Medium Term Growth: The Role of Policies and Institutions

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Abstract

In this chapter, we review the recent and growing literature on medium-term growth patterns. This strand of research emerged from the realization that for most countries economic development is a highly unstable process; over a few decades, a typical country enjoys periods of rapid growth as well episodes of stagnation and economic decline. This approach highlights the complex nature of growth and implies that studying transitions between periods of fast growth, stagnation, and collapse is essential for understanding the process of long-run growth. We document recent efforts to characterize and study such growth transitions. We also update and extend some of our earlier research. Specifically, we use historical data from Maddison to confirm a link between political institutions and propensity to experience large swings in growth. We also study the role of institutions and macroeconomic policies, such as inflation, openness to trade, size of government, and real exchange rate overvaluation, in the context of growth transitions. We find surprisingly complex effects of some policies. For example, openness to trade makes fast growth more likely but also increase the frequency of crises. The size of government reduces the likelihood of fast miracle-like growth while at the same time limiting the risk of stagnation. Moreover, these effects are nonlinear and dependent on the quality of institutions. We conclude by highlighting potentially promising areas for future research.

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1 Introduction

The revival of research on economic growth that began in the last decades of the 20th century was spurred on by both theoretical and empirical contributions. On the theoretical front the papers by Romer (1986, 1990), Lucas (1988), and later Grossman and Helpman (1991), and Aghion and Howitt (1992) provided new ways of modeling endogenous growth and technological progress. On the empirical side, the availability of a large cross-country data set, the Penn World Tables, and early papers exploiting it (Mankiw et al. 1992, Barro and Sala-i-Martin 1991) gave impetus for researchers to test old and new theories of growth against the facts.

Following the early contributions (Barro, 1991; Barro and Sala-i-Martin, 1992) most researchers adopted the approach of using long run, 20 years or more, averages of growth of GDP per capita (or per worker) as the variable to be explained in the empirical analysis. There is enormous variation in long-run growth rates. For example, Jordan's income per capita increased by only 30% between 1970 and 2000, while that of Singapore increased 7-fold. In much of the growth literature of the last two decades, researchers tried to explain such difference by looking for factors – openness to trade, protection of property rights, high investment rates, etc. – that are necessary for growth and which Jordan lacks while Singapore has in abundance. This literature has delivered many important insights but has also come under severe criticism for difficulties with establishing causality and the lack of robustness of many results (for example, the effect of trade on growth). However, there is another reason why the overall balance of this empirical approach is quite disappointing. While focusing on explaining long-run average growth rates is a sensible starting point, when one wants to isolate long-run tendencies from higher frequency phenomena such as business cycle fluctuations, it also removes the information about how economic growth changed within a country over time. This would not be a significant loss if countries behaved like in the growth models where economies approach balanced growth paths in a smooth monotonic fashion. Unfortunately, most countries' growth experiences are far from smooth; they often experience long stretches of moderate growth interrupted by 5 or 10 year periods of rapid development only to later fall victim to decades of stagnation or years of decline. Long term averages remove these patterns and preclude us from using this variation to learn about the nature of the process of economic growth. Lant Pritchett, a leading development economist, has been one of the first to point out the disconnect between the prevailing empirical approach and reality of economic growth. In one of the papers (Pritchett 2000), he writes:

> *The historical path of gross domestic product (GDP) per capita in the United States is, except for the interlude of the Great Depression, well characterized by reasonably stable exponential trend growth with modest cyclical deviations: graphically, it is a modestly sloping, slightly bumpy hill. However, almost nothing that is true of U.S. GDP per capita (or that of other countries of the Organization for Economic Co-operation and Development) is true of the growth experience of developing countries. A single time trend does not adequately characterize the evolution of GDP per capita in most developing countries. Instability in growth rates over time for a single country is great, relative to both the average level of growth and the variance across countries.*

These observations led Pritchett to list the fact that "Growth has been enormously variable within developing countries, and there is little persistence of economic growth rates" as one of his seven stylized facts of the international growth experience. To make things concrete, consider Jordan and Singapore again. Their growth paths are plotted in Figure 22. It is apparent that the performance of the two countries is radically different, with Singapore experiencing a spectacular period of rapid growth, and Jordan suffering a dramatic stagnation. However, when inspecting Jordan's growth in greater detail, as is done in Figure 23, it becomes apparent that the forty years of its economic history are more than just a period of uninterrupted stagnation. The years 1960-75, and even more so the periods 1985-90 and 1995-2000 have been relatively successful while the years 1975-1985 and 1990-95 brought a substantial decline in income level. As it turns out, Jordan did not perpetually stagnate but instead had periods of rapid growth and also of dramatic decline; its economic growth seems to wax and wane. Explaining such medium-term cycles in economic performance seems key to understanding long-run economic growth and discovering the right set of policies for development and stability.

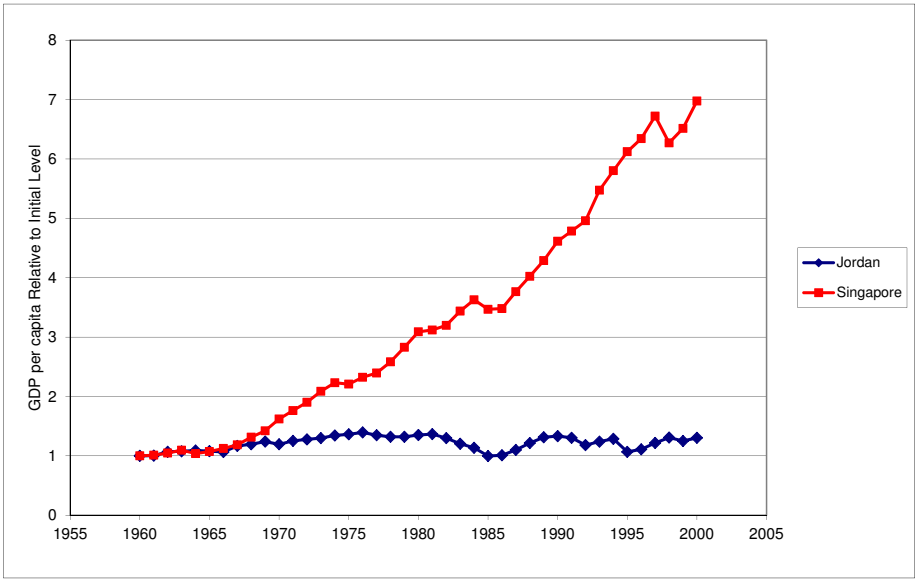

Figure 1: Relative growth performance of Singapore and Jordan, 1960-2000. Initial GDP per capita normalized to 100.

To see even more directly how average growth studies can be misleading consider Figure 24, which illustrates the paths of output per worker in three countries, the Republic of Congo, Gabon, and Portugal, over the period 1960-1995. The values have been normalized to equal one at the beginning of the period. The growth experiences of these three countries differ vastly: Portugal experienced a period of rapid growth followed by a mild slowdown and a return to relatively rapid growth, Congo went through a long period of rapid growth and then a period of equally rapid decline. Finally, Gabon grew faster than the two remaining countries until the late 1970s but stagnated after that. Yet after 40 years all three countries have grown by a surprisingly similar amount, roughly tripling their GDP per capita. If we look at average performance only, we will conclude that Congo, Gabon, and Portugal's

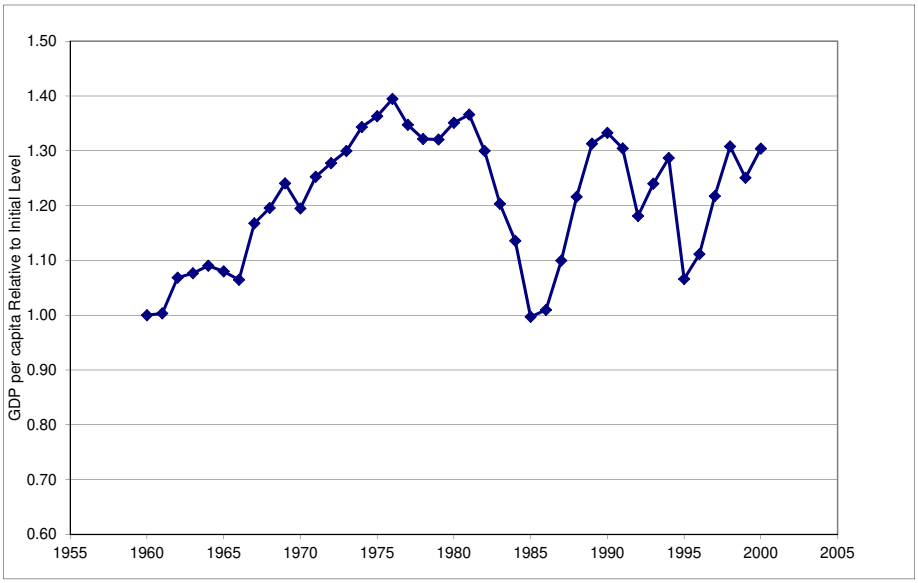

Figure 2: Jordan's growth performance 1960-2000. Initial GDP per capita normalized to 100.

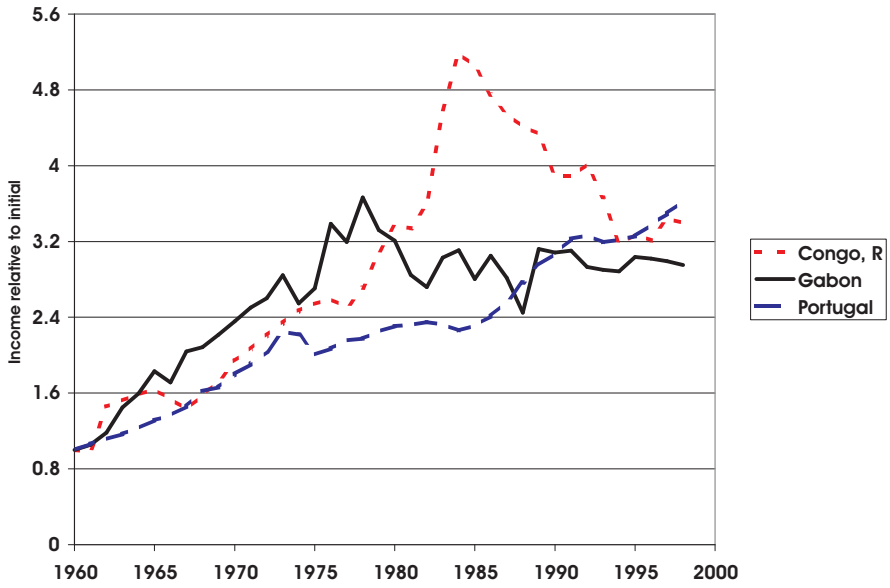

Figure 3: Different growth paths lead to similar average outcomes; Democratic Rep. of Congo, Gabon, and Portugal.

growth looks the same.

Why is understanding these patterns important? As a number of the papers described in this chapter emphasize, starting rapid growth and sustaining it are two different phenomena. We do not yet understand either of them very well. For example, increases in the variables usually found to be strongly correlated with average long-run growth, such as investment rates or trade openness, do not seem to initiate accelerations of economic growth. This suggests that what the standard literature identifies as correlates of growth may not be the factors that are needed to ignite it.

This chapter is an overview of the recent literature which studies the within-country growth patterns and tries to, among other things, learn about the nature of the growth process from analyzing differences in growth patterns such as those in Figure 24. This approach highlights the complex nature of growth and implies that studying "growth transitions", i.e. switches between periods of fast growth, stagnation, and collapse is essential for understanding the process of long-run growth. We begin by discussing early research that emphasized the lack of persistence of growth and the diversity of growth experiences among developing countries. We then summarize a series of more recent papers that look at growth transitions. Here we extend one of our earlier contributions to look at growth transitions going back to the late 19th century. We also discuss the idea of modeling growth in a non-linear structure of multiple growth regimes and transitions between them. Here too, we extend our earlier work by studying the role of macroeconomic policies in shaping growth patterns. We conclude by highlighting the achievements of the literature so far and pointing to potentially fruitful avenues for future research.

2 Lack of Growth Persistence

The traditional analysis of growth assumes that there exist specific characteristics of countries which are conducive to development. They either affect the growth rate of the economy along a balanced growth path (BGP) or the level of the BGP or both. Among such factors suggested by theory and explored empirically are investment rates, population growth rates, quality of institutions, development of financial markets, quality of macroeconomic policies, openness to trade, and many more. To keep our discussion general, we will refer to any such growth-enhancing factor as X. An increase in X will, therefore, shift the BGP up or increase its slope. In either case, a monotonic convergence to the new BGP follows. Once on the BGP, of course, the economy will grow at a constant rate. It is instructive to start by asking why, in this framework, would the growth rate of an economy change? Most models predict that if a country is not on its BGP but is approaching it from below, growth will fall monotonically. Similarly, if a country is above the BGP growth will increase monotonically. Both of these possibilities suggest smoothly evolving growth and a reasonably large degree of persistence of growth rates. Leaving aside, for now, the possibility of frequent shocks that move the economy away from the BGP, the only way to get growth to change non-monotonically is to have changes in X, i.e., to have changes that affect the BGP. If the variable X, which determines the position and slope of the BGP jumps around a lot, so will growth. Conversely, if X is reasonably stable, we would expect growth rates to be stable, too. However, they are not. One of the first papers to draw attention to the variability of

the growth process was Easterly et al. (1993). Specifically, they computed the correlation of growth rates across decades (e.g., 1960-70 and 1970-80) as well as longer time periods (20 and 30 years) in a sample of Penn World Table countries and found it to be quite low: depending on sample and period the correlation coefficient was around 0.2-0.3. That is, countries that developed rapidly in one decade are unlikely to be found in the group of fast growers in the following ten years and conversely, slow growers are likely to pick up speed.

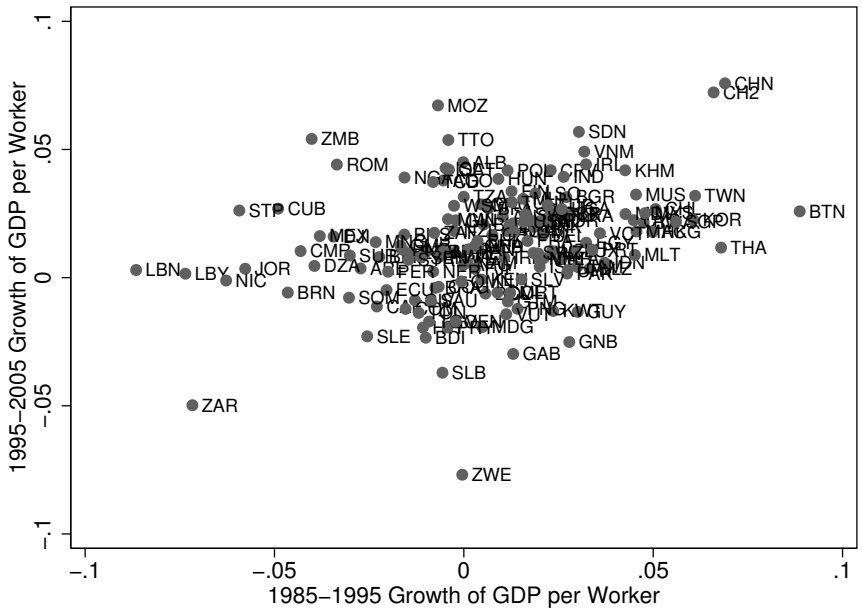

Figure 4: Lack of growth persistence. Growth in GDP per capita 1985-95 versus 1995-2005.

Here we re-do the same exercise using more recent data. In Figure 25 we plot the average growth of GDP per worker between 1985 and 1995 on the horizontal axis against the average growth in the following decade using 150 countries in the PWT 6.3 data set. Just like Easterly and his coauthors, we find very little persistence; the correlation coefficient is only 0.3.[1] In Table 11 we report the results of regressing growth in a given decade on growth in the previous one. While the relationship is positive (although not always significant), the explanatory power of the regression never exceeds 11%.

Perhaps then the growth determinants – the X's which much of the empirical growth literature sought to identify – vary over time. Easterly et al. consider this possibility but as they point out most growth determinants suggested by theory are very persistent: investment rates, trade openness, and even government policies do not vary much from decade to decade. In fact, one of the most robust correlates of development is the quality of institutions, a characteristic which is usually thought to be a deep-rooted and very slow-moving variable.

This leaves the possibility that the growth rates we observe are just a consequence of random shocks pushing countries out of steady states and the transitional dynamics that follows

[1]It is even lower when we keep two outliers: Liberia (whose output declined by an average 22% per year between 1985 and 1995) and Equatorial Guinea (whose output increased by 28% annually during the decade following 1995.)

	1995-2005	1985-1995	1975-1985
Growth in Previous Decade	0.226	0.326	0.121
	(0.059)	(0.075)	(0.109)
Constant	0.012	0.004	0.006
	(0.002)	(0.002)	(0.004)
R-squared	0.086	0.110	0.002
Obs.	150	146	112

Table 1: Update on Easterly et al (1993). Growth over a decade regressed on growth during previous decade.

such shocks. However, Pritchett(2000) looks more closely at growth in developing countries and concludes that a complex set of growth patterns can indeed be identified. These patterns often do not resemble a shock-and-monotonic-transition-back-to-BGP scenario. Pritchett writes *"[S]hifts in growth rates lead to distinct patterns. While some countries have steady growth (hills and steep hills), others have rapid growth followed by stagnation (plateaus), rapid growth followed by a decline (mountains) or even catastrophic falls (cliffs), continuous stagnation (plains), or steady decline (valleys)."* He concludes that the empirics of growth should focus on identifying factors that initiate and stop growth, instead of analyzing what explains average growth.

3 Growth Transitions

Following the contributions by Easterly et al. (1993) and Pritchett (1998) several recent papers have focused attention on growth transitions, i.e., points in time when a substantial shift in growth occurs, such as an acceleration when the rate of expansion of GDP per capita suddenly picks up significantly for an extended period. The main focus of these papers is to identify such turning points.[2] The common finding in all of these papers is that such large growth changes are a common phenomenon in both rich and developing countries. In particular, growth accelerations – defined in one paper as periods of rapid growth over 3.5 % per year (but usually much higher) – are quite common even among countries that are regarded as unsuccessful developers. That is, now and then even poor countries grow rapidly for a significant time. One of the key conclusions from this research is that igniting

[2]In this chapter, we focus on papers employing statistical methods to detect and analyze growth transitions. Another approach is to look at case studies, that is analyze the development history of a single country at a time with close attention to economic, political, and social changes. While important, this approach offers a limited possibility for generalization of results, and we view it as complementary to the systematic statistical approach. See the volume edited by Dani Rodrik (2003).

rapid growth and sustaining it are two very different enterprises and that the latter seems much more difficult (see Rodrik 2005). This is an important finding for policymakers but also for the field of economic growth because it casts doubt on the applicability of standard growth models to the question of economic development. The obvious next step in this literature is to determine what forces lead to growth accelerations and how they can be sustained. Here the literature has been less successful. Each of the contributions described below attempts to shed some light on the causes of growth transitions, but our understanding of this phenomenon is still limited.

Hausmann et al. (2005) are the first to develop a formal methodology for identifying growth accelerations. They define "growth acceleration" as an episode satisfying three criteria: (1) growth of GDP per capita exceeds 3.5% per year, (2) the increase in growth rate exceeds 2 percentage points, and (3) after 7 years output per capita exceeds the highest level attained prior to the episode. They use a spline regression to identify such episodes in a large sample of countries between 1950 and 2000. To their surprise, they find a great many accelerations; there are a total of 83 accelerations in their sample during the 36 years where their methodology allowed for accelerations to occur. This implies that an average country would have about a 25 % chance of experiencing a growth acceleration per decade. In fact, 60% of the countries in the sample had at least one episode of acceleration, and 23% had at least two. The accelerations were also significant in magnitude with an average of 4.7 percentage points increase in growth. Hausmann and co-authors also investigate the causes of growth accelerations. They run a probit where the dependent variable is a dummy that takes the value of 1 around the time of a growth acceleration and 0 otherwise. The list of covariates in their regressions includes a terms-of-trade shock, political regime change, and economic liberalization. They find many results consistent with the conventional wisdom in the growth literature: episodes of financial liberalization are positively correlated with the probability of experiencing a growth acceleration, economic reforms help produce more sustained accelerations, while shocks tend to produce short-lived growth. Additionally, they find that the negative impact of a movement towards autocracy is much larger than the positive impact of a movement towards democracy. However, many growth accelerations do not appear to be spurred by any apparent changes in standard growth determinants and, equally interestingly, many instances of reform fail to produce fast growth. As the authors emphasize, growth accelerations are surprisingly hard to explain, i.e., even if some of the variables have a statistically significant effect, the overall predictive power of these regressions remains quite low.[3]

[3]de Haan, J., and Jong-A-Pin (2007) use a different indicator of growth accelerations and find that they tend to be preceded by economic reforms and that they are more likely to take place after the start of a new political regime. In a related paper, Jones and Olken (2005) study in more detail the impact of the accidental death of a political leader on the subsequent growth performance of the country he was ruling. They find robust evidence that the impact of the death of a leader, particularly in an autocracy, has a positive and significant impact on growth. Imam and Salinas (2008) study growth accelerations in Sub-Saharan Africa and find that they are mostly associated with external shocks, episodes of economic liberalization, political stability, and geographical variables such as proximity to the coast. On the other hand, high levels of corruption, as well as falling domestic credit, seem to be correlated with sharp growth decelerations. Aizenman and Spiegel (2010) focus on take-off from stagnation to rapid growth (i.e., they exclude accelerations from already rapid growth to even higher one) and explore, among other factors, the

Jones and Olken (2008) extend the analysis of Hausmann et al. to include both accelerations and decelerations in growth episodes. They identify growth transitions using the Bai-Perron test (Bai and Perron 1998).[4] Their findings confirm that such episodes are frequent for most rich and developing countries; they detect 73 structural breaks in 48 of the 125 countries with at least 20 years of Penn World Table data. Of these transitions, 43 are "up-breaks" or accelerations, and 30 are "down-breaks" or collapses. The breaks identified by the Bai-Perron test are large: the mean change in growth during a break is 6.8 percentage points for "up-breaks" and - 6 percentage points for "down-breaks". Since their test seems to set the bar for identifying an acceleration higher, they find fewer of them than Hausmann et al. (2005). To better understand the nature of growth transitions, Jones and Olken (2008) look for significant changes in main macroeconomic variables and measures of institutions around the time of the transition. First, they perform a standard growth decomposition separating growth of GDP into that of physical capital and the residual (TFP) and find an interesting asymmetry whereby accelerations are associated with rapid TFP growth but not significantly faster capital accumulation. "Down-breaks" are associated with declines in both TFP and capital accumulation. They fail to find any significant change in institutional variables at the time of growth breaks. Of the macroeconomic variables, accelerations appear to be associated with a significant increase in trade (both imports and exports) while collapses coincide with increases in nominal instability (increase in inflation and nominal exchange rate depreciation).

In Cuberes and Jerzmanowski (2009), we follow a similar approach. We also start by identifying and documenting structural breaks in the growth process using the Bai-Perron approach in the following specification

$$y_t = \alpha_n + g_n t + \varepsilon_t \quad \text{for} \quad t_n < t \leq t_{n+1}, \forall t = 1, ...T, \tag{1}$$

where y_t represents the logarithm of real output per worker relative to the United States, the variable t indexes time, while n indexes growth breaks, g_n represents the trend growth following n-th break, and ε_t is the error term. That is, each time a break occurs, there can potentially be a change in the intercept parameter, the slop, or both. We focus our attention on the changes in growth rate (slope parameter).

We use data on real output per worker from the Penn World Table (Heston et al., 2006) for the period 1950-2000. We find a total of 208 breaks, which corresponds to 1.8 breaks per country. Of these breaks, 49% represent increases in the growth rate. Figure 26 shows the case of Argentina, where the Bai-Perron methodology finds two structural breaks. The first break occurs around 1980, and it corresponds to a substantial decline in Argentina's growth rate, which moves from positive (catching up to the U.S.) to negative (falling behind it). The second break occurs around 1990, and this time growth becomes less negative without changing its sign. The graph also shows the confidence intervals of these estimated breaks.[5]

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composition of the country's output.

[4]See also Ben-David et al. (2003).

[5]One concern about the Bai-Perron test of structural breaks is that it relies on asymptotic properties.

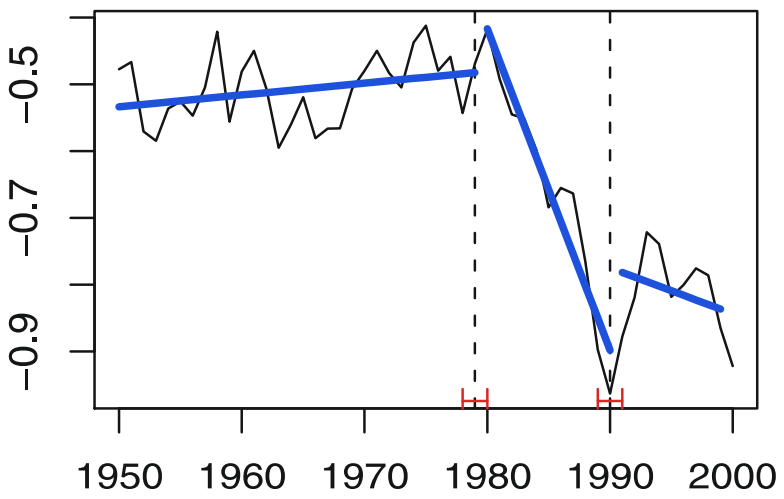


Figure 5: Argentina's log real output per worker relative to the US. The vertical dashed lines indicate Bai-Perron break dates. The solid lines show the estimate of the trend part of $y_t = \alpha_n + g_n t$. The figure also shows the confidence intervals around the estimated break dates.

Next, we analyze the patterns in the trend-growth changes we have identified. We are particularly interested in the link between political institutions and the magnitude of growth swings. We are motivated by the strong evidence that democratic countries are less volatile (Rodrik 2000, Quinn and Woolley 2001). This interesting correlation proved to be much more robust than the democracy-growth relationship: while various studies find that the effect of democracy on growth is rather weak (Przeworski and Limongi 1993, Barro and Sala-i-Martin 2003), the link between a greater degree of democracy and lower economic instability appears very robust. For example, Rodrik (1999) provides compelling evidence that democratic countries experience less volatility. However, this literature usually measures volatility using the standard deviation of *annual* growth rates. Having uncovered large and frequent medium-term swings in growth, we investigate whether this sort of lower frequency volatility is also related to political institutions. In particular, we estimate: (i) how the magnitude of trend-growth changes varies with the degree of the country's democracy, and (ii) whether democracy affects the likelihood of experiencing large trend-growth swings.

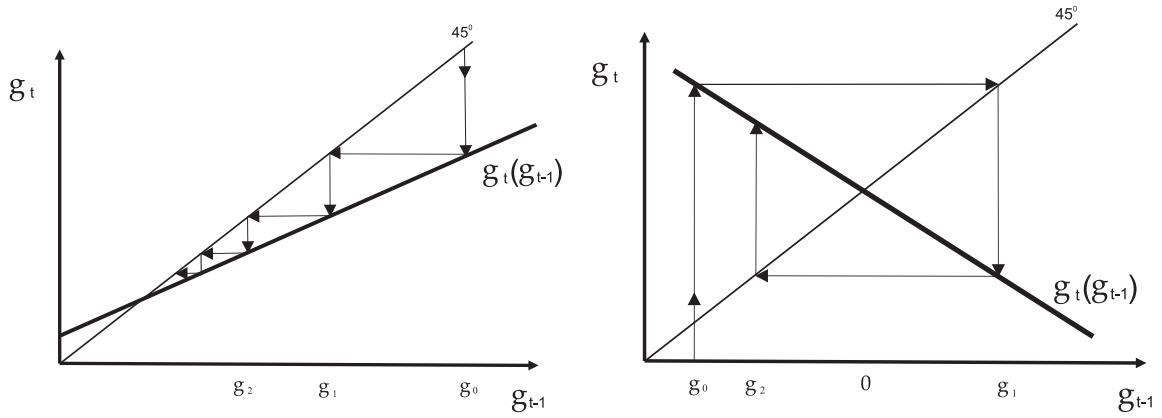
To analyze the dynamics of growth transitions we estimate the following regression

$$g_{in} = \beta_0 + \beta_1 g_{in-1} + \varepsilon_{in}, \tag{2}$$

where g_{in} represents the growth rate in country i after break n estimated from (1). We

Since we use relatively short time series throughout the analysis, one may be concerned about inference based on asymptotic results. To check the robustness of our break detection results, we employ a Bayesian approach based on Wang and Zivot (2000) to estimate these breaks and compare our results with the ones obtained using the Bai-Perron method. Our comparison focuses on the years at which breaks occur with each method. The average difference (in absolute value) between the two estimates is 0.33 years, and its standard deviation is 3.23. In 67% of the cases, the break dates are identical, and the difference is no larger than 5 years 92% of the time.

are interested in the coefficient β_1, i.e., the existence and direction of a relation between pre-break and post-break growth rates. Depending on the value of the β_1 parameter, we can have three interesting cases. First, if $\hat{\beta}_1 = 0$ then, on average, the growth rate before a break does not help predict the growth rate after it. If $\hat{\beta}_1 \in (0, 1)$ then there is monotonic convergence in growth rates. This is a reversion-to-the-mean dynamic; i.e., exceptionally fast growers before the break still grow fast after the break, just slightly less so; in the long run, there is convergence to the BGP. Figure 27(a) illustrates the dynamics of this system for the case where initial growth is above the long-run equilibrium value. When interpreting the figure, recall that "periods" here are not calendar years but break dates. Thus growth may remain constant for a long time, but when a break occurs, the adjustment is as illustrated in the figure. Figure 27(b) shows the case in which $\hat{\beta}_1 \in (-1, 0)$ and so growth fluctuates from above and below the BGP during its transition, in other words, the process is characterized by growth cycles or reversals.



