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

Benjamin F. Jones
Northwestern University

and

Benjamