0.0164903\\ \hat{\mu}_c(S) &= 0.0651828\end{aligned}$$

so that we calculate from equation (3)

$$\begin{aligned}\hat{\kappa}_c(W) &= 0.0164903 + \frac{1}{2}0.0055651 = 0.01927\\ \hat{\kappa}_c(S) &= 0.0651828 + \frac{1}{2}0.0028882 = 0.06627\end{aligned}$$

and, inserting in equation (4), we get

$$\begin{aligned}\hat{\lambda}_{Wc} &= \frac{0.01927 + 0.0321}{0.0842 + 0.0321} = 0.44\\ \hat{\lambda}_{Sc} &= \frac{0.06627 + 0.0107}{0.0842 + 0.0107} = 0.81\end{aligned}$$

which are the values reported in Table A3. All calculations, including in Table A4, use the estimates $\hat{\Delta}_0$, $\hat{\Delta}_L$ and $\hat{\Delta}_H$ presented above. This makes lambda values comparable across tables.

Table A1: Performance Controlling for GDPpc

Panel A: Growth in percent (entire sample)

	strong executive constraints	weak executive constraints
mean	2.41	2
within sd	3.51	6.86
across sd	1.18	1.94

Panel B: Growth in percent (sample of switchers)

	strong executive constraints	weak executive constraints
mean	2.34	2.13
within sd	3.72	5.12
across sd	1.81	2.29

Note: Growth is real GDP pc growth from 1952-2010. Within sd is the standard deviation of growth within the country/regime episodes. Across sd is the standard deviation of growth across countries. For details see the discussion of equation (1). Switchers are countries with at least three years under both strong and weak executive constraints.

Table A2: Robustness Delta Parameter Estimates

VARIABLES	(1) sample of switchers	(2) sample of switchers (5 years)	(3) controlling for year fixed effects	(4) controlling for year fixed effects and GDP pc
delta 0	-0.0107	-0.0106	-0.0111	-0.0152*
	(0.0101)	(0.0111)	(0.00849)	(0.00882)
delta L	-0.0321**	-0.0357*	-0.0342**	-0.0395***
	(0.0150)	(0.0194)	(0.0138)	(0.0138)
delta H	0.0842***	0.0841***	0.0790***	0.0737***
	(0.0182)	(0.0196)	(0.0181)	(0.0158)
Observations	76	66	76	76

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Table shows the fit of non-linear least squares regressions of productivity growth variances on productivity growth means at the country/regime level. In columns (1), (3) and (4) the sample is countries with at least three years under both strong and weak executive constraints. In column (2) the sample is countries with at least five years under both strong and weak executive constraints. Columns (3) and (4) use within and across errors from equation (1) in the main text. Column (4) adds GDP per capita as an additional control. For details see Appendix B.

Table A2: Lambda Estimates in Detail (Switchers)

country	number of years under strong executive constraints	number of years under weak executive constraints	estimated lambda under strong executive constraints	estimated lambda under weak executive constraints
Albania	6	34	0.81	0.44
Argentina	6	53	0.13	0.43
Bolivia	27	32	0.17	0.29
Botswana	14	31	0.43	0.99
Bulgaria	21	19	0.34	0.72
Chile	22	37	0.58	0.41
Colombia	4	55	0.37	0.44
Croatia	11	9	0.41	0.21
Ecuador	17	42	0.11	0.52
France	6	53	0.53	0.48
Greece	40	19	0.46	0.58
Haiti	3	47	0.01	0.29
Hungary	21	19	0.26	0.51
Kenya	3	45	0.26	0.32
Lesotho	18	27	0.47	0.49
Macedonia	9	11	0.43	0.22
Madagascar	5	45	0.00	0.23
Malaysia	12	42	0.44	0.68
Mongolia	19	21	0.36	0.45
Nicaragua	16	43	0.29	0.32
Niger	4	46	0.00	0.23
Nigeria	11	40	0.04	0.42
Pakistan	15	44	0.32	0.49
Paraguay	18	41	0.20	0.44
Peru	12	47	0.47	0.40
Philippines	5	54	0.29	0.46
Poland	16	24	0.59	0.42
Portugal	29	30	0.33	0.69
Romania	7	43	0.60	0.64
Slovak Republic	13	5	0.54	0.82
Spain	33	26	0.30	0.72
Sri Lanka	26	33	0.34	0.65
Taiwan	7	52	0.58	0.79
Thailand	14	45	0.44	0.64
Turkey	33	26	0.38	0.50
Uganda	4	45	0.43	0.38
Uruguay	26	33	0.47	0.30
Zimbabwe	9	32	0.54	0.27

Note: Table reports lambda estimates from country level growth data. See equation (8) in the main text. Delta estimates are from Table (2), column 2. We set lambda=0 if lambda<0. This affects two countries under strong executive constraints. Switchers are countries with at least three years under both strong and weak executive constraints. For details see Appendix B.

Table A3: Lambda Estimates in Detail (Non-Switchers)

strong executive constraints			weak executive constraints					
country	number of years under strong executive constraints	estimated lambda under strong executive constraints	country	number of years under weak executive constraints	estimated lambda under weak executive constraints	country	number of years under weak executive constraints	estimated lambda under weak executive constraints
Jamaica	52	0.1937645	Zaire	51	0.1579847	Russia	19	0.4480533
Germany	21	0.2656223	Central African Repul	50	0.2143668	Cambodia	40	0.4515659
New Zealand	59	0.2857883	Somalia	40	0.2195743	Afghanistan	40	0.4541863
Switzerland	59	0.2866702	Guinea-Bissau	37	0.2533247	Mexico	59	0.4548987
United States	59	0.3127012	Guinea	51	0.2907248	Malawi	47	0.4550214
Sweden	59	0.3273843	United Arab Emirates	24	0.2950792	Congo	50	0.4635868
Canada	59	0.3278764	Senegal	50	0.2985381	Mozambique	36	0.4659553
Australia	59	0.3288229	Togo	50	0.3088084	Sierra Leone	49	0.4684476
Costa Rica	59	0.3453206	Papua New Guinea	36	0.331327	Jordan	56	0.4722169
United Kingdom	59	0.3516399	Cameroon	50	0.3363642	Tanzania	50	0.4853273
Netherlands	59	0.3641433	Ivory Coast	50	0.3452897	Syria	50	0.5029489
Denmark	59	0.3666467	Honduras	59	0.3555568	Cuba	40	0.5081167
Belgium	59	0.3838525	Burundi	49	0.3574763	Tunisia	49	0.5083231
Slovenia	20	0.3918306	Zambia	47	0.3621306	Brazil	59	0.5211203
Italy	59	0.4130659	Venezuela	59	0.3682407	Angola	36	0.5246832
Norway	59	0.4148351	Benin	51	0.3827547	Yemen	21	0.5443435
Finland	59	0.4184764	Ghana	51	0.3896005	Rwanda	50	0.5499016
Israel	59	0.4232882	Saudi Arabia	24	0.3934998	Kuwait	24	0.5553586
Austria	59	0.4396705	Burkina Faso	51	0.393961	Iran	55	0.5588563
Ireland	59	0.4401067	El Salvador	59	0.3970633	Egypt	59	0.5598378
Czech Republic	18	0.4409154	Guatemala	59	0.398022	Mauritania	50	0.5617237
Trinidad & Tobago	49	0.4507808	Libya	24	0.4033666	Morocco	55	0.5638446
Estonia	20	0.5094685	Liberia	40	0.4129353	Panama	59	0.5747808
Mauritius	43	0.5117725	Nepal	50	0.4164572	Indonesia	50	0.6040246
Serbia	5	0.5135689	Mali	50	0.4171661	Oman	40	0.625513
Japan	59	0.5524339	Ethiopia	59	0.4181266	Laos	40	0.6279387
			Algeria	49	0.4194807	Vietnam	35	0.6962028
			Namibia	21	0.4224324	Iraq	40	0.778589
			Chad	50	0.4245364	China	58	0.8476712
			Uzbekistan	20	0.4467294	Bosnia and H.	19	1

Note: Table reports lambda estimates from country level growth data. See equation (8) in the main text. Delta estimates are from Table (2), column 2. We set lambda=1 if lambda>1. This affects one country under weak executive constraints. For details see Appendix B.