(a) Monotonic Convergence (b) Cycling

Figure 6: *Panel (a): Monotonic convergence in growth rates ($\hat{\beta}_1 \in (0, 1)$). Panel (b): Growth reversals ($\hat{\beta}_1 \in (-1, 0)$).*

To see if the degree of democracy affect the dynamics of growth transition we split the sample into high and low democracy groups and estimate equation (7).[6] We use the variable *polity2* from the dataset *POLITY IV* (Marshall and Jaggers, 2002) as our measure of democracy.[7] As additional covariates in the estimated version of (7) we also include the level of democracy and the log of initial income (to capture the standard convergence dynamics) and decade dummies. We use alternative panel data estimators, but in Table 12 we only report the estimates obtained using the dynamic Arellano-Bond estimator. While among the democratic countries we find no significant relationship between the pre and

[6]In Cuberes and Jerzmanowski (2009) we use an interaction term to avoid picking an arbitrary cut-off level of democracy to split the sample.

[7]*polity2* is an average of autocracy and democracy scores. It ranges from -10 to 10 (-10 = high autocracy; 10 = high democracy) and includes specific indexes meant to capture constraints on the executive, the degree of political competition, the legislature effectiveness, etc.

post break growth rates ($\beta_1 \approx 0$), in the less democratic sample we see evidence of growth reversals ($\beta_1 < 0$). That is, periods of exceptionally high growth are, on average, followed by periods of exceptionally low growth, and vice versa. Growth rates in less democratic economies are not monotone; rather, they cycle between high and low (or even negative) values as in Figure 27(b). Interestingly, the income level does not affect the propensity to experience growth reversals.

	Low Democracy	High Democracy
Growth before Break	-0.374**	0.083
	(0.146)	(0.202)
Initial Income	-0.074**	-0.069***
	(0.036)	(0.018)
Democracy	0.000	0.000
	(0.001)	(0.001)
Constant	-0.006	0.003
	(0.005)	(0.005)
Obs.	84	49

Table 2: Penn World Table data. Arellano-Bond.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Using a probit and linear probability models, we also find that the propensity to experience substantial swings of trend-growth is not uniform across countries – less democratic countries are more susceptible to it. When compared with factors commonly associated with volatility, such as measures of quality of institutions, macroeconomic policies, and financial development, as well as income level, we find that democracy is the most robust predictor of a country's propensity for growth reversals. Finally, we test whether our results can be explained by the fact that countries which rely heavily on natural resources tend to be less democratic and also exposed to large shocks (in the form of large swings of world prices of the resources they export). While shocks to prices of natural resources appear to contribute to the propensity for growth reversals, they do not account for the effect of democracy.[8]

[8]One may think that greater growth variability in less democratic countries is a reflection of more frequent regime changes: i.e., whenever a ruler changes there is an abrupt change in growth. While Jones and Olken's (2005) result suggest leaders do matter for growth in less democratic countries, the average time between breaks is usually shorter than many autocrats' tenure. Easterly (2011) studies this question directly and concludes that growth is equally variable within autocrats' tenure as between them.

In the above analysis, we use data on output per worker from the Penn World Table covering, for most countries, the period 1960-2000. Here, in order to explore the presence and dynamics of growth transitions in a longer time series, we extend our analysis to the historical figures on output per capita from Maddison (1995, 2001) which covers the period 1870-1994.[9] We again use the Bai-Perron test for structural breaks and we exploit the same measures of democracy.[10] We find that during this period the average number of breaks per country in the Maddison sample is around 4. In 48% of the cases these breaks represent an increase in growth. The lowest number of breaks per country is 2, and the largest is 8. Figure 28 presents an histogram of the changes in growth rates at the time of the structural break. Since in the Maddison data the number of countries with available information on income changes significantly over time, going from 14 countries in the 1870s to 29 in the 1920s and to 54 from the 1960s on, we divide the number of breaks by the number of countries in each year to better assess the relative frequency of breaks.

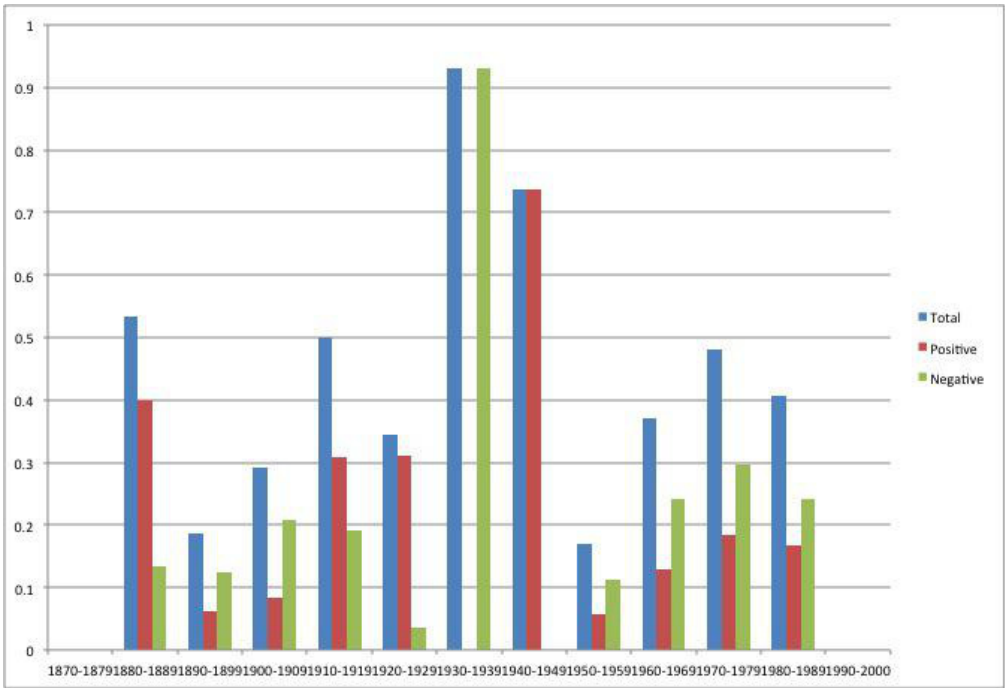


Figure 7: Frequency of growth breaks in the Maddison data set.

The first observation is that the frequency of breaks does not show a very clear trend if one considers the entire period. The incidence of breaks was quite high in the 1880s, and in

[9]The 112 countries in Maddison's unbalanced panel are: Argentina, Australia, Austria, Belgium, Bangladesh, Bulgaria, Brazil, Canada, Chile, China, Colombia, Cote d'Ivoire, Congo Rep., Czech Republic, Denmark, Egypt, Ethiopia, Finland, France, Germany, Ghana, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, Kenya, Korea Rep., Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, South Africa, Spain, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Turkey, United Kingdom, Venezuela, and Yugoslavia.

[10]Using the Bayesian methodology of Wang and Zivot (2001), we get similar results.

most cases, they represented sudden increases in growth. After that decade, the frequency of breaks decreased and then rose again until the 1920s. The vast majority of structural breaks that we detect in the 1930s were negative, indicating the economic turbulence of the Great Depression. The opposite happens in the aftermath of WW2 (the 1940s), a period of very frequent growth accelerations that reflect the economic recovery in many of the countries in our sample. The number of breaks dropped drastically in the 1950s and rose again in the last three decades of the studied period. It is noticeable that in these decades growth decelerations were more common than accelerations. The key conclusion we draw from this exercise is that the phenomenon of growth transitions is not unique to the modern period studied by most papers in this literature.

Next, we ask whether, as was the case in the modern period PWT data, there is a tendency for less democratic countries to experience larger growth swings. As we did in Cuberes and Jerzmanowski (2009), we split countries into two groups: those with high democracy and those with low democratic scores. [11] We then estimate an equation (7) including as regressors initial income, the initial level of democracy, and time dummies for each decade. Table **??** displays the results obtained using the fixed effects estimator.

	All Coutries		High Democracy		Low Democracies	
Growth before Break	-0.307***	-0.157	-0.223	0.174	-0.388***	-0.468***
	(0.095)	(0.1)	(0.148)	(0.157)	(0.113)	(0.134)
Initial Income	-0.029	-0.075***	-0.033	-0.109***	-0.048***	-0.062***
	(0.018)	(0.023)	(0.027)	(0.038)	(0.015)	(0.017)
Democracy		0.000		-0.001		0.001
		(0.001)		(0.001)		(0.001)
Obs.	130	85	74	46	56	39

Table 3: Growth Reversals in Maddison data; Arellano-Bond. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

In the entire sample there is evidence of growth reversals even after controlling for initial income (column 2), although it is not statistically significant once one includes initial democracy as an additional control (column 3). Columns 4 and 5 show that democratic countries exhibit no cycling. The coefficient associated with growth before the break is not significant

[11] In both cases, the cut-off here is chosen to be the median value of polity2 in the sample, i.e. countries with a democracy score equal or larger than this threshold are labeled "high democracies," and below it, they are considered "low democracies. Alternative cutoffs deliver very similar results.

and it even turns positive. On the other hand, non-democracies experience growth reversals. Columns 6 and 7 show that, in these countries, even after including democracy as an explanatory variable, periods of rapid growth are followed by periods of much slower growth, and vice versa. This is very much consistent with the results obtained using the PWT data for the period 1950-2000.[12]

The above exercise gives us further confidence in the phenomenon of growth reversals first described in Cuberes and Jerzmanowski (2009). Of course, the natural question to ask is why less democratic institutions lead to larger growth swings? We hypothesize, following arguments made by Acemoglu (2008) and Aghion et al. (2007), that less democracy implies larger barriers to entry for firms and thus a larger degree of concentration in production. With less diversification comes the potential for larger growth swings. Using data on manufacturing concentration from the U.N's Industrial Statistics Database (revision 2), we find support for this argument. Specifically, we first calculate the Herfindahl-Hirschmann index of concentration for the manufacturing industry in each of the 181 countries in our sample during the period 1963-2003.[13] We then regress this index against the POLITY IV measure of democracy as well as per capita GDP and its square. Table 14 shows that the coefficient on democracy is negative and significant at conventional levels, indicating that the manufacturing sector is indeed less concentrated in more democratic countries, even after controlling for income effects.

Another reason less democratic countries may experience growth reversals is due to social conflict. For example, Rodrik (1999) shows that the growth slowdowns of the 1970s were larger in less democratic and more ethnolinguistically fictionalized countries. He argues that both of these characteristics lead to more internal conflict because there are more groups in the society who may have opposing interests, and the lack of democracy prevents peaceful resolution of disputes among them. It is plausible that a mechanism like this could lead to growth reversals. In early stages of rapid growth, its benefits are usually distributed unevenly among the various groups in the society (workers vs. capital owners, exporters vs. import-competing producers, educated vs. uneducated workers, etc.). If the rising income inequality leads to social tension and conflict, and there are not peaceful resolution mechanisms, internal turmoil and a growth collapse may be a direct consequence of the preceding rapid growth. But there has been no formal test of this hypothesis

An interesting alternative explanation for growth reversals has recently been suggested by Boucekkine and Pintus (2011). They develop an AK model of a small open economy with borrowing constraints that allows for both leapfrogging and growth reversals. In their model, economies have access to the international capital market, but there exists a borrowing limit determined by the amount of available collateral. The novel element comes for the fact that, if it is not possible for the borrower to commit to a future investment plan, the lender uses the borrower's past stock of capital as collateral. This assumption leads to interesting history

[12]It is also noticeable that in all cases, richer countries tend to experience more slow growth in the next regime, indicating some degree of neoclassical convergence. The initial level of democracy, on the other hand, is uncorrelated with future rates of growth.

[13]The dataset contains information on 29 manufacturing categories at the 3-digit level of disaggregation.

	Value Added	Output	Value Added	Output
Democracy	-0.159***	-0.166***	-0.111*†	-0.121**
	(0.052)	(0.048)	(0.070)	(0.061)
GDP p.c.			-0.386	-0.623**
			(0.269)	(0.263)
GDP p.c. Squared			0.019	0.034**
			(0.018)	(0.017)
Constant	2.880***	2.739***	4.629***	5.402***
	(0.136)	(0.127)	(1.060)	(1.037)
R^2	0.072	0.084	0.109	0.127
Obs.	2695	2623	2649	2591

Table 4: Democracy and Industrial Concentration. Pooled OLS regression of the Herfindahl-Hirschman index in manufacturing on democracy, GDP per capita, and GDP per capita squared. Standard errors clustered by country. *† < 0.12, *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

dependence: the BGP of the economy depends not only on the initial level of capital but also on its past growth path. This dependence of the borrowing limit on a lagged capital stock is also key to generating growth reversals and/or leapfrogging. If the delay – the number of periods before the borrowing date that the lender takes into account as collateral – is short, then history does not matter much. Therefore, a rich country that had a recent slow growth will receive a low amount of credit, and therefore, it will grow slowly in the future. So, in this case, there will be leapfrogging and no growth reversals (a country that had performed poorly will continue to do so in the future). Growth reversals (instances when growth goes from above BGP value to below it) are also possible. They occur when a fast-growing country faces the borrowing constraint with a sufficiently long lag. Since its capital stock was low in the past, its current debt limit is low, and the lack of foreign capital inflow leads to a growth slowdown. There is also an intermediate case where both leapfrogging and growth reversals are possible. The authors argue that under reasonable parameter values, the model is able to replicate characteristics of growth reversals reported in Cuberes and Jerzmanowski (2009). The paper by Boucekkine and Pintus is especially noteworthy because it represents one of the first attempts to construct a theory of growth transitions.[14]

Finally, we should note that the theories of poverty traps would appear to be natural explanations for growth transitions. After all, most such models predict a long period of stagnation or slow growth (poverty trap) and a sudden acceleration of growth once the

[14]Aghion et al. (2004) are motivated by more high-frequency volatility but their model, in which periods of economic boom put upward pressure on the price of the scarce domestic factor of production which leads to a slowdown, suggest another interesting mechanism for generating growth reversals.

economy escapes the trap. However, most of these theories also imply that the escape from the trap is once and for all. Easterly (2006) uses the Bai-Perron test to identify episodes of permanent growth take-off, i.e., growth permanently transiting from zero to a positive value, which he interprets as evidence of emergence from a poverty trap. He finds very few such episodes. This is consistent with our findings that growth accelerations, especially in non-democratic countries, are ultimately reversed.

One conclusion reiterated in the papers discussed above is that initiating growth and sustaining it require different policies and/or environments. For example, Hausmann et al. (2005) show that standard economic and political fundamentals (economic reform, political regime change, terms of trade shocks, etc.) do rather poorly at explaining the timing of growth accelerations. A paper by Berg et al. (2008) asks a very natural complementary question: what is the role of standard growth determinants in sustaining growth? Of course, knowing what makes growth sustained is key for policymakers in developing world, perhaps more important than knowing how to start it since accelerations happen quite often (even if we don't fully understand why). To investigate the duration of growth spells Berg and coauthors estimate a proportional hazard model using a host of potential determinants including shocks (world interest rate, terms of trade), institutions, macroeconomic stability, social and economic homogeneity, human capital, and trade and financial openness (including structure of exports and capital inflows). Where appropriate and possible, the authors include the initial level as well as the change during the spell for the explanatory variables. To measure growth spell duration, they use a combination of the Hausmann et al. (2005), and Jones and Olken (2008) approaches to dating growth accelerations. Specifically, the authors focus their attention on episodes of growth acceleration to above 2% followed by deceleration to below 2% (complete spells) or end of sample (incomplete spells). Among their findings, they report that democracy, income equality, macroeconomic stability as well as export orientation (including propensity to export manufactures, openness to FDI, and avoidance of exchange rate overvaluation) all help sustain growth spells. Perhaps surprisingly, violent conflict doesn't appear to matter. Conditional on the covariates the authors usually find positive but often not significant duration dependence.[15]

4 Growth Regimes

Just as averaging growth over long periods of time masks the diverse experience of growth accelerations and collapses, the binary classification of a growth transition (acceleration versus its absence) removes some important variation across countries and time. In fact, in Pritchett's analysis cited above he distinguished multiple growth patterns, of which accelerations (and collapses) were just one example. In another paper, Pritchett (2003) suggest that an appropriate way to think about growth is to imagine that there exist multiple growth states, or regimes, each of which represents a distinct growth behavior.

Pritchett illustrates his idea with a simulation of a simple model with four states: a stagnation state with constant growth of 0.5 %, a convergence state with rapid growth, an implosion state with negative growth, and a state of steady growth at 1.8 %. He assumes that

[15]See also Johnson et al. (2007).

the state characteristics (growth rates in each state) and that transition probabilistically are constant and identical for all developing countries. He then calibrates the transition matrix in so that the world economy with 103 developing countries and 14 developed countries (which are restricted to always be in the steady growth regime) matches the observed dispersion of GDP per capita in 1995. His main message is that a model of this kind has the potential to generate a wide range of growth patterns among developing countries as well as account for low persistence of growth discussed above. Notice that in this model, it is only the randomness of the (common) transition dynamics that generates the diversity of growth patterns across developing countries. However, in practice, there is no particular reason to think that transition probabilities are the same for all countries. The idea that country-specific characteristics affect growth by determining transition probabilities leads to some interesting possibilities.

To illustrate the idea, consider the following simple example. Suppose that there are only two possible states of the world - one in which the economy stagnates and another in which it grows at 3% per year. If over time a country switches between regimes, growth will be an uneven process. This is, of course, what growth looks like for many countries. For example, Japan accelerated in the 1950s and '60s and then stagnated in the 1990s, while India grew slowly until it took off in the 1990s. If we further assume that these transition probabilities themselves depend on some country-specific characteristic X (e.g., quality of institutions), we have a model where country characteristics, such as policies or institutional quality, shape long-run growth by affecting the frequency of the two regimes.

Within a standard approach to growth, if a characteristic X is "good" for growth then countries with a high level of X are expected to be growing fast (say, at 3% per year) and countries with low levels of X are expected, all else equal, to be growing slowly (say, stagnate); this is a world where "you either have what it takes for growth, or you don't". In the regimes approach it becomes possible for country characteristics to be favorable to growth by affecting the transition probabilities; good X means more frequent episodes of growth, but it is possible for a high-X country to stagnate just as it is possible for the low-X country to grow from time to time. A stylized illustration of the switching process of growth for two countries is presented below in Figure 29.

Country 1 has a lower level of the growth-conducive characteristic X, and so it spends more time in the stagnation regime. However, it is capable of periods of fast growth. In fact, when it is growing, it grows as fast as country 2. Of course, country two with high X visits the growth regime more frequently, and so, in the long run, it will grow faster. However, it too stagnates from time to time. What determines the long run growth performance of an economy is the within-regime dynamics (3% vs. 0), and the frequency of visits to the two growth regimes. The growth regimes approach calls for identifying the regimes as well as the properties of transitions, including the set of X's which may include present-day economic and political characteristics of the country, regional or world variables, the country's history, etc.

Jerzmanowski (2005) estimates a model where transition probabilities are allowed to differ across countries, as was the case in the example of Figure 29. He builds on Pritchett's insights and applies the framework of Markov-switching regression to identify the regimes. Assuming that there are four regimes, each with a distinct AR(1) growth process leads to

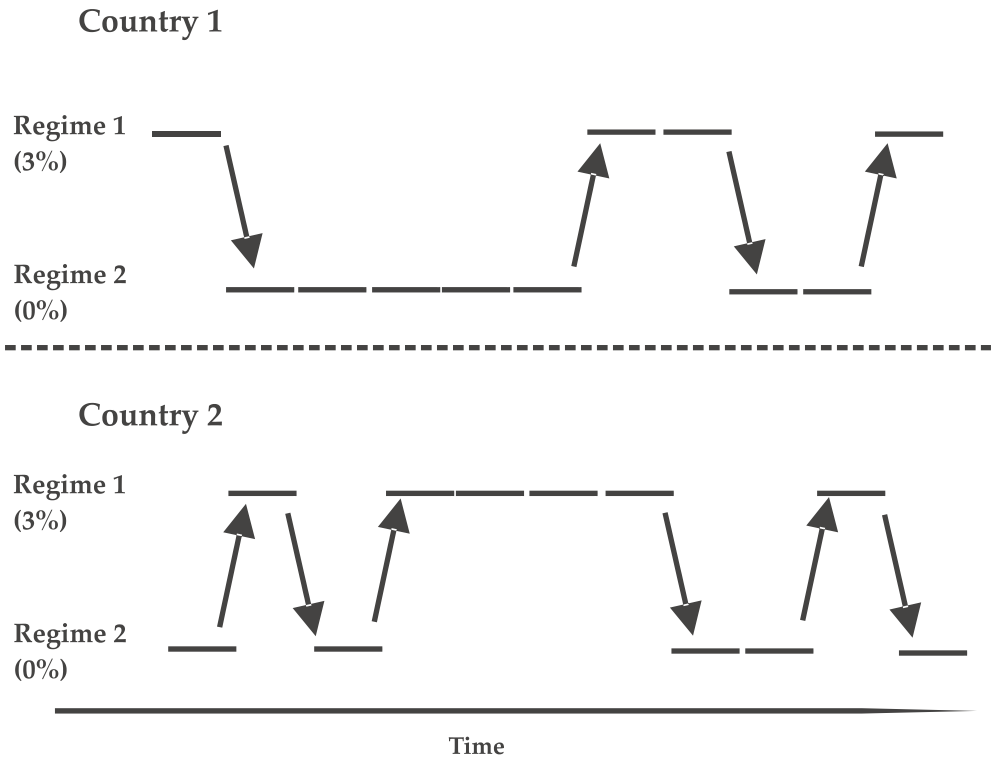


Figure 8: A stylized illustration of the switching process of growth. Some country-specific characteristic X makes the growth regime more likely (e.g., good institutions). Country one has a low value of X, and so it spends more time in the stagnation regime. However, it is capable of periods of fast growth. Country two has high X, and so it visits the growth regime more frequently. However, it too stagnates from time to time.

the following model[16]

$$\hat{y}_{it} = \alpha_{s_t} + \beta_{s_t}\hat{y}_{it-1} + \varepsilon_{it}^{s_t}, \tag{3a}$$

$$\varepsilon_{it}^{s_t} \sim i.i.d.N(0, \sigma_{s_t}^2), \tag{3b}$$

where $\hat{y}_{t\,i}$ is the growth rate of country i in period t and s_t indicates the regime that is in effect at time t, that is for every t, $s_t \in \{1, 2, 3, 4\}$.

The growth process is fully characterized by the above within regime dynamics (8) and the evolution of regimes, which is assumed to follow a 4-state Markov process where the transition probabilities are allowed to depend on the country's quality of institutions. That is, $P\{s_{it} = k \mid s_{it-1} = j\} \equiv p_{jk} = p_{jk}(z_i)$ for $j, k = 1, ..., 4$, where z_i is a measure of the quality of institutions in country i. Thus unlike in Pritchett's simple simulation, transition probabilities are country specific. This model is estimated using maximum likelihood (see Jerzmanowski (2005) a for details). The resulting estimates consist of the within-regime parameters (α's,

[16]Unfortunately, the correct number of regimes cannot be tested with the simple likelihood ratio test. See Hamilton (1994) for discussion and references. The informal procedure followed by Jerzmanowski (2005) was to start with two regimes and increase the number of regimes as long as all estimated regimes appeared distinct.

β's, and σ's), the parameters of the transition matrix $p_{jk}(z_i)$ for $j,k = 1,...,4$, and the inference about regimes s_t for *t=1,...T*. We discuss them in turn.

Table 15 shows the parameter estimates. Each of the four AR(1) processes implies a different long-run growth rate, i.e., the average growth rate that would obtain if the economy were to remain in that regime indefinitely, given by $\alpha/(1-\beta)$ and shown in the last column. Notice that these average long-run growth rates (from which we derive the regime labels) do not fully characterize the regimes. In addition to the long run average performance, regimes differ significantly in the volatility of growth (σ) and persistence of growth shocks (β).[17] The stable regime corresponds to the growth experience predominant among developed economies, with a long-run average growth of about 2 percent. The volatility is relatively low, and there is a great deal of persistence in the growth process. The stagnation regime is characterized by no growth on average and larger volatility of growth shocks. In this regime, periods of growth and decline occur but are not very persistent. The crisis regime is an episode of large shocks to growth. While these shocks tend on average to be negative reflecting economic crises, the dispersion is very large and positive shocks are also possible. These shocks have no persistence. Finally, there exists the regime of fast, miracle-like growth with a long run average growth of 6% and modest volatility.

	Constant (α_s)	AR Coeff. (β_s)	Std. Dev.(σ_s)	Long Run Growth
Stable Growth	0.0132**	0.3761**	2.11%	2.12%
Stagnation	0.0010	0.1799**	4.56%	0.12%
Crisis	−0.0101**	-0.0045	13.16%	−1.00%
Miracle Growth	0.0536**	0.1417**	2.71%	6.25%

Table 5: Within regime estimates of $\hat{y}_{t\,i} = \alpha_{s_t} + \beta_{s_t}\hat{y}_{t-1\,i} + \varepsilon_{ti}^{s_t}$, and $\varepsilon_{ti}^{s_t} \sim i.i.d.\, N(0, \sigma_{s_t}^2)$ for each of the four states. The first column shows the constant term, the second is the autoregressive coefficient and the third is the estimate of the standard deviation of the error component. The last column shows the implied long run growth. A * denotes significance at 10% level, ** denotes significance at 5% level.

Figure 30 summarizes the estimates of transition matrices. Each of the four boxes plots the probability of moving from a given state to each of the four states as a function of the institutions index. For example, the upper left-hand side box shows the probability of moving from the stable growth state to each of the four states. The solid line shows the

[17]Note that the within-regime persistence of the growth process β, say 0.3761 for the stable growth regime, should not be confused with the persistence of the stable growth regime itself. The former is assumed to be a property of the stable growth process common to all countries, whereas the latter depends on the country-specific transition probabilities, which will be discussed below.

probability of moving to the stable state (i.e., in this case remaining in the same state), the dash-dot line shows the probability of moving to stagnation while the dashed and dotted lines show the same for crisis and miracle regimes, respectively. The upper right-hand side box shows the same set of plots conditional on the current state being stagnation and so on.

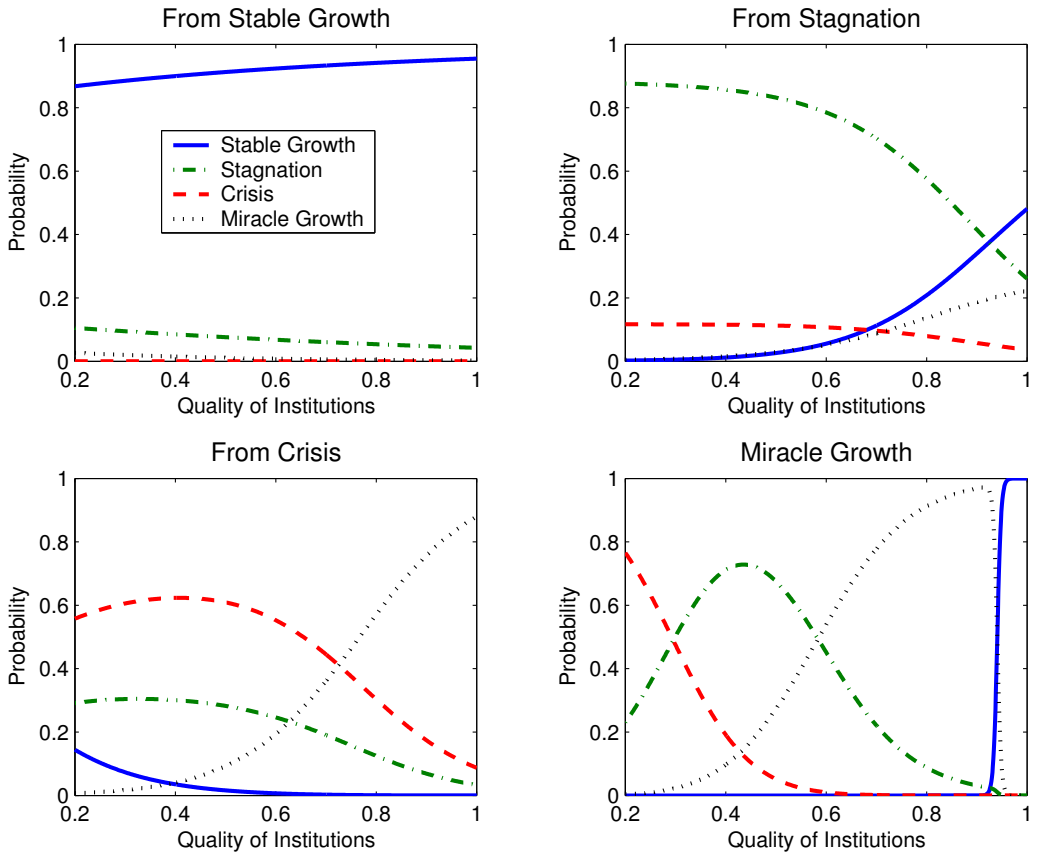


Figure 9: Transition probabilities as a function of the quality of institutions. The upper left-hand side box shows plots of the probability of moving from state one to each of the four states. The solid line shows the probability of moving to state one (i.e., probability of remaining in the same state), the dash-dot line shows the probability of moving to state two while the dashed and dotted lines show the same for state three and four, respectively.

The stable growth regime is very persistent for all values of the institutions index, but the persistence does increase with the quality of institutions. Stagnation is very persistent for weak-institutions countries, but this persistence falls off markedly with the quality of institutions above 0.6 (e.g., Turkey). For high quality of institutions countries, a period of stagnation is more likely to be followed by a reversal to stable growth. The lower left-hand side graph shows the probability of changing regimes conditional on the current state being the growth shock (crisis) state. Finally, the lower right-hand side graph shows the probability of changing regimes conditional on the current state being the fast growth state. For low-quality countries, a period of fast growth is very likely followed by a growth shock state. Intermediate quality countries are also not likely to remain in the growth regime for long and most likely revert to stagnation. However for mid-to-high institutions countries the

fast growth regime is very persistent.

Figure 31 shows the plots of the ergodic distribution of states for different levels of institutional quality. The most important feature is that countries with low quality of institutions spend about 60% of the time in stagnation, and only around 15-20% of the time growing at positive and sustained but moderate rates. For values of the quality of institutions above 0.4, the time spent stagnating starts decreasing while the fraction of time spent growing increases. However, the quality of institutions must be above 0.6 for stagnation to no longer be the most frequent state. Improving institutions also increases the time spent growing fast (Miracle Growth). For values of the index above 0.7 (e.g., Mauritius) more time is spent growing fast than stagnating.

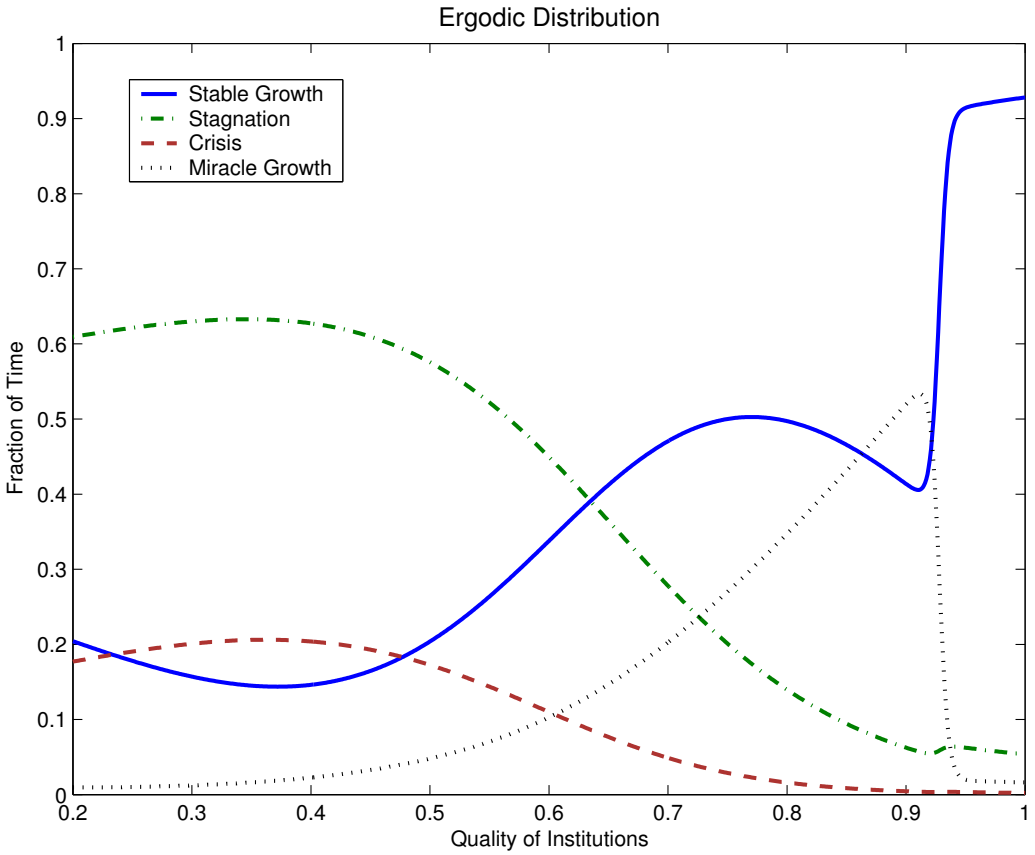


Figure 10: Ergodic probabilities of the four regimes as functions of the quality of institutions.

These estimated transition probabilities imply that institutions are more important in sustaining growth than in igniting it. In particular, low quality of institutions countries have a significant probability of entering growth regimes, however, the probability of exit is high. In the long run regimes follow an ergodic distribution where low quality of institutions leads to frequent stagnation and crises whereas high quality, while not ruling out stagnation or crises, reduces their frequency and increases that of the growth regimes.

These results suggest that randomness of the transition between regimes is not the only factor accounting for differences in growth patterns across countries. In particular, the quality of institutions, widely believed to be an important growth determinant, affect the

transition dynamics. High quality of institutions, such as a strong rule of law and protection of private property, increase the frequency of visits to favorable regimes but most importantly make them more persistent; countries with weak institutions are capable of growth takeoffs, however, they are unable to sustain them.

5 Policies, Institutions, and Regime Switching

Pritchett's (2003) simple simulation illustrated that a model which includes multiple growth regimes and random transitions between them can account for the large diversity of growth patterns. Jerzmanowski (2005) extends this insight by explicitly estimating a regime-switching growth model and allowing the transition probabilities to depend on the quality of the country's institutions. This raises a natural question about what other country characteristics influence the probability of transitions between regimes. In this section, we provide a novel analysis of this question. We focus on the role of macroeconomic policies.

The question of whether macroeconomic policies such as inflation, government spending, real exchange rate overvaluation, and trade openness matter for long-run economic growth has a long history in empirical growth literature. Early research on determinants of growth in a cross-section of countries found significant effects of macroeconomic policies on long-run growth (e.g. Barro 1991, Dollar 1992, Sachs and Warner 1995). However, much of the recent literature is more skeptical. Easterly and Levine (2003) argue that, after controlling for institutions, policies do not affect the level of income. Easterly (2005) shows that the findings of significant effects of policies on growth are driven by extreme outliers. Finally, Acemoglu et al. (2003) argue that once institutions are controlled for, policies do not matter much for growth and volatility. Here we re-examine the question of policies and growth, while explicitly accounting for within-country variation in the growth process. This framework is richer than the standard average growth analysis since it allows policies to work through multiple channels by differentially affecting the likelihood of growth accelerations, stagnation, and crisis. We use the regime probabilities obtained by Jerzmanowski (2005) to estimate the effects of policies on the frequency of the four growth regimes. We ask whether some policies are associated with a country spending more time in periods of growth, stagnation, or crisis.

In order to study the joint effect of institutions and policies on growth through their effect on regimes changes, one could follow the same approach as Jerzmanowski (2005) and extend the vector z in the transition probabilities matrix $p(z)$ to include measures of policy. In practice, the estimation is quite computationally intensive, even with only one variable. Instead, we use the inference about the likelihood of regimes obtained from the estimation of the baseline model. The logic of the approach is as follows.

Since the true value of the regime is unobservable, we can never know with certainty whether a given country is in any given state. However, conditional on the model, the estimated parameters, and all the observations for a given country, we can form inference about the probability of the regimes during the sample period. These *smoothed probabilities*, denoted by $\hat{P}(s_t = j|\mathcal{Y}_{m\,T})$, where $\mathcal{Y}_{m\,T}$ stands for the entire time series for country m, give us an estimate of the likelihood of each of the four regimes for country m at all sample dates

t. For example, $\hat{P}(s_{1979} = 1|\mathcal{Y}_{UST})$ tells us the (conditional) probability that the U.S. was in the stable growth regime in 1979. Figures 32 and 33 plot examples of the smoothed regime probabilities.

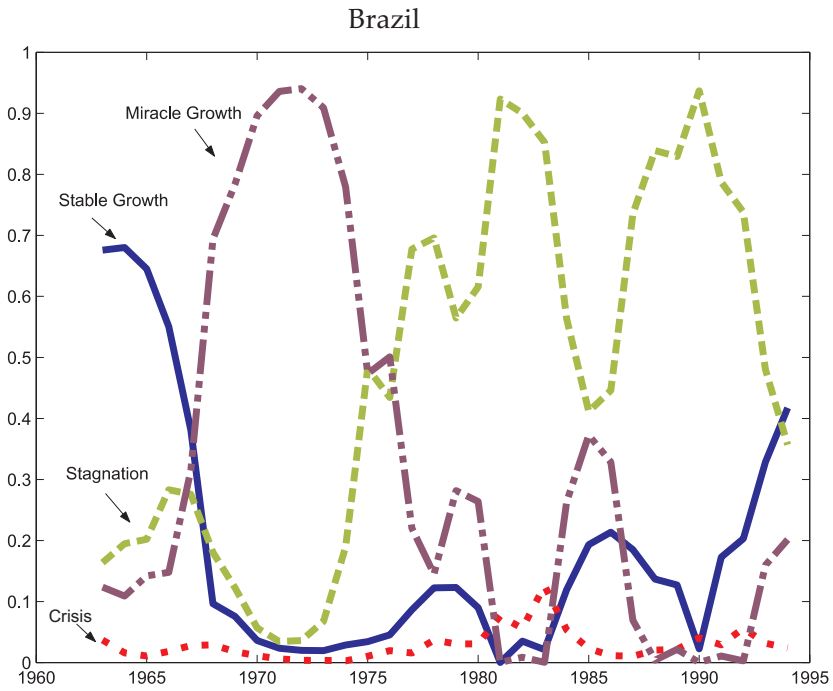


Figure 11: Regime probabilities: Brazil

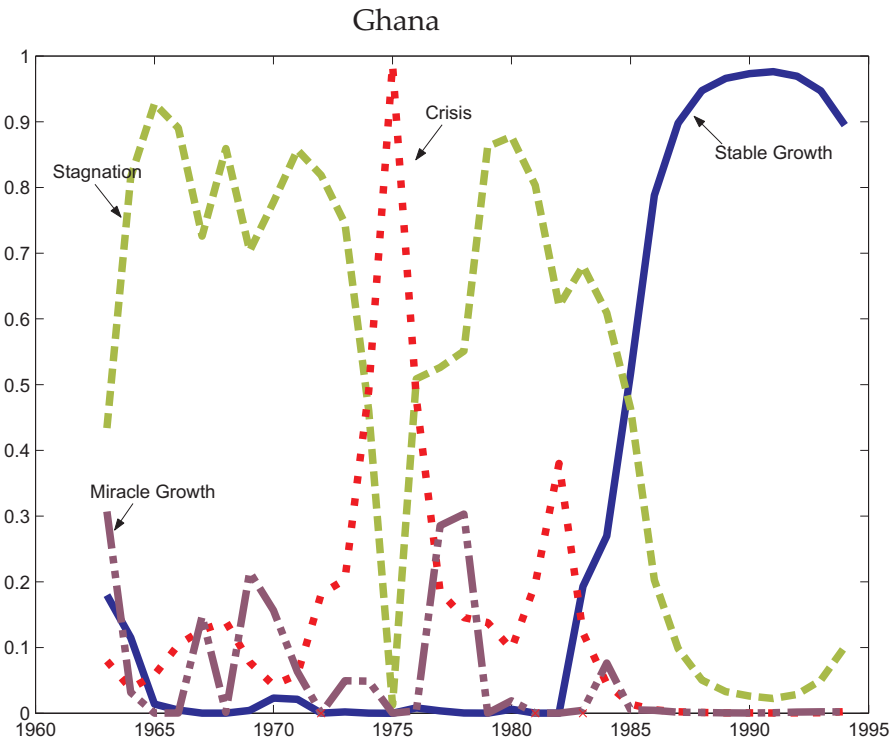


Figure 12: Regime probabilities: Ghana

Table 16 below presents the smoothed probabilities averaged over the sample period 1970-94 for each of the regimes for a selected group of countries. That is, for each country the first column gives the average probability of the stable growth regime $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 1|\mathcal{Y}_T)$, the second column gives the average probability of stagnation $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 2|\mathcal{Y}_T)$, and so on. These probabilities tell us what is the average (over sample years) probability that a country was in a given regime. For example, on average the probability that Japan was in the miracle growth regime is 33% while the average probability that it was stagnating is 5%.

country	Stable Growth	Stagnation	Crisis	Miracle Growth	Avg. Growth
Hong Kong	0.04	0.17	0.06	0.72	5.56%
Japan	0.62	0.05	0.00	0.33	4.31%
Thailand	0.13	0.33	0.03	0.51	4.36%
Portugal	0.51	0.13	0.01	0.36	3.92%
Malaysia	0.31	0.24	0.03	0.42	3.48%
Egypt	0.50	0.40	0.05	0.06	2.20%
India	0.37	0.51	0.03	0.09	2.10%
USA	0.89	0.07	0.00	0.03	2.04%
Mexico	0.52	0.35	0.02	0.11	1.68%
Chile	0.05	0.45	0.16	0.34	1.64%
Zimbabwe	0.05	0.72	0.15	0.08	1.03%
New Zealand	0.74	0.21	0.01	0.04	0.90%
Bolivia	0.45	0.43	0.08	0.03	0.10%
Cote d'Ivoire	0.02	0.61	0.15	0.22	0.07%

Table 6: The columns report average smoothed probabilities of regimes, i.e. the estimates of regimes' likelihood based on the entire sample. Let $\hat{P}(s_t = 1|Y_T)$, the smoothed inference about the likelihood that regime one was in effect in period t. Column one is $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 1|Y_T)$, column two is $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 2|Y_T)$ and so on.

We assume that the averages frequencies approximate the ergodic regime distribution and use them to compute the average number of occurrences of each regime during the sample period. We then ask how the country's quality of institutions and macroeconomic policies affect regime probabilities. In particular, we average the estimated probabilities over two subperiods, 1970-82 and 1983-1994, and run a pooled multinomial logit. If, as was assumed by Jerzmanowski (2005), quality of institutions is the only variable determining

transition probabilities, we would expect to replicate the estimates of the relationship between the ergodic distribution of regimes and the institutional quality presented in Figure 31, with departures from this distribution being purely random and unrelated to policies. Alternatively, if policies do matter, they will add additional explanatory power in fitting the observed regime distributions.[18]

To determine the relationship between policies and institutions and regime frequencies we estimate the following multinomial logit model.

$$\Pr(\text{regime} = j)_i = \frac{\exp(X_i\,\beta_j)}{\sum_{s=1}^{4}\exp(X_i\,\beta_s)}, \tag{4}$$

$$\tag{5}$$

for $j = 1, 2, 3,4$. $\Pr(\text{regime} = j)$ is the average probability of regime j during the sample periods, and X_i is a vector of country specific characteristics including initial income, quality of institutions and four policy measures: log of average inflation, real exchange rate overvaluation, the share of government's consumption in GDP, and trade to GDP ratio. Quality of institutions is measured using the rule of law index from Kaufmann et al. (2003). Policy variables are averaged over the relevant period and are taken from World Bank economic indicators, except the real exchange rate overvaluation, which comes from Dollar (1992).

This model is a simple multinomial logit model with 4 (unordered) outcomes: stable growth, stagnation, collapse, and miracle growth. Of course, as discussed above, we do not actually observe whether a country is in a given regime in any given year, but instead we have the (estimated) probabilities of regime occurrences. To proceed with the logit estimation, we convert the data on regime probabilities into counts of regime occurrences by multiplying the probabilities by the number of years in the sample. For example, the data in Table 16 corresponds to the period 1970-94 and so multiplying the entries in the first row we attribute to Hong Kong one year of stable growth, four years of stagnation, one year of crisis, and 17 years of miracle growth.[19]

We estimate the above model using pooled data for the subperiods 1970-82 and 1983-94. Since the coefficient estimates are not easily interpreted, we do not report them here; instead, we tabulate the estimated marginal effects at the median. Below we also examine how these effects vary over the entire distribution of the right-hand side variables. This is important since, as Easterly (2005) points out, there are often significant outliers in the policy measures.

Table 17 shows the marginal effects of institutions, policies and income on the probability of each of the four regimes for a hypothetical country with all the right-hand side variables

[18]See Kerekes (2009) for an alternative way to extend the approach in Jerzmanowski (2005) to multivariate transition probabilities.

[19]An alternative strategy, would be to estimate a linear model of the log odds-ratios, which are given by $\ln(\Pr(\text{regime} = j)_i / \Pr(\text{regime} = 4)_i = X_i\,\beta_j$ for $j = 1, 2, 3$. where we have normalized $\beta_4 = 0$. Here we could use the probabilities of regime occurrences (Table 16) without the need to compute regime counts. This approach gives very similar results but has the disadvantage of considerably over-predicting (in sample) the probability of miracle growth, and we do not pursue it.

Variable	Stable Growth	Stagnation	Crisis	Miracle Growth
Rule of Law	0.202***	-0.199***	-0.064***	0.060***
	(0.026)	(0.026)	(0.012)	(0.015)
Inflation	-0.110	0.058	0.015	0.037
	(0.100)	(0.073)	(0.014)	(0.027)
Overvaluation	-0.310***	0.240***	0.043**	0.026
	(0.065)	(0.057)	(0.018)	(0.031)
Gov't	2.086***	-0.806**	-0.056	-1.224***
	(0.445)	(0.394)	(0.153)	(0.400)
Trade	-0.434***	0.228***	0.046	0.161***
	(0.072)	(0.071)	(0.032)	(0.034)
Initial Income	0.132***	-0.078***	-0.018**	-0.035**
	(0.028)	(0.025)	(0.008)	(0.016)

Table 7: Multinomial logit: marginal effects at the median. Standard errors in parentheses. Significance levels:* 10%, ** 5%, *** 1%.

equal to the sample median (we refer to it as "median country"). The quality of institutions increase the probability of favorable outcomes - miracle growth and stable growth while reducing the chances of unfavorable regimes - stagnation and crisis. The size of government lowers the likelihood of miracle growth but compensates this effect by increasing the chances of stable growth and reducing the probability of stagnation and crisis. Trade lowers the probability of stable growth while increasing that of miracle growth; it also increases the chances of crisis and stagnation. Both distortionary policies, inflation and real exchange rate overvaluation, increase the chances of stagnation and crisis, and lower the chances of stable growth, although the effect of inflation is not statistically significant. Their effect on miracle growth is also insignificant. Finally, the level of development as captured by initial income has an independent influence on regimes; it lowers the probability of miracle growth, which is the familiar convergence effect, albeit in a probabilistic sense. That is, richer countries are less likely to grow at very rapid rates as predicted by the neoclassical model as well as technology catch-up models. This effect is, however, mitigated by the fact that income also increases the chances of stable growth. Higher income countries also appear to stagnate less and have less frequent crises. We can use the marginal effect to calculate the change in the probability of each regime given a one standard deviation change in the right-hand side variables. These results are displayed in Figure 34.

Clearly, institutions not only deliver the desirable effects (more frequent growth states,

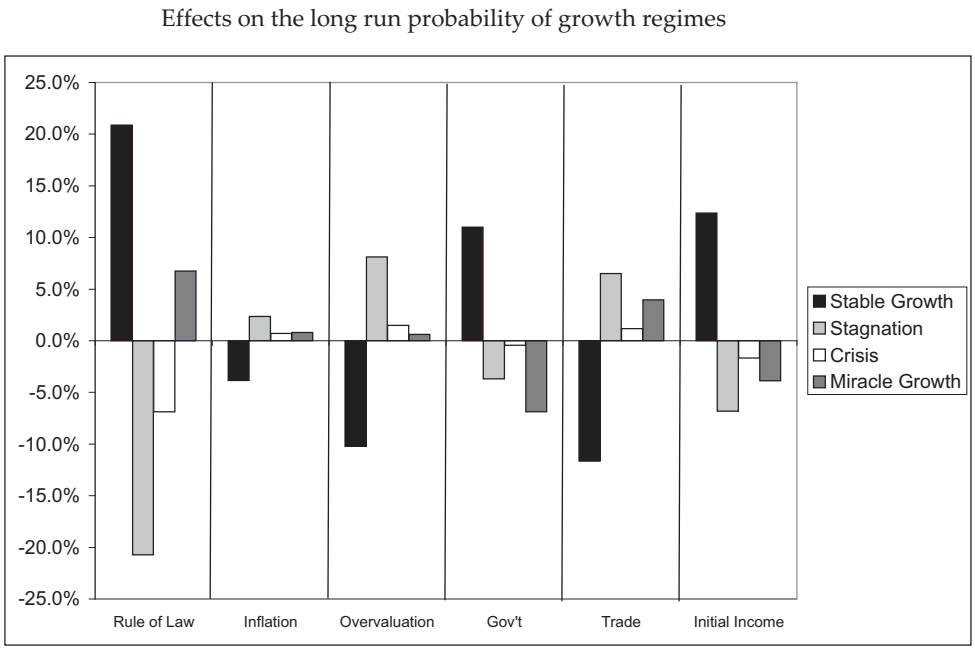


Figure 13: Effects of a one standard deviation change in the right-hand side variables on long run regime probabilities. All right-hand side variables set to the sample median.

less stagnation, and crises) but quantitatively also have a large impact. However, the effects of government size and trade openness are also nontrivial, but they are, to some extent, off-setting across regimes. For example, a one standard deviation increase in trade share means 3.5% more time spent growing fast and 10% less time growing at moderate stable rates. To translate the effects on probabilities of regimes into effects on long-run growth, we can multiply the effects from Figure 34 by the average long-run growth numbers for each regime, reported in Table 15. We can perform a similar calculation for the volatility of growth. The results are shown in Table 18. Note that the median growth rate in the sample was 1.46%, so that for the median country a one standard deviation improvement in the rule of law results in growth increasing to 2.38% (1.46 + 0.92). On the other hand, a one standard deviation increase in government's size results in growth falling to 1.26%. This relatively small change is a net effect of the offsetting forces; larger government leads to less miracle growth but also less stagnation and more stable growth. Overall, we can conclude that at the median the effect of institutions on growth is much greater than that of any policy.[20] This reflects two findings. First, institutions do have a quantitatively large effect on growth, and second, for some policies the effects on long run growth are off-setting across regimes. Similarly, note that despite evidence of convergence (richer countries are less likely to grow very fast) poor countries do not grow faster than rich ones. This is because at lower income levels they are also more susceptible to prolonged periods of stagnation.

Of course, the above calculations do not fully characterize the effects of policies as these are nonlinear and depend on the value of other explanatory variables. That is, the effect of

[20]Policies affect volatility more than average growth but again institutions are more important.

Variable	Growth	Volatility
Rule of Law	0.922	-1.270
Inflation	-0.037	0.149
Overvaluation	-0.188	0.388
Gov't	-0.200	-0.195
Trade	-0.004	0.294
Initial Income	0.029	-0.387

Table 8: Change in the average growth rate and volatility in response to one standard deviation change in the right hand side variables. In % points.

inflation may be much different when it is close to the median level (as in the table above) than when it is in the hyperinflation range. Similarly, the effect on inflation may be different in countries with different quality of institutions. Finally, the distributions of the right-hand side variables may be skewed so that a one standard deviation change (as in the table above) may be either large or small relative to realistic changes in these variables. To get a better understanding of these effects, we will graph them for the entire distribution of the right-hand side variables. We will also look at whether the effects differ significantly across countries with different institutional environments.

Figure 35 shows plots of the probability of the stable growth regime as functions of the six explanatory variables. In each box, the probabilities are calculated by setting the value of five variables to the sample median and varying the remaining variable over the percentiles of the sample distribution. The first box shows that for a median country, the probability of stable growth is increasing with income. With low income, the long run probability of growing at stable rates is one-third, while for the richest country it is 60%. The quality of institutions also improves the chances of stable growth (box two); however, the effect is small in the lower part of the institutions' distribution, it rises sharply around the median, and flattens out again around the 60th percentile. Inflation (box three) has very little effect except for values above the 88th percentile of the distribution where it significantly lowers the likelihood of stable growth. This corresponds to 0.287 log inflation or about 33% annual rate of inflation. Notice that while the effect of inflation on stable growth is consistent with the idea that only extreme values of inflation matter, the threshold is not exceedingly high. Real exchange rate overvaluation has a significant negative effect throughout the distribution, but similarly to inflation, the effect is much more pronounced beyond the 88th percentile, which is an overvaluation of 47%. The size of the government increases the chance of stable growth; the estimates imply that going from 10% of government consumption in GDP to

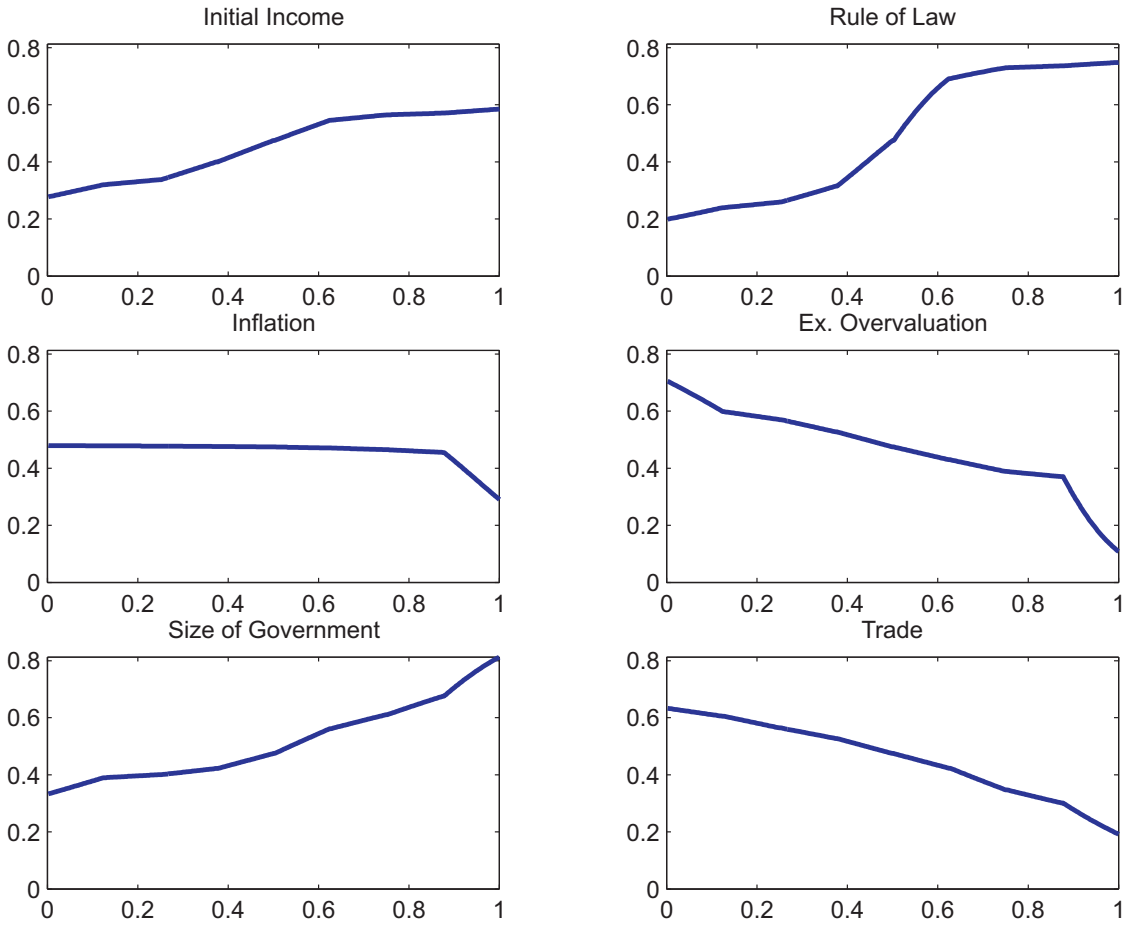


Figure 14: Probability of Stable Growth for the "median country".

20% increases the long-run probability of stable growth from 40% to 60%. Finally, trade lowers the probability of stable growth; quantitatively the estimates imply that increasing the trade to GDP ratio from 36% to 96% results in the long run likelihood of stable growth falling from 60% to 20%.

Figure 36 shows the probabilities of the miracle growth regime for a median country. Income lowers the chance of fast growth reflecting convergence, but the effect is not very large. As with stable growth, institutions have a positive effect, which again is steepest in the middle of the distribution. Inflation matters only above the 88th percentile where it lowers the chances of miracle growth. Real exchange rate overvaluation does not appear to have a large effect. Government size significantly reduces the probability of a growth miracle; increasing the share of government consumption from 10% to 20% reduces the probability from 15% to only 5%. Finally, greater trade openness appears to increase the chances of a growth take-off.

Note that in none of the boxes does the probability of miracle growth exceed 20%. In fact, a hypothetical country with all the right-hand side variables set to the most miracle-growth conducive values is predicted to spend 55% of time in miracle growth regime - below actual values for countries like Hong Kong (72%) and Korea (86%). Of course, neither of

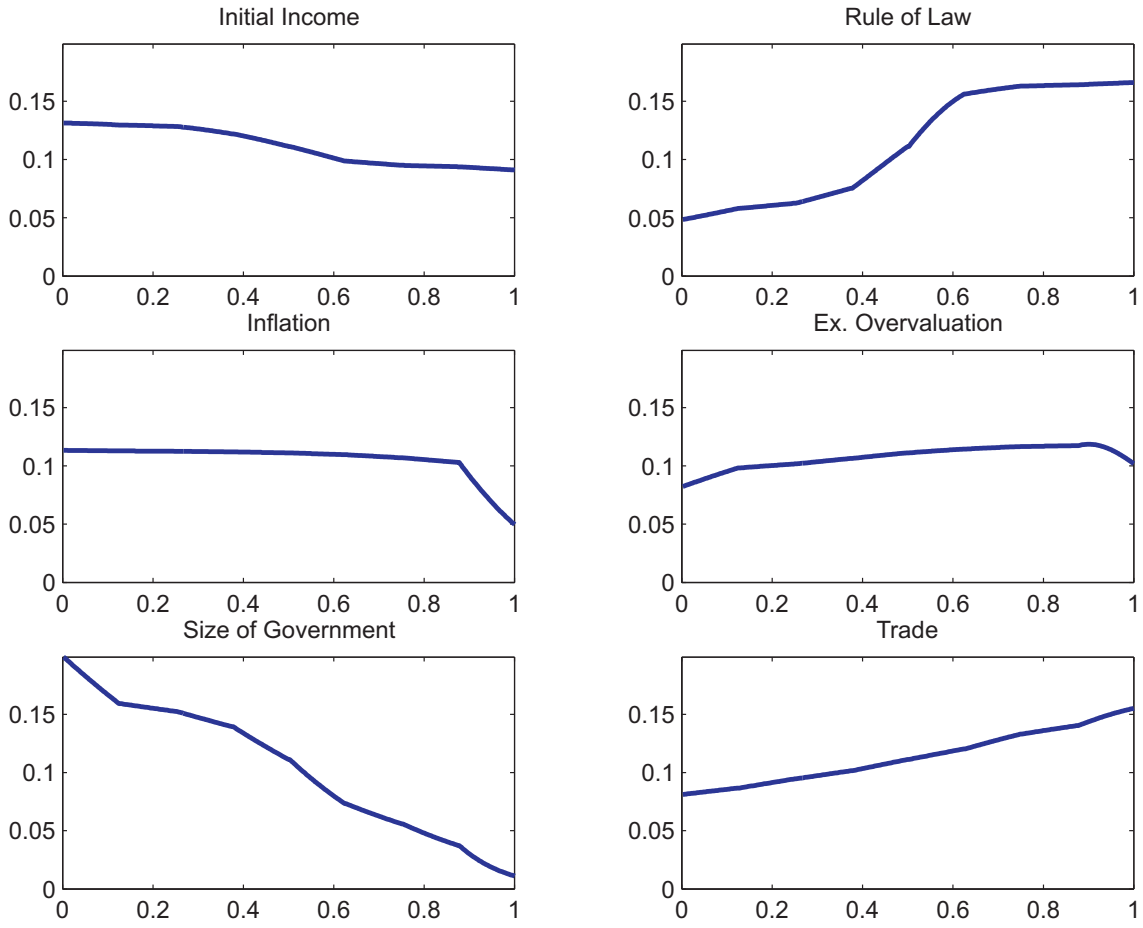


Figure 15: Probability of Miracle Growth for the "median country".

these countries had the hypothetical perfect policy mix, and consequently, the model predicts they should spend even less than 55% of the time in miracle growth. We conclude from this that while institutions and policy variables do affect the likelihood of miracle growth, there are other factors at work (including possibly pure chance). This result mirrors the lack of success of Hausmann and co-authors in explaining growth accelerations.

Several authors have investigated the relationship between the quality of institutions and the effects of various other country characteristics on growth (e.g., Burnside and Dollar 2000, Servén et al. 2005). Aghion et al. (2004) show that the relationship between financial openness and volatility may depend on the degree of development of financial markets, which is presumably highly correlated with measures of institutions such as protection of property rights - a part of the rule of law index.[21] Here, because of the nonlinear nature of the probability model, the effects of one variable depend on the level of the remaining variables. The figure below shows plots of the miracle growth regime probabilities, calculated as above, for two hypothetical economies: one with the sample's highest value of quality of institutions

[21]Similarly, Aghion et al. (2008) provide a model and some evidence showing that the effects of fiscal policy on growth again depend on the development of financial markets.

(solid line) and another with the sample's lowest (dashed line). All other variables remain at the median level.

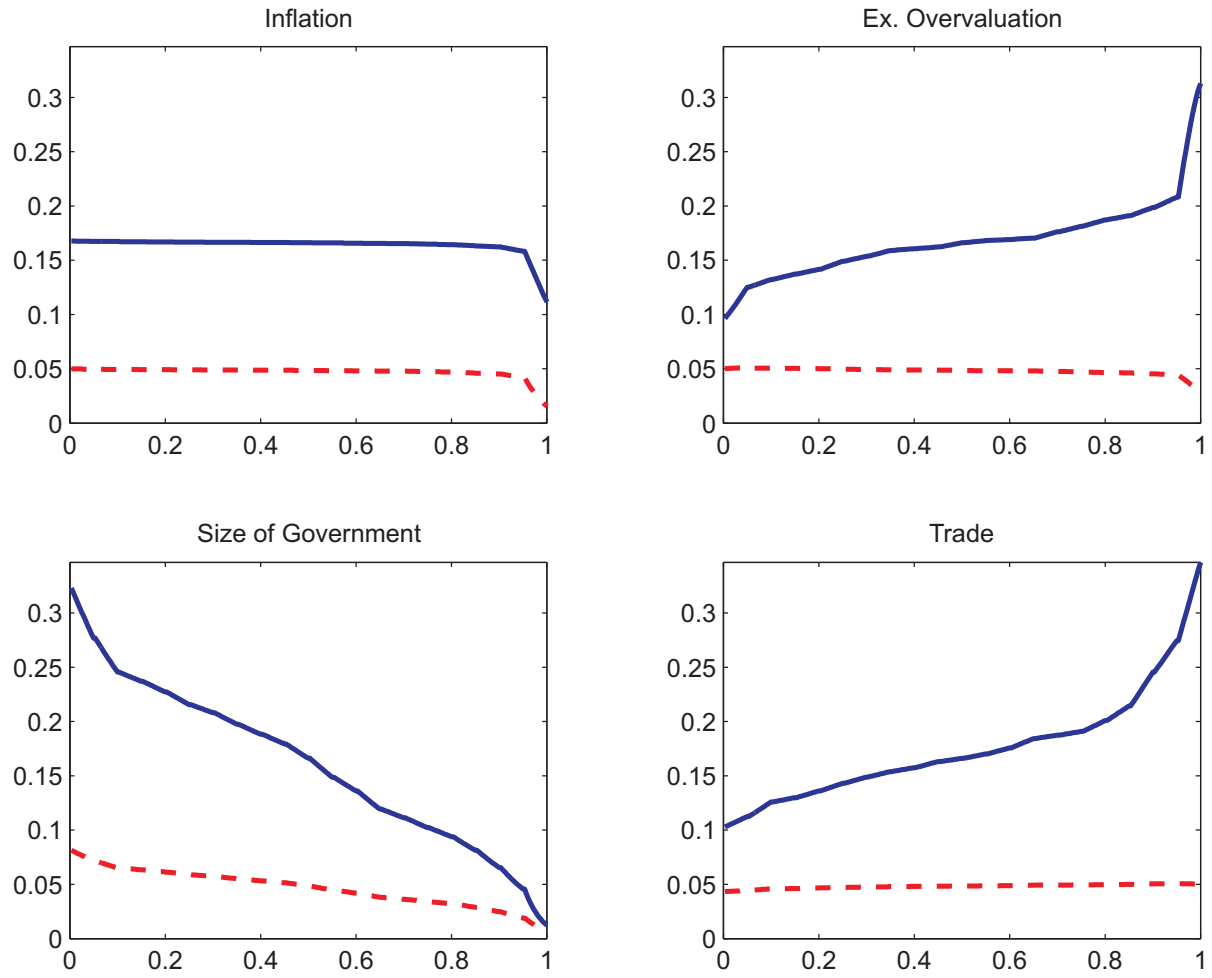


Figure 16: Probability of Miracle Growth for good (solid line) and weak (dashed) institutions countries.

Figure 37 compares the probabilities of the miracle growth state. The large gap between the two lines indicates how much higher the probability of the miracle regime is for countries with good institutions. With the exception of inflation, policies have very different effects depending on the quality of institutions. Exchange rate overvaluation, which appears to have no effect for countries with weak institutions, increases the chances of miracle growth for countries with good institutions. The opposite is true for the size of government; while it appears to have little effect when institutions are weak, it greatly reduces the likelihood of fast growth where institutions are strong. Finally, trade does not affect the probability of fast growth with weak institutions but greatly increases it with good institutions.[22]

[22]The main findings for other regimes are that: (1) greater share of government consumption in GDP reduces the probability of stagnation for weak-institutions countries, while also increasing, albeit by much

We can take the approach used to construct Table 18 and translate the effects in Figures 35 - 37 into effects on long run growth and volatility. First, let's again consider a country with all variables except that of interest set to the sample median (the "median country") without distinguishing between high and low quality institutions.

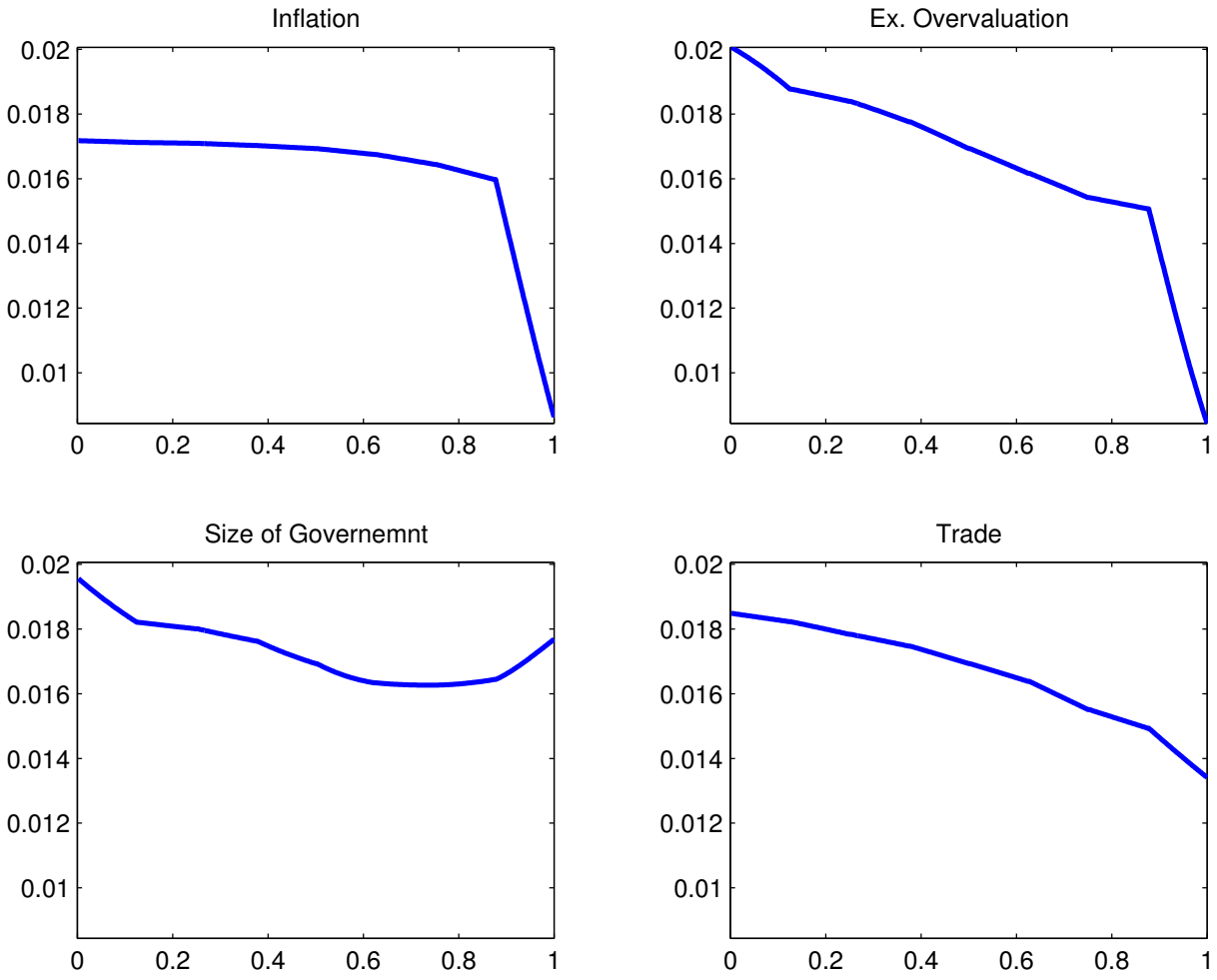


Figure 17: Effects of policies on growth in the "median country".

Figure 38 shows the effects of policies on long-run growth for the median country. Inflation does not significantly affect growth as long as it remains below the 88th percentile or about 33%, however, instances of extreme inflation have a devastating effect on growth. Exchange rate overvaluation, especially when it is extremely high, lowers growth. The size of the government initially lowers growth and then raises it, but the overall effect is small. This is a result of two offsetting forces affecting the median country. As government size increases, the likelihood of miracle growth falls, however, so does the probability of stagnation, and the probability of stable growth rises significantly. This suggests that otherwise identical

less, the chances of a crisis, (2) trade significantly increases the probability of a crisis but only for countries with weak institutions, and (3) extreme inflation increases the chance of a crisis everywhere, but the effect is much stronger with weak institutions.

countries with different sizes of government may grow at similar rates, but the nature of the growth process will be different. Countries with a lower size of government will go through periods of stagnation but will also enjoy periods of fast growth. Countries with a higher size of government are more likely to grow at moderate but uninterrupted rates.

Figure 39 shows the effect of initial income and quality of institutions. As could be anticipated from the effects on regime probabilities, institutions have a stronger effect on long-run growth than any of the policies examined in Figure 38. Note , however, that the effect is greatest around the median of the quality of institutions distribution. While the leveling off could well be expected at high levels of institutional quality, the relatively smaller effect for low quality of institutions is not obvious. It suggests the existence of a "threshold effect" with regards to institutions and casts doubt on the ability of incremental improvements of institutions to generate sustained growth accelerations in countries with a weak rule of law. A qualitative summary is presented in Table 19.

	10th Percentile	Median	90th Percentile
Inflation	0	0	−−
Real Exchange Overvaluation	−	−	−−
Government Spending	−	−	+
Trade	−	−	−
Rule of Law	+	++	0
Initial Income	+	+	0

Table 9: Effect on long run growth at the 10th percentile, the median, and the 90th percentile of variables' distribution. Effects are categorized as strongly negative (−−), negative (-), negligible (0), positive (+), and strongly positive (++).

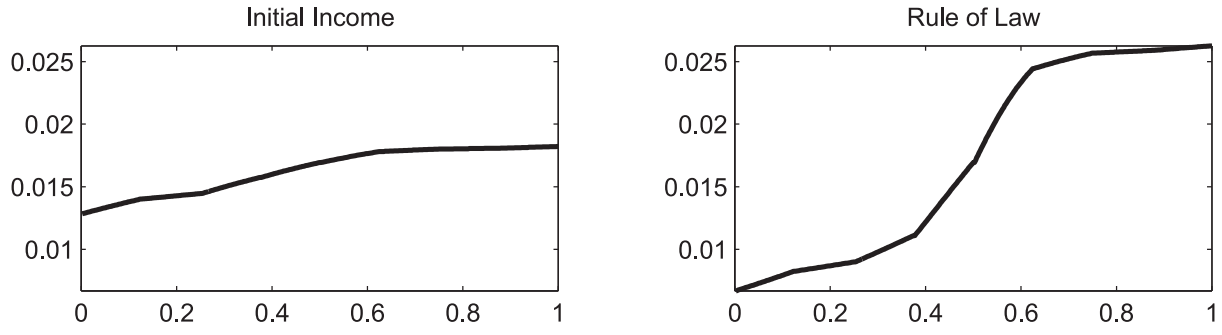


Figure 18: Effects of initial income and institutions on growth in the "median country".

Figure 40 contrasts the long run growth effects of policies for countries with good (solid line) and weak institutions(dashed line). The plots show growth relative to that of a country

with all variables set to the sample median. Weak institutions appear to make economies more vulnerable to the damaging effect of real exchange rate overvaluation and high inflation. The size of government lowers growth for countries with good institutions in the entire range, while for countries with weak institutions it lowers growth, albeit less strongly, below median and raises it sharply above the median. As discussed above, this is a consequence of the differential effect of government on the likelihood of stable growth versus miracle growth - it increases the former while lowering the latter. For good-institutions countries, where stable growth is the most likely regime this lowers average growth. However, for weak-institutions countries, where stagnation dominates, stable growth is rare, and miracle growth is even rarer, this raises growth.

Trade's effect on growth also depends on institutions; it is positive when institutions are good but turns strongly negative when they are weak. The beneficial effect of trade is to increase the likelihood of miracle growth while the cost is the increase in the probability of a crisis. The former effect is very strong with good institutions but virtually nonexistent with weak ones (Figure 37). The latter, on the other hand, is insignificant for countries with good institutions and quite strong for weak institutions.

These results, summarized in Table 20, suggest that the relationship between policies and institutions is potentially quite complex and goes beyond the view that bad policies are merely a manifestation of weak institutions, which are the ultimate determinants of economic development as argued by Acemoglu et al. (2003). This is consistent with some other recent findings. Fatás and Mihov (2003) show that a country's degree of discretionary fiscal policy (measured by the unexplained variance from an estimated government spending rule) is related to lax political institutions and is associated with lower growth and higher GDP volatility. Cuberes and Mountford (2011) show that Fatás and Mihov's measure of fiscal discretion is, in part, explained by historical variables. In particular, they argue that a significant fraction of this "discretionary" policy is indeed better attributed to institutional quality. They then construct a tighter variable for fiscal discretion than the one explored in Fatás and Mihov (2003), i.e., the part of the unexplained variance of government spending that is not accounted for by historical or geographical variables. Interestingly, they show that even this, much tighter, measure of discretionary fiscal policy is negatively associated with GDP volatility and growth. However, historical institutions also seem to have a direct impact. Thus as in the above analysis, they conclude that while institutions are important for growth and volatility, fiscal policy has an independent effect on growth performance.

Before concluding, we want to extend our analysis to include the effect of democracy on regime switching. We do so because the strong and robust effect on growth reversals reported above suggest the type of political institutions plays a role in growth transitions. Introducing democracy into the analysis decreases the sample size somewhat so we decide to treat this analysis in separation from the above main results.

The inclusion of democracy does not change the estimated effects of policies substantially so we omit their exposition and focus on the effects of the rule of law, level of income and democracy.[23] Figure 41 below shows the estimated effects, evaluated at the median, of a

[23]One interesting change is that the effect of the rule of law on growth does not flatten out at high levels, i.e., it goes from being S-shaped (see figures 35-36) to being J-shaped. It suggests that the flattening out was a consequence of the correlation between democracy and the rule of law.

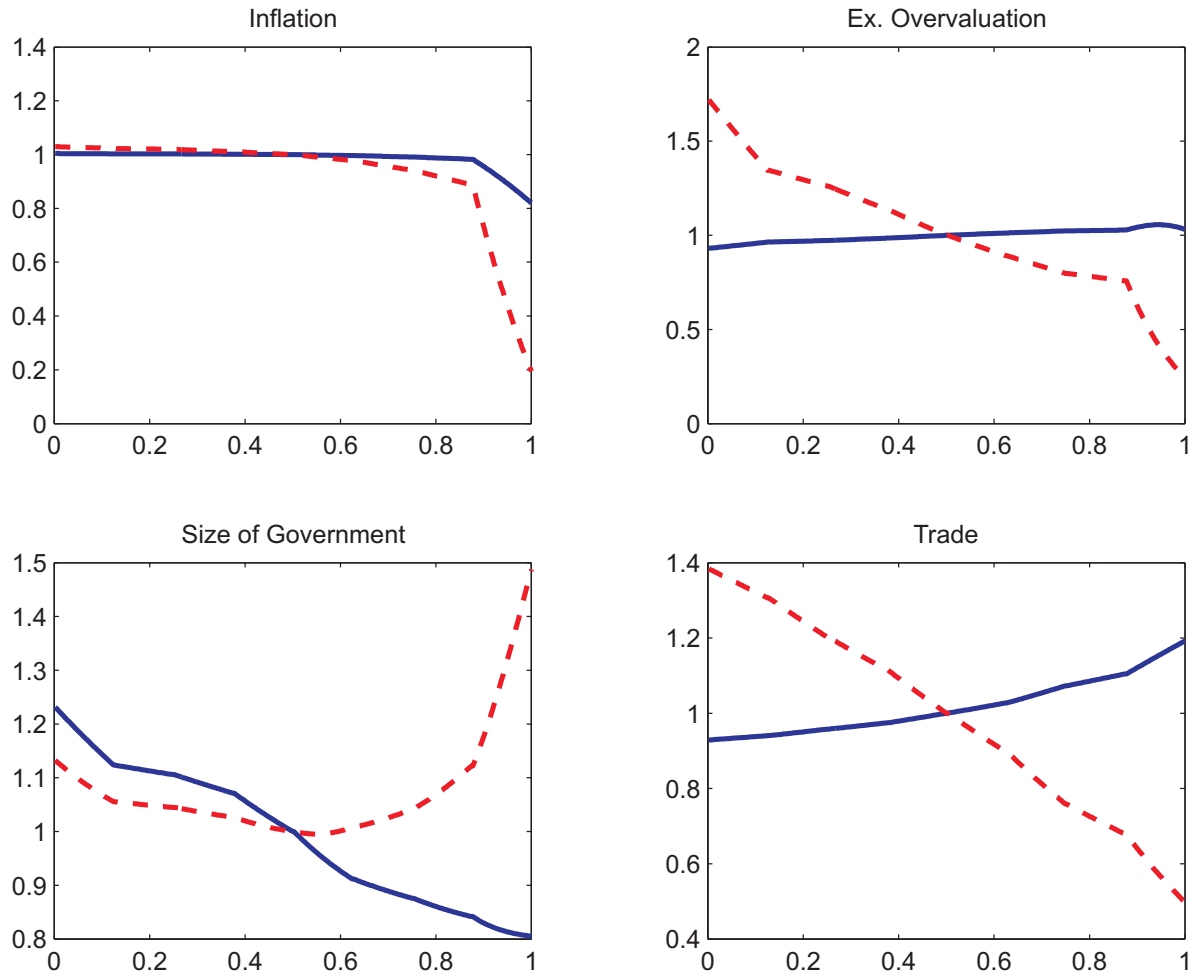


Figure 19: Effects of policies on growth for good (solid line) and weak (dashed) institutions countries. The vertical axis measures growth relative to an economy where all variables are equal to the median.

one standard deviation change in initial income and the rule of law index from the model without democracy (these are the same estimates as in Figure 34 and Table 18).

As discussed above, rule of law increases the probability of good regimes (miracle and stable growth) while income increases the likelihood of stable growth and lowers that of stagnation but also decreases the frequency of miracle growth (convergence effect). Figure 42 shows the effects in a model with democracy included among the explanatory variables.

Democracy increases the likelihood of stable growth and the estimated effects of rule of law and income are now reduced. Democracy also slightly increases the probability of stagnation and has a negative effect on the chance of a crisis that is similar in magnitude to that of rule of law. Most importantly, however, democracy significantly lowers the likelihood of miracle growth episodes. Furthermore, once democracy is accounted for, income has a positive and small effect on the probability of a miracle take-off. That is richer countries are less likely to grow rapidly because they are more democratic. This suggests that the convergence effect uncovered before works mainly through the political economy channel and not

		10th Percentile	Median	90th Percentile
Inflation	Good Inst.	0	0	−
	Weak Inst.	0	0	−−
Real Exchange Overvaluation	Good Inst.	0	0	0
	Weak Inst.	−	−	−−
Government Spending	Good Inst.	−	−	−
	Weak Inst.	−	0	++
Trade	Good Inst.	+	+	+
	Weak Inst.	−	−	−

Table 10: Effect on long run growth at the 10th percentile, the median, and the 90th percentile of variables' distribution; good institutions vs. weak institutions. Effects are categorized as strongly negative (−−), negative (−), negligible (0) , positive (+), and strongly positive (++).

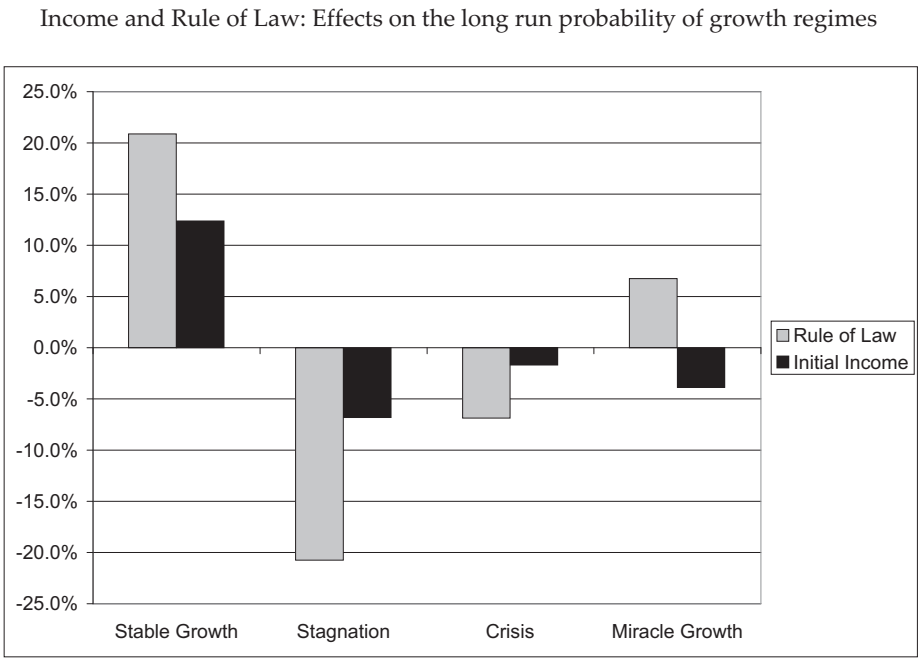


Figure 20: Effects of a one standard deviation change in initial income and rule of law index on long run regime probabilities. All right-hand side variables set to the sample median. Model without democracy.

through standard channels such as diminishing marginal product of capital or technological

Income, Rule of Law and Democracy: Effects on the long run probability of growth regimes

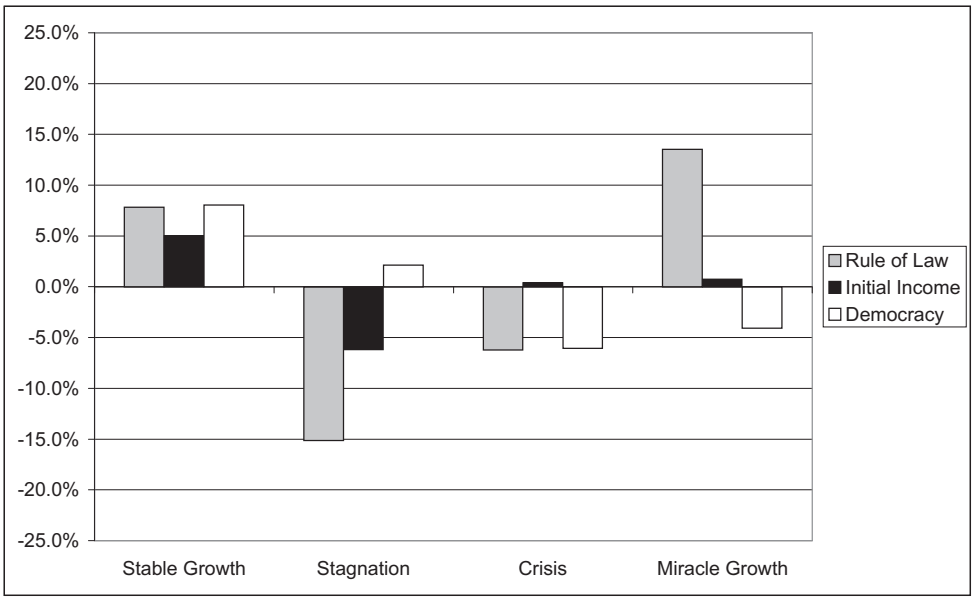


Figure 21: Effects of a one standard deviation change in initial income, rule of law index and democracy score on long run regime probabilities. All right-hand side variables set to the sample median.

catch-up.[24] This is consistent with the view of Olson (1982) who argued that democratic societies may stagnate in the long run due to the detrimental effect of special-interest groups which are able to organize and lobby for inefficient policies. Overall, the results imply that democracy favors the middle at the expense of extremes - either very fast growth or severe crises.

Overall the results of our investigation confirm some of the existing findings, namely that institutional quality is a key determinant of long-run growth, as well as Easterly's finding that only extreme values of the distortionary policies (inflation rate and real exchange rate overvaluation) have a significantly negative effect on growth. However, macro policies, especially trade openness and the size of government also matter for changes in growth patterns and thus influence the average growth and volatility in the long run. Crucially, policies also differ in the channel through which they affect long-run growth. For example, trade lowers the probability of stable growth and increases that of a crisis, while also making miracle growth more likely. The size of government, on the other hand, lowers the chances of miracle growth, while increasing the probability of stable growth at moderate rates. In addition, the effects of policies depend in an important way on the quality of institutions. In general, low quality of institutions makes economies more vulnerable to the harmful effects of inflation and real exchange rate overvaluation. In some cases, the direction of the effect is actually reversed; trade appears to be conducive to growth for countries with good

[24]Note that to the extent that Lipset hypothesis holds, i.e., democracy increases with income, this effect will still lead to the standard convergence, whereby poor countries are catching up to the rich. However, see Acemoglu et al. (2009) for evidence against the Lipset hypothesis.

institutions and detrimental to growth for countries with bad ones. The size of government has the opposite effect - it lowers growth when combined with good institutions and increases it with weak institutions. Finally, when we extend the analysis to the effects of political institutions by including a measure of democracy among the explanatory variables, we find that similar to the rule of law, democracy increases the frequency of stable growth. Unlike rule of law, however, democracy significantly lowers the chances of miracle growth takeoffs. We also find that accounting for democracy removes the negative effect of initial income on the probability of miracle growth, i.e., the convergence effect. This suggests that political economy, in addition to diminishing marginal product of capital or technological catch-up, is an important channel of convergence.

Abstract

In this chapter, we review the recent and growing literature on medium-term growth patterns. This strand of research emerged from the realization that for most countries economic development is a highly unstable process; over a few decades, a typical country enjoys periods of rapid growth as well episodes of stagnation and economic decline. This approach highlights the complex nature of growth and implies that studying transitions between periods of fast growth, stagnation, and collapse is essential for understanding the process of long-run growth. We document recent efforts to characterize and study such growth transitions. We also update and extend some of our earlier research. Specifically, we use historical data from Maddison to confirm a link between political institutions and propensity to experience large swings in growth. We also study the role of institutions and macroeconomic policies, such as inflation, openness to trade, size of government, and real exchange rate overvaluation, in the context of growth transitions. We find surprisingly complex effects of some policies. For example, openness to trade makes fast growth more likely but also increase the frequency of crises. The size of government reduces the likelihood of fast miracle-like growth while at the same time limiting the risk of stagnation. Moreover, these effects are nonlinear and dependent on the quality of institutions. We conclude by highlighting potentially promising areas for future research.

6 Introduction

The revival of research on economic growth that began in the last decades of the 20th century was spurred on by both theoretical and empirical contributions. On the theoretical front the papers by Romer (1986, 1990), Lucas (1988), and later Grossman and Helpman (1991), and Aghion and Howitt (1992) provided new ways of modeling endogenous growth and technological progress. On the empirical side, the availability of a large cross-country data set, the Penn World Tables, and early papers exploiting it (Mankiw et al. 1992, Barro and Sala-i-Martin 1991) gave impetus for researchers to test old and new theories of growth against the facts.

Following the early contributions (Barro, 1991; Barro and Sala-i-Martin, 1992) most researchers adopted the approach of using long run, 20 years or more, averages of growth of GDP per capita (or per worker) as the variable to be explained in the empirical analysis. There is enormous variation in long-run growth rates. For example, Jordan's income per capita increased by only 30% between 1970 and 2000, while that of Singapore increased 7-fold. In much of the growth literature of the last two decades, researchers tried to explain such difference by looking for factors – openness to trade, protection of property rights, high investment rates, etc. – that are necessary for growth and which Jordan lacks while Singapore has in abundance. This literature has delivered many important insights but has also come under severe criticism for difficulties with establishing causality and the lack of robustness of many results (for example, the effect of trade on growth). However, there is another reason why the overall balance of this empirical approach is quite disappointing. While focusing on explaining long-run average growth rates is a sensible starting point, when one wants to isolate long-run tendencies from higher frequency phenomena such as business cycle fluctuations, it also removes the information about how economic growth changed within a country over time. This would not be a significant loss if countries behaved like in the growth models where economies approach balanced growth paths in a smooth monotonic fashion. Unfortunately, most countries' growth experiences are far from smooth; they often experience long stretches of moderate growth interrupted by 5 or 10 year periods of rapid development only to later fall victim to decades of stagnation or years of decline. Long term averages remove these patterns and preclude us from using this variation to learn about the nature of the process of economic growth. Lant Pritchett, a leading development economist, has been one of the first to point out the disconnect between the prevailing empirical approach and reality of economic growth. In one of the papers (Pritchett 2000), he writes:

> *The historical path of gross domestic product (GDP) per capita in the United States is, except for the interlude of the Great Depression, well characterized by reasonably stable exponential trend growth with modest cyclical deviations: graphically, it is a modestly sloping, slightly bumpy hill. However, almost nothing that is true of U.S. GDP per capita (or that of other countries of the Organization for Economic Co-operation and Development) is true of the growth experience of developing countries. A single time trend does not adequately characterize the evolution of GDP per capita in most developing countries. Instability in growth rates over time for a single country is great, relative to both the average level of growth and the variance across countries.*

These observations led Pritchett to list the fact that "Growth has been enormously variable within developing countries, and there is little persistence of economic growth rates" as one of his seven stylized facts of the international growth experience. To make things concrete, consider Jordan and Singapore again. Their growth paths are plotted in Figure 22. It is apparent that the performance of the two countries is radically different, with Singapore experiencing a spectacular period of rapid growth, and Jordan suffering a dramatic stagnation. However, when inspecting Jordan's growth in greater detail, as is done in Figure 23, it becomes apparent that the forty years of its economic history are more than just a period of uninterrupted stagnation. The years 1960-75, and even more so the periods 1985-90 and 1995-2000 have been relatively successful while the years 1975-1985 and 1990-95 brought a substantial decline in income level. As it turns out, Jordan did not perpetually stagnate but instead had periods of rapid growth and also of dramatic decline; its economic growth seems to wax and wane. Explaining such medium-term cycles in economic performance seems key to understanding long-run economic growth and discovering the right set of policies for development and stability.

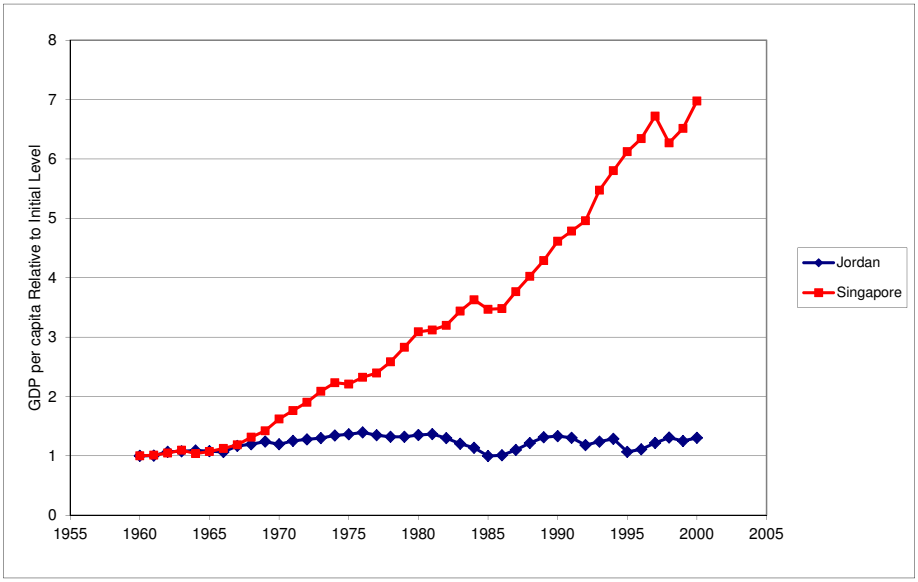


Figure 22: Relative growth performance of Singapore and Jordan, 1960-2000. Initial GDP per capita normalized to 100.

To see even more directly how average growth studies can be misleading consider Figure 24, which illustrates the paths of output per worker in three countries, the Republic of Congo, Gabon, and Portugal, over the period 1960-1995. The values have been normalized to equal one at the beginning of the period. The growth experiences of these three countries differ vastly: Portugal experienced a period of rapid growth followed by a mild slowdown and a return to relatively rapid growth, Congo went through a long period of rapid growth and then a period of equally rapid decline. Finally, Gabon grew faster than the two remaining countries until the late 1970s but stagnated after that. Yet after 40 years all three countries have grown by a surprisingly similar amount, roughly tripling their GDP per capita. If we look at average performance only, we will conclude that Congo, Gabon, and Portugal's

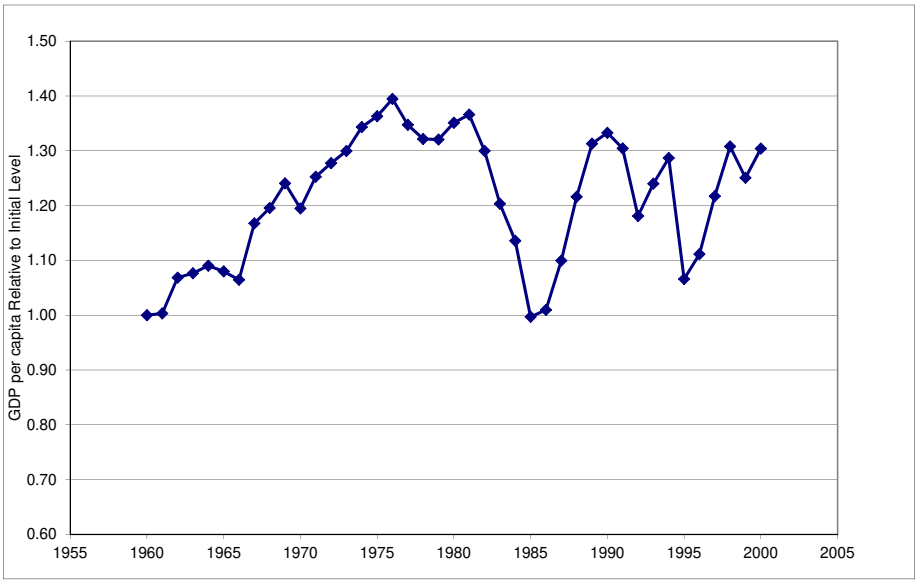


Figure 23: Jordan's growth performance 1960-2000. Initial GDP per capita normalized to 100.

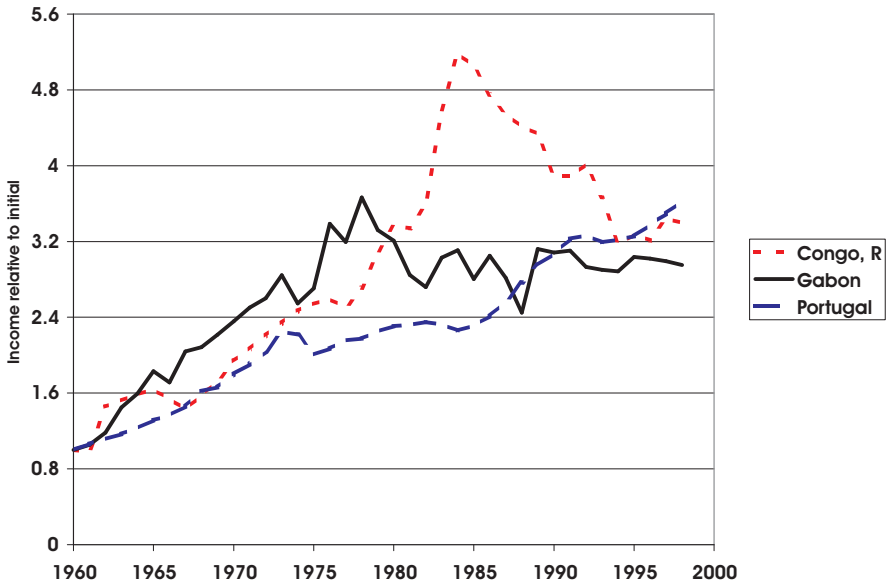


Figure 24: Different growth paths lead to similar average outcomes; Democratic Rep. of Congo, Gabon, and Portugal.

growth looks the same.

Why is understanding these patterns important? As a number of the papers described in this chapter emphasize, starting rapid growth and sustaining it are two different phenomena. We do not yet understand either of them very well. For example, increases in the variables usually found to be strongly correlated with average long-run growth, such as investment rates or trade openness, do not seem to initiate accelerations of economic growth. This suggests that what the standard literature identifies as correlates of growth may not be the factors that are needed to ignite it.

This chapter is an overview of the recent literature which studies the within-country growth patterns and tries to, among other things, learn about the nature of the growth process from analyzing differences in growth patterns such as those in Figure 24. This approach highlights the complex nature of growth and implies that studying "growth transitions", i.e. switches between periods of fast growth, stagnation, and collapse is essential for understanding the process of long-run growth. We begin by discussing early research that emphasized the lack of persistence of growth and the diversity of growth experiences among developing countries. We then summarize a series of more recent papers that look at growth transitions. Here we extend one of our earlier contributions to look at growth transitions going back to the late 19th century. We also discuss the idea of modeling growth in a non-linear structure of multiple growth regimes and transitions between them. Here too, we extend our earlier work by studying the role of macroeconomic policies in shaping growth patterns. We conclude by highlighting the achievements of the literature so far and pointing to potentially fruitful avenues for future research.

7 Lack of Growth Persistence

The traditional analysis of growth assumes that there exist specific characteristics of countries which are conducive to development. They either affect the growth rate of the economy along a balanced growth path (BGP) or the level of the BGP or both. Among such factors suggested by theory and explored empirically are investment rates, population growth rates, quality of institutions, development of financial markets, quality of macroeconomic policies, openness to trade, and many more. To keep our discussion general, we will refer to any such growth-enhancing factor as X. An increase in X will, therefore, shift the BGP up or increase its slope. In either case, a monotonic convergence to the new BGP follows. Once on the BGP, of course, the economy will grow at a constant rate. It is instructive to start by asking why, in this framework, would the growth rate of an economy change? Most models predict that if a country is not on its BGP but is approaching it from below, growth will fall monotonically. Similarly, if a country is above the BGP growth will increase monotonically. Both of these possibilities suggest smoothly evolving growth and a reasonably large degree of persistence of growth rates. Leaving aside, for now, the possibility of frequent shocks that move the economy away from the BGP, the only way to get growth to change non-monotonically is to have changes in X, i.e., to have changes that affect the BGP. If the variable X, which determines the position and slope of the BGP jumps around a lot, so will growth. Conversely, if X is reasonably stable, we would expect growth rates to be stable, too. However, they are not. One of the first papers to draw attention to the variability of

the growth process was Easterly et al. (1993). Specifically, they computed the correlation of growth rates across decades (e.g., 1960-70 and 1970-80) as well as longer time periods (20 and 30 years) in a sample of Penn World Table countries and found it to be quite low: depending on sample and period the correlation coefficient was around 0.2-0.3. That is, countries that developed rapidly in one decade are unlikely to be found in the group of fast growers in the following ten years and conversely, slow growers are likely to pick up speed.

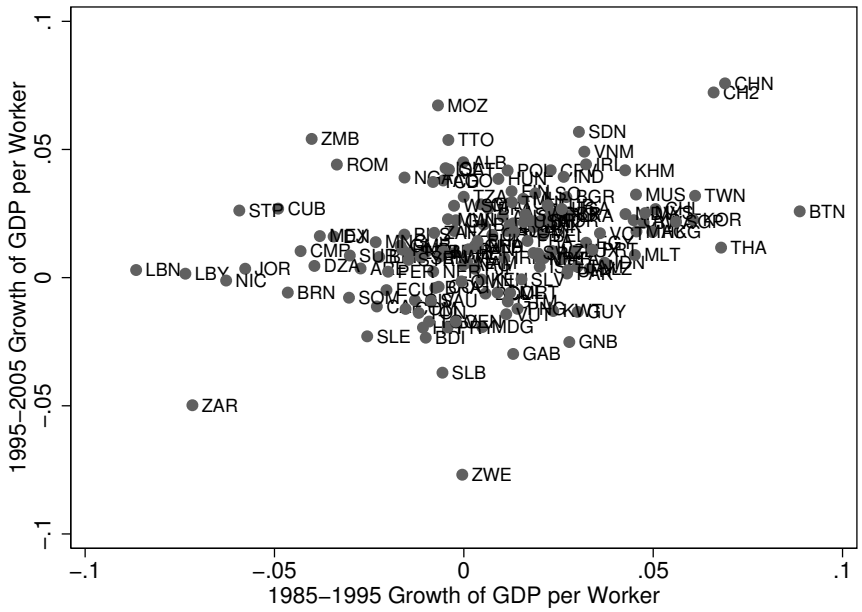


Figure 25: Lack of growth persistence. Growth in GDP per capita 1985-95 versus 1995-2005.

Here we re-do the same exercise using more recent data. In Figure 25 we plot the average growth of GDP per worker between 1985 and 1995 on the horizontal axis against the average growth in the following decade using 150 countries in the PWT 6.3 data set. Just like Easterly and his coauthors, we find very little persistence; the correlation coefficient is only 0.3.[25] In Table 11 we report the results of regressing growth in a given decade on growth in the previous one. While the relationship is positive (although not always significant), the explanatory power of the regression never exceeds 11%.

Perhaps then the growth determinants – the X's which much of the empirical growth literature sought to identify – vary over time. Easterly et al. consider this possibility but as they point out most growth determinants suggested by theory are very persistent: investment rates, trade openness, and even government policies do not vary much from decade to decade. In fact, one of the most robust correlates of development is the quality of institutions, a characteristic which is usually thought to be a deep-rooted and very slow-moving variable.

This leaves the possibility that the growth rates we observe are just a consequence of random shocks pushing countries out of steady states and the transitional dynamics that follows

[25]It is even lower when we keep two outliers: Liberia (whose output declined by an average 22% per year between 1985 and 1995) and Equatorial Guinea (whose output increased by 28% annually during the decade following 1995.)

	1995-2005	1985-1995	1975-1985
Growth in Previous Decade	0.226	0.326	0.121
	(0.059)	(0.075)	(0.109)
Constant	0.012	0.004	0.006
	(0.002)	(0.002)	(0.004)
R-squared	0.086	0.110	0.002
Obs.	150	146	112

Table 11: Update on Easterly et al (1993). Growth over a decade regressed on growth during previous decade.

such shocks. However, Pritchett(2000) looks more closely at growth in developing countries and concludes that a complex set of growth patterns can indeed be identified. These patterns often do not resemble a shock-and-monotonic-transition-back-to-BGP scenario. Pritchett writes *"[S]hifts in growth rates lead to distinct patterns. While some countries have steady growth (hills and steep hills), others have rapid growth followed by stagnation (plateaus), rapid growth followed by a decline (mountains) or even catastrophic falls (cliffs), continuous stagnation (plains), or steady decline (valleys)."* He concludes that the empirics of growth should focus on identifying factors that initiate and stop growth, instead of analyzing what explains average growth.

8 Growth Transitions

Following the contributions by Easterly et al. (1993) and Pritchett (1998) several recent papers have focused attention on growth transitions, i.e., points in time when a substantial shift in growth occurs, such as an acceleration when the rate of expansion of GDP per capita suddenly picks up significantly for an extended period. The main focus of these papers is to identify such turning points.[26] The common finding in all of these papers is that such large growth changes are a common phenomenon in both rich and developing countries. In particular, growth accelerations – defined in one paper as periods of rapid growth over 3.5 % per year (but usually much higher) – are quite common even among countries that are regarded as unsuccessful developers. That is, now and then even poor countries grow rapidly for a significant time. One of the key conclusions from this research is that igniting

[26]In this chapter, we focus on papers employing statistical methods to detect and analyze growth transitions. Another approach is to look at case studies, that is analyze the development history of a single country at a time with close attention to economic, political, and social changes. While important, this approach offers a limited possibility for generalization of results, and we view it as complementary to the systematic statistical approach. See the volume edited by Dani Rodrik (2003).

rapid growth and sustaining it are two very different enterprises and that the latter seems much more difficult (see Rodrik 2005). This is an important finding for policymakers but also for the field of economic growth because it casts doubt on the applicability of standard growth models to the question of economic development. The obvious next step in this literature is to determine what forces lead to growth accelerations and how they can be sustained. Here the literature has been less successful. Each of the contributions described below attempts to shed some light on the causes of growth transitions, but our understanding of this phenomenon is still limited.

Hausmann et al. (2005) are the first to develop a formal methodology for identifying growth accelerations. They define "growth acceleration" as an episode satisfying three criteria: (1) growth of GDP per capita exceeds 3.5% per year, (2) the increase in growth rate exceeds 2 percentage points, and (3) after 7 years output per capita exceeds the highest level attained prior to the episode. They use a spline regression to identify such episodes in a large sample of countries between 1950 and 2000. To their surprise, they find a great many accelerations; there are a total of 83 accelerations in their sample during the 36 years where their methodology allowed for accelerations to occur. This implies that an average country would have about a 25 % chance of experiencing a growth acceleration per decade. In fact, 60% of the countries in the sample had at least one episode of acceleration, and 23% had at least two. The accelerations were also significant in magnitude with an average of 4.7 percentage points increase in growth. Hausmann and co-authors also investigate the causes of growth accelerations. They run a probit where the dependent variable is a dummy that takes the value of 1 around the time of a growth acceleration and 0 otherwise. The list of covariates in their regressions includes a terms-of-trade shock, political regime change, and economic liberalization. They find many results consistent with the conventional wisdom in the growth literature: episodes of financial liberalization are positively correlated with the probability of experiencing a growth acceleration, economic reforms help produce more sustained accelerations, while shocks tend to produce short-lived growth. Additionally, they find that the negative impact of a movement towards autocracy is much larger than the positive impact of a movement towards democracy. However, many growth accelerations do not appear to be spurred by any apparent changes in standard growth determinants and, equally interestingly, many instances of reform fail to produce fast growth. As the authors emphasize, growth accelerations are surprisingly hard to explain, i.e., even if some of the variables have a statistically significant effect, the overall predictive power of these regressions remains quite low.[27]

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[27]de Haan, J., and Jong-A-Pin (2007) use a different indicator of growth accelerations and find that they tend to be preceded by economic reforms and that they are more likely to take place after the start of a new political regime. In a related paper, Jones and Olken (2005) study in more detail the impact of the accidental death of a political leader on the subsequent growth performance of the country he was ruling. They find robust evidence that the impact of the death of a leader, particularly in an autocracy, has a positive and significant impact on growth. Imam and Salinas (2008) study growth accelerations in Sub-Saharan Africa and find that they are mostly associated with external shocks, episodes of economic liberalization, political stability, and geographical variables such as proximity to the coast. On the other hand, high levels of corruption, as well as falling domestic credit, seem to be correlated with sharp growth decelerations. Aizenman and Spiegel (2010) focus on take-off from stagnation to rapid growth (i.e., they exclude accelerations from already rapid growth to even higher one) and explore, among other factors, the

Jones and Olken (2008) extend the analysis of Hausmann et al. to include both accelerations and decelerations in growth episodes. They identify growth transitions using the Bai-Perron test (Bai and Perron 1998).[28] Their findings confirm that such episodes are frequent for most rich and developing countries; they detect 73 structural breaks in 48 of the 125 countries with at least 20 years of Penn World Table data. Of these transitions, 43 are "up-breaks" or accelerations, and 30 are "down-breaks" or collapses. The breaks identified by the Bai-Perron test are large: the mean change in growth during a break is 6.8 percentage points for "up-breaks" and - 6 percentage points for "down-breaks". Since their test seems to set the bar for identifying an acceleration higher, they find fewer of them than Hausmann et al. (2005). To better understand the nature of growth transitions, Jones and Olken (2008) look for significant changes in main macroeconomic variables and measures of institutions around the time of the transition. First, they perform a standard growth decomposition separating growth of GDP into that of physical capital and the residual (TFP) and find an interesting asymmetry whereby accelerations are associated with rapid TFP growth but not significantly faster capital accumulation. "Down-breaks" are associated with declines in both TFP and capital accumulation. They fail to find any significant change in institutional variables at the time of growth breaks. Of the macroeconomic variables, accelerations appear to be associated with a significant increase in trade (both imports and exports) while collapses coincide with increases in nominal instability (increase in inflation and nominal exchange rate depreciation).

In Cuberes and Jerzmanowski (2009), we follow a similar approach. We also start by identifying and documenting structural breaks in the growth process using the Bai-Perron approach in the following specification

$$y_t = \alpha_n + g_n t + \varepsilon_t \text{ for } t_n < t \leq t_{n+1}, \forall t = 1, ...T, \tag{6}$$

where y_t represents the logarithm of real output per worker relative to the United States, the variable t indexes time, while n indexes growth breaks, g_n represents the trend growth following n-th break, and ε_t is the error term. That is, each time a break occurs, there can potentially be a change in the intercept parameter, the slop, or both. We focus our attention on the changes in growth rate (slope parameter).

We use data on real output per worker from the Penn World Table (Heston et al., 2006) for the period 1950-2000. We find a total of 208 breaks, which corresponds to 1.8 breaks per country. Of these breaks, 49% represent increases in the growth rate. Figure 26 shows the case of Argentina, where the Bai-Perron methodology finds two structural breaks. The first break occurs around 1980, and it corresponds to a substantial decline in Argentina's growth rate, which moves from positive (catching up to the U.S.) to negative (falling behind it). The second break occurs around 1990, and this time growth becomes less negative without changing its sign. The graph also shows the confidence intervals of these estimated breaks.[29]

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composition of the country's output.

[28] See also Ben-David et al. (2003).

[29] One concern about the Bai-Perron test of structural breaks is that it relies on asymptotic properties.

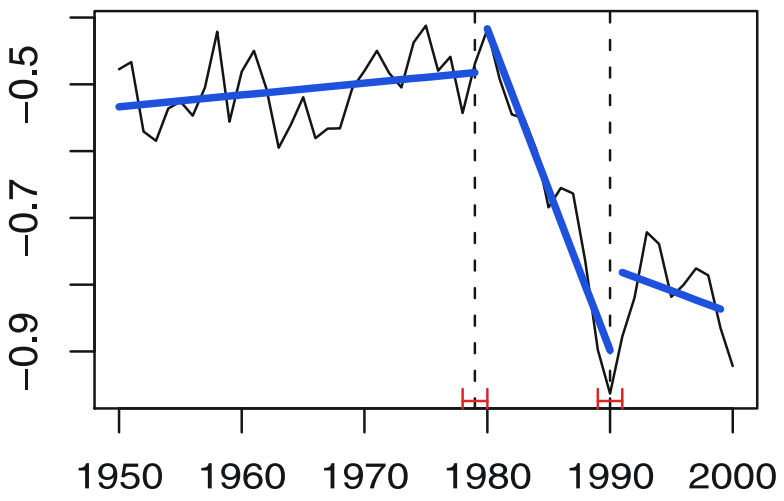


Figure 26: Argentina's log real output per worker relative to the US. The vertical dashed lines indicate Bai-Perron break dates. The solid lines show the estimate of the trend part of $y_t = \alpha_n + g_n t$. The figure also shows the confidence intervals around the estimated break dates.

Next, we analyze the patterns in the trend-growth changes we have identified. We are particularly interested in the link between political institutions and the magnitude of growth swings. We are motivated by the strong evidence that democratic countries are less volatile (Rodrik 2000, Quinn and Woolley 2001). This interesting correlation proved to be much more robust than the democracy-growth relationship: while various studies find that the effect of democracy on growth is rather weak (Przeworski and Limongi 1993, Barro and Sala-i-Martin 2003), the link between a greater degree of democracy and lower economic instability appears very robust. For example, Rodrik (1999) provides compelling evidence that democratic countries experience less volatility. However, this literature usually measures volatility using the standard deviation of *annual* growth rates. Having uncovered large and frequent medium-term swings in growth, we investigate whether this sort of lower frequency volatility is also related to political institutions. In particular, we estimate: (i) how the magnitude of trend-growth changes varies with the degree of the country's democracy, and (ii) whether democracy affects the likelihood of experiencing large trend-growth swings.

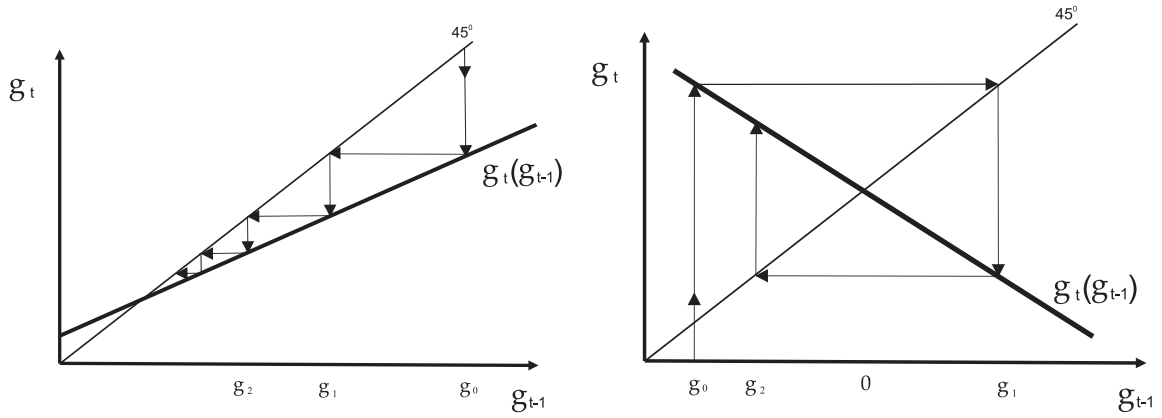
To analyze the dynamics of growth transitions we estimate the following regression

$$g_{in} = \beta_0 + \beta_1 g_{in-1} + \varepsilon_{in}, \tag{7}$$

where g_{in} represents the growth rate in country i after break n estimated from (1). We

Since we use relatively short time series throughout the analysis, one may be concerned about inference based on asymptotic results. To check the robustness of our break detection results, we employ a Bayesian approach based on Wang and Zivot (2000) to estimate these breaks and compare our results with the ones obtained using the Bai-Perron method. Our comparison focuses on the years at which breaks occur with each method. The average difference (in absolute value) between the two estimates is 0.33 years, and its standard deviation is 3.23. In 67% of the cases, the break dates are identical, and the difference is no larger than 5 years 92% of the time.

are interested in the coefficient β_1, i.e., the existence and direction of a relation between pre-break and post-break growth rates. Depending on the value of the β_1 parameter, we can have three interesting cases. First, if $\hat{\beta}_1 = 0$ then, on average, the growth rate before a break does not help predict the growth rate after it. If $\hat{\beta}_1 \in (0, 1)$ then there is monotonic convergence in growth rates. This is a reversion-to-the-mean dynamic; i.e., exceptionally fast growers before the break still grow fast after the break, just slightly less so; in the long run, there is convergence to the BGP. Figure 27(a) illustrates the dynamics of this system for the case where initial growth is above the long-run equilibrium value. When interpreting the figure, recall that "periods" here are not calendar years but break dates. Thus growth may remain constant for a long time, but when a break occurs, the adjustment is as illustrated in the figure. Figure 27(b) shows the case in which $\hat{\beta}_1 \in (-1, 0)$ and so growth fluctuates from above and below the BGP during its transition, in other words, the process is characterized by growth cycles or reversals.



(a) Monotonic Convergence (b) Cycling

Figure 27: *Panel (a): Monotonic convergence in growth rates ($\hat{\beta}_1 \in (0, 1)$). Panel (b): Growth reversals ($\hat{\beta}_1 \in (-1, 0)$).*

To see if the degree of democracy affect the dynamics of growth transition we split the sample into high and low democracy groups and estimate equation (7).[30] We use the variable *polity2* from the dataset *POLITY IV* (Marshall and Jaggers, 2002) as our measure of democracy.[31] As additional covariates in the estimated version of (7) we also include the level of democracy and the log of initial income (to capture the standard convergence dynamics) and decade dummies. We use alternative panel data estimators, but in Table 12 we only report the estimates obtained using the dynamic Arellano-Bond estimator. While among the democratic countries we find no significant relationship between the pre and

[30]In Cuberes and Jerzmanowski (2009) we use an interaction term to avoid picking an arbitrary cut-off level of democracy to split the sample.

[31]*polity2* is an average of autocracy and democracy scores. It ranges from -10 to 10 (-10 = high autocracy; 10 = high democracy) and includes specific indexes meant to capture constraints on the executive, the degree of political competition, the legislature effectiveness, etc.

post break growth rates ($\beta_1 \approx 0$), in the less democratic sample we see evidence of growth reversals ($\beta_1 < 0$). That is, periods of exceptionally high growth are, on average, followed by periods of exceptionally low growth, and vice versa. Growth rates in less democratic economies are not monotone; rather, they cycle between high and low (or even negative) values as in Figure 27(b). Interestingly, the income level does not affect the propensity to experience growth reversals.

	Low Democracy	High Democracy
Growth before Break	-0.374**	0.083
	(0.146)	(0.202)
Initial Income	-0.074**	-0.069***
	(0.036)	(0.018)
Democracy	0.000	0.000
	(0.001)	(0.001)
Constant	-0.006	0.003
	(0.005)	(0.005)
Obs.	84	49

Table 12: Penn World Table data. Arellano-Bond.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Using a probit and linear probability models, we also find that the propensity to experience substantial swings of trend-growth is not uniform across countries – less democratic countries are more susceptible to it. When compared with factors commonly associated with volatility, such as measures of quality of institutions, macroeconomic policies, and financial development, as well as income level, we find that democracy is the most robust predictor of a country's propensity for growth reversals. Finally, we test whether our results can be explained by the fact that countries which rely heavily on natural resources tend to be less democratic and also exposed to large shocks (in the form of large swings of world prices of the resources they export). While shocks to prices of natural resources appear to contribute to the propensity for growth reversals, they do not account for the effect of democracy.[32]

[32]One may think that greater growth variability in less democratic countries is a reflection of more frequent regime changes: i.e., whenever a ruler changes there is an abrupt change in growth. While Jones and Olken's (2005) result suggest leaders do matter for growth in less democratic countries, the average time between breaks is usually shorter than many autocrats' tenure. Easterly (2011) studies this question directly and concludes that growth is equally variable within autocrats' tenure as between them.

