Do Leaders Matter?*
National Leadership and Growth since World War II

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ABSTRACT

Economic growth within countries varies sharply across decades. This paper examines one explanation for these sustained shifts in growth—changes in the national leader. We use deaths of leaders while in office as a source of exogenous variation in leadership, and ask whether these randomly-timed leadership transitions are associated with shifts in country growth rates. We find robust evidence that leaders matter, particularly in autocratic settings. Moreover, the death of autocrats appears to lead towards improvements in growth. We investigate the mechanisms through which leaders affect growth and find that autocrats affect growth directly, through fiscal and monetary policy. Autocrats also influence political institutions that, in turn, appear to affect growth. In particular, we find that small movements toward democracy following the death of an autocrat appear to improve growth, while dramatic democratizations are associated with reductions in growth. The results suggest that individual leaders can play crucial roles in shaping the growth of nations.

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"The historians, from an old habit of acknowledging divine intervention in human affairs, look for the cause of events in the expression of the will of someone endowed with power, but that supposition is not confirmed either by reason or by experience."
-- Leo Tolstoy

"There is no number two, three, or four… There is only a number one: that's me and I do not share my decisions."
-- Felix Houphouet-Boigny, President of Cote D'Ivoire (1960-1993)

1. Introduction

In the large literature on cross-country economic performance, economists have given little attention to the role of national leadership. While the idea of leadership as a causative force is as old if not older than many other ideas, it is deterministic country characteristics and relatively persistent policy variables that have been the focus of most econometric work.[1]

A smaller strand of the literature has recently suggested a more volatile view of growth. The correlation in growth rates within countries turns out to be modest across decades – the correlation coefficient in a world-wide sample is only 0.3 (Easterly et al, 1993). This weak correlation suggests that countries are, at different times, in substantially different growth regimes, and recent econometric work has helped to further substantiate this view (Pritchett, 2000; Jerzmanowski, 2002). For many countries, particularly in the developing world, growth is neither consistently good nor consistently bad. Rather, many countries experience substantially different growth episodes that can last for years or decades.

To take an important example, consider post-war growth in China. Figure 1 plots the log of real per-capita gross domestic product over time. It is quite clear from the graph that China moved from a low-growth regime to a high-growth regime in or around 1978. Growth between 1952 and 1978 averaged 1.7% per year, while growth since 1978 has averaged 6.4%. To understand the development experience of China, one wants to

[1] See, for example, Sachs & Warner (1997) on geography, Easterly & Levine (1997) on ethnic fragmentation, La Porta et al (1999) on legal origin, and Acemoglu et al (2001) on political institutions.

know what caused this dramatic shift. The answer is not likely to be found -- for China or the many other countries that exhibit such shifts -- in the slow-moving explanatory variables typically used in the cross-country growth literature. Shocks and/or high frequency events can presumably provide better explanations. The purpose of this paper is to examine the role of one possible force that changes sharply and at high frequency: the national leader.

Even casual observers of Chinese history might immediately notice a coincidence between the low-growth period in China and the rule of Mao Tse-Tung. Mao came to power in 1949 and remained the national leader until his death on September 9, 1976. The forced collectivization of agriculture and later, in the mid-1960's, the Cultural Revolution were among many national policies that likely served to retard growth during Mao's tenure. Arguably, Mao himself – the individual – could be seen as a powerful causative force. This type of interpretation is often described as the Great Man view of history, where events are best understood through the lives and actions of extraordinary individuals.[2] The antithesis, prominently associated in leadership studies with Leo Tolstoy and more generally seen in the deterministic historical interpretations of Hegel and Marx, suggests that leaders are almost entirely subjugated to the various forces operating around them. A more modern view in political science can point to the median voter theorem to suggest that national policy is not chosen by individual leaders (Downs, 1957). Recent work in the psychology literature suggests that the very idea of powerful leaders is a social myth, embraced to satisfy individuals' psychological needs (Gemmill & Oakley, 1999).

This paper investigates whether national leaders have a causative impact on national economic performance. Growth, the main object of explanation in this paper, was chosen partly because of its general import and partly because it sets the bar for leaders very high. One might believe that leaders can influence various policies and outcomes long before one is willing to believe that leaders could impact something as significant as national economic growth.

[2] For example, the British historian John Keegan has written that the political history of the 20th Century can be found in the biographies of six men: Lenin, Stalin, Hitler, Mao, Roosevelt, and Churchill (Keegan, 2003).

To examine whether leaders can affect growth, one can investigate whether changes in national leaders are systematically associated with changes in growth. The difficulty, of course, is that leadership transitions are often non-random and may in fact be driven by underlying economic conditions. For example, there is evidence in the United States that incumbents are much more likely to be reelected during economic booms than during recessions (Fair 1978; Wolfers 2001). Other research has found, in cross-country settings, that high growth rates inhibit coup d'etats (Londregan & Poole, 1990).[3] Examining the impact of leaders on growth therefore requires identifying leader transitions that are unrelated to economic conditions or any other unobserved factor that may influence subsequent economic performance.

To solve this problem, we can again look to Mao as our guide. For a number of leaders, the leader's rule ended at death due to either natural causes or an accident. In these cases, the *timing of the transfer* from one leader to the next was essentially random, determined by the death of the leader rather than underlying economic conditions. These deaths therefore provide an opportunity to examine whether leaders have a causative impact on growth.

This paper uses a data set on leaders collected by the authors to examine the impact of leadership on growth. We identified all national leaders worldwide in the post World War II period, from 1945 to 2000, for whom growth data was available in the Penn World Tables. For each leader, we also identified the circumstances under which the leader came to and went from power. Using the 57 "random" leader transitions, where the leaders' rule ended by death due to natural causes or an accident, we find robust evidence that leaders matter. Growth patterns change in a sustained fashion across these randomly-timed leadership transitions.

We then examine whether leaders matter more or less in different institutional contexts. In particular, one might expect that the degree to which leaders can affect growth depends on the amount of power vested in the national leader. We find evidence that the death of leaders in autocratic regimes leads to changes in growth while the death

[3] Although other literature has found that growth rates have little predictive power in explaining the tenure of leaders more generally (Bienen & van de Walle, 1991).

of leaders in democratic regimes does not. We further find that high settler mortality, which has been used as an instrument for low levels of political institutional quality, also predicts where leaders are more likely to matter. Moreover, we find evidence that when autocrats die growth appears to improve on average, with annual growth rates rising by as much as 3 percentage points following the deaths of highly autocratic leaders.

The remainder of the paper provides evidence on the mechanisms through which leaders affect growth. We find two main results. First, with regard to macroeconomic channels, we show that leaders appear to have a direct impact on growth through changes in monetary and fiscal policy, rather than an indirect impact through changes in private investment. Second, we investigate the impact of leaders on institutions by examining how institutions change following leaders' deaths. We find that the deaths of autocrats, unlike democrats, lead to unusual changes in political regimes, which suggests that autocratic leaders also appear to play important roles through their influence on political institutions. Moreover, we find that the deaths of autocrats tend to be followed by *increases* in democracy.

The fact that autocrats' deaths provide opportunities for democratization suggests that we can further use the random timing of these leader deaths to examine the causative impact of institutional change on economic growth. To do so, one needs a further instrument that predicts the *degree* to which institutions will change following a leader's death. We use the regional average levels of democracy prevailing at the time of a leader's death, as well as a country's prior experience with democracy, to instrument for the degree to which democracy increases when leaders die. We find, both in the OLS regressions and when using instrumental variables, that modest increases in democracy following leaders' deaths lead to substantial increases in growth, whereas dramatic transitions toward full democracy are associated with declines in growth. This result suggests that democratization only produces beneficial economic outcomes when small steps are made.

The remainder of this paper is organized as follows. Section 2 describes the leadership data set and examines the "random" leadership transitions in detail. Section 3 presents the empirical framework used in the paper and investigates the impact of national leaders on their nations' growth. Section 4 examines the channels through which leaders impact growth, focusing on macroeconomic and institutional changes that occur when leaders die. Section 5 presents a number of robustness checks on the results, and Section 6 concludes.

2. The Leadership Data and "Random" Leader Deaths

This paper uses a data set on national leadership collected by the authors. The data set includes every post-war leader in every sovereign nation in the Penn World Tables for which there is sufficient data to estimate leader effects – a total of 130 countries, covering essentially every nation today that existed prior to 1990.[4] The resulting data set includes 1,108 different national leaders, representing 1,294 distinct leadership periods.[5] More details about the leadership dataset can be found in the Appendix.

The leaders of particular interest for this paper are those who died in office, either by natural causes or by accident.[6] To define this group, further biographical research was undertaken to determine how each leader came and went from power. Table 1 presents summary statistics describing the departure of leaders. Of the 105 leaders who died in office, 28 were assassinated, 65 died of natural causes, and 12 died in accidents.[7] As will be discussed in more detail below, it is important for the identification strategy that the timing of these leader deaths be unrelated to underlying economic conditions. For this reason, it is important that assassinations, which may be motivated by underlying changes in the country, be purged from the set of random leader deaths. We therefore define the 57 leaders who died either of natural causes or in accidents, and for whom we can estimate growth effects, as the "random" deaths that we focus on in the paper.[8] Of these,

[4] Leader data is collected from 1945 or the date of independence, whichever came later.

[5] The data set is similar to one collected by Bienen and Van de Walle (1991), with the main exceptions that our data focuses more closely on the nature of leadership transfer and extends to the year 2000, while their data includes countries that are not covered by the Penn World Tables and extends further into the past.

[6] The use of random leader deaths to identify leader effects appears to have been first employed in the literature on CEO succession (Johnson et al, 1985).

[7] A further 21 leaders, not counted here, were killed during coups.

[8] Of the 77 leaders who died of natural causes or in accidents, sufficient Penn World Tables data to estimate the change in growth around the leader's death was available for 62 of them. As discussed in footnote 17 below, we exclude a further 5 leaders whose deaths were too close to the deaths of other leaders to separately estimate their impacts on growth. This yields the 57 leader deaths we focus on in the empirical analysis.

heart disease is the most common cause of death, while cancer and air accidents were also relatively common. The most unusual death was probably that of Don Stephen Senanayake of Sri Lanka, who was thrown from a horse and died the following day from brain injury. Table 2 describes each of these cases in further detail.

A natural question is the degree to which leaders who die in office differ from other leaders. To investigate this issue, the first column of Table 3 presents summary statistics in the year of death for the leaders who die in office. For comparison, column two presents summary statistics for all leader-year observations. As one might expect, comparing columns one and two shows that leaders who die in office tend to be somewhat older than is typical – by 8 years. They are also slightly more likely to be autocrats, though this difference is not statistically significant. On other dimensions, such as the tenure of the leader, the wealth level of the country, or the region of the world, the country-years in which a leader dies look similar to randomly drawn years from the sample. These results suggest that, with the main exception of age, the sample of leaders who die in office is broadly similar to the set of leaders in power in the world at any given time.

Section 5 will present a number of robustness checks on the results, including additional investigations of whether the timing of leader deaths appear to be truly random. We show there that recent economic growth does not predict the timing of leader deaths. Furthermore, we show that the results are robust to excluding categories of leader deaths, including plane crashes, which sometimes engender conspiracy theories, and heart attacks, which could conceivably be stress-induced and hence related to underlying economic conditions.

3. Do Leaders Matter?

Random leader deaths provide an opportunity to identify the causal impact of leaders on economic growth. Such deaths produce exogenously-timed shocks to the national leader, allowing one to ask whether national leaders – as individuals – can impact the growth experience of their countries.

This section uses these randomly-timed leader transitions to show that leaders do, in fact, matter for growth. Section 3.1 provides a graphical overview of those countries with randomly-timed leader deaths. This analysis is informal but worthwhile; in many cases, the graphs show sharp, prolonged changes in national growth experiences when leaders die. Section 3.2 presents a formal econometric framework to clarify the empirical strategy and develop statistical tests, and Section 3.3 then employs these tests, showing that leaders have statistically significant effects on growth. Section 3.4 explores the context in which leaders matter and finds that autocrats have detectable effects on growth, whereas democrats do not. Section 3.5 then considers the directional effects of the death of different types of leaders on growth, and shows that the deaths of autocrats tend to be followed on average by improvements in economic performance.

3.1 Graphical Evidence

Before beginning the econometric analysis, it is informative to examine graphically the relationship between random leader deaths and changes in growth. Figure 2 presents the log of real per-capita PPP gross domestic product over time for each country with a leader death, using data from the Penn World Tables version 6.1 (Heston et. al 2002). A solid vertical line represents the exact date at which a leader died. A dashed line represents the exact date at which that leader came to power. Cases where the entrance and/or exit from power occur prior to the beginning of the Penn World Table observation period are not presented.

Looking at the graphs, it is clear that in a number of cases there is a sharp, prolonged change in the growth regime coincident with or just following the death of the national leader. This is particularly clear for Toure in Guinea, Khomeini in Iran, Machel in Mozambique, Franco in Spain and, as already discussed, Mao Tse-Tung in China. Short-run changes in the growth pattern might also be seen in many other countries, including Angola, Cote d'Ivoire, Egypt, India, and Nigeria, while subtler long-run changes might plausibly be seen surrounding leader deaths in several further cases, including Botswana, Gabon, Kenya, Pakistan, and Panama.

It is instructive to consider some of the more dramatic cases in further detail. The death of Samora Machel led to an especially sharp turnaround in the economic performance of Mozambique (see Figure 2). Machel, the leader of the Frelimo guerrilla movement, became president in Mozambique in 1975 as Portuguese colonial rule collapsed. He established a one-party communist state, nationalized all land in the country, and declared free education and health care for all citizens. Coincident with Machel's aggressive policies, most Portuguese settlers fled Mozambique, and a new, debilitating guerilla insurgency was born. As is seen in Figure 2, Mozambique entered a sustained period of economic decline that continued throughout Machel's tenure. Upon Machel's death in 1986, his foreign minister, Joaquin Chissano, became the national leader. Chissano moved the country firmly toward free-market policies, sought peace with the insurgents, and established a multi-party democracy by 1990. Growth during Machel's eleven-year tenure was persistently negative, averaging –7.7% per year; since Machel's death, growth in Mozambique has averaged 2.4% per year.

The case of Felix Houphouet-Boigny of Cote d'Ivoire provides a somewhat more ambiguous example. The sharp downturn in economic performance that began in the early 1980's is coincident with a collapse in the commodity prices for cocoa and coffee, Cote d'Ivoire's main exports. Shortly after Houphouet-Boigny's death, the CFA, the regional currency shared by Cote d'Ivoire, was devalued, which may have helped restore the country's competitiveness. At the same time, one can look to a number of policies associated with Houphouet-Boigny that appear poorly chosen: for example, his government borrowed and spent large sums in the 1980's despite existing debt problems to construct a new capital in Houphouet-Boigny's hometown of Yamoussoukro along with the world's largest Catholic basilica, which would serve as his burial site.[9] In 1980, Cote d'Ivoire had one of the highest per-capita incomes in Sub-Saharan Africa; in 1993, at the time of Houphouet-Boigny's death, it had experienced 14 consecutive years of economic decline, with growth rates averaging 3.0% per year.

[9] This $300 million church was constructed from 1986-89, coincident with the arrest of striking government teachers and other governments workers who refused to accept pay cuts. Meanwhile, Cote d'Ivoire had to suspend and then restructure its debt payments in 1987.

The case of Ayatollah Ruhollah Khomeini of Iran is more widely known. The Islamic Revolution in 1979 was followed by large-scale executions of opponents, international isolation over hostage-taking at the US Embassy, and a refusal to negotiate peace with Iraq despite massive losses of life and poor military prospects on both sides of the Iran-Iraq war. In particular, Khomeini cast the Iran-Iraq war in strictly religious terms, which is said to have prevented any peace negotiations, although Iraq, having invaded unsuccessfully, withdrew from Iranian territory in 1982 and began seeking peace from that time. Iranian military tactics in the ensuing warfare relied heavily on sending "human waves" of conscripts to their death against the superior firepower of entrenched Iraqi lines (Wagner, 1990). In the face of renewed Iraqi attacks, Iran finally accepted a UN brokered ceasefire in 1988, the year before Khomeini's death. Since his death, Iranian politics have become (relatively) more moderate; as can be seen in Figure 2, growth has turned substantially positive.

While these illustrations can provide some plausible examples in which leaders may matter, such historical analysis does not produce definitive conclusions or statistical assessment of leaders' impacts. Moreover, there are many other countries that appear to experience no change in growth across leader deaths. Examples include a number of more democratic countries as well as Guyana, Taiwan, and Thailand (see Figure 2). In Taiwan, for example, the death of Chiang Kai-Shek in 1975, and the passage of power to his son, Chiang Ching-Kuo, appears to have been entirely seamless. This case highlights the possibility that, even if leaders do matter, their effects may be hard to detect if the characteristics of successive leaders are highly correlated. In the next sections we pursue the question of whether leaders matter for economic growth using more rigorous econometric methods.

3.2 Empirical Framework

The key question in the following analysis is whether growth rates change in a statistically significant manner across randomly-timed leader deaths. In this section, we derive two tests for whether leaders matter, a standard Wald test and a non-parametric rank test.

To begin, suppose that:

$$g_{it} = \nu_i + \theta l_{it} + \varepsilon_{it}$$

where g_{it} represents growth in country i at time t, ν_i is a fixed-effect of country i, ε_{it} is Normal with mean 0 and variance $\sigma^2_{\varepsilon i}$, and l_{it} is leader quality, which is fixed over the life of the leader. Leaders are selected as follows:

$$l_{it} = \begin{cases} l_{it-1} & P(\delta_0 g_{it} + \delta_1 g_{it-1} + \ldots) \\ l' & 1 - P(\delta_0 g_{it} + \delta_1 g_{it-1} + \ldots) \end{cases}$$

where l' is distributed Normal, with mean μ, variance σ^2_l, and $Corr(l,l') = \rho$.[10] The fact that the probability of a leader transition can depend on growth captures the idea that, in general, leader transitions may be related to economic conditions.

The question we wish to answer is whether θ=0 or not, i.e. whether leaders have an impact on economic outcomes. If leader transitions were exogenous, a natural approach would be to look at the joint significance of leader fixed effects—i.e., dummy variables for each value of l_{it}— to see whether there were systematic differences in growth associated with different leaders. Given the endogeneity of leader transitions, however, this test may find significant results even under the null that $\theta = 0$, because leadership transitions, and thus the end dates of the leader fixed effect, may be related to atypical realizations of growth.

Comparing the difference in these fixed effects across leadership transitions caused by random leader deaths solves part of the problem, as the date of the transition between leaders is now exogenously determined with respect to growth. However, the other end of the fixed effect for these leaders is still endogenously determined. Therefore, rather than compare differences in fixed effects, we compare differences in dummies that are true in the T periods before the death and in the T periods after the leader death. Since the end points of these dummies are now fully exogenous with respect to growth, these dummies provide an instrument for the leader's fixed effect. We focus on these dummies for the remainder of the analysis.

[10] For ease of exposition, we focus throughout this analysis on the time-invariant component of leader quality. We relax this assumption in the empirical work below.

In particular, denote by $\overline{PRE}_z$ average growth in the *T* years before a leader death in year *z*, and denote by $\overline{POST}_z$ average growth in the *T* years after the leader dies. To keep the analysis tractable, assume for the moment that during each of these periods, there is only one leader.[11] Then for a given set of leaders *l* and *l'*,

$$\overline{PRE}_z \sim N\left(\nu_i + \theta l, \frac{\sigma_{\varepsilon i}^2}{T}\right)$$

$$\overline{POST}_z \sim N\left(\nu_i + \theta l', \frac{\sigma_{\varepsilon i}^2}{T}\right)$$

where $\sigma_{\varepsilon i}^2 / T$ is the sampling variance. Recalling that *l* and *l'* are distributed normally with mean μ, variance σ^2_l, and correlation ρ, we see that the distribution of *PRE* and *POST* over all possible leaders for country *i* can be written as

$$\widehat{PRE}_z \sim N\left(\nu_i + \theta\mu, \frac{\sigma_{\varepsilon i}^2}{T} + \theta^2\sigma_l^2\right)$$

$$\widehat{POST}_z \sim N\left(\nu_i + \theta\mu, \frac{\sigma_{\varepsilon i}^2}{T} + \theta^2\sigma_l^2\right)$$

The change in growth across the leader transition in country *i* will therefore be:

$$\widehat{POST - PRE}_z \sim N\left(0, 2\frac{\sigma_{\varepsilon i}^2}{T} + 2\theta^2\sigma_l^2(1-\rho)\right) \qquad (1)$$

The variance of $\widehat{POST - PRE}_z$ is equal to the sampling variance, $2\sigma_{\varepsilon i}^2 / T$, plus the variance from the expected difference in leaders, $2\theta^2\sigma_l^2$, less twice the covariance due to the correlation in leaders, $\theta^2\sigma_l^2\rho$. If in addition there is an average shift in leader quality following a leader's death (for instance, due to a change in political institutions), so that **E***l*=μ and **E***l'*=μ', then

[11] This assumption is not necessary for the analysis, but simplifies the exposition. If we explicitly incorporated the fact that there can be multiple leaders in a given $\overline{PRE}$ or $\overline{POST}$ dummy, the variance under the hypothesis that leaders matter would be higher than the variance stated in expression (1). Under the null that $\theta = 0$, however, the variance as written in expression (2) would still be exactly correct. As a result, this assumption imposes no loss of generality on the tests of the null developed in this section.

$$\widehat{POST-PRE}_z \sim N\left(\theta(\mu'-\mu), 2\frac{\sigma_{\varepsilon i}^2}{T} + 2\theta^2\sigma_l^2(1-\rho)\right)$$

Under the null hypothesis that leaders do not matter, $\theta = 0$. Therefore, under the null, the change in growth across a leader transition in country *i* will be distributed:

$$\widehat{POST-PRE}_z \sim N\left(0, 2\frac{\sigma_{\varepsilon i}^2}{T}\right) \quad (2)$$

The test of whether leaders matter is a test of whether $\widehat{POST-PRE}_z$ is actually distributed $N\left(0, 2\frac{\sigma_{\varepsilon i}^2}{T}\right)$.

We can easily develop a Wald test statistic based on this null hypothesis. This is a test of whether changes in growth around the periods when leaders die are unusual given the underlying growth process in their countries. Define

$$J = \sum_i \frac{\left(\widehat{POST-PRE}_i\right)^2}{2\widehat{\sigma_{\varepsilon i}^2}/T}$$

where $\widehat{\sigma_{\varepsilon i}^2}$ is an estimate of $\sigma^2_{\varepsilon I}$ for country *i*, and $\widehat{POST-PRE}_i$ represents the change in growth around a leader death in country *i*. If the number of observations of country *i* is large, so that $\widehat{\sigma_{\varepsilon i}^2}$ is a good estimate for $\sigma^2_{\varepsilon i}$, then under the null that $\theta = 0$ the distribution of $\left(\widehat{POST-PRE}_i\right)^2/(2\widehat{\sigma_{\varepsilon i}^2}/T)$ is $\chi^2(1)$, and, as with all Wald tests, *J* is distributed $\chi^2(Z)$ when *Z* leader deaths are considered together. This is the distribution we use to test the *J*-statistic in the empirical work.

As is clear from expression (2), underestimating the variance of $\widehat{POST-PRE}_z$ under the null can lead to over-rejections. In particular, failing to account properly for positive serial correlation in ε can lead to an underestimate of the variance of $\widehat{POST-PRE}_z$ and to a propensity to over-reject the null. In the empirical work, we therefore pay careful attention to autocorrelation in the growth process and present results with different specifications for the error term to ensure that we have properly accounted for this autocorrelation.

As an alternative approach, it is useful to consider a non-parametric test which does not depend on assumptions about the structure of the error term in the growth equation. We develop such a non-parametric test as follows.[12] For each country *i*, we calculate $\widehat{POST-PRE}_{it}$ for every possible break date *t*. We then calculate the percentile rank of $\widehat{POST-PRE}_z$ for each actual leader death date within the actual distribution of $\widehat{POST-PRE}_{it}$ for that country. Letting r_z denote the percentile rank for each leader death, under the null hypothesis r_z will be uniformly distributed over the interval [0,1]. That is, it will be distributed no differently than any randomly chosen year. Under the alternative hypothesis that leaders matter, r_z should be closer to extreme values—i.e. closer to 0 or 1—than would be predicted by a uniform distribution. We can therefore form a test-statistic that is the non-parametric analogue of the Wald test. To do so, first define:

$$y_z = \left| r_z - \frac{1}{2} \right|$$

Under the null, $E[y_z] = \frac{1}{4}$, $Var[y_z] = \frac{1}{48}$, so that one can form the test-statistic

$$K = \frac{\sum\left(y_z - \frac{1}{4}\right)}{\sqrt{\frac{N}{48}}}$$

A non-parametric test for whether $\theta \neq 0$—i.e., whether the changes in $\widehat{POST-PRE}_z$ at leader deaths are systematically larger than average—is a one-sided test of whether *K* is systematically larger than is expected under the null. In the empirical work, we use Monte Carlo simulations to find the distribution of the *K*-statistic under the null that r_z is uniform, and use this distribution to provide an additional "rank test" of the null hypothesis that leader do not matter.[13] While this test has the virtue of making no

[12] This test is a modification of the rank test developed by Corrado (1989) in the context of the event study literature in finance.

[13] In large samples, the Central Limit Theorem implies that *K* will be distributed under the null as *N*(0,1). A non-parametric test for whether $\theta \neq 0$—i.e., whether the changes in $\widehat{POST-PRE}_z$ at leader deaths are systematically larger than average—could therefore also be implemented as a one-sided test of whether *K* is distributed *N*(0,1) against the alternative hypothesis that *K* is systematically larger. In practice, given the

parametric assumptions about the error process, it is likely to have lower power than the parametric Wald test, as it throws away useful information about the magnitude of the difference in growth when building the simple rank measure.

Several observations are worth making about these tests. First, there are several reasons why, even if $\theta \neq 0$, the tests may still fail to reject the null. Noting that leader effects will be detectable if the variance in $\widehat{POST - PRE_z}$ is substantially greater under the alternative than under the null, we see from (1) and (2) that leader effects will be detectable if

$$1 + \frac{\theta^2 \sigma_l^2 (1-\rho)}{\sigma_{\varepsilon i}^2 / T}$$

is substantially greater than 1. In particular, if ρ is close to 1 or σ^2_l is close to 0, so that successive leaders tend to be alike, the tests will fail to reject even if leaders affect growth. A hint of this possibility was seen informally in Section 3.1, where a patrilineal transfer in Taiwan appeared to have little consequence for growth. Moreover, if the growth process in a country is extremely noisy, so that $\sigma^2_{\varepsilon i}$ is large, then it becomes more difficult to detect leader effects. A rejection of the null hypothesis therefore implies that leaders matter in three senses: (i) leaders impact outcomes, (ii) leaders vary enough that different leaders lead to different outcomes, and (iii) the impact of leader transitions is large relative to average events that occur in their countries.

Second, and related to the first observation, many individual realizations of $\widehat{POST - PRE_z}$ may be close to zero, simply because consecutive leaders tend to be similar. Thus, even if $\widehat{POST - PRE_z}$ is not statistically distinguishable from 0 for many leader transitions, that does not necessarily imply that $\theta = 0$ for those leaders.

Finally, it is possible that there might be substantial heterogeneity in θ and ρ across countries so that leader changes affect growth in some countries but not in others.

small number (≤50) of growth observations in each country, the rank is distributed as a discrete uniform variable rather than a continuous uniform. This discreteness slightly increases the variance of y_z, and failing to account for this issue will lead to over-rejection of the null. To be conservative, we therefore rely on Monte Carlo simulations to generate the exact distribution of K under the null.

A natural way to examine this hypothesis is to split the sample of leader deaths based on some observable characteristic and compute the J and K statistics for that sub-sample. We will employ this strategy in some of the empirical work below.

3.3 Econometric Evidence

To implement the tests developed in Section 3.2, we estimate the following regression:

$$g_{it} = \alpha_z PRE_z + \beta_z POST_z + \nu_i + \nu_t + \varepsilon_{it} \qquad (3)$$

where g_{it} is the annual growth rate of real purchasing-power-parity GDP per capita taken from the Penn World Tables, i indexes countries, t indexes time in years, and z indexes random leader deaths. Country and time fixed effects are included through ν_i and ν_t respectively. For each leader death, indexed by z, there is a separate set of dummies, denoted PRE_z and $POST_z$. PRE_z is a dummy equal to 1 in the T years prior to leader z's death in that leader's country. $POST_z$ is a dummy equal to 1 in the T years after leader z's death in that leader's country. We estimate a separate coefficient α_z and β_z for each leader death z. Note that we estimate equation (3) using all countries and all years of data, as countries without random leader deaths can be used to help estimate time fixed effects.

In the main analysis, we will choose the period of observation, T, to be five years, though in Section 5 we will show that the results are robust to choosing smaller or larger values of T. Note also that PRE_z and $POST_z$ are defined so that the actual year of the death is not included in either dummy. This is probably the most conservative strategy when looking for longer-term leader effects, as it helps to exclude any immediate turbulence caused by the fact of leader transition itself.[14]

Under the null hypothesis that a particular leader z does not matter for growth, we expect that α_z will be similar to β_z. That is, conditional on other regressors, we expect the difference in growth rates before and after a leader death z to be no more different than

[14] The results in this paper are robust to a number of other methods of handling transition years. For example, assigning the transition year to either the PRE or POST dummy, or assigning a fraction of the dummy to either the PRE or POST dummy, produces similar or slightly stronger results than those presented here.

what would be expected given the underlying noise in the growth process. As discussed in Section 3.2, we can use a Wald test to determine whether a change in growth is in fact unusual. To answer the question of whether leaders matter for growth in general, we can employ a Wald test on all leader deaths collectively. If the error structure for ε_{it} is correctly specified, this test procedure will produce the correct inference.

However, we may be concerned both that the error ε_{it} is neither identically distributed across countries nor independently distributed over time within the same country. In such cases, the Wald test may not produce the correct inference. To deal with these concerns, we employ two strategies. First, we attempt to determine the correct error structure and model the data generating process accordingly, allowing for heteroskedasticity and autocorrelation parameters that vary by region.[15,16] Second, we present results from the non-parametric "rank test" developed above.

Table 4 presents the main results from the formal econometric tests developed in Section 3.2. The cells of the table present p-values for the null hypothesis that countries do not experience unusual growth changes when leaders die. Each cell presents the results from a separate regression. We present two different specifications for the error structure along with the rank test. Column (1) presents Wald tests with the errors corrected for region-specific heteroskedasticity and a common, worldwide AR(1) process. Column (2) further allows for region-specific AR(1) processes. Column (3) presents the results from the non-parametric "rank-test." The final three columns in the table repeat the analysis restricting the leader sample to leaders who were in power for at least two years, whose effect on growth we would expect to be stronger.

[15] Likelihood ratio and Breusch-Pagan tests for heteroskedasticity strongly reject homoskedastic errors in favor of regional or country-specific heteroskedasticity. Breusch-Godfrey tests for auto-correlation show that auto-correlation is weak but present in 20% of the sample countries, with significant country and regional heterogeneity. To produce Wald tests of the correct size, we estimate the model allowing for regional rather than country-specific variation in the error structure and autocorrelation, which ensures large samples for each estimate of the error-variance and autocorrelation parameter. The results, however, are robust to a large number of other error specifications. In particular, specifications that employ country-specific rather than region-specific heteroskedasticity, country-specific autocorrelation, or spherical errors tend to produce stronger results than those presented.

[16] Another possibility would be to use White or Newey-West robust standard errors. However, as there are only 5 observations for each fixed effect, there are not enough observations for each variable to satisfy the consistency requirements of these methods. By estimating heteroskedasticity and autocorrelation at the regional level, we have much larger numbers of observations with which to estimate the error parameters, and so the inference will be more accurate.

For each specification of the error structure, we present three different timings of the *PRE* and *POST* dummies. The actual timing is represented by the row labeled *t*. To ensure that the effects we ascribe to leaders are not caused by temporary changes during the transition period, the timings *t+1* and *t+2* are included, indicating that the *POST* dummies have been shifted 1 and 2 years later in time. Put another way, in the *t+1* timing, we exclude the year of the transition and the subsequent year from the analysis; in the *t+2* timing, we exclude the year of the transition and the two subsequent years from the analysis.[17]

The results presented in Table 4 show that leaders have significant effects on growth. Using the contemporaneous leader timing (*t*), both error specifications reject the null hypothesis that leaders do not matter. Results are also strong when we shift the *POST* timing forward one or two years, suggesting that the effect of leaders is not due to temporary effects of the transition. The rank test, which requires no assumptions about the underlying growth process, shows significant effects at *t* and *t+2*, while insignificant effects at the timings *t+1*. If we restrict the data to rule out leader deaths where the leader was in power for a very short period of time, then the results become stronger, despite having 10 fewer deaths in the sample.

These tests survive a wide range of robustness and specification checks. In particular, the final rows of Table 4 present p-values for "control timings", where the *PRE* and *POST* dummies are shifted 5 or 6 years backwards in time. If the identification strategy is valid and the growth process is correctly specified, one should not witness unusual changes in growth at these timings. In fact, we find that such control timings fail to reject the null, further confirming both the identification assumption and the specification of the error structure used in forming the Wald tests. The results are also robust to a number of further specification checks, discussed in Section 5, where we consider different lengths of the observation window, T, different sets of right-hand-side control variables, and the exclusion of certain decades or types of death.

[17] Note that we exclude five leader deaths (Barrow of Barbados, Hedtoft of Denmark, Shastri of India, Frieden of Luxembourg, and Gestido in Uruguay), because their deaths followed closely on a prior leader death in their countries. Including both leaders would cause the *PRE* and *POST* dummies to overlap, contaminating the results. In each case, we drop the leader who died second, though the results are robust to dropping the leader who died first instead.

3.4. In What Contexts do Leaders Matter?

The above results indicate that, on average, leaders have detectable, causative impacts on national growth. However, the degree to which leaders matter may well be a function of their context. In particular, one might expect that different institutional systems might amplify or retard a leader's influence. If leaders do appear to matter on average, in what context do they matter the most? Are there some contexts in which they do not seem to matter at all?

To explore this question, we begin with Figure 3, which examines the relationship between changes in growth at leader deaths and political institutions. The y-axis presents the estimated change in growth after the leader's death, i.e., $\beta_z - \alpha_z$ as estimated by equation (3). The x-axis indicates the nature of each country's political institutions in the year prior to each leader's death. This measure, "polity", is taken from the Polity IV data set and is normalized to vary from 0 (indicating a highly autocratic regime) to 1 (indicating a highly democratic regime). (Marshall and Jaggers, 2000) The first panel of Figure 3 marks each death with the name of the country in which the death occurs, and the second panel of Figure 3 marks each death by the precision of the estimated change in growth – large circles indicate cases where the change in growth is tightly estimated.[18]

Figure 3 reveals two important facts. First, the figure indicates a greater dispersion in outcomes when deaths occur in more autocratic regimes. Second, there appears to be an average increase in growth following the death of autocrats, whereas there is no such average increase in growth following the death of democrats. This is particularly visible in the second-panel of Figure 3, where each change in growth is weighted by the precision with which it is estimated.

This visual exercise suggests that leaders may matter more in more autocratic settings, where there may be fewer institutional constraints on the individual leader's ability to influence policy. To test this hypothesis more formally, we can extend the regression framework above to consider hypothesis tests on subsets of the leader deaths. This approach allows us to consider the interaction of various national characteristics with the ability of leaders to influence national growth.

[18] The area of each circle is equal to the inverse of the variance of the estimate of β_z-α_z for that observation.

The results from such tests are presented in Table 5, which compares those leaders whose nations receive a polity score less than 0.5 in the year prior to their death, who we will refer to as "Autocrats", with those leaders whose nations receive a polity score better than 0.5, who we will refer to as "Democrats".[19] The results indicate that autocratic leaders on average have a significant causative influence on national growth. These leader effects are strongly significant at treatment timings of *t*, *t+1*, and *t+2*, suggesting that the growth effects last over substantial periods and are not due to immediate turbulence in the first two years after the transition. On the other hand, across a wide range of specifications, the deaths of leaders in democratic regimes produce no detectable impact on growth.

Another approach is to divide countries by their level of settler mortality, rather than by their current institutional scores. Recent work has shown that the relative mortality of early colonial settlers is a strong predictor of current political institutional quality (Acemoglu et al, 2001). In particular, high settler mortality is shown to predict increased autocracy. The first columns of the top panel of Table 6 investigate the impact of settler mortality on leader effects. These results show that leaders appear to matter in countries with high settler mortality (i.e., weak political institutions) but not in countries with low settler mortality (i.e., strong political institutions).[20]

An alternative hypothesis would be that it is income, rather than institutions per se, which is driving the observed difference in leader effects. The second panel of Table 6 further explores whether national income can explain leader effects and shows that leader effects are not simply a matter of poverty. Indeed, the poorest countries show no leader effects on average, while middle income countries show the most significant effects. The richest countries, which are nearly all democracies, show no leader effects among

[19] Note that in Table 5, and subsequently, the number of leader deaths may not add to 57 because not all variables used to split the leader sample are available for all leader deaths.

[20] Colonial origin might also be expected to predict where leaders matter, given the comparatively negative impact of French legal origin on property rights and democracy among other institutional variables (La Porta et al, 1998; La Porta et al, 1999). However, in results not reported, distinguishing between British, French, and Spanish colonial origin does not appear to capture where leaders matter, although there is weak evidence across some specifications that British and Spanish colonies show leader effects on average. While the comparison between these cases is not definitive given the small sample sizes, the presumed negative impact of French colonial inheritance on institutional quality does not appear to operate here, as leaders show no detectable impact in the French setting.

democrats on average, while the one example of an autocrat (Franco) in this richer group does show a significant effect. Meanwhile, the distinction between autocrats and democrats continues to operate powerfully within the middle income countries. Increasingly small sample sizes preclude conclusive interpretations, but one might speculate that the absence of autocrat effects among the poorest countries may be related to weaker state institutions and failed states, which may limit a leader's ability to influence national outcomes.

Table 6 further explores a third dimension in understanding leader effects, the degree of ethnic fragmentation in a country. Previous work has shown that ethnic fragmentation is a strong negative predictor of growth (Easterly and Levine, 1997; Alesina et al, 2002) and helps predict institutional quality, including measures for the quality of government (La Porta et al, 1999) and corruption (Mauro, 1995). With regard to national leadership, ethnically fragmented nations may provide particular opportunities for leaders to impact national outcomes by choosing to foment or suppress ethnic conflict. For instance, the difference between Tito and Milosevic could be seen as the difference between Balkan war and peace.

We divide countries into high and low ethnic fragmentation groups depending on whether they fall above or below the median level of ethno-linguistic fractionalization measure from Easterly & Levine (1997). We find that leaders appear to have a strong impact on growth in highly ethnically fragmented countries, whereas the effect of leaders is much weaker for countries that have less ethnic fragmentation. However, when we subdivide ethnically fragmented countries according to their political institutions, we find once again that the leader effect is limited to autocracies. Interestingly, though samples are small, we find no leader effects in non-fragmented autocracies, which suggests that it may be the interaction of weak political institutions and ethnic heterogeneity that leads to a powerful role for leaders.

Finally, the well-known negative growth effect of being located in Sub-Saharan Africa suggests that we consider whether the leader results are a regional phenomenon. In results not presented, while we find that leader effects are strongest in Sub-Saharan Africa, we also find that substantial leader effects are found in other regions, including the Middle East & North Africa, and Latin America, which suggests that leaders' impacts are not constrained to one part of the world. Moreover, even within Sub-Saharan Africa, we find that leader effects are limited to autocracies, suggesting that it is political institutions, rather than region of the world, that is the main predictor of the degree to which leaders matter.

The results in this section show that the deaths of autocrats lead to unusual changes in growth, while the deaths of democrats do not. A natural interpretation of this result is that the institutional constraints imposed by democracies limit the degree to which any particular leader can affect economic outcomes. In the language of the model, this interpretation is that $\theta = 0$ in democracies—i.e., in democracies, individual leaders don't matter.

As discussed in Section 3.2, however, this is not the only possible interpretation of this result. One more basic explanation could be that the underlying variance of the growth process is higher in democratic regimes, so that leader effects are harder to detect statistically in democracies than in autocracies. In fact, however, the opposite is the case, so this explanation can be ruled out.

A more substantive alternative explanation is that leaders who come to power following the death of a democrat are more similar to their predecessors than those leaders who follow the death of an autocrat. For example, in democracies, institutional succession rules that keep power within the same political party following a leader's death may result in a high correlation (ρ) between leaders. In fact, we do find in many of the democracies we study that the leader who dies is succeeded by a leader of the same party, which provides suggestive evidence that this may be occurring.

Finally, from the perspective of the median voter theorem, even if leaders in principle have significant executive authority in democracies, stability in the distribution of voter preferences may create greater policy continuity in democracies—i.e., lower σ^2_l —and hence an absence of detectable leader effects. These three possible explanations—greater institutional constraints on leaders' power (i.e. lower θ), higher correlation between successive leaders (i.e. higher ρ), and lower variance in policy preferences (i.e.

lower σ^2_l)—are not mutually exclusive and may all be playing a role in the failure to detect leader effects in democracies.

3.5 When Does New Leadership Improve Growth?

The analysis in Section 3.4 showed that the death of autocrats leads to changes in growth, whereas the deaths of democrats do not. However, the analysis was purely non-directional—the tests did not distinguish whether the death of an autocrat led on average to increases or decreases in growth. This section examines the directional impact of leadership transitions.

To investigate this question, we employ a two-step procedure.[21] In the first step, we estimate equation (3), from which we obtain an estimate of the change in growth after each leader transition. Using the notation of equation (3), the estimate of the change in growth after the death of leader z in country i is $\beta_z - \alpha_z$. In the second step, we estimate the following equation:

$$\beta_z - \alpha_z = \gamma_1 + X_z \gamma_2 + \varepsilon_z \qquad (4)$$

where X_z represent leader or country-specific characteristics. We estimate equation (4) using weighted least squares, where the weights are equal to the inverse of the estimated variance of $\beta_z - \alpha_z$.[22]

The results from estimating equation (4), where the dependent variable $\beta_z - \alpha_z$ is obtained by estimating equation (3), are presented in Table 7. The independent variables include: (i) a dummy for being an autocrat, defined as having a polity score less than 1/2 in the year prior to death; (ii) the interaction of this dummy with the degree of autocracy, normalized to have mean 0 and standard deviation of 1; and (iii) controls for the age and tenure of the leader in the year prior to death. Column (1) indicates that there is a statistically insignificant positive increase in growth of about 1% when an autocrat dies.

[21] This procedure is similar to the two-step procedure used in the CEO literature (Bertrand and Schoar 2002) and the event study literature in finance (Campbell, Lo, and MacKinlay 1997).

[22] The most careful weighting scheme uses the country-based estimated variance of $\beta_z - \alpha_z$, and these are the results reported in Table 7. Note however, that other weighting schemes (such as regional weighting, or not weighting at all) can reduce the statistical significance and magnitude of the coefficients on autocracy, though the signs on the estimated coefficients always remain the same. This sensitivity of the results to the weights suggests that some caution should be used in the interpretation of these results.

Column (2) indicates that, when controlling for the degree of autocracy, we begin to see weak significance in the effect, with deaths of the most autocratic leaders producing an additional 1% increase in the growth rate. Columns (3) and (4) show that age or tenure appear to have no appreciable impact on the change in growth.[23] When controlling for age and tenure, however, column (5) indicates larger and more significant results for autocracy. We see that the death of autocrats leads to an average of a 2% point increase in growth rates, while the death of extreme autocrats produces a further 1% increase in growth.

The finding that growth tends to improve following autocrats' deaths is informative for several reasons. First, one might have expected the death of autocrats, particularly extreme autocrats, to induce economic chaos instead of accelerated growth. Indeed, concerns over national stability are often used by leaders to justify extensions to their rule. Second, even in the absence of such chaos, one might have expected the regime that follows an autocrat's death to be no better or worse on average than what came before. In fact, it appears the new regime may be systematically better.

These results suggest further investigation, and there are several possible explanations for positive growth effects when autocrats die. Some theories of leadership, such as Olson (1982), suggest that the performance of autocrats may become worse over their tenure. For example, corruption might increase as cronies become more established, or leaders may be unable to adapt their policies as the world around them changes. With such time-varying leader effects, even a transition from autocrat to autocrat would on average produce an increase in growth when comparing the end of one leader's rule with the beginning of the next, and this effect would be larger the longer the tenure of the outgoing autocrat. Evidence from Table 7 provides little support for this hypothesis, however, as controls for tenure do not show significant growth effects when the leader dies; moreover, if anything, the point-estimate on the tenure coefficient is negative, which runs against the idea that the death of longer tenure leaders is especially beneficial.

A second hypothesis is that the effects of leaders are largely fixed over their rule, and that improvements in growth are not coming from autocrats being replaced by

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[23] In results not shown, we find that tenure and age also do not matter when interacted with whether the leader was an autocrat.

autocrats (who would presumably, on average, be no better or worse than one another) but rather from leader deaths that lead to shifts in the political regime. In this view, the deaths of autocrats provide opportunities not simply for leadership change, but also for beneficial institutional change, with associated positive growth effects. The next section explores this hypothesis in detail as we investigate the channels through which leaders affect growth.

4. Through What Channels do Leaders Affect Growth?

The analysis presented above has shown that leaders, particularly autocrats, affect growth, and that growth tends to increase following the death of an autocrat. A natural question, then, is how these effects occur—i.e., through what mechanisms leaders appear to affect growth.

This section explores two questions about the way in which leaders affect growth. First, broadly speaking, leaders could have a *direct* impact on growth by altering the variables they plausibly control, namely, government fiscal and monetary policy, or they could have an *indirect* impact on growth by altering perceptions about the business climate, and therefore spur private investment. Section 4.1 explores whether the effect of leaders is direct or indirect by examining the impact of leaders on a number of macroeconomic variables.

Second, a large literature has argued that political institutions may be important to growth. If leaders can prevent institutional change while in power, then the death of leaders may open up opportunities for institutional change, and the effect of leaders we detect may operate in part through changes in institutions. Section 4.2 explores the effect of leader deaths on institutions, particularly on the level of democracy, and investigates whether increases in democracy following the deaths of autocrats may be responsible for part of the increase in growth we observe.

4.1. Do Leaders Have Direct or Indirect Effects on Growth?

To investigate whether the impact of leaders is direct or indirect, we examine a number of different economic variables. First, we break down growth in GDP into growth in its components—i.e., growth in consumption, government expenditures, investment, exports, and imports. Second, we examine the effect of leaders on monetary policy, by looking at changes in inflation and real exchange rates. All data comes from the Penn World Tables. We focus on growth in government expenditures, inflation, and the real exchange rate—all variables directly affected by government policy—to investigate the direct effect of leaders, and on investment to capture the indirect effect of leaders. We also investigate changes in foreign aid, using data from the World Development Indicators.

The methodology we follow in this section is similar to the methodology developed above. First, for each of the new dependent variables, we re-estimate equation (3) and test the null hypothesis that the dependent variable does not change in an unusual manner across leadership transitions. We also test the same null hypothesis on the subset of leader transitions where the outgoing leader was an autocrat and the outgoing leader was a democrat. The results are reported in Table 8.

Table 8 suggests that leader deaths have a strong effect on consumption growth and growth in government spending but little detectable effect on investment, export, or import growth. As in the results for GDP growth, the effect of leaders on consumption, government spending, and foreign aid rates appears to be driven entirely by the leadership transitions where the outgoing leader was an autocrat. For autocrats, there is also a change in foreign aid, albeit with a slight lag, which may be related to the observed increase in government expenditures.

The lack of an investment response suggests that the effect of the leadership change on growth does not come through effects on investor confidence and private investment. On the other hand, investment is noisier than consumption or government spending, so it is possible that we are failing to detect an investment response when in fact there is one. Consistent with the view that leaders affect growth through direct policy channels, there is also evidence that leaders affect monetary policy, with real exchange rates showing unusual changes following autocrats' deaths.

To examine the directional impact of autocrats on each of these dependent variables, we re-estimate equation (4) for each of these dependent variables. The results are presented in Table 9. The result that emerges most strongly is that there is a substantial increase in the growth rate in government expenditure in the years following the death of an autocrat—from 4.8 percentage points to 5.8 percentage points, depending on the specification. This remains true when controlling for other characteristics of the leader, such as the leader's age and tenure, and it provides further evidence that the effect of leaders on growth is through direct government policy.[24] There is also evidence of a statistically significant increase in exports following the death of highly autocratic leaders, which is consistent with an increase (i.e. devaluation) in the real exchange rate. While other components of GDP do not show statistically significant directional changes, it is noteworthy that all components have positive point estimates for the average autocrat, suggesting a more general increase in economic activity when an autocrat dies.

4.2. Leaders and Institutional Change

A second potentially important channel through which leaders may affect growth is through their impact on institutions. For example, if a particular leader is reluctant to allow institutional changes that might threaten his ability to rule, then the leader's death may provide an opportunity for institutional change. The change in institutions may, in turn, impact growth.

The first question is whether institutions do in fact change in an unusual manner following the death of leaders. To investigate this, we repeat the previous analysis on two different sets of institutional measures. The first set is the Polity IV dataset, which we

[24] Using data from the World Development Indicators, it is possible to examine more detailed aspects of fiscal policy; however, limited data availability results in very small sample sizes and these results are therefore highly speculative. We find that the growth rate in public investment increases on average by a (statistically insignificant) 11% when autocrats die. Furthermore, government revenues appear to increase after the death of highly autocratic leaders not through a broadening of the tax base, but rather through non-tax revenue sources and deficit financing. Attempts to determine whether increased government expenditure is due to human capital expenditures, such as spending on education or health, or other expenditures such as military budgets, are not possible given the very poor data coverage of these variables.

used above to classify leaders as either autocrats or democrats. In addition to the “polity” variable used above, we also examine two other variables in the data set—“democracy”, which measures the intensity of democratic institutions, and “autocracy,” which measures the intensity of autocratic institutions.

The second source of data we use is data from Freedom House (2003). Unlike the Polity data, which is constructed retrospectively, the Freedom House institutional measures are published annually, based on data from the previous year. However, the Freedom House data only begin in 1972, so this data is unavailable for a substantial number of leaders in our sample. We use two measures of democracy produced by Freedom House—“civil freedom” and “political freedom.” To clarify comparisons across the institutional scores, we scale all variables so that 0 represents the most autocratic (least “free”) and 1 represents the most democratic (most “free”).

The results of non-directional tests for changes in institutions at leader deaths are presented in Table 10. Across four of the five measures of democracy examined, we find consistent evidence that institutions change in an unusual manner following the death of autocrats. These results suggest that individual autocrats are able to prevent institutional change while they are in power. Meanwhile, democracies appear to show no unusual changes following leader deaths. As a result, while an autocrat’s death often leads to a new regime, with a different set of institutions, a democrat’s death appears to lead to a new democrat being chosen within the existing institutional environment.[25]

Table 11 presents the directional tests for how institutions change following the death of different types of leaders. With no controls, the results show that, on average, the democracy scores improve by about 10 to 15 percentage points following the death of an autocrat. The interaction with the level of autocracy is not statistically significant, but the point estimates suggest that, if anything, the more autocratic the outgoing leader, the smaller the subsequent increase in democracy following the leader’s death.

[25] In results not reported, we also find that the control timings (t-5 and t-6) are highly significant for democracies. This finding does not appear to be due to specification error, as it is quite robust across many different specifications of the data generating process; rather, it appears to indicate that several democracies in our sample are very new. That is, they moved sharply towards democracy in the ten years preceding the leader death we observe. Examples include Hungary, Portugal, and Guyana among others. Notably, despite their short histories, these new democracies do not slip backwards after an early leader’s death, suggesting that democratic institutions become strong enough to withstand the leader’s death quite quickly.

The directional effects change substantially, however, when we include controls for the age and tenure of the outgoing leader. Now, we find that the main effect for the average difference between autocrats and democrats disappears. Instead, the Polity IV variables show significant offsetting effects for the degree of autocracy and tenure. The deaths of highly autocratic leaders result in still more autocracy, while the deaths of long-serving leaders result in more democracy. The first panel of Table 11 indicates that, on net, the death of autocrats leads on average toward more democracy, because the most autocratic leaders tend to be the longest-serving and the tenure effect wins out.

Given that political institutions change following the death of autocrats, it is worth investigating whether there is a relationship between the tendency toward increased democracy and the change in growth rates discussed above. Figure 4 shows the relationship between the change in democracy level and change in growth rates ($\beta_z - \alpha_z$), for all leader deaths in which there was some subsequent change in political institutions in the period following the leader's death. Democracy is measured using the "polity" variable in the Polity IV dataset. The figure suggests that those countries that experienced relatively small increases in democracy also tended to experience increases in growth — 10 of the 12 countries with small improvements in democracy also experienced improvements in growth. On the other hand, all 5 countries that experienced large increases in democracy following the death of an autocrat experienced declines in growth rates. While of course sample sizes are small, this figure suggests that incremental improvements in democracy may be good for growth, while dramatic shifts to democracy may be bad for growth.

Methodologically, of course, these changes in growth and institutions are simultaneous, so any change in the political regime cannot be viewed as exogenous with respect to changes in growth during the same period. To examine whether the relationship between the change in democracy and the change in growth is causal, one needs instruments to explain the changes in democracy that occur following the death of an autocrat. Three such instruments are (i) the level of democracy currently prevailing elsewhere in the region at the time of the transition; (ii) the highest level of democracy a country has experienced in the past, and (iii) the percentage of time a country has experienced democracy in the past. The first instrument makes sense if, following the death of an autocrat, countries adopt new institutions that are similar to the norms prevailing in their region at the time. The second and third instruments make sense if democratization is more likely in countries that have experienced democracy before. In fact, these instruments have substantial explanatory power for the degree of institutional change, explaining 44% of the variation in institutional change when leaders die.

Table 12 presents the econometric results for the relationship between changes in institutions and changes in growth. In particular, we regress the estimated change in growth, $\beta_z - \alpha_z$, on the ex-post change in democracy, in addition to the set of explanatory variables considered in Section 3.5. The results, both from the OLS and the IV, confirm the pattern in Figure 4. The OLS results indicate that small increases in democracy are associated with 2 to 3 percentage point increases in annual growth rates. Large increases in democracy are associated with substantial decreases in growth, although the significance of this result is lost when controlling for other observable factors about the prior leader. Interestingly, conditioning on the amount of democratization *ex-post* weakens the earlier result that autocrat deaths lead to growth improvements, which suggests that much of the reduced form growth effect of autocrat deaths is captured by institutional change.

The IV results are quite similar to the OLS results. Small increases in democracy appear to lead to 4 to 5 percentage point increases in annual growth on average. Large increases in democracy are not significant but remain similar in sign and magnitude to the OLS coefficients. This confirms the OLS findings that small steps towards democracy improve growth, whereas dramatic democratizations may be bad for growth.

In sum, the results in this section indicate that autocrats affect political institutions. Furthermore, the deaths of autocrats tend to produce substantial increases in democracy. These results are not only interesting in their own right, but they also suggest a further mechanism through which leaders affect growth. By combining (i) the deaths of autocrats, as an exogenous shock to the *timing* of institutional change with (ii) regional institutional norms and national institutional history as instruments for the *extent* of institutional change, we are able identify the effect of institutional change on growth. Our results suggest that a small amount of democratization can be good for growth, whereas dramatic democratization appears to have a negative but statistically insignificant effect.

The specific effect of *democratization* on growth, as distinct from the level effects of democracy, is an important practical policy question. While the empirical literature on the level effect of democracy on growth has produced ambiguous results (See Przeworski & Limongi, 1993, for a survey), more recent work has suggested that moves toward democracy are associated with higher subsequent growth rates (Minier, 1998). The results in this paper imply that democratization should be pursued, but pursued slowly, although the small sample sizes suggest that this result should be interpreted with some caution.[26]

5. Robustness of Results

The results presented above incorporated three kinds of robustness checks. First, they considered different specifications for the error structure. Second, they considered control experiments as falsification exercises. Third, they presented results from a non-parametric "rank test." This section presents several additional types of robustness and specification checks on the main result that leaders matter for growth. In section 5.1, we investigate whether leader deaths are random with regard to underlying economic conditions. In section 5.2, we investigate the implications of different choices for the length of observation before and after leader deaths, the implications of using different control variable strategies, and the power of specific decades to drive the results.

5.1. Investigating leader deaths

Throughout the paper, we have argued that death of leaders while in office provides a source of variation in leadership that is unrelated to underlying economic conditions, and that therefore these deaths can be used to examine whether leaders have an impact on growth. A natural specification check that these deaths are, in fact, random

[26] A separate and extensive literature has found that political regime changes and instability are associated with lower growth rates (see, e.g., Barro, 1996 and Alesina et al, 1996), suggesting that radical shifts in political institutions may be detrimental, as is seen in our results.

with respect to the economic variables of interest is to check that these variables do not predict the timing of leader deaths. To examine this, we estimate a conditional fixed-effects logit model, where the independent variables are lags of economic variables of interest in the paper, the dependent variable is a dummy variable that is 1 in the year of a random leader death, and the fixed effect captures the number of leader deaths that occur in a given country. This model estimates whether, given that a country has a leader die in office, growth or other economic variables predict the timing of a leader death.

The results are presented in Table 13 with 1 year lags of the independent variables; results using the averages of the dependent variable over the previous 3 or 5 years are qualitatively similar. Importantly, we see that growth, as well as changes in the components of GDP and changes in the terms of trade, do not predict the death of leaders. The only variable that appears to predict the death of leaders are changes in the real exchange rate. Given that the exchange rate is a financial variable, it should incorporate all information known about the future. If the exchange rate is anticipated to shift when the leader dies and government policy changes, and the leaders' death is anticipated (say, due to a prolonged illness), then we might expect the exchange rate to move in advance of the leader's actual death. To check this hypothesis, column (4) presents the results for the subset of leader deaths that were accidental, and therefore completely unanticipated. As this hypothesis would suggest, in these cases the real exchange rate no longer predicts the leader's death.

A second, related question is what happens when we exclude certain types of leader deaths. Even though the analysis above suggests that, on average, growth does not predict leader deaths, conspiracy theories are sometimes suggested when leaders die in plane crashes, and one might be concerned that deaths from heart attacks could be due to stress induced by unfavorable economic conditions. Therefore, as a robustness check, the first panel of Table 14 presents the main non-directional results excluding, separately, all deaths from heart attacks and all deaths from air crashes. Though the results lose some power, they are still statistically significant and similar to the main results. This confirms that, at least individually, neither of these two stories is driving the results.

5.2 Alternative Specifications

In the main analysis presented above, average growth was compared for 5 year periods before and after each leader death. The choice of 5 years is essentially *ad hoc* and can only approximate the effect of leaders who may have been in power for substantially more or less than 5 years. As a general matter, we might think that choosing any fixed number of years for the comparison should bias the results against finding a growth effect, since we are capturing the actual tenure of the leaders poorly. In particular, a 5-year period may be too long to capture the effects of short term leaders and too short to capture the effects of long-term leaders, such as Mao, whose influence would have been felt over a much longer period.

One simple robustness check on the results is to consider observation periods of different lengths. The second panel of Table 14 reconsiders the growth regressions and hypothesis tests using both a 3-year observation window and a 7-year observation window. The results appear essentially similar to the main results in Table 14, which suggests that the results do not depend on the time window chosen. Moreover, the fact that the results are still present with a 7-year observation window suggests that the effects we detect are quite persistent.

A further question when estimating equation (3) is the appropriate choice of right-hand side control variables. All of the main results have included a set of time fixed effects to pick up common, worldwide trends in growth. The final panel of Table 14 presents several alternatives, including no time fixed effects, separate time fixed effects for each region of the world, and a set of time-varying variables that control for a set of exogenous shocks.[27] In results not reported, we also include the lag of log per-capita GDP to capture the convergence effect, as well as a variety of further combinations of regressors and their interactions. These different control strategies do not substantially affect the main results.

[27] The regions of the world are Asia, Latin America, Western Europe, Eastern Europe/Transition, Middle East/North Africa, Sub-Saharan Africa, and Other. The exogenous controls are terms of trade (levels and changes), oil prices interacted with average net oil exports (levels and changes), and a number of variables that capture different types of natural disasters, including droughts, floods, epidemics, earthquakes, and windstorms.

Finally, it is worth checking that no particular decade is driving the results. In particular, one might be concerned that the 1970s, with the oil shocks and worldwide productivity slowdown, might be driving the results if the time fixed effects were not properly accounting for these effects. To confirm that this is not the case, in results not presented, we have repeated the analysis, sequentially dropping leaders from each decade. We find that the results are robust to excluding any decade's leader deaths.

6. Conclusion

Recent work in the cross-country growth literature has suggested that growth in the typical country changes dramatically from one decade to the next, with developing countries in particular showing sharp changes in growth patterns. This observation suggests that growth is, to an important degree, a function of relatively short-run forces.

This paper considers one possible force – the national leader – in explaining these growth experiences. Randomly-timed leader deaths are used as a natural experiment to identify the causative impact of leaders. We find that countries experience persistent changes in growth rates across these leadership transitions, suggesting that leaders have a large causative influence on the economic outcomes of their nations.

The paper further shows that the effects of leaders are very strong in autocratic settings but undetectable in the presence of democratic institutions. Moreover, we find some evidence that the deaths of autocrats, and particularly extreme autocrats, lead on average to improvements in growth rates. The effect of leaders appears to be felt through their ability to influence fiscal and monetary policy and their ability to influence political institutions. Finally, we identify the causative effect of institutional change on subsequent growth, finding that a small amount of democratization is beneficial, whereas dramatic democratization appears to have a negative effect.

These results add texture to a growing literature on institutions in shaping economic outcomes. In particular, this research suggests that political institutions, separate from property rights or other institutional features, have large implications for growth. One interpretation of these results is that international intervention to remove an autocrat may have a first-order economic basis, particularly if the leadership change is associated with modest increases in democracy. Of course, a leadership change caused by external forces may be very different from a natural leader death, and the policies used to effect such a change may have their own adverse consequences for growth.[28]

The authors' primary interest in this study is to improve our understanding of the forces behind economic outcomes. However, this research also informs a separate and very old literature in history and political science that considers the role of national leaders in shaping events. Deterministic views suggest that leaders have little or no influence, while the Great Man view of history, at the other extreme, sees history as the biographies of a small number of individuals. Tolstoy believed this debate methodologically impossible to settle (Tolstoy, 1869). Using randomly-timed leader deaths, the analysis in this paper presents a methodology for analyzing the causative impact of leaders. We find that leaders do matter, and they matter to something as significant as national economic growth.

[28] Policy instruments that can promote leadership change include the leverage of international financial institutions, bilateral foreign aid, amnesty offers, economic sanctions, and military intervention. Such instruments have been used recently with leadership change in mind; examples include Robert Mugabe in Zimbabwe, Charles Taylor in Liberia, Jean-Bertrand Aristide in Haiti, and Saddam Hussein in Iraq.

Appendix: The leadership data set

For each country in the sample, we began with a list of all heads of state and heads of government in the 1945-1992 period, compiled from Lentz (1994). To extend this list of leaders through the end of the year 2000, we used data from the CIA World Factbook (2003) and the Zarate Political Collections (Zarate, 2003). The identity of each leader, their title, dates of tenure, and date of birth were assembled into a preliminary data set.

The next step was to determine, at each point in the sample period for each country, which individual was the "national leader": the head of state, usually under the title of President, the head of government, usually under the title of Prime Minister, or perhaps some third figure. We defined the national leader to be the individual in the country who holds the most executive power, and determined the identity of this individual through extensive historical and biographical research. The major biographical sources used in making this determination are listed at the end of paper.

In most cases, identifying the national leader was straightforward, as most countries fell into one of five institutional structures with a clear national leader. In one set of countries, only one leadership position exists. This situation is particularly common in Latin America, where countries typically have presidents but no prime ministers. In the second set of countries, the same individual is both head of state and head of government. This situation is most common in dictatorial regimes and appears relatively often in Africa. In the third set of countries, the head of state is separate from the head of government, but one of the two is clearly subordinate to the other. Typically, the subordinate position is regularly appointed and dismissed by the other leader, and there are often interregnum periods in the subordinate role. This is particularly common in monarchies but holds in many other cases throughout the world. In the fourth set of countries, most often in Western Europe and the former British colonies, the head of state is a figurehead and power lies with the prime minister. Finally, a number of democracies vest executive power in the president, with legislative authority delegated to the national assembly. Collectively, these five institutional settings, in which the national leader is clearly defined, account for 90% of the leaders in the sample.

Identifying the national leader in the remaining 10% of cases required further historical and biographical research. True institutional parity between the two roles is rare, so identifying which individual held the most executive power remained straightforward in most cases. Military juntas, for example, often begin with a notionally rotating chairman, but such institutional arrangements do not last. An example of a more persistent, ambiguous situation is Thailand, where power over significant periods was held in a compromise arrangement between the military, the prime minister, and the king.

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Table 1: How Leaders Leave Power

130 Countries
All Leaders from 1945 or National Independence Date through 2000
Number of Observations, by Type

Lost Election	Term Limits	Voluntary Retirement	Deposed	Death[a]	Other	Total
310	178	131	222	105	225	1184[b]

Death, by type:

Assassination	Natural	Accidental	Total
28	65	12	105

Natural and accidental deaths, by cause:

Natural: Heart disease	Natural: Cancer	Natural: Stroke	Natural: Other Disease	Natural: Surgical complications	Natural: Other	Accidental: Air crash	Accidental: Other	Total
29	12	6	6	3	9	10	4	79[c]

Notes: [a] There are 21 further cases (not included here) where leaders are killed during a coup. [b] There are 1294 distinct terms in which leaders are in power in the data set, but only 1184 counted in this table, as we do not witness the exit of leaders who are still in power at the end of the year 2000. [c] There are 79 cases of leaders who die in office by natural causes or accidents, but only 57 who die during periods where there is available growth data before and after the leader's death.

Table 2: Random Deaths of National Leaders

Country	Leader	Year of Death	Tenure (Years)	Nature of Death
Algeria	Houari Boumediene	1978	13.5	Waldenstrom's disease (blood disorder)
Angola	Agostinho Neto	1979	3.9	Cancer of the pancreas
Argentina	Juan Peron	1974	.7[a]	Heart and kidney failure
Australia	John Curtin	1945	3.7	Heart attack
Australia	Harold Holt	1967	1.9	Drowned while skin-diving in Port Philip Bay
Barbados	John (Tom) Adams	1985	8.5	Heart attack
Barbados	Errol Barrow	1987	1.0[a]	No cause of death announced
Bolivia	Rene Barrientos (Ortuna)	1969	2.7[a]	Helicopter crash
Botswana	Sir Seretse Khama	1980	13.8	Cancer of the stomach
Brazil	Arthur da Costa e Silva	1969	2.6	Paralytic stroke, then heart attack
China	Mao Tse-tung	1976	26.9	Parkinson's disease
China	Deng Xiaoping	1997	19.2	Parkinson's disease
Comoros	Prince Jaffar	1975	.4	While on pilgrimage to Mecca
Comoros	Mohamad Taki	1998	2.7	Heart attack
Cote d'Ivoire	Felix Houphouet-Boigny	1993	33.3	Following surgery for prostate cancer
Denmark	Hans Hedtoft	1955	1.3[a]	Heart attack in hotel in Stockholm
Denmark	Hans Hansen	1960	5.0	Cancer
Dominica	Roosevelt Douglas	2000	0.7	Heart attack
Ecuador	Jaime Roldos (Aguilera)	1981	1.8	Plane crash in Andes
Egypt	Gamal Abdel Nasser	1970	15.9	Heart attack
France	Georges Pompidou	1974	4.8	Cancer
Gabon	Leon Mba	1967	7.3	Cancer (in Paris)
Greece	Georgios II	1947	11.4	Heart attack
Grenada	Herbert Blaize	1989	5.0	Prostate cancer

Guinea	Sekou Toure	1984	25.5	Heart attack during surgery in Cleveland
Guyana	Linden Burnham	1985	19.2	During surgery
Guyana	Cheddi Jagan	1997	4.4	Heart attack a few weeks after heart surgery
Haiti	Francois Duvalier	1971	13.5	Heart disease
Hungary	Jozsef Antall	1993	3.6	Lymphatic cancer
Iceland	Bjarni Benediktsson	1970	6.7	House fire
India	Jawaharlal Nehru	1964	16.8	Stroke
India	Lal Bahadur Shastri	1966	1.6	Heart attack
Iran	Ayatollah Khomeini	1989	10.3	Following surgery to stem intestinal bleeding
Israel	Levi Eshkol	1969	5.7	Heart attack
Jamaica	Donald Sangster	1967	0.1	Stroke
Japan	Masayoshi Ohira	1980	1.5	Heart attack
Japan	Keizo Obuchi	2000	1.7	Stroke
Jordan	Hussein al-Hashimi	1999	46.5	Non-Hodgkin's lymphoma
Kenya	Jomo Kenyatta	1978	14.7	While sleeping
Liberia	William V.S. Tubman	1971	27.6	Complications surrounding surgery on prostate
Luxembourg	Pierre Dupong	1953	16.1	Complications from broken leg
Luxembourg	Pierre Frieden	1959	0.9	Cause unclear
Malaysia	Tun Abdul Razak	1976	5.3[a]	Leukemia (in London)
Mauritania	Ahmed Ould Bouceif	1979	.1	Plane crash in sandstorm over Atlantic
Morocco	Mohammed V	1961	5.3[a]	Following operation to remove growth in throat
Morocco	Hassan II	1999	38.4	Heart attack
Mozambique	Samora Machel	1986	11.3	Plane crash near Maputo
Nepal	Tribhuvan	1955	4.1	Heart attack in Zurich
Nepal	Mahendra	1972	16.9	Heart attack
New Zealand	Norman Kirk	1974	1.7	Heart attack
Nicaragua	Rene Schick Gutierrez	1966	3.3	Heart attack
Niger	Seyni Kountche	1987	13.6	Cancer (brain tumor)
Nigeria	Sani Abacha	1998	4.6	Heart attack (some say poisoned)
Pakistan	Mohammed Ali Jinnah	1948	1.1	Heart failure
Pakistan	Mohammed Zia Ul-Haq	1988	11.1	Plane crash in Pakistan
Panama	Domingo Diaz Arosemena	1949	.9	Heart attack
Panama	Omar Torrijos Herrera	1981	12.8	Plane crash near Penonomé
Philippines	Manuel Roxas y Acuna	1948	1.9	Heart attack
Philippines	Ramon Magsaysay	1957	3.2	Plane crash on Cebu Island
Poland	Boleslaw Bierut	1956	11.2	Heart attack
Portugal	Francisco de Sa Carneiro	1980	0.9	Light plane crash near Lisbon
Romania	Gheorghe Gheorghiu-Dej	1965	17.2	Pneumonia
Sierra Leone	Sir Milton Margai	1964	3.0	After "brief illness"
South Africa	Johannes G. Strijdom	1958	3.7	Heart disease
Spain	Francisco Franco	1975	36.3	Heart failure
Sri Lanka	Don Stephen Senanayake	1952	4.5	Thrown from horse
Swaziland	Sobhuza II	1982	60.7	Unknown
Sweden	Per Hansson	1946	10.0	Stroke
Syria	Hafiz al-Assad	2000	29.6	Heart attack
Taiwan	Chiang Kai-Shek	1975	25.3[a]	Heart attack
Taiwan	Chiang Ching-Kuo	1988	12.8	Heart attack
Thailand	Sarit Thanarat	1963	5.1	Heart and lung ailments
Trinidad & Tobago	Eric Williams	1981	18.6	Complications from diabetes
USA	Franklin D. Roosevelt	1945	12.1	Stroke
Uruguay	Tomas Berreta	1947	.4	During emergency surgery
Uruguay	Luis Ganattasio	1965	.9	Heart attack
Uruguay	Oscar Gestido	1967	.8	Heart attack

Notes: [a] Second time in power.

Table 3: Summary Statistics -- Who dies in office?

	"Random" leaders in last year of rule	All leader – year observations
Autocrat	0.519	0.427
	(0.505)	(0.494)
Age	64.623***	56.404
	(11.742)	(11.094)
Tenure	10.623	10.803
	(10.727)	(10.148)
Log Real GDP Per Capita	8.150	8.180
	(0.922)	(1.020)
Western Europe	0.123	0.164
	(0.331)	(0.370)
Transition / Eastern Europe	0.035	0.041
	(0.185)	(0.198)
Latin America	0.228	0.235
	(0.423)	(0.424)
Sub-Saharan Africa	0.247	0.290
	(0.434)	(0.454)
Asia	0.211*	0.131
	(0.411)	(0.337)
Middle East/North Africa	0.123	0.074
	(0.331)	(0.262)
Year 1951 – 1960	0.105	0.123
	(0.309)	(0.327)
Year 1961 – 1970	0.263	0.199
	(0.444)	(0.340)
Year 1971 – 1980	0.243	0.212
	(0.434)	(0.409)
Year 1981 – 1990	0.211	0.219
	(0.411)	(0.413)
Year 1991 – 2000	0.175	0.248
	(0.383)	(0.432)

Notes: Standard deviations in parentheses. The sample period includes all years for which growth data is available from the Penn World Tables. Asterisks report results of a two-sample t-test of differences in means between the random leaders and all leader-year observations. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Do Leaders Matter?

	P-values: Probability that average growth does not change systematically across randomly-timed leader deaths					
	All Leaders			Leaders with Tenure >= 2 Years		
	(1) Wald	(2) Wald	(3) Rank	(4) Wald	(5) Wald	(6) Rank
Treatment Timings						
t	.0918*	.0573*	.0260**	.0620*	.0390**	.0187**
t+1	.0860*	.0845*	.1187	.0529*	.0537*	.1387
t+2	.0573*	.0669*	.0313**	.0237**	.0314**	.0053***
Control Timings						
t-5	.7585	.7953	.6391	.6066	.6269	.5053
t-6	.3911	.5026	.8950	.4841	.5409	.9640
Number of leaders (t)	57	57	57	47	47	47
Number of observations (t)	5567	5567	5567	5567	5567	5567
Region-specific heteroskedasticity	Yes	Yes	N/A	Yes	Yes	N/A
AR(1) error structure:	Common	Region	N/A	Common	Region	N/A

Notes: The table reports p-values, indicating the probability that the null hypothesis is true. Under the null hypothesis, growth is similar before and after randomly-timed leader transitions. P-values in columns (1), (2), (4) and (5) are from Chi-squared tests, where the POST and PRE dummies are estimated via OLS with the variance-covariance structure specified in the column; estimation of columns (3) and (6) is via the rank-method described in the text. Region-specific error structures estimate separate variance and AR(1) coefficients for each of the following regions: Asia, Latin America, Western Europe, Eastern Europe/Transition, Middle East/North Africa, Sub-Saharan Africa, and Other.

The regressions reported in this table compare 5-year growth averages before and after leader deaths. The treatment timing "t" considers growth in the 5-year period prior to the transition year with growth in the 5-year period after the transition year. The treatment timings "t+1" and "t+2" shift the POST period forward 1 and 2 years respectively. The control timings shift both PRE and POST dummies 5 and 6 years backwards in time, respectively.

Asterisks indicate the significance with which the null is rejected:

* indicates 90% significance; ** indicates 95% significance; *** indicates 99% significance.

Table 5: Interactions with Type of Political Regime in Year Prior to Death

	P-values: Probability that average growth does not change systematically across randomly-timed leader deaths					
	(1) Wald	(2) Wald	(3) Rank	(4) Wald	(5) Wald	(6) Rank
	Autocrats			Democrats		
Treatment Timings						
t	.0517*	.0186**	.0527*	.3764	.4597	.1293
t+1	.0225**	.0157**	.0973*	.4591	.5522	.4647
t+2	.0353**	.0283**	.0447**	.3035	.4318	.2007
Control Timings						
t-5	.7610	.6981	.8293	.5107	.6316	.1293
t-6	.3234	.3340	.9840	.7993	.8730	.4093
Number of leaders (t)	29	29	29	22	22	22
Heteroskedasticity	Region	Region	N/A	Region	Region	N/A
AR(1)	Common	Region	N/A	Common	Region	N/A

Notes: See notes to previous table. Distinctions across leader sets are defined using the "polity" variable in the Polity IV data set in the year prior to the leader's death. Autocrats are defined by having a polity score less than 1/2. Democrats are those leaders with a polity score greater than or equal to 1/2.

Table 6: Interactions with Deterministic Variables

	Settler Mortality		High Ethnic Fragmentation			Low Ethnic Fragmentation		
	High	Low	All	Autoc	Democ	All	Autoc	Democ
Treatment timings								
t	.0323**	.6539	.0236**	.0036***	.7819	.2701	.5558	.1390
t+1	.0287**	.5871	.0132**	.0062***	.3855	.6053	.3671	.5236
t+2	.0258**	.9291	.0608*	.0401**	.3922	.3178	.1863	.4408
Control timings								
t-5	.4618	.6694	.4509	.5935	.2493	.7506	.5405	.7824
t-6	.4501	.6585	.3065	.2450	.4948	.5924	.5959	.8848
Number of leaders (t)	16	15	28	18	10	22	8	10

	Low Income in 1960			Middle Income in 1960			High Income in 1960		
	All	Autoc	Democ	All	Autoc	Democ	All	Autoc	Democ
Treatment timings									
t	.3762	.2356	.8933	.1005	.0298**	.7797	.1029	.0637*	.1239
t+1	.4215	.2462	.9455	.0606*	.0262**	.4108	.2528	.0548*	.2852
t+2	.7214	.6788	.9599	.0191**	.0122**	.2104	.2610	.0706*	.2937
Control timings									
t-5	.8951	.7361	.8778	.3480	.4979	.1259	.7556	.5341	.7968
t-6	.6844	.4600	.8425	.2666	.2308	.4544	.5197	.8999	.8221
Number of leaders (t)	15	11	3	24	17	5	15	1	12

Notes: See Notes to previous tables. “High” settler mortality and ethnic fragmentation refer to all countries above the median in that variable among all countries in the sample, not just countries with random leader deaths. Low Income, Middle Income, and High Income split countries into thirds by per-capita income in 1960. The table reports p-values for the Wald test of the null hypothesis that growth does not change unusually in the five years before and after a random leadership transition. All specifications reported here are from OLS regressions that allow for a region-specific AR(1) process and region-specific heteroskedasticity.

Table 7: How Does Growth Change Following Leader Transitions?

	(1)	(2)	(3)	(4)	(5)
Autocrat	0.00903	0.01023			0.02084*
	(0.00901)	(0.00886)			(0.01200)
Autocrat * Degree of		0.00904*			0.01112**
Autocracy		(0.00526)			(0.00546)
Tenure			0.00012		-0.00097
			(0.00049)		(0.00070)
Age				0.00007	0.00033
				(0.00034)	(0.00037)
Constant	-0.00386	-0.00386	-0.00214	-0.00584	-0.02051
	(0.00582)	(0.00571)	(0.00654)	(0.02308)	(0.02320)
Observations	51	51	53	53	51
R-squared	0.02	0.08	0.00	0.00	0.12

Notes: This table presents the results from estimating equation (4) using weighted least-squares. The dependent variable is the average difference in annual growth rates between the five years after the leader's death and the five years before the leader's death, estimated by OLS with country-specific heteroskedasticity and regional AR(1) using equation (3). Standard errors are in parentheses.
* indicates 90% significance; ** indicates 95% significance; *** indicates 99% significance.

Table 8: Through What Channels Do Leaders Affect Growth? Non-directional Results

	P-values: Probability that dependent variable does not change systematically across randomly-timed leader deaths							
	Growth in Components of GDP						Change in Real Exchg. Rate	Growth in Foreign Aid
	C	G	I	X	M	Inflation		
All leaders								
t	.0288**	.0007***	.6564	.8544	.7281	.7546	.0001***	.3855
t+1	.0023***	.0109**	.5325	.7982	.8181	.5073	.3996	.3775
t+2	.1901	.2323	.1656	.3180	.8306	.7076	.2222	.1707
t-5	.3732	.9391	.5312	.7723	.9996	.4324	.9859	.4911
t-6	.4494	.9507	.9227	.2029	.5485	.9914	.4271	.0001***
Autocrats								
t	.0041***	.0000***	.7395	.5209	.8272	.1728	.0001***	.2425
t+1	.0001***	.0003***	.3789	.3664	.7427	.0915*	.0384**	.0936*
t+2	.3082	.0798*	.4547	.0705*	.9754	.3036	.0313**	.0517**
t-5	.7711	.7515	.5889	.8050	.9846	.7373	.8961	.1672
t-6	.8852	.7281	.7375	.7054	.7496	.9702	.1982	.0001***
Democrats								
t	.8817	.9479	.2272	.9198	.4655	.9281	.7462	.4732
t+1	.6165	.9347	.6698	.9458	.7484	.6960	.9251	.7657
t+2	.1914	.9280	.3347	.8276	.3614	.6114	.8246	.7887
t-5	.2759	.8857	.7001	.3678	.9429	.0230**	.8583	.9730
t-6	.2967	.9009	.9236	.0298**	.3498	.7120	.5014	.7842
Country-specific heteroskedasticity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	Region	Region	Region	Region	Region	Region	Region	Region
Number of leaders (t)	57	57	57	57	57	57	57	39

Notes: See notes to Table 4. The table reports p-values for the Wald test that the dependent variable does not change systematically in the five years before and after a random leadership transition. All specifications reported are from OLS regressions that allow for a region-specific AR(1) process and country-specific heteroskedasticity.

Table 9: Through What Channels Do Leaders Affect Growth? Directional Results

	Growth in Components of GDP						Change in Real Exchg. Rate	Growth in Foreign Aid
	C	G	I	X	M	Inflation		
No Controls								
Autocrat	0.007	0.048***	0.022	0.008	0.017	-0.009	-0.014	0.009
	(0.011)	(0.018)	(0.029)	(0.018)	(0.023)	(0.026)	(0.018)	(0.102)
Autocrat * Degree of	0.002	0.004	-0.010	0.040**	0.016	0.014	0.018	-0.001
Autocracy	(0.006)	(0.010)	(0.018)	(0.016)	(0.017)	(0.017)	(0.013)	(0.062)
Tenure/Age Controls								
Autocrat	0.018	0.058**	0.046	0.015	0.030	-0.036	-0.015	0.029
	(0.015)	(0.023)	(0.037)	(0.021)	(0.028)	(0.031)	(0.024)	(0.110)
Autocrat * Degree of	0.005	0.007	-0.010	0.042***	0.017	0.014	0.018	0.001
Autocracy	(0.007)	(0.010)	(0.019)	(0.015)	(0.017)	(0.017)	(0.014)	(0.062)
Number of leaders (t)	51	51	51	51	51	51	51	35

Notes: This table presents the results from estimating equation (4) using weighted least-squares. The dependent variable is given at the top of each column. Estimation is by OLS with country-specific heteroskedasticity and regional AR(1) using equation (3). Standard errors are given in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 10: Do Leaders Affect Institutions? Non-Directional Results

P-values: Probability that dependent variable does not change systematically across randomly-timed leader deaths

	Polity IV Measures			Freedom House Measures	
	Polity	Democracy	Autocracy	Civil Freedom	Political Freedom
Autocrats					
t	.0009***	.0029***	.0012***	.0109**	.3678
t+1	.0010***	.0013***	.0106**	.0256**	.1739
t+2	.0001***	.0001***	.0024***	.0558*	.2390
Democrats					
t	.9909	.9281	.9997	.5057	.2331
t+1	.9972	.9907	.9995	.5494	.2290
t+2	.9918	.9709	.9982	.5001	.3562
Num of leaders	52	52	52	34	34

Notes: See notes to Table 4. The table reports p-values for the Wald test of the null hypothesis that the dependent variable does not change systematically in the five years before and after a random leadership transition. All specifications reported here are from OLS regressions that allow for a region-specific AR(1) process and heteroskedasticity that varies by the lagged dependent variable.

Table 11: Do Leaders Affect Institutions? Directional Results

	(1)	(2)	(3)	(4)	(5)
	Polity IV Measures			Freedom House Measures	
	Polity	Democracy	Autocracy	Civil Freedom	Political Freedom
No Controls					
Autocrat	0.128**	0.105*	0.158***	0.155**	0.073
	(0.052)	(0.056)	(0.046)	(0.060)	(0.070)
Autocrat * Degree of Autocracy	-0.070	-0.067	-0.067	0.002	0.001
	(0.043)	(0.043)	(0.043)	(0.038)	(0.041)
Tenure/Age Controls					
Autocrat	0.001	-0.009	0.012	0.082	0.024
	(0.056)	(0.061)	(0.053)	(0.080)	(0.093)
Autocrat * Degree of Autocracy	-0.111***	-0.112**	-0.101**	0.009	0.010
	(0.040)	(0.043)	(0.039)	(0.038)	(0.043)
Tenure	0.014***	0.014***	0.013***	0.005	0.003
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Age	-0.002	-0.002	-0.002	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Number of observations	49	49	49	30	30

Notes: See notes to previous tables.

Table 12: Do Changes in Institutions Affect Growth?

	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Small Increase in Democracy	0.027**	0.024*	0.026*	0.045***	0.056**	0.044**
	(0.010)	(0.013)	(0.013)	(0.016)	(0.027)	(0.020)
Large Increase in Democracy	-0.024*	-0.037*	-0.032	-0.027	-0.037	-0.043
	(0.013)	(0.019)	(0.020)	(0.021)	(0.035)	(0.035)
Autocrat		0.008	0.013		-0.004	0.008
		(0.010)	(0.012)		(0.015)	(0.0137)
Autocrat * Degree of Autocracy		0.005	0.003		0.011	0.009
		(0.007)	(0.008)		(0.011)	(0.011)
Tenure			-0.0006			-0.0006
			(0.0007)			(0.0008)
Age			0.00008			-0.00004
			(0.00037)			(0.00039)
Constant	-0.003	-0.004	-0.007	-0.006	-0.006	0.0002
	(0.005)	(0.005)	(0.023)	(0.006)	(0.006)	(0.0245)
Number of leaders	49	49	49	49	49	49

Notes: The dependent variable is the change in growth, comparing the 5 years after a leader death with the 5 years before the leader death, as estimated by equation (3). Estimation is by weighted OLS and weighted IV regressions, where the weights are equal to the inverse of the estimated variance of $\beta_z - \alpha_z$. Instruments are the regional mean democracy level at time of death, the percentage of time the country has experienced democracy in the past, the maximum degree of democracy experienced in the past, and the interaction of these instruments with a dummy for autocracy. Standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 13: Do Economic Variables Predict "Random" Leader Deaths?

	Leader dies by natural causes or accident	Leader dies by natural causes or accident	Leader dies by natural causes	Leader dies in accident	Leader dies by natural causes or accident
Previous Year's					
Growth	2.468	1.998	1.582	4.091	
	(2.240)	(2.292)	(2.596)	(4.905)	
Change in Terms of Trade		0.850	0.825	3.210	0.572
		(1.141)	(1.231)	(3.172)	(1.158)
Change in Exchange Rate		-3.498**	-4.731***	0.118	-3.586**
		(1.486)	(1.782)	(1.821)	(1.502)
Change in Consumption					0.151
					(1.558)
Change in Government Expenditure					-0.132
					(1.151)
Change in Investment					0.544
					(0.767)
Change in Trade					0.797
					(1.337)
Observations	2217	2217	1699	459	2215

Notes: Reported coefficients are from a conditional fixed-effects logit model of the probability of a "random" leader break occurring in a given year, conditional on the number of leader deaths that actually occurred in each country. Results using mean change in independent variable over the previous 3 or 5 years, rather than in the previous year, are qualitatively similar. Standard errors are in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 14: Alternative Specifications

	Excluding Air Crashes			Excluding Heart Attacks		
	All	Autoc	Democ	All	Autoc	Democ
t	.0768*	.0326**	.4603	.1100	.0925*	.2749
t+1	.1859	.0331**	.7245	.1037	.0859*	.2423
t+2	.2020	.0698*	.5766	.0228**	.0300**	.1657
t-5	.7685	.6160	.6877	.5184	.4008	.5345
t-6	.5665	.1989	.8886	.0748*	.0581*	.7035
Number of leaders (t)	49	25	20	39	20	14

	3 Year Dummies			7 Year Dummies		
	All	Autoc	Democ	All	Autoc	Democ
t	.0220**	.0265**	.0900*	.0442**	.0069***	.5752
t+1	.0877*	.0526*	.2116	.0856*	.0168**	.4570
t+2	.1447	.1852	.2050	.2564	.1029	.6533
t-5	.7449	.7995	.3607	.4086	.2764	.6772
t-6	.4296	.3387	.9260	.1714	.4543	.5775
Number of leaders (t)	57	29	22	57	29	22

	No Time FE			Time FE Interacted with Region			Time FE plus exogenous shocks		
	All	Autoc	Democ	All	Autoc	Democ	All	Autoc	Democ
t	.0473**	.0538*	.2897	.0408**	.0208**	.4150	.0414**	.0210**	.3106
t+1	.0949*	.0369**	.4348	.0561*	.0099***	.5957	.0837*	.0273**	.4315
t+2	.0912*	.0494**	.4151	.0303**	.0264**	.2373	.0723	.0564*	.2875
t-5	.6349	.4830	.6822	.8551	.6634	.7292	.8627	.7551	.7236
t-6	.3145	.1416	.9019	.5570	.2061	.9447	.5009	.3692	.8871
Number of leaders (t)	57	29	22	57	29	22	53	29	19

Notes: See notes to previous tables.
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1: China's Growth Experience

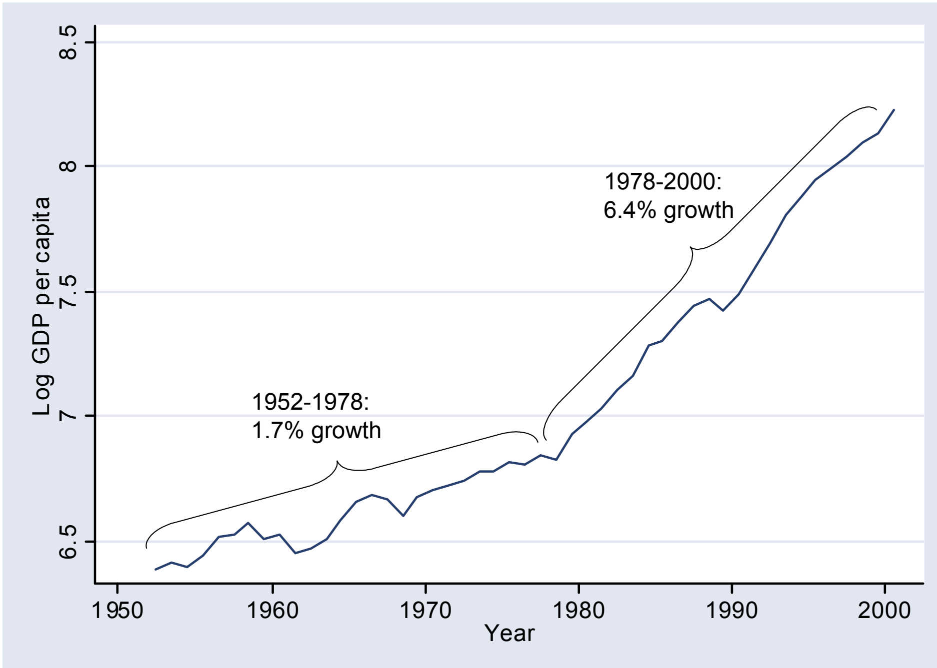


Figure 2: Growth and Random Leader Deaths

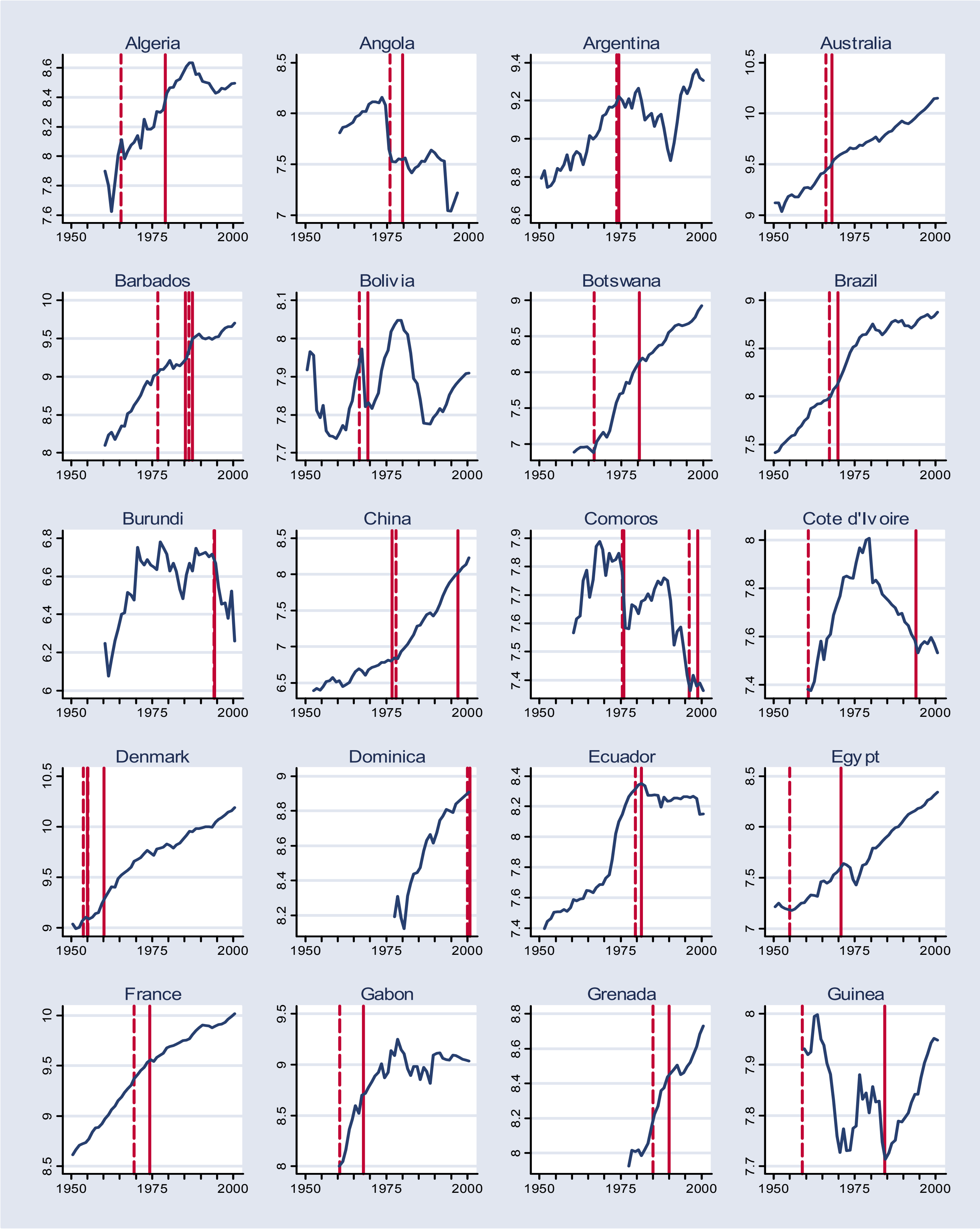
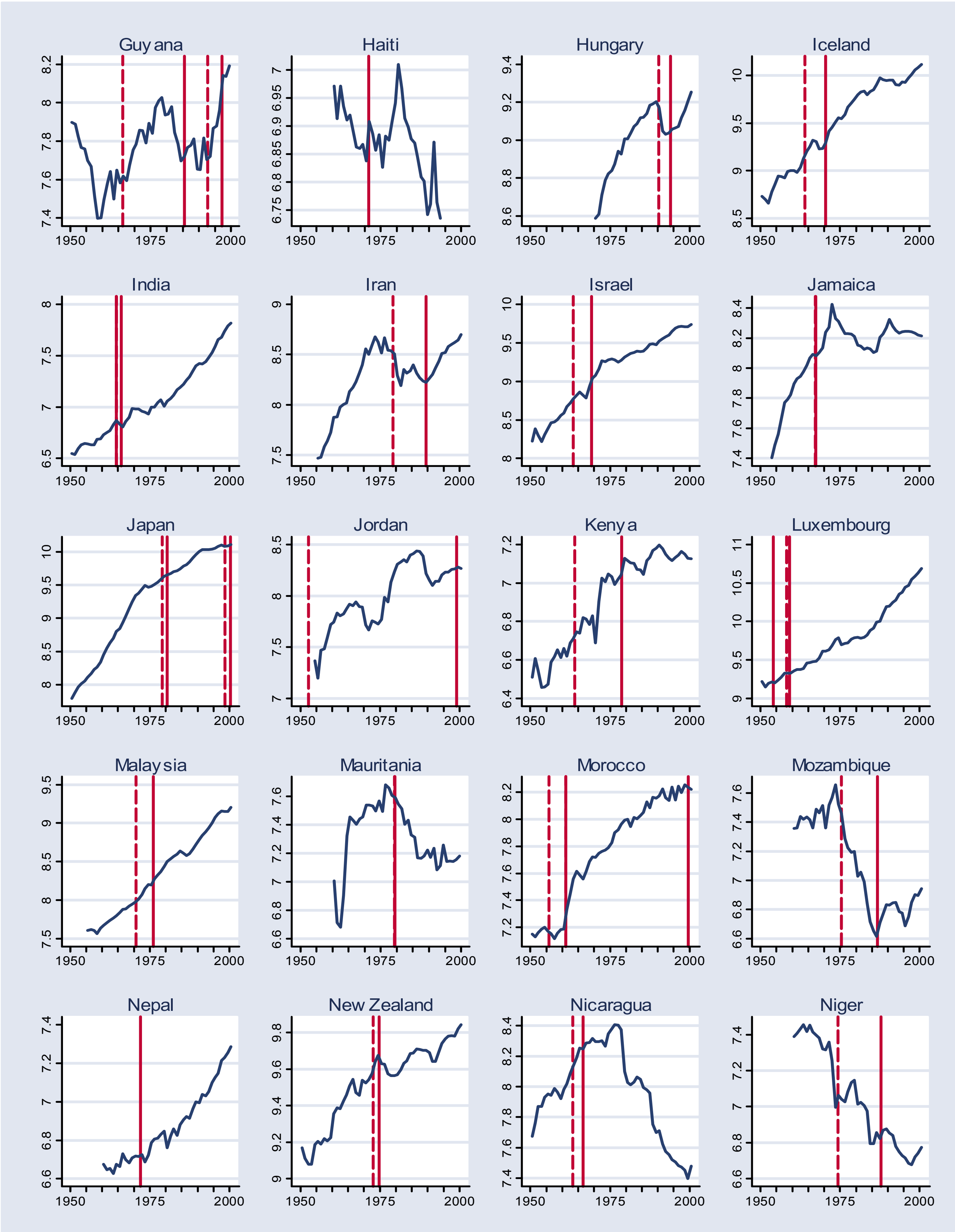


Figure 2 (continued)



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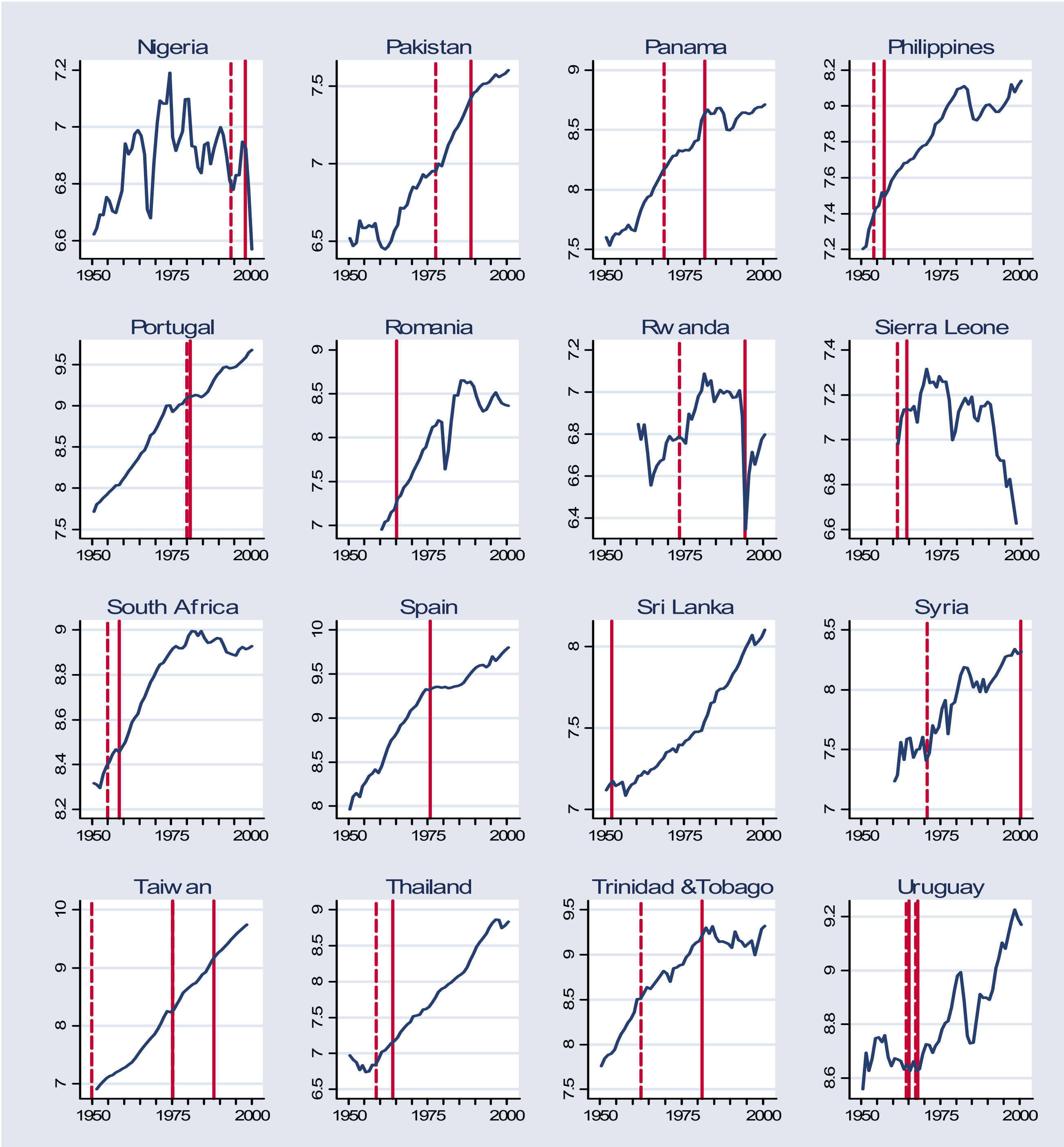
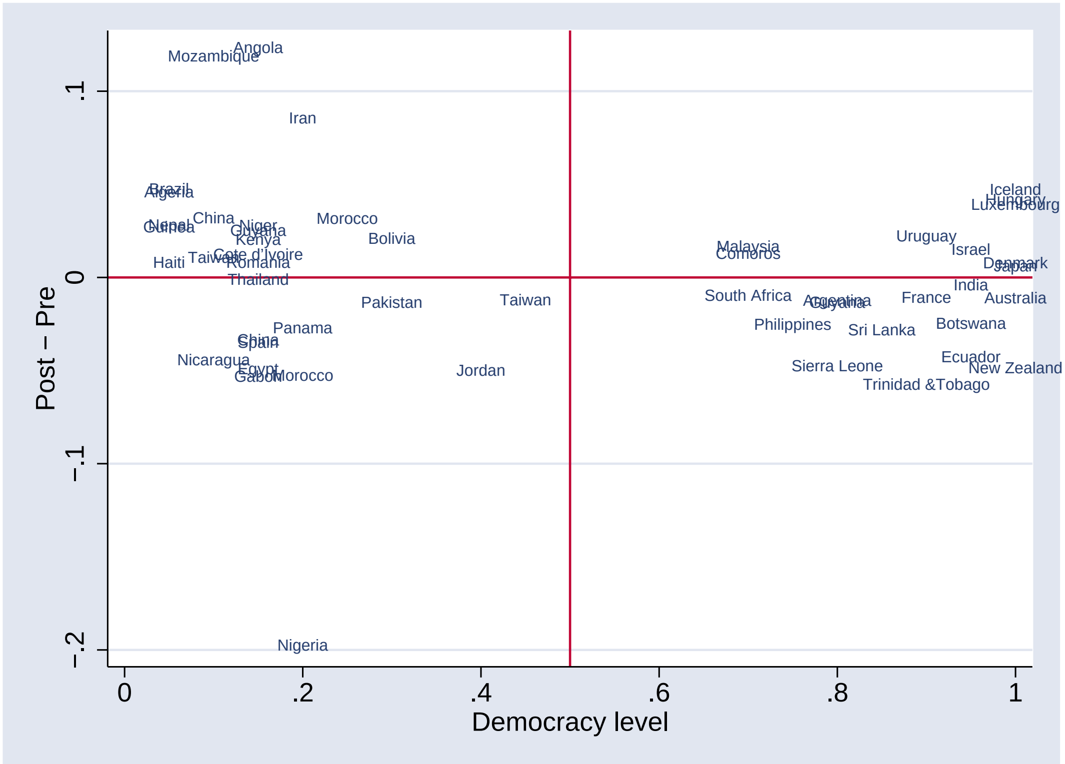


Figure 3: Changes in Growth vs. Political Institutions Prior to Death



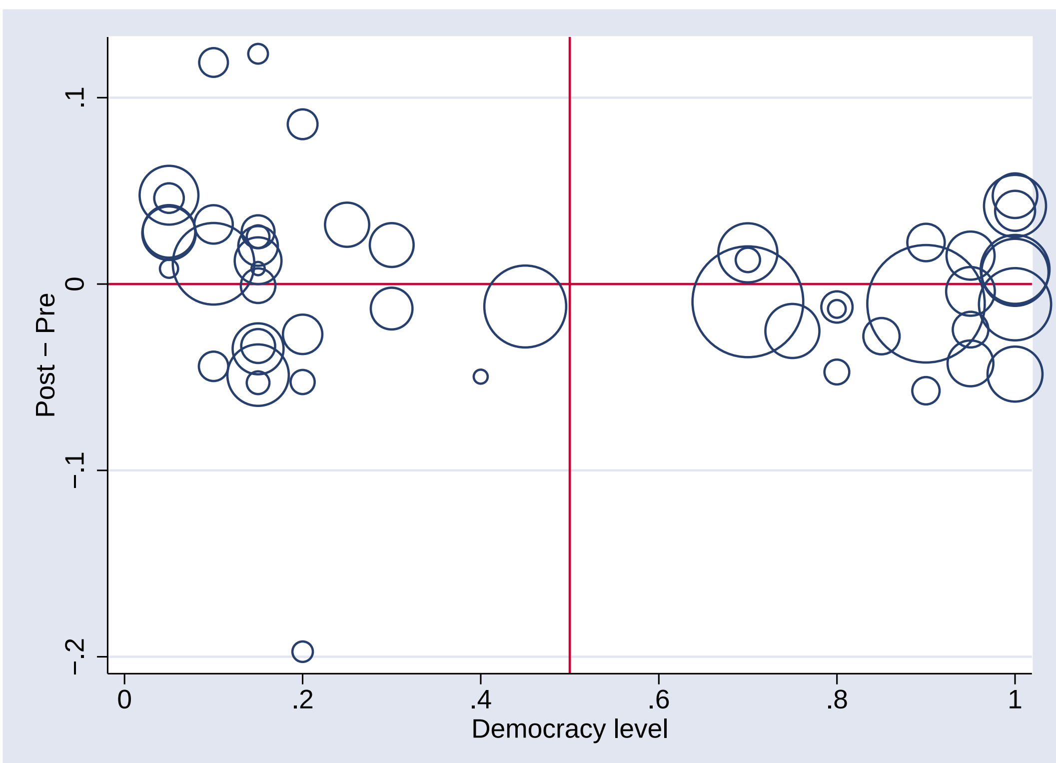


Figure 4: Institutional Changes after Leader Changes