In the above analysis, we use data on output per worker from the Penn World Table covering, for most countries, the period 1960-2000. Here, in order to explore the presence and dynamics of growth transitions in a longer time series, we extend our analysis to the historical figures on output per capita from Maddison (1995, 2001) which covers the period 1870-1994.[33] We again use the Bai-Perron test for structural breaks and we exploit the same measures of democracy.[34] We find that during this period the average number of breaks per country in the Maddison sample is around 4. In 48% of the cases these breaks represent an increase in growth. The lowest number of breaks per country is 2, and the largest is 8. Figure 28 presents an histogram of the changes in growth rates at the time of the structural break. Since in the Maddison data the number of countries with available information on income changes significantly over time, going from 14 countries in the 1870s to 29 in the 1920s and to 54 from the 1960s on, we divide the number of breaks by the number of countries in each year to better assess the relative frequency of breaks.

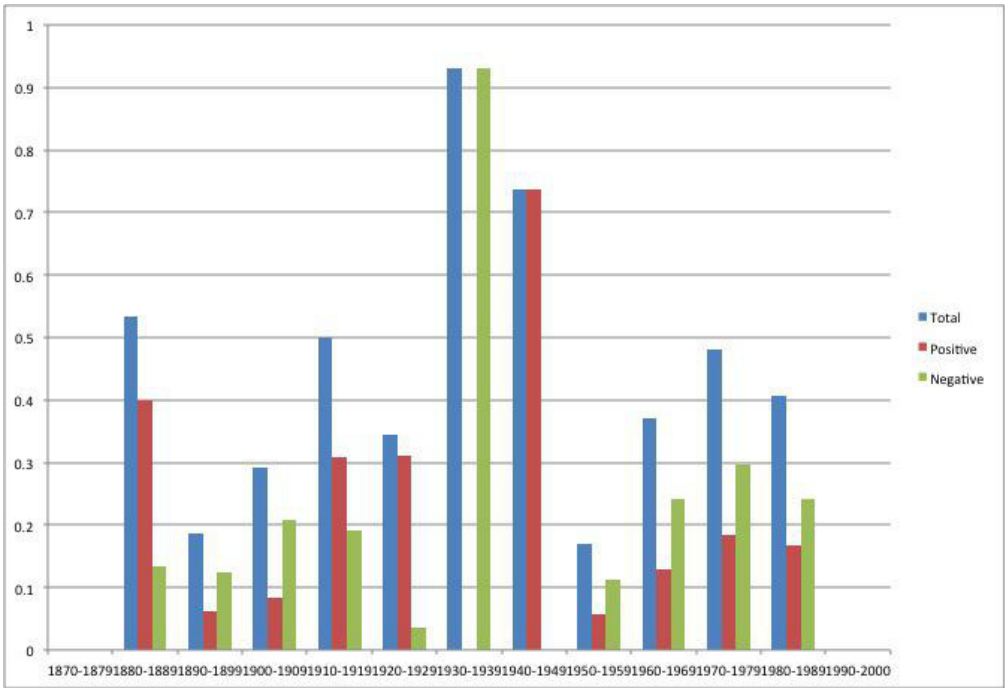


Figure 28: Frequency of growth breaks in the Maddison data set.

The first observation is that the frequency of breaks does not show a very clear trend if one considers the entire period. The incidence of breaks was quite high in the 1880s, and in

[33]The 112 countries in Maddison's unbalanced panel are: Argentina, Australia, Austria, Belgium, Bangladesh, Bulgaria, Brazil, Canada, Chile, China, Colombia, Cote d'Ivoire, Congo Rep., Czech Republic, Denmark, Egypt, Ethiopia, Finland, France, Germany, Ghana, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, Kenya, Korea Rep., Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, South Africa, Spain, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Turkey, United Kingdom, Venezuela, and Yugoslavia.

[34]Using the Bayesian methodology of Wang and Zivot (2001), we get similar results.

most cases, they represented sudden increases in growth. After that decade, the frequency of breaks decreased and then rose again until the 1920s. The vast majority of structural breaks that we detect in the 1930s were negative, indicating the economic turbulence of the Great Depression. The opposite happens in the aftermath of WW2 (the 1940s), a period of very frequent growth accelerations that reflect the economic recovery in many of the countries in our sample. The number of breaks dropped drastically in the 1950s and rose again in the last three decades of the studied period. It is noticeable that in these decades growth decelerations were more common than accelerations. The key conclusion we draw from this exercise is that the phenomenon of growth transitions is not unique to the modern period studied by most papers in this literature.

Next, we ask whether, as was the case in the modern period PWT data, there is a tendency for less democratic countries to experience larger growth swings. As we did in Cuberes and Jerzmanowski (2009), we split countries into two groups: those with high democracy and those with low democratic scores. [35] We then estimate an equation (7) including as regressors initial income, the initial level of democracy, and time dummies for each decade. Table **??** displays the results obtained using the fixed effects estimator.

	All Coutries		High Democracy		Low Democracies	
Growth before Break	-0.307***	-0.157	-0.223	0.174	-0.388***	-0.468***
	(0.095)	(0.1)	(0.148)	(0.157)	(0.113)	(0.134)
Initial Income	-0.029	-0.075***	-0.033	-0.109***	-0.048***	-0.062***
	(0.018)	(0.023)	(0.027)	(0.038)	(0.015)	(0.017)
Democracy		0.000		-0.001		0.001
		(0.001)		(0.001)		(0.001)
Obs.	130	85	74	46	56	39

Table 13: Growth Reversals in Maddison data; Arellano-Bond. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

In the entire sample there is evidence of growth reversals even after controlling for initial income (column 2), although it is not statistically significant once one includes initial democracy as an additional control (column 3). Columns 4 and 5 show that democratic countries exhibit no cycling. The coefficient associated with growth before the break is not significant

[35] In both cases, the cut-off here is chosen to be the median value of polity2 in the sample, i.e. countries with a democracy score equal or larger than this threshold are labeled "high democracies," and below it, they are considered "low democracies. Alternative cutoffs deliver very similar results.

and it even turns positive. On the other hand, non-democracies experience growth reversals. Columns 6 and 7 show that, in these countries, even after including democracy as an explanatory variable, periods of rapid growth are followed by periods of much slower growth, and vice versa. This is very much consistent with the results obtained using the PWT data for the period 1950-2000.[36]

The above exercise gives us further confidence in the phenomenon of growth reversals first described in Cuberes and Jerzmanowski (2009). Of course, the natural question to ask is why less democratic institutions lead to larger growth swings? We hypothesize, following arguments made by Acemoglu (2008) and Aghion et al. (2007), that less democracy implies larger barriers to entry for firms and thus a larger degree of concentration in production. With less diversification comes the potential for larger growth swings. Using data on manufacturing concentration from the U.N's Industrial Statistics Database (revision 2), we find support for this argument. Specifically, we first calculate the Herfindahl-Hirschmann index of concentration for the manufacturing industry in each of the 181 countries in our sample during the period 1963-2003.[37] We then regress this index against the POLITY IV measure of democracy as well as per capita GDP and its square. Table 14 shows that the coefficient on democracy is negative and significant at conventional levels, indicating that the manufacturing sector is indeed less concentrated in more democratic countries, even after controlling for income effects.

Another reason less democratic countries may experience growth reversals is due to social conflict. For example, Rodrik (1999) shows that the growth slowdowns of the 1970s were larger in less democratic and more ethnolinguistically fictionalized countries. He argues that both of these characteristics lead to more internal conflict because there are more groups in the society who may have opposing interests, and the lack of democracy prevents peaceful resolution of disputes among them. It is plausible that a mechanism like this could lead to growth reversals. In early stages of rapid growth, its benefits are usually distributed unevenly among the various groups in the society (workers vs. capital owners, exporters vs. import-competing producers, educated vs. uneducated workers, etc.). If the rising income inequality leads to social tension and conflict, and there are not peaceful resolution mechanisms, internal turmoil and a growth collapse may be a direct consequence of the preceding rapid growth. But there has been no formal test of this hypothesis

An interesting alternative explanation for growth reversals has recently been suggested by Boucekkine and Pintus (2011). They develop an AK model of a small open economy with borrowing constraints that allows for both leapfrogging and growth reversals. In their model, economies have access to the international capital market, but there exists a borrowing limit determined by the amount of available collateral. The novel element comes for the fact that, if it is not possible for the borrower to commit to a future investment plan, the lender uses the borrower's past stock of capital as collateral. This assumption leads to interesting history

[36]It is also noticeable that in all cases, richer countries tend to experience more slow growth in the next regime, indicating some degree of neoclassical convergence. The initial level of democracy, on the other hand, is uncorrelated with future rates of growth.

[37]The dataset contains information on 29 manufacturing categories at the 3-digit level of disaggregation.

	Value Added	Output	Value Added	Output
Democracy	-0.159***	-0.166***	-0.111*†	-0.121**
	(0.052)	(0.048)	(0.070)	(0.061)
GDP p.c.			-0.386	-0.623**
			(0.269)	(0.263)
GDP p.c. Squared			0.019	0.034**
			(0.018)	(0.017)
Constant	2.880***	2.739***	4.629***	5.402***
	(0.136)	(0.127)	(1.060)	(1.037)
R^2	0.072	0.084	0.109	0.127
Obs.	2695	2623	2649	2591

Table 14: Democracy and Industrial Concentration. Pooled OLS regression of the Herfindahl-Hirschman index in manufacturing on democracy, GDP per capita, and GDP per capita squared. Standard errors clustered by country. *† < 0.12, *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

dependence: the BGP of the economy depends not only on the initial level of capital but also on its past growth path. This dependence of the borrowing limit on a lagged capital stock is also key to generating growth reversals and/or leapfrogging. If the delay – the number of periods before the borrowing date that the lender takes into account as collateral – is short, then history does not matter much. Therefore, a rich country that had a recent slow growth will receive a low amount of credit, and therefore, it will grow slowly in the future. So, in this case, there will be leapfrogging and no growth reversals (a country that had performed poorly will continue to do so in the future). Growth reversals (instances when growth goes from above BGP value to below it) are also possible. They occur when a fast-growing country faces the borrowing constraint with a sufficiently long lag. Since its capital stock was low in the past, its current debt limit is low, and the lack of foreign capital inflow leads to a growth slowdown. There is also an intermediate case where both leapfrogging and growth reversals are possible. The authors argue that under reasonable parameter values, the model is able to replicate characteristics of growth reversals reported in Cuberes and Jerzmanowski (2009). The paper by Boucekkine and Pintus is especially noteworthy because it represents one of the first attempts to construct a theory of growth transitions.[38]

Finally, we should note that the theories of poverty traps would appear to be natural explanations for growth transitions. After all, most such models predict a long period of stagnation or slow growth (poverty trap) and a sudden acceleration of growth once the

[38]Aghion et al. (2004) are motivated by more high-frequency volatility but their model, in which periods of economic boom put upward pressure on the price of the scarce domestic factor of production which leads to a slowdown, suggest another interesting mechanism for generating growth reversals.

economy escapes the trap. However, most of these theories also imply that the escape from the trap is once and for all. Easterly (2006) uses the Bai-Perron test to identify episodes of permanent growth take-off, i.e., growth permanently transiting from zero to a positive value, which he interprets as evidence of emergence from a poverty trap. He finds very few such episodes. This is consistent with our findings that growth accelerations, especially in non-democratic countries, are ultimately reversed.

One conclusion reiterated in the papers discussed above is that initiating growth and sustaining it require different policies and/or environments. For example, Hausmann et al. (2005) show that standard economic and political fundamentals (economic reform, political regime change, terms of trade shocks, etc.) do rather poorly at explaining the timing of growth accelerations. A paper by Berg et al. (2008) asks a very natural complementary question: what is the role of standard growth determinants in sustaining growth? Of course, knowing what makes growth sustained is key for policymakers in developing world, perhaps more important than knowing how to start it since accelerations happen quite often (even if we don't fully understand why). To investigate the duration of growth spells Berg and coauthors estimate a proportional hazard model using a host of potential determinants including shocks (world interest rate, terms of trade), institutions, macroeconomic stability, social and economic homogeneity, human capital, and trade and financial openness (including structure of exports and capital inflows). Where appropriate and possible, the authors include the initial level as well as the change during the spell for the explanatory variables. To measure growth spell duration, they use a combination of the Hausmann et al. (2005), and Jones and Olken (2008) approaches to dating growth accelerations. Specifically, the authors focus their attention on episodes of growth acceleration to above 2% followed by deceleration to below 2% (complete spells) or end of sample (incomplete spells). Among their findings, they report that democracy, income equality, macroeconomic stability as well as export orientation (including propensity to export manufactures, openness to FDI, and avoidance of exchange rate overvaluation) all help sustain growth spells. Perhaps surprisingly, violent conflict doesn't appear to matter. Conditional on the covariates the authors usually find positive but often not significant duration dependence.[39]

9 Growth Regimes

Just as averaging growth over long periods of time masks the diverse experience of growth accelerations and collapses, the binary classification of a growth transition (acceleration versus its absence) removes some important variation across countries and time. In fact, in Pritchett's analysis cited above he distinguished multiple growth patterns, of which accelerations (and collapses) were just one example. In another paper, Pritchett (2003) suggest that an appropriate way to think about growth is to imagine that there exist multiple growth states, or regimes, each of which represents a distinct growth behavior.

Pritchett illustrates his idea with a simulation of a simple model with four states: a stagnation state with constant growth of 0.5 %, a convergence state with rapid growth, an implosion state with negative growth, and a state of steady growth at 1.8 %. He assumes that

[39]See also Johnson et al. (2007).

the state characteristics (growth rates in each state) and that transition probabilistically are constant and identical for all developing countries. He then calibrates the transition matrix in so that the world economy with 103 developing countries and 14 developed countries (which are restricted to always be in the steady growth regime) matches the observed dispersion of GDP per capita in 1995. His main message is that a model of this kind has the potential to generate a wide range of growth patterns among developing countries as well as account for low persistence of growth discussed above. Notice that in this model, it is only the randomness of the (common) transition dynamics that generates the diversity of growth patterns across developing countries. However, in practice, there is no particular reason to think that transition probabilities are the same for all countries. The idea that country-specific characteristics affect growth by determining transition probabilities leads to some interesting possibilities.

To illustrate the idea, consider the following simple example. Suppose that there are only two possible states of the world - one in which the economy stagnates and another in which it grows at 3% per year. If over time a country switches between regimes, growth will be an uneven process. This is, of course, what growth looks like for many countries. For example, Japan accelerated in the 1950s and '60s and then stagnated in the 1990s, while India grew slowly until it took off in the 1990s. If we further assume that these transition probabilities themselves depend on some country-specific characteristic X (e.g., quality of institutions), we have a model where country characteristics, such as policies or institutional quality, shape long-run growth by affecting the frequency of the two regimes.

Within a standard approach to growth, if a characteristic X is "good" for growth then countries with a high level of X are expected to be growing fast (say, at 3% per year) and countries with low levels of X are expected, all else equal, to be growing slowly (say, stagnate); this is a world where "you either have what it takes for growth, or you don't". In the regimes approach it becomes possible for country characteristics to be favorable to growth by affecting the transition probabilities; good X means more frequent episodes of growth, but it is possible for a high-X country to stagnate just as it is possible for the low-X country to grow from time to time. A stylized illustration of the switching process of growth for two countries is presented below in Figure 29.

Country 1 has a lower level of the growth-conducive characteristic X, and so it spends more time in the stagnation regime. However, it is capable of periods of fast growth. In fact, when it is growing, it grows as fast as country 2. Of course, country two with high X visits the growth regime more frequently, and so, in the long run, it will grow faster. However, it too stagnates from time to time. What determines the long run growth performance of an economy is the within-regime dynamics (3% vs. 0), and the frequency of visits to the two growth regimes. The growth regimes approach calls for identifying the regimes as well as the properties of transitions, including the set of X's which may include present-day economic and political characteristics of the country, regional or world variables, the country's history, etc.

Jerzmanowski (2005) estimates a model where transition probabilities are allowed to differ across countries, as was the case in the example of Figure 29. He builds on Pritchett's insights and applies the framework of Markov-switching regression to identify the regimes. Assuming that there are four regimes, each with a distinct AR(1) growth process leads to

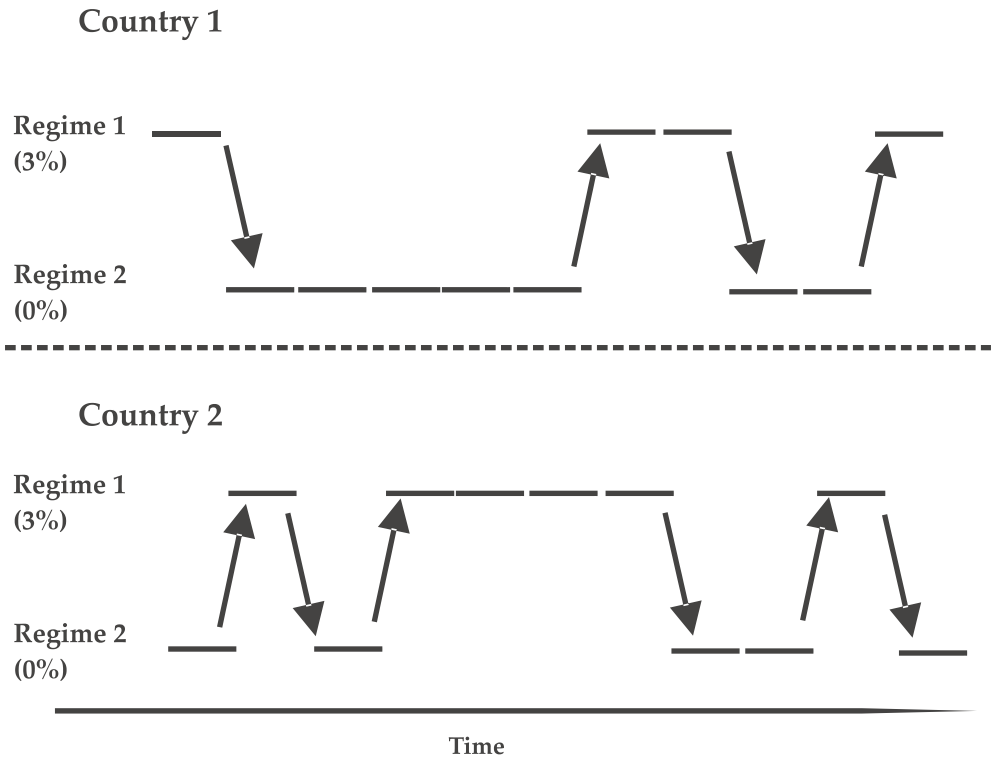


Figure 29: A stylized illustration of the switching process of growth. Some country-specific characteristic X makes the growth regime more likely (e.g., good institutions). Country one has a low value of X, and so it spends more time in the stagnation regime. However, it is capable of periods of fast growth. Country two has high X, and so it visits the growth regime more frequently. However, it too stagnates from time to time.

the following model[40]

$$\hat{y}_{it} = \alpha_{s_t} + \beta_{s_t}\hat{y}_{it-1} + \varepsilon_{it}^{s_t}, \tag{8a}$$

$$\varepsilon_{it}^{s_t} \sim i.i.d.N(0, \sigma_{s_t}^2), \tag{8b}$$

where $\hat{y}_{t\,i}$ is the growth rate of country i in period t and s_t indicates the regime that is in effect at time t, that is for every t, $s_t \in \{1, 2, 3, 4\}$.

The growth process is fully characterized by the above within regime dynamics (8) and the evolution of regimes, which is assumed to follow a 4-state Markov process where the transition probabilities are allowed to depend on the country's quality of institutions. That is, $P\{s_{it} = k \mid s_{it-1} = j\} \equiv p_{jk} = p_{jk}(z_i)$ for $j, k = 1, ..., 4$, where z_i is a measure of the quality of institutions in country i. Thus unlike in Pritchett's simple simulation, transition probabilities are country specific. This model is estimated using maximum likelihood (see Jerzmanowski (2005) a for details). The resulting estimates consist of the within-regime parameters (α's,

[40]Unfortunately, the correct number of regimes cannot be tested with the simple likelihood ratio test. See Hamilton (1994) for discussion and references. The informal procedure followed by Jerzmanowski (2005) was to start with two regimes and increase the number of regimes as long as all estimated regimes appeared distinct.

β's, and σ's), the parameters of the transition matrix $p_{jk}(z_i)$ for $j,k = 1,...,4$, and the inference about regimes s_t for *t=1,...T*. We discuss them in turn.

Table 15 shows the parameter estimates. Each of the four AR(1) processes implies a different long-run growth rate, i.e., the average growth rate that would obtain if the economy were to remain in that regime indefinitely, given by $\alpha/(1-\beta)$ and shown in the last column. Notice that these average long-run growth rates (from which we derive the regime labels) do not fully characterize the regimes. In addition to the long run average performance, regimes differ significantly in the volatility of growth (σ) and persistence of growth shocks (β).[41] The stable regime corresponds to the growth experience predominant among developed economies, with a long-run average growth of about 2 percent. The volatility is relatively low, and there is a great deal of persistence in the growth process. The stagnation regime is characterized by no growth on average and larger volatility of growth shocks. In this regime, periods of growth and decline occur but are not very persistent. The crisis regime is an episode of large shocks to growth. While these shocks tend on average to be negative reflecting economic crises, the dispersion is very large and positive shocks are also possible. These shocks have no persistence. Finally, there exists the regime of fast, miracle-like growth with a long run average growth of 6% and modest volatility.

	Constant (α_s)	AR Coeff. (β_s)	Std. Dev.(σ_s)	Long Run Growth
Stable Growth	0.0132**	0.3761**	2.11%	2.12%
Stagnation	0.0010	0.1799**	4.56%	0.12%
Crisis	−0.0101**	-0.0045	13.16%	−1.00%
Miracle Growth	0.0536**	0.1417**	2.71%	6.25%

Table 15: Within regime estimates of $\hat{y}_{ti} = \alpha_{s_t} + \beta_{s_t}\hat{y}_{t-1\,i} + \varepsilon_{ti}^{s_t}$, and $\varepsilon_{ti}^{s_t} \sim i.i.d.\, N(0, \sigma_{s_t}^2)$ for each of the four states. The first column shows the constant term, the second is the autoregressive coefficient and the third is the estimate of the standard deviation of the error component. The last column shows the implied long run growth. A * denotes significance at 10% level, ** denotes significance at 5% level.

Figure 30 summarizes the estimates of transition matrices. Each of the four boxes plots the probability of moving from a given state to each of the four states as a function of the institutions index. For example, the upper left-hand side box shows the probability of moving from the stable growth state to each of the four states. The solid line shows the

[41] Note that the within-regime persistence of the growth process β, say 0.3761 for the stable growth regime, should not be confused with the persistence of the stable growth regime itself. The former is assumed to be a property of the stable growth process common to all countries, whereas the latter depends on the country-specific transition probabilities, which will be discussed below.

probability of moving to the stable state (i.e., in this case remaining in the same state), the dash-dot line shows the probability of moving to stagnation while the dashed and dotted lines show the same for crisis and miracle regimes, respectively. The upper right-hand side box shows the same set of plots conditional on the current state being stagnation and so on.

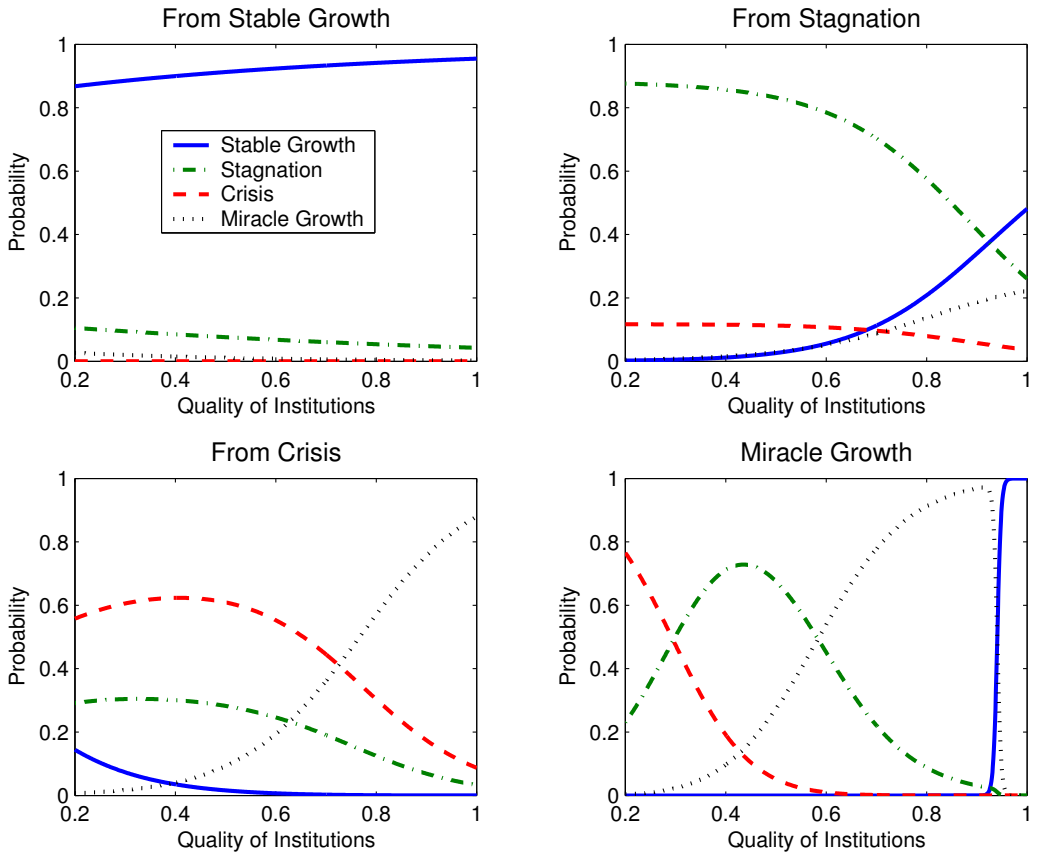


Figure 30: Transition probabilities as a function of the quality of institutions. The upper left-hand side box shows plots of the probability of moving from state one to each of the four states. The solid line shows the probability of moving to state one (i.e., probability of remaining in the same state), the dash-dot line shows the probability of moving to state two while the dashed and dotted lines show the same for state three and four, respectively.

The stable growth regime is very persistent for all values of the institutions index, but the persistence does increase with the quality of institutions. Stagnation is very persistent for weak-institutions countries, but this persistence falls off markedly with the quality of institutions above 0.6 (e.g., Turkey). For high quality of institutions countries, a period of stagnation is more likely to be followed by a reversal to stable growth. The lower left-hand side graph shows the probability of changing regimes conditional on the current state being the growth shock (crisis) state. Finally, the lower right-hand side graph shows the probability of changing regimes conditional on the current state being the fast growth state. For low-quality countries, a period of fast growth is very likely followed by a growth shock state. Intermediate quality countries are also not likely to remain in the growth regime for long and most likely revert to stagnation. However for mid-to-high institutions countries the

fast growth regime is very persistent.

Figure 31 shows the plots of the ergodic distribution of states for different levels of institutional quality. The most important feature is that countries with low quality of institutions spend about 60% of the time in stagnation, and only around 15-20% of the time growing at positive and sustained but moderate rates. For values of the quality of institutions above 0.4, the time spent stagnating starts decreasing while the fraction of time spent growing increases. However, the quality of institutions must be above 0.6 for stagnation to no longer be the most frequent state. Improving institutions also increases the time spent growing fast (Miracle Growth). For values of the index above 0.7 (e.g., Mauritius) more time is spent growing fast than stagnating.

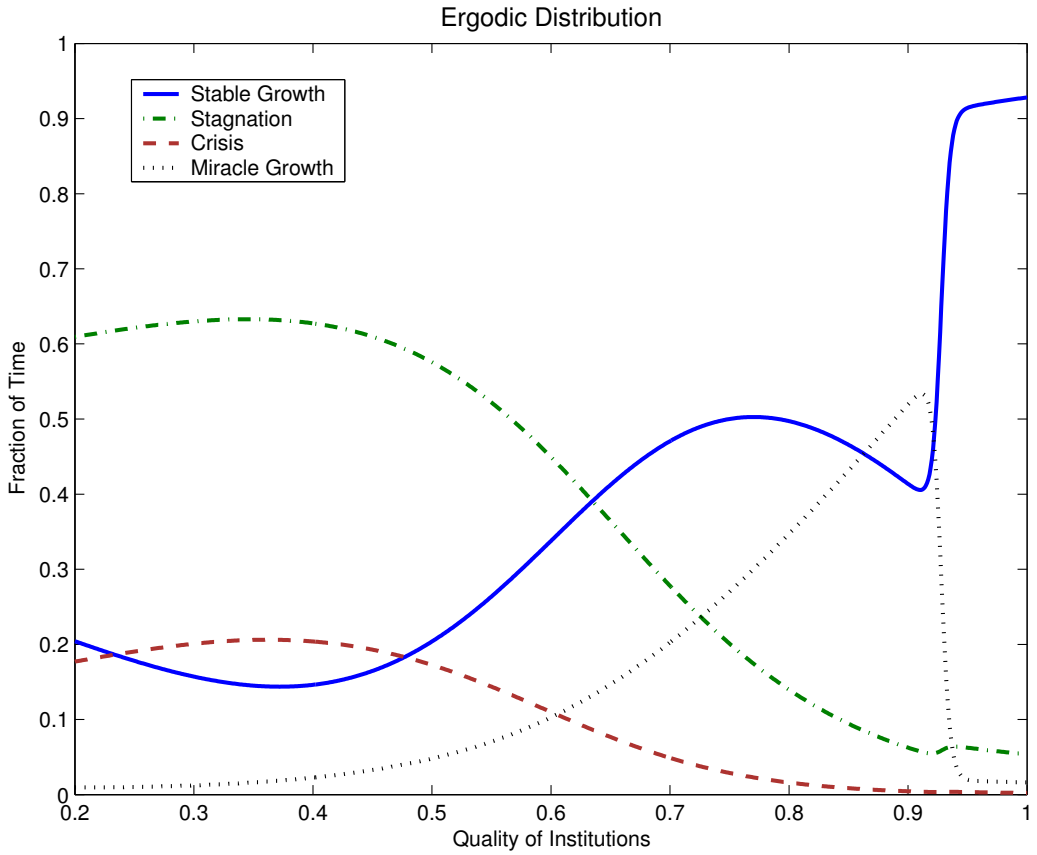


Figure 31: Ergodic probabilities of the four regimes as functions of the quality of institutions.

These estimated transition probabilities imply that institutions are more important in sustaining growth than in igniting it. In particular, low quality of institutions countries have a significant probability of entering growth regimes, however, the probability of exit is high. In the long run regimes follow an ergodic distribution where low quality of institutions leads to frequent stagnation and crises whereas high quality, while not ruling out stagnation or crises, reduces their frequency and increases that of the growth regimes.

These results suggest that randomness of the transition between regimes is not the only factor accounting for differences in growth patterns across countries. In particular, the quality of institutions, widely believed to be an important growth determinant, affect the

transition dynamics. High quality of institutions, such as a strong rule of law and protection of private property, increase the frequency of visits to favorable regimes but most importantly make them more persistent; countries with weak institutions are capable of growth takeoffs, however, they are unable to sustain them.

10 Policies, Institutions, and Regime Switching

Pritchett's (2003) simple simulation illustrated that a model which includes multiple growth regimes and random transitions between them can account for the large diversity of growth patterns. Jerzmanowski (2005) extends this insight by explicitly estimating a regime-switching growth model and allowing the transition probabilities to depend on the quality of the country's institutions. This raises a natural question about what other country characteristics influence the probability of transitions between regimes. In this section, we provide a novel analysis of this question. We focus on the role of macroeconomic policies.

The question of whether macroeconomic policies such as inflation, government spending, real exchange rate overvaluation, and trade openness matter for long-run economic growth has a long history in empirical growth literature. Early research on determinants of growth in a cross-section of countries found significant effects of macroeconomic policies on long-run growth (e.g. Barro 1991, Dollar 1992, Sachs and Warner 1995). However, much of the recent literature is more skeptical. Easterly and Levine (2003) argue that, after controlling for institutions, policies do not affect the level of income. Easterly (2005) shows that the findings of significant effects of policies on growth are driven by extreme outliers. Finally, Acemoglu et al. (2003) argue that once institutions are controlled for, policies do not matter much for growth and volatility. Here we re-examine the question of policies and growth, while explicitly accounting for within-country variation in the growth process. This framework is richer than the standard average growth analysis since it allows policies to work through multiple channels by differentially affecting the likelihood of growth accelerations, stagnation, and crisis. We use the regime probabilities obtained by Jerzmanowski (2005) to estimate the effects of policies on the frequency of the four growth regimes. We ask whether some policies are associated with a country spending more time in periods of growth, stagnation, or crisis.

In order to study the joint effect of institutions and policies on growth through their effect on regimes changes, one could follow the same approach as Jerzmanowski (2005) and extend the vector z in the transition probabilities matrix $p(z)$ to include measures of policy. In practice, the estimation is quite computationally intensive, even with only one variable. Instead, we use the inference about the likelihood of regimes obtained from the estimation of the baseline model. The logic of the approach is as follows.

Since the true value of the regime is unobservable, we can never know with certainty whether a given country is in any given state. However, conditional on the model, the estimated parameters, and all the observations for a given country, we can form inference about the probability of the regimes during the sample period. These *smoothed probabilities*, denoted by $\hat{P}(s_t = j|\mathcal{Y}_{m\,T})$, where $\mathcal{Y}_{m\,T}$ stands for the entire time series for country m, give us an estimate of the likelihood of each of the four regimes for country m at all sample dates

t. For example, $\hat{P}(s_{1979} = 1|\mathcal{Y}_{UST})$ tells us the (conditional) probability that the U.S. was in the stable growth regime in 1979. Figures 32 and 33 plot examples of the smoothed regime probabilities.

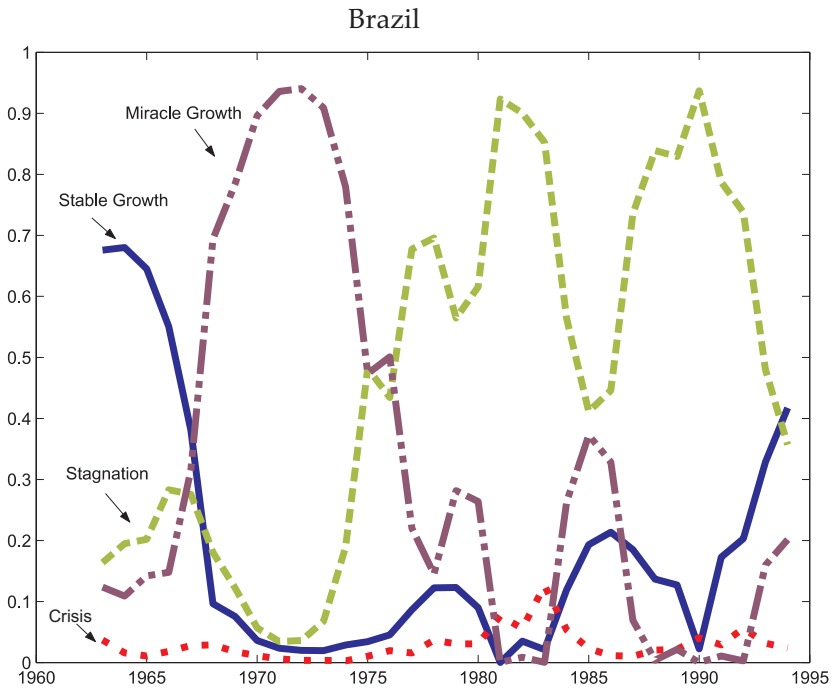


Figure 32: Regime probabilities: Brazil

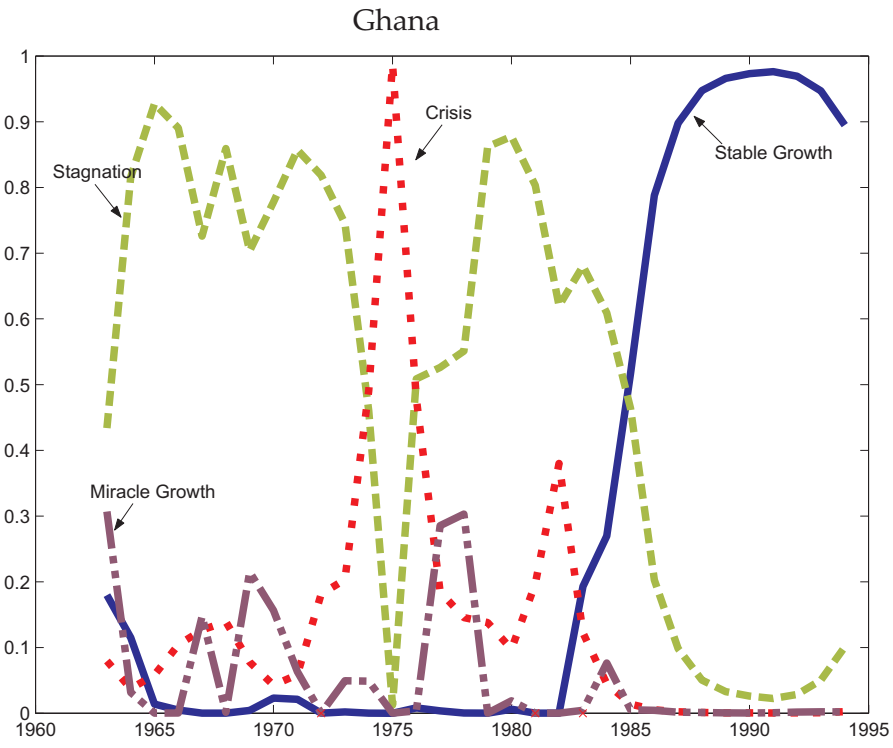


Figure 33: Regime probabilities: Ghana

Table 16 below presents the smoothed probabilities averaged over the sample period 1970-94 for each of the regimes for a selected group of countries. That is, for each country the first column gives the average probability of the stable growth regime $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 1|\mathcal{Y}_T)$, the second column gives the average probability of stagnation $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 2|\mathcal{Y}_T)$, and so on. These probabilities tell us what is the average (over sample years) probability that a country was in a given regime. For example, on average the probability that Japan was in the miracle growth regime is 33% while the average probability that it was stagnating is 5%.

country	Stable Growth	Stagnation	Crisis	Miracle Growth	Avg. Growth
Hong Kong	0.04	0.17	0.06	0.72	5.56%
Japan	0.62	0.05	0.00	0.33	4.31%
Thailand	0.13	0.33	0.03	0.51	4.36%
Portugal	0.51	0.13	0.01	0.36	3.92%
Malaysia	0.31	0.24	0.03	0.42	3.48%
Egypt	0.50	0.40	0.05	0.06	2.20%
India	0.37	0.51	0.03	0.09	2.10%
USA	0.89	0.07	0.00	0.03	2.04%
Mexico	0.52	0.35	0.02	0.11	1.68%
Chile	0.05	0.45	0.16	0.34	1.64%
Zimbabwe	0.05	0.72	0.15	0.08	1.03%
New Zealand	0.74	0.21	0.01	0.04	0.90%
Bolivia	0.45	0.43	0.08	0.03	0.10%
Cote d'Ivoire	0.02	0.61	0.15	0.22	0.07%

Table 16: The columns report average smoothed probabilities of regimes, i.e. the estimates of regimes' likelihood based on the entire sample. Let $\hat{P}(s_t = 1|Y_T)$, the smoothed inference about the likelihood that regime one was in effect in period t. Column one is $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 1|Y_T)$, column two is $(1/T)\sum_{l=1}^{T}\hat{P}(s_l = 2|Y_T)$ and so on.

We assume that the averages frequencies approximate the ergodic regime distribution and use them to compute the average number of occurrences of each regime during the sample period. We then ask how the country's quality of institutions and macroeconomic policies affect regime probabilities. In particular, we average the estimated probabilities over two subperiods, 1970-82 and 1983-1994, and run a pooled multinomial logit. If, as was assumed by Jerzmanowski (2005), quality of institutions is the only variable determining

transition probabilities, we would expect to replicate the estimates of the relationship between the ergodic distribution of regimes and the institutional quality presented in Figure 31, with departures from this distribution being purely random and unrelated to policies. Alternatively, if policies do matter, they will add additional explanatory power in fitting the observed regime distributions.[42]

To determine the relationship between policies and institutions and regime frequencies we estimate the following multinomial logit model.

$$\Pr(\text{regime} = j)_i = \frac{\exp(X_i\,\beta_j)}{\sum_{s=1}^{4}\exp(X_i\,\beta_s)}, \tag{9}$$

$$\tag{10}$$

for $j = 1, 2, 3,4$. $\Pr(\text{regime} = j)$ is the average probability of regime j during the sample periods, and X_i is a vector of country specific characteristics including initial income, quality of institutions and four policy measures: log of average inflation, real exchange rate overvaluation, the share of government's consumption in GDP, and trade to GDP ratio. Quality of institutions is measured using the rule of law index from Kaufmann et al. (2003). Policy variables are averaged over the relevant period and are taken from World Bank economic indicators, except the real exchange rate overvaluation, which comes from Dollar (1992).

This model is a simple multinomial logit model with 4 (unordered) outcomes: stable growth, stagnation, collapse, and miracle growth. Of course, as discussed above, we do not actually observe whether a country is in a given regime in any given year, but instead we have the (estimated) probabilities of regime occurrences. To proceed with the logit estimation, we convert the data on regime probabilities into counts of regime occurrences by multiplying the probabilities by the number of years in the sample. For example, the data in Table 16 corresponds to the period 1970-94 and so multiplying the entries in the first row we attribute to Hong Kong one year of stable growth, four years of stagnation, one year of crisis, and 17 years of miracle growth.[43]

We estimate the above model using pooled data for the subperiods 1970-82 and 1983-94. Since the coefficient estimates are not easily interpreted, we do not report them here; instead, we tabulate the estimated marginal effects at the median. Below we also examine how these effects vary over the entire distribution of the right-hand side variables. This is important since, as Easterly (2005) points out, there are often significant outliers in the policy measures.

Table 17 shows the marginal effects of institutions, policies and income on the probability of each of the four regimes for a hypothetical country with all the right-hand side variables

[42]See Kerekes (2009) for an alternative way to extend the approach in Jerzmanowski (2005) to multivariate transition probabilities.

[43]An alternative strategy, would be to estimate a linear model of the log odds-ratios, which are given by $\ln(\Pr(\text{regime} = j)_i / \Pr(\text{regime} = 4)_i = X_i\,\beta_j$ for $j = 1, 2, 3$. where we have normalized $\beta_4 = 0$. Here we could use the probabilities of regime occurrences (Table 16) without the need to compute regime counts. This approach gives very similar results but has the disadvantage of considerably over-predicting (in sample) the probability of miracle growth, and we do not pursue it.

Variable	Stable Growth	Stagnation	Crisis	Miracle Growth
Rule of Law	0.202***	-0.199***	-0.064***	0.060***
	(0.026)	(0.026)	(0.012)	(0.015)
Inflation	-0.110	0.058	0.015	0.037
	(0.100)	(0.073)	(0.014)	(0.027)
Overvaluation	-0.310***	0.240***	0.043**	0.026
	(0.065)	(0.057)	(0.018)	(0.031)
Gov't	2.086***	-0.806**	-0.056	-1.224***
	(0.445)	(0.394)	(0.153)	(0.400)
Trade	-0.434***	0.228***	0.046	0.161***
	(0.072)	(0.071)	(0.032)	(0.034)
Initial Income	0.132***	-0.078***	-0.018**	-0.035**
	(0.028)	(0.025)	(0.008)	(0.016)

Table 17: Multinomial logit: marginal effects at the median. Standard errors in parentheses. Significance levels:* 10%, ** 5%, *** 1%.

equal to the sample median (we refer to it as "median country"). The quality of institutions increase the probability of favorable outcomes - miracle growth and stable growth while reducing the chances of unfavorable regimes - stagnation and crisis. The size of government lowers the likelihood of miracle growth but compensates this effect by increasing the chances of stable growth and reducing the probability of stagnation and crisis. Trade lowers the probability of stable growth while increasing that of miracle growth; it also increases the chances of crisis and stagnation. Both distortionary policies, inflation and real exchange rate overvaluation, increase the chances of stagnation and crisis, and lower the chances of stable growth, although the effect of inflation is not statistically significant. Their effect on miracle growth is also insignificant. Finally, the level of development as captured by initial income has an independent influence on regimes; it lowers the probability of miracle growth, which is the familiar convergence effect, albeit in a probabilistic sense. That is, richer countries are less likely to grow at very rapid rates as predicted by the neoclassical model as well as technology catch-up models. This effect is, however, mitigated by the fact that income also increases the chances of stable growth. Higher income countries also appear to stagnate less and have less frequent crises. We can use the marginal effect to calculate the change in the probability of each regime given a one standard deviation change in the right-hand side variables. These results are displayed in Figure 34.

Clearly, institutions not only deliver the desirable effects (more frequent growth states,

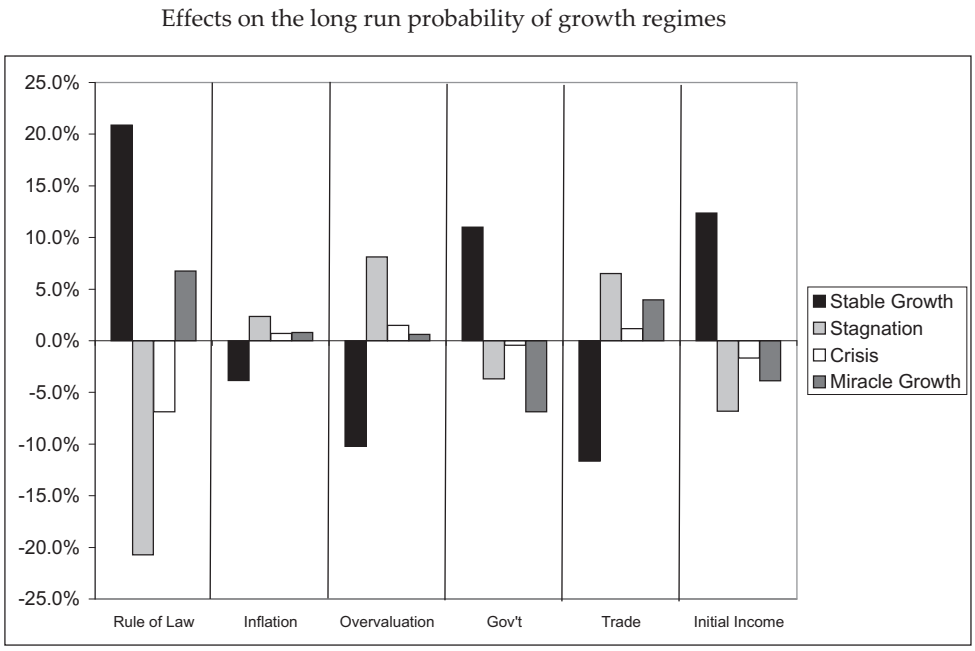


Figure 34: Effects of a one standard deviation change in the right-hand side variables on long run regime probabilities. All right-hand side variables set to the sample median.

less stagnation, and crises) but quantitatively also have a large impact. However, the effects of government size and trade openness are also nontrivial, but they are, to some extent, off-setting across regimes. For example, a one standard deviation increase in trade share means 3.5% more time spent growing fast and 10% less time growing at moderate stable rates. To translate the effects on probabilities of regimes into effects on long-run growth, we can multiply the effects from Figure 34 by the average long-run growth numbers for each regime, reported in Table 15. We can perform a similar calculation for the volatility of growth. The results are shown in Table 18. Note that the median growth rate in the sample was 1.46%, so that for the median country a one standard deviation improvement in the rule of law results in growth increasing to 2.38% (1.46 + 0.92). On the other hand, a one standard deviation increase in government's size results in growth falling to 1.26%. This relatively small change is a net effect of the offsetting forces; larger government leads to less miracle growth but also less stagnation and more stable growth. Overall, we can conclude that at the median the effect of institutions on growth is much greater than that of any policy.[44] This reflects two findings. First, institutions do have a quantitatively large effect on growth, and second, for some policies the effects on long run growth are off-setting across regimes. Similarly, note that despite evidence of convergence (richer countries are less likely to grow very fast) poor countries do not grow faster than rich ones. This is because at lower income levels they are also more susceptible to prolonged periods of stagnation.

Of course, the above calculations do not fully characterize the effects of policies as these are nonlinear and depend on the value of other explanatory variables. That is, the effect of

[44]Policies affect volatility more than average growth but again institutions are more important.

Variable	Growth	Volatility
Rule of Law	0.922	-1.270
Inflation	-0.037	0.149
Overvaluation	-0.188	0.388
Gov't	-0.200	-0.195
Trade	-0.004	0.294
Initial Income	0.029	-0.387

Table 18: Change in the average growth rate and volatility in response to one standard deviation change in the right hand side variables. In % points.

inflation may be much different when it is close to the median level (as in the table above) than when it is in the hyperinflation range. Similarly, the effect on inflation may be different in countries with different quality of institutions. Finally, the distributions of the right-hand side variables may be skewed so that a one standard deviation change (as in the table above) may be either large or small relative to realistic changes in these variables. To get a better understanding of these effects, we will graph them for the entire distribution of the right-hand side variables. We will also look at whether the effects differ significantly across countries with different institutional environments.

Figure 35 shows plots of the probability of the stable growth regime as functions of the six explanatory variables. In each box, the probabilities are calculated by setting the value of five variables to the sample median and varying the remaining variable over the percentiles of the sample distribution. The first box shows that for a median country, the probability of stable growth is increasing with income. With low income, the long run probability of growing at stable rates is one-third, while for the richest country it is 60%. The quality of institutions also improves the chances of stable growth (box two); however, the effect is small in the lower part of the institutions' distribution, it rises sharply around the median, and flattens out again around the 60th percentile. Inflation (box three) has very little effect except for values above the 88th percentile of the distribution where it significantly lowers the likelihood of stable growth. This corresponds to 0.287 log inflation or about 33% annual rate of inflation. Notice that while the effect of inflation on stable growth is consistent with the idea that only extreme values of inflation matter, the threshold is not exceedingly high. Real exchange rate overvaluation has a significant negative effect throughout the distribution, but similarly to inflation, the effect is much more pronounced beyond the 88th percentile, which is an overvaluation of 47%. The size of the government increases the chance of stable growth; the estimates imply that going from 10% of government consumption in GDP to

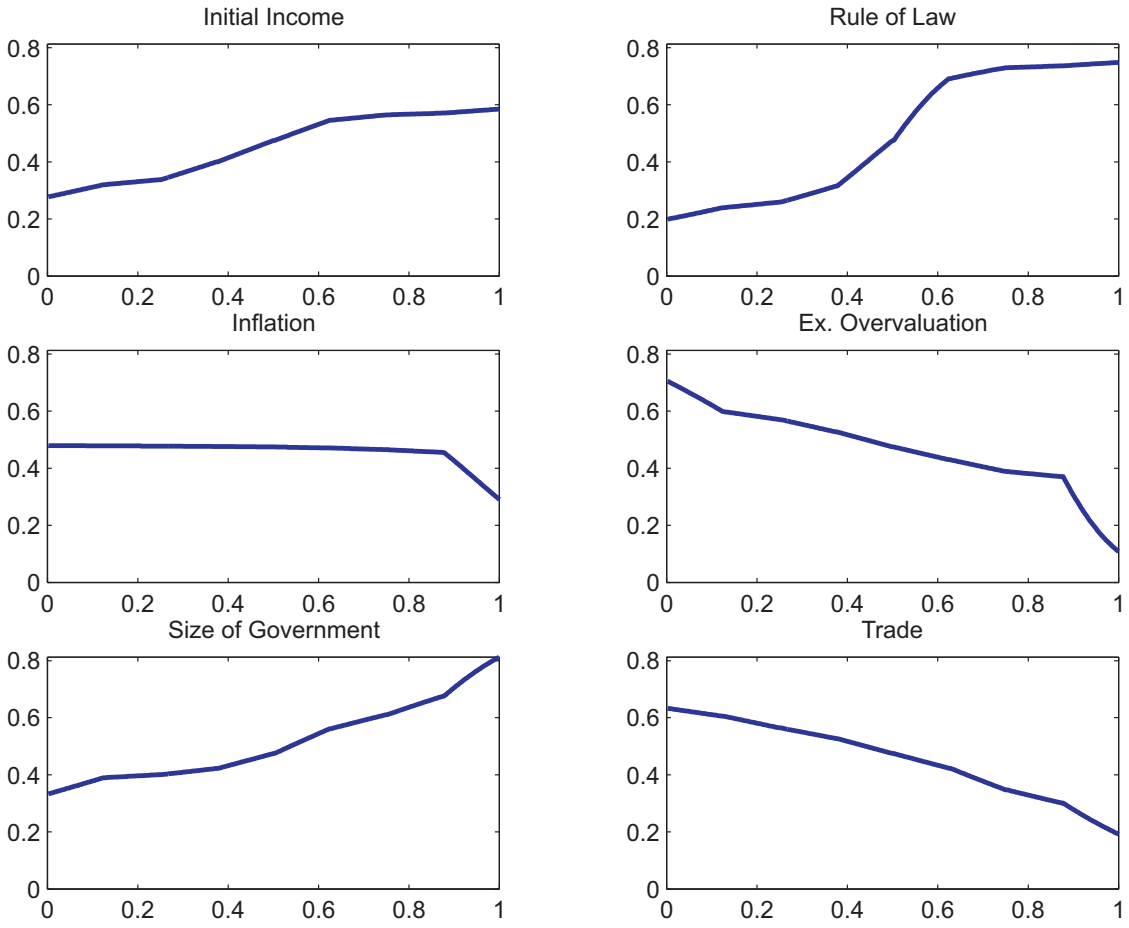


Figure 35: Probability of Stable Growth for the "median country".

20% increases the long-run probability of stable growth from 40% to 60%. Finally, trade lowers the probability of stable growth; quantitatively the estimates imply that increasing the trade to GDP ratio from 36% to 96% results in the long run likelihood of stable growth falling from 60% to 20%.

Figure 36 shows the probabilities of the miracle growth regime for a median country. Income lowers the chance of fast growth reflecting convergence, but the effect is not very large. As with stable growth, institutions have a positive effect, which again is steepest in the middle of the distribution. Inflation matters only above the 88th percentile where it lowers the chances of miracle growth. Real exchange rate overvaluation does not appear to have a large effect. Government size significantly reduces the probability of a growth miracle; increasing the share of government consumption from 10% to 20% reduces the probability from 15% to only 5%. Finally, greater trade openness appears to increase the chances of a growth take-off.

Note that in none of the boxes does the probability of miracle growth exceed 20%. In fact, a hypothetical country with all the right-hand side variables set to the most miracle-growth conducive values is predicted to spend 55% of time in miracle growth regime - below actual values for countries like Hong Kong (72%) and Korea (86%). Of course, neither of

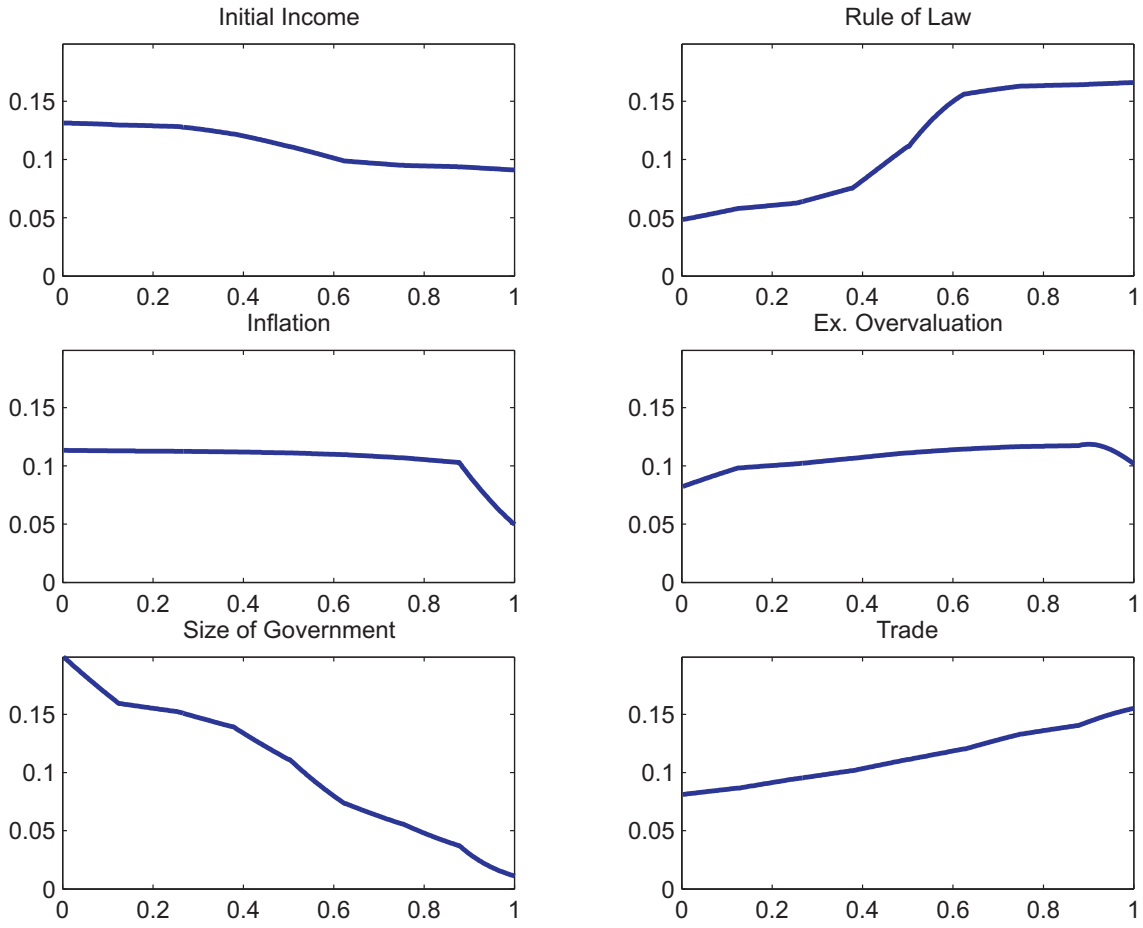


Figure 36: Probability of Miracle Growth for the "median country".

these countries had the hypothetical perfect policy mix, and consequently, the model predicts they should spend even less than 55% of the time in miracle growth. We conclude from this that while institutions and policy variables do affect the likelihood of miracle growth, there are other factors at work (including possibly pure chance). This result mirrors the lack of success of Hausmann and co-authors in explaining growth accelerations.

Several authors have investigated the relationship between the quality of institutions and the effects of various other country characteristics on growth (e.g., Burnside and Dollar 2000, Servén et al. 2005). Aghion et al. (2004) show that the relationship between financial openness and volatility may depend on the degree of development of financial markets, which is presumably highly correlated with measures of institutions such as protection of property rights - a part of the rule of law index.[45] Here, because of the nonlinear nature of the probability model, the effects of one variable depend on the level of the remaining variables. The figure below shows plots of the miracle growth regime probabilities, calculated as above, for two hypothetical economies: one with the sample's highest value of quality of institutions

[45]Similarly, Aghion et al. (2008) provide a model and some evidence showing that the effects of fiscal policy on growth again depend on the development of financial markets.

(solid line) and another with the sample's lowest (dashed line). All other variables remain at the median level.

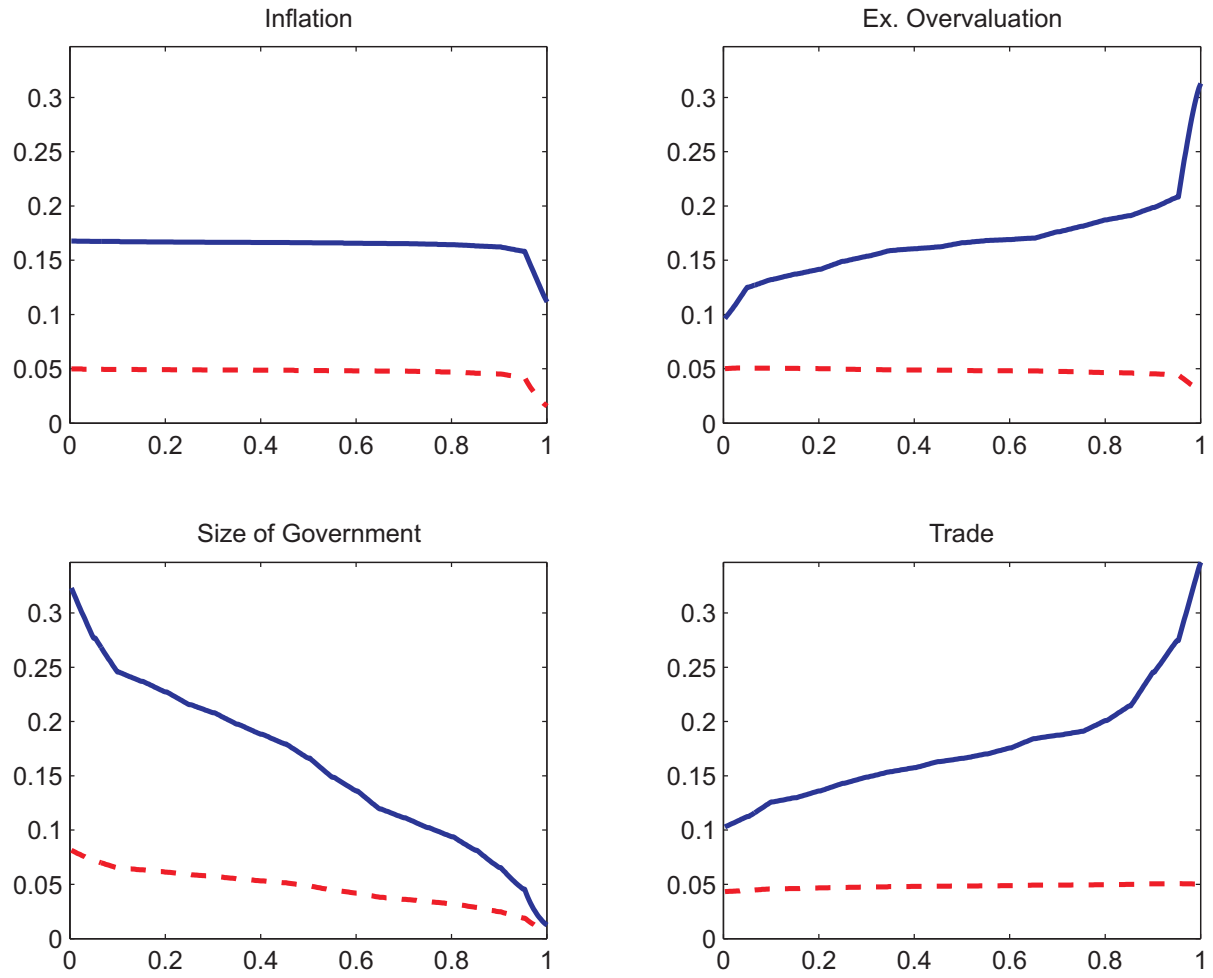


Figure 37: Probability of Miracle Growth for good (solid line) and weak (dashed) institutions countries.

Figure 37 compares the probabilities of the miracle growth state. The large gap between the two lines indicates how much higher the probability of the miracle regime is for countries with good institutions. With the exception of inflation, policies have very different effects depending on the quality of institutions. Exchange rate overvaluation, which appears to have no effect for countries with weak institutions, increases the chances of miracle growth for countries with good institutions. The opposite is true for the size of government; while it appears to have little effect when institutions are weak, it greatly reduces the likelihood of fast growth where institutions are strong. Finally, trade does not affect the probability of fast growth with weak institutions but greatly increases it with good institutions.[46]

[46]The main findings for other regimes are that: (1) greater share of government consumption in GDP reduces the probability of stagnation for weak-institutions countries, while also increasing, albeit by much

We can take the approach used to construct Table 18 and translate the effects in Figures 35 - 37 into effects on long run growth and volatility. First, let's again consider a country with all variables except that of interest set to the sample median (the "median country") without distinguishing between high and low quality institutions.

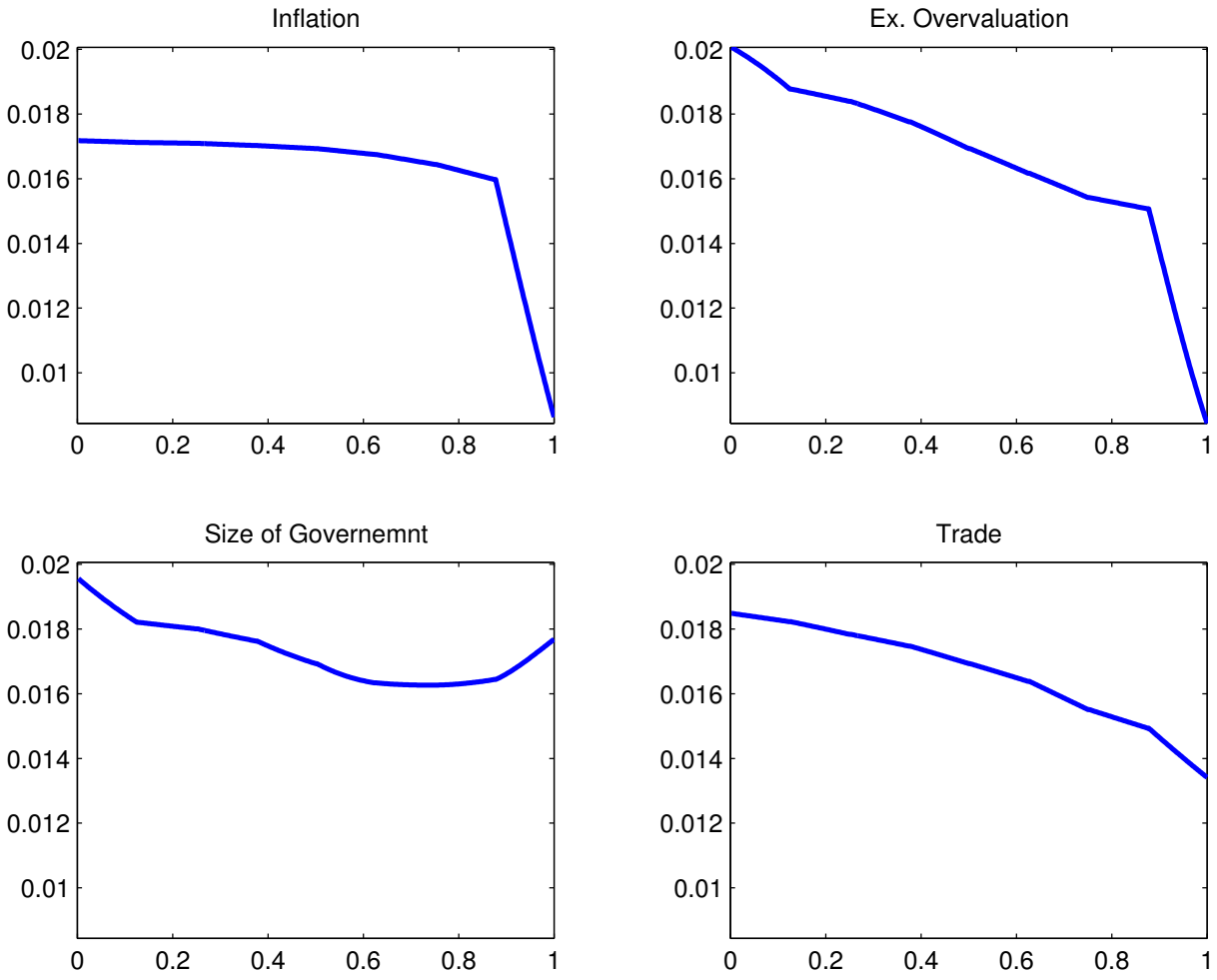


Figure 38: Effects of policies on growth in the "median country".

Figure 38 shows the effects of policies on long-run growth for the median country. Inflation does not significantly affect growth as long as it remains below the 88th percentile or about 33%, however, instances of extreme inflation have a devastating effect on growth. Exchange rate overvaluation, especially when it is extremely high, lowers growth. The size of the government initially lowers growth and then raises it, but the overall effect is small. This is a result of two offsetting forces affecting the median country. As government size increases, the likelihood of miracle growth falls, however, so does the probability of stagnation, and the probability of stable growth rises significantly. This suggests that otherwise identical

less, the chances of a crisis, (2) trade significantly increases the probability of a crisis but only for countries with weak institutions, and (3) extreme inflation increases the chance of a crisis everywhere, but the effect is much stronger with weak institutions.

countries with different sizes of government may grow at similar rates, but the nature of the growth process will be different. Countries with a lower size of government will go through periods of stagnation but will also enjoy periods of fast growth. Countries with a higher size of government are more likely to grow at moderate but uninterrupted rates.

Figure 39 shows the effect of initial income and quality of institutions. As could be anticipated from the effects on regime probabilities, institutions have a stronger effect on long-run growth than any of the policies examined in Figure 38. Note , however, that the effect is greatest around the median of the quality of institutions distribution. While the leveling off could well be expected at high levels of institutional quality, the relatively smaller effect for low quality of institutions is not obvious. It suggests the existence of a "threshold effect" with regards to institutions and casts doubt on the ability of incremental improvements of institutions to generate sustained growth accelerations in countries with a weak rule of law. A qualitative summary is presented in Table 19.

	10th Percentile	Median	90th Percentile
Inflation	0	0	−−
Real Exchange Overvaluation	−	−	−−
Government Spending	−	−	+
Trade	−	−	−
Rule of Law	+	++	0
Initial Income	+	+	0

Table 19: Effect on long run growth at the 10th percentile, the median, and the 90th percentile of variables' distribution. Effects are categorized as strongly negative (−−), negative (-), negligible (0), positive (+), and strongly positive (++).

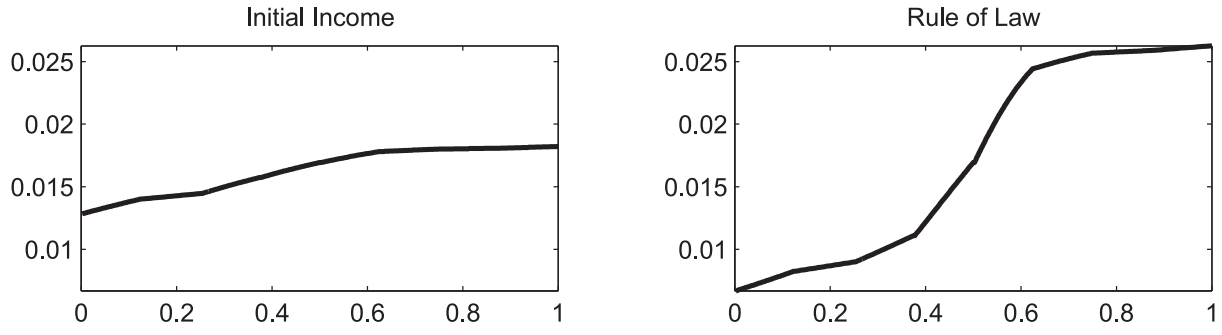


Figure 39: Effects of initial income and institutions on growth in the "median country".

Figure 40 contrasts the long run growth effects of policies for countries with good (solid line) and weak institutions(dashed line). The plots show growth relative to that of a country

with all variables set to the sample median. Weak institutions appear to make economies more vulnerable to the damaging effect of real exchange rate overvaluation and high inflation. The size of government lowers growth for countries with good institutions in the entire range, while for countries with weak institutions it lowers growth, albeit less strongly, below median and raises it sharply above the median. As discussed above, this is a consequence of the differential effect of government on the likelihood of stable growth versus miracle growth - it increases the former while lowering the latter. For good-institutions countries, where stable growth is the most likely regime this lowers average growth. However, for weak-institutions countries, where stagnation dominates, stable growth is rare, and miracle growth is even rarer, this raises growth.

Trade's effect on growth also depends on institutions; it is positive when institutions are good but turns strongly negative when they are weak. The beneficial effect of trade is to increase the likelihood of miracle growth while the cost is the increase in the probability of a crisis. The former effect is very strong with good institutions but virtually nonexistent with weak ones (Figure 37). The latter, on the other hand, is insignificant for countries with good institutions and quite strong for weak institutions.

These results, summarized in Table 20, suggest that the relationship between policies and institutions is potentially quite complex and goes beyond the view that bad policies are merely a manifestation of weak institutions, which are the ultimate determinants of economic development as argued by Acemoglu et al. (2003). This is consistent with some other recent findings. Fatás and Mihov (2003) show that a country's degree of discretionary fiscal policy (measured by the unexplained variance from an estimated government spending rule) is related to lax political institutions and is associated with lower growth and higher GDP volatility. Cuberes and Mountford (2011) show that Fatás and Mihov's measure of fiscal discretion is, in part, explained by historical variables. In particular, they argue that a significant fraction of this "discretionary" policy is indeed better attributed to institutional quality. They then construct a tighter variable for fiscal discretion than the one explored in Fatás and Mihov (2003), i.e., the part of the unexplained variance of government spending that is not accounted for by historical or geographical variables. Interestingly, they show that even this, much tighter, measure of discretionary fiscal policy is negatively associated with GDP volatility and growth. However, historical institutions also seem to have a direct impact. Thus as in the above analysis, they conclude that while institutions are important for growth and volatility, fiscal policy has an independent effect on growth performance.

Before concluding, we want to extend our analysis to include the effect of democracy on regime switching. We do so because the strong and robust effect on growth reversals reported above suggest the type of political institutions plays a role in growth transitions. Introducing democracy into the analysis decreases the sample size somewhat so we decide to treat this analysis in separation from the above main results.

The inclusion of democracy does not change the estimated effects of policies substantially so we omit their exposition and focus on the effects of the rule of law, level of income and democracy.[47] Figure 41 below shows the estimated effects, evaluated at the median, of a

[47]One interesting change is that the effect of the rule of law on growth does not flatten out at high levels, i.e., it goes from being S-shaped (see figures 35-36) to being J-shaped. It suggests that the flattening out was a consequence of the correlation between democracy and the rule of law.

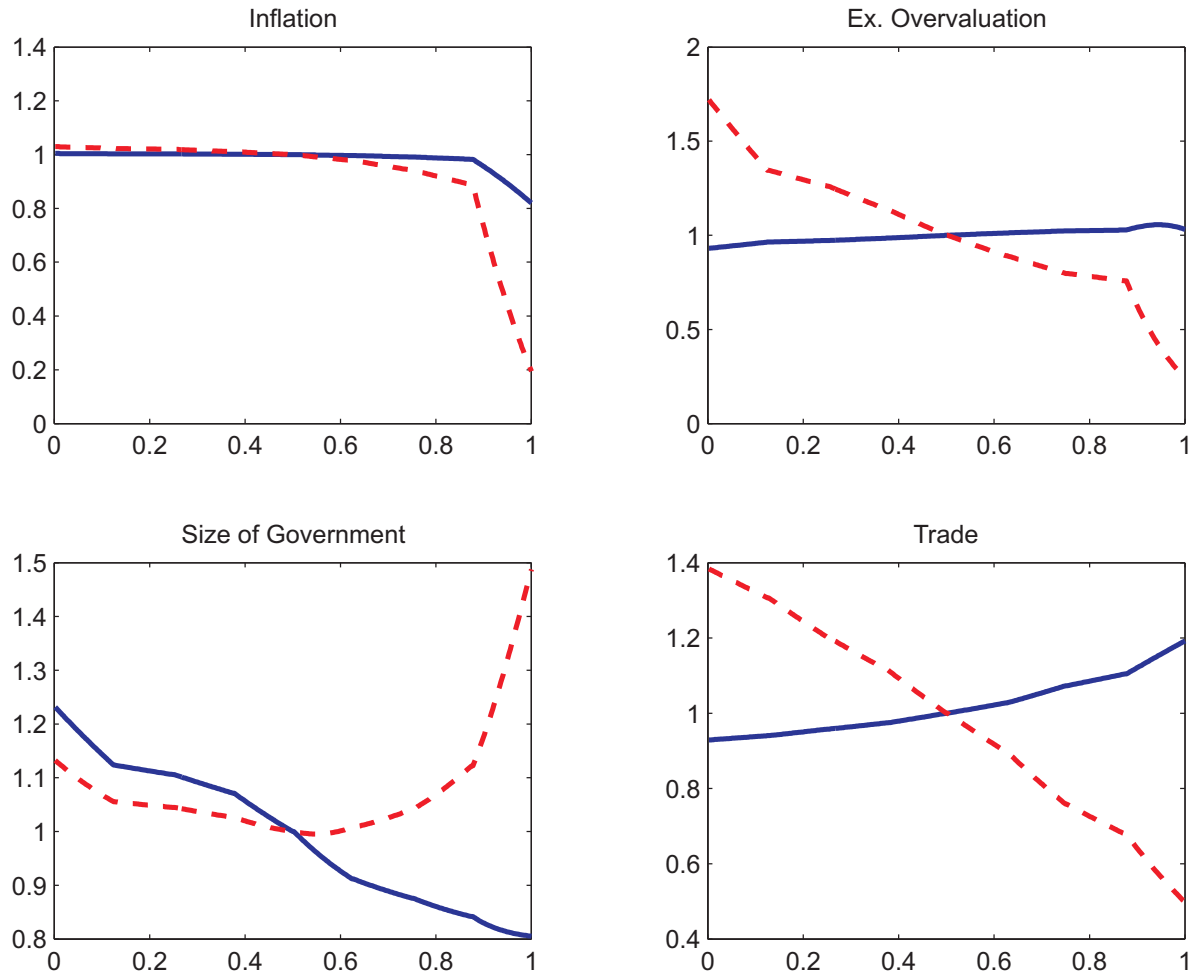


Figure 40: Effects of policies on growth for good (solid line) and weak (dashed) institutions countries. The vertical axis measures growth relative to an economy where all variables are equal to the median.

one standard deviation change in initial income and the rule of law index from the model without democracy (these are the same estimates as in Figure 34 and Table 18).

As discussed above, rule of law increases the probability of good regimes (miracle and stable growth) while income increases the likelihood of stable growth and lowers that of stagnation but also decreases the frequency of miracle growth (convergence effect). Figure 42 shows the effects in a model with democracy included among the explanatory variables.

Democracy increases the likelihood of stable growth and the estimated effects of rule of law and income are now reduced. Democracy also slightly increases the probability of stagnation and has a negative effect on the chance of a crisis that is similar in magnitude to that of rule of law. Most importantly, however, democracy significantly lowers the likelihood of miracle growth episodes. Furthermore, once democracy is accounted for, income has a positive and small effect on the probability of a miracle take-off. That is richer countries are less likely to grow rapidly because they are more democratic. This suggests that the convergence effect uncovered before works mainly through the political economy channel and not

		10th Percentile	Median	90th Percentile
Inflation	Good Inst.	0	0	−
	Weak Inst.	0	0	−−
Real Exchange Overvaluation	Good Inst.	0	0	0
	Weak Inst.	−	−	−−
Government Spending	Good Inst.	−	−	−
	Weak Inst.	−	0	++
Trade	Good Inst.	+	+	+
	Weak Inst.	−	−	−

Table 20: Effect on long run growth at the 10th percentile, the median, and the 90th percentile of variables' distribution; good institutions vs. weak institutions. Effects are categorized as strongly negative (−−), negative (−), negligible (0) , positive (+), and strongly positive (++).

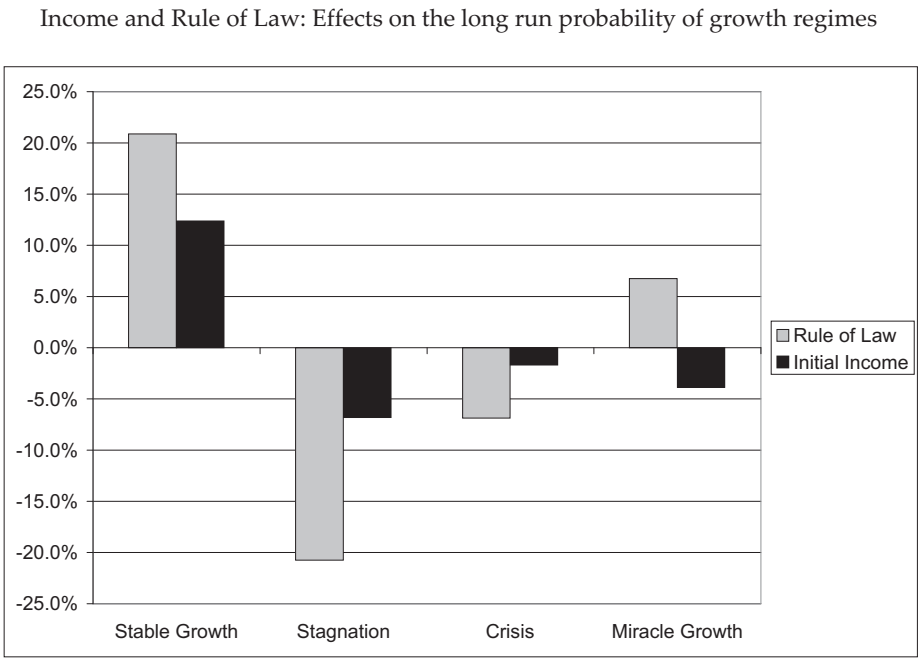


Figure 41: Effects of a one standard deviation change in initial income and rule of law index on long run regime probabilities. All right-hand side variables set to the sample median. Model without democracy.

through standard channels such as diminishing marginal product of capital or technological

Income, Rule of Law and Democracy: Effects on the long run probability of growth regimes

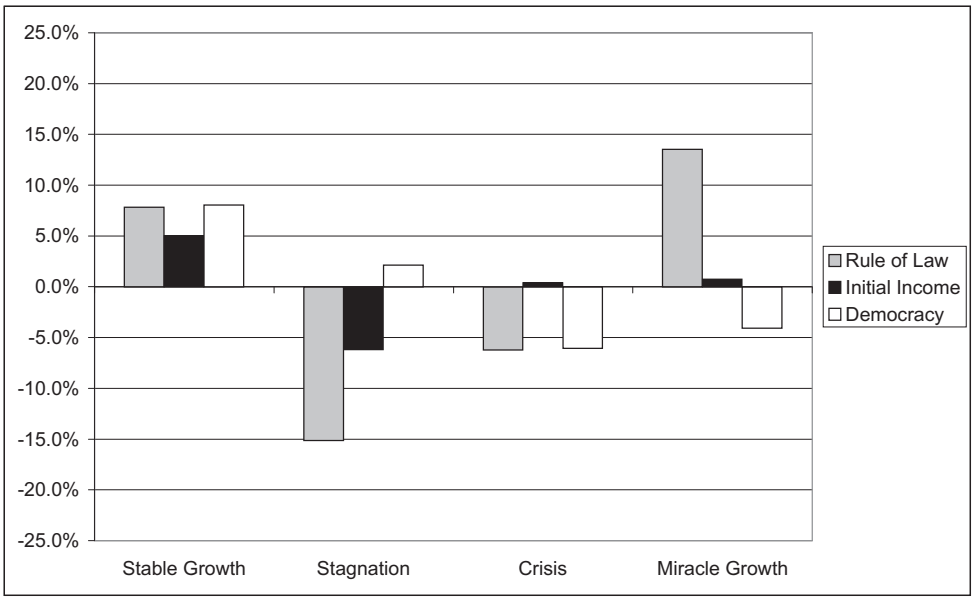


Figure 42: Effects of a one standard deviation change in initial income, rule of law index and democracy score on long run regime probabilities. All right-hand side variables set to the sample median.

catch-up.[48] This is consistent with the view of Olson (1982) who argued that democratic societies may stagnate in the long run due to the detrimental effect of special-interest groups which are able to organize and lobby for inefficient policies. Overall, the results imply that democracy favors the middle at the expense of extremes - either very fast growth or severe crises.

Overall the results of our investigation confirm some of the existing findings, namely that institutional quality is a key determinant of long-run growth, as well as Easterly's finding that only extreme values of the distortionary policies (inflation rate and real exchange rate overvaluation) have a significantly negative effect on growth. However, macro policies, especially trade openness and the size of government also matter for changes in growth patterns and thus influence the average growth and volatility in the long run. Crucially, policies also differ in the channel through which they affect long-run growth. For example, trade lowers the probability of stable growth and increases that of a crisis, while also making miracle growth more likely. The size of government, on the other hand, lowers the chances of miracle growth, while increasing the probability of stable growth at moderate rates. In addition, the effects of policies depend in an important way on the quality of institutions. In general, low quality of institutions makes economies more vulnerable to the harmful effects of inflation and real exchange rate overvaluation. In some cases, the direction of the effect is actually reversed; trade appears to be conducive to growth for countries with good

[48]Note that to the extent that Lipset hypothesis holds, i.e., democracy increases with income, this effect will still lead to the standard convergence, whereby poor countries are catching up to the rich. However, see Acemoglu et al. (2009) for evidence against the Lipset hypothesis.

institutions and detrimental to growth for countries with bad ones. The size of government has the opposite effect - it lowers growth when combined with good institutions and increases it with weak institutions. Finally, when we extend the analysis to the effects of political institutions by including a measure of democracy among the explanatory variables, we find that similar to the rule of law, democracy increases the frequency of stable growth. Unlike rule of law, however, democracy significantly lowers the chances of miracle growth takeoffs. We also find that accounting for democracy removes the negative effect of initial income on the probability of miracle growth, i.e., the convergence effect. This suggests that political economy, in addition to diminishing marginal product of capital or technological catch-up, is an important channel of convergence.

11 Conclusions

For most countries, economic growth is not a smooth process. It consists of periods of rapid growth, stagnation, decline, and crises. While this has been known for almost as long as the large cross-country data sets on output per capita have been available, only in the last seven years have researchers began exploring the within-country variation in growth. In this chapter, we have summarized these recent contributions. Following earlier papers, which have documented growth variability and its lack of persistence, the latest papers try to identify distinct growth patterns in the data and use them to learn about the nature of the process of economic development. So far most work has focused on detecting turning points in the growth process, instances when growth suddenly accelerates or falls for an extended time. Various papers, using different methods, have detected the existence of growth accelerations (and decelerations) – periods of sustained and unusually rapid growth (decline). The first key finding is that such episodes appear ubiquitous among both rich and poor countries. Unfortunately, in poor countries, the acceleration episodes tend to last shorter and are oftne undone by subsequent periods of decline. This leads to two critical sets of questions: what triggers growth accelerations? And what makes them sustained? Unfortunately, here the literature has been less successful. Some factors that help ignite growth have been identified: political transitions, economic reforms, and external shock all coincide with episodes of growth acceleration. Total factor productivity, rather than investment in physical capital, seem to be driving most accelerations. Finally, the degree of democracy appears to play an important role in growth reversals, i.e., the episodes where a period of rapid growth is undone by an equally dramatic decline. However, most episodes of growth acceleration remain unexplained. Similarly, we still know relatively little about what sustains growth at a high level once it accelerates. Several authors have come to the conclusions that the set of factors responsible for igniting growth may be quite different from that which is responsible for sustaining it, but we still do not have convincing evidence of what they are. There is some indication that the quality of institutions, which has lately received enormous attention in the growth literature, may play a more critical role in sustaining growth than in igniting it in the first place but much more work is needed.

We devote considerable space to discussing the idea of modeling growth as a sequence of transitions between different growth states. Initially proposed by Pritchett, this view suggests it is useful to think of the economy as obeying different growth regimes over time.

Following a growth acceleration, a country may look much like a Solow-model economy growing rapidly due to the forces of convergence; however once a transition occurs, it may resemble a poverty-trapped economy. The key question remains what triggers the transition between growth regimes. However, unlike in the growth acceleration approach, there is room for more diverse growth dynamics than just rapid growth or lack thereof. We discussed attempts to implement this idea empirically and provided an extension of one of them. Focusing on macroeconomic policies, we have found that once we allow for different growth states, policies may have a very complex and subtle impact on growth. Some policies may leave the average long-run growth unaffected by increasing the frequency of some growth regimes but decreasing that of others. For example, we found that the size of government spending reduces the frequency of both very rapid growth and large crises while increasing that of stable but slower growth. The net effect, in the long run, is small but clearly, we would not want to conclude that the size of government spending is irrelevant for the process of growth.

We believe these results are interesting, but much more work remains to be done. We see the research described above as only the beginning of a more ambitious research program. Understanding economic growth in a country is an extremely complex issue, since it necessarily implies dealing with not just the economics of the country, but also its political and institutional setup. Exploring within-country variation in growth gives us yet more information from which to try to uncover the laws governing the process of growth. Two key questions, from both an academic and a practical viewpoint: what causes growth accelerations and what makes them sustained, still lack a satisfactory answers. All papers discussed above shared the very limited success in explaining what causes economic growth to accelerate suddenly. Jones and Olekn (2008) finding that accelerations appear to be periods of rapid TFP growth is not very comforting given our lack of understanding of what TFP is. Similarly, while some progress has been made on understanding what distinguishes sustained accelerations from unsustainable ones, we still know very little. Notice that our reduced form analysis of regime switching is not very helpful here since we are not studying the direct effect of policies on regime changes, but instead we ask what is their effect on the long run distribution of the frequency of visits to each regime. This means that if we find that a specific policy increases the fraction of time spent in a given regime, we will not be able to tell whether this is because the policy increases the persistence of this regime or because it makes the transition to that regime from other regimes more likely. Unbundling these effects ia an essential next step for future research. We also believe that the link between political institutions (democracy) and growth transitions is one where important contributions can be made. The idea put forth by Rodrik (1999), that rapid growth may bring social conflict which in the absence of democratic institutions turns to turmoil and growth collapse is an intuitively appealing one, but more work is needed to establish its validity. More broadly, the question of what policies outside the realm of the usual growth-promoting strategies help sustain growth episodes seems worth exploring. Are there political or social arrangements which do not play a direct role in economic growth but help sustain it? Finally, we would like to emphasize the lack of a theory of growth transitions. Pritchett sketches out a model of growth regimes, but despite a few interesting contributions, we do not yet have a plausible theory of growth transitions.

Our final thought is that after only several years, the research program focusing on the within-country growth patterns has delivered some interesting and promising results but still remains largely unexplored. We see this as a potentially very fruitful avenue of empirical and theoretical research in economic growth.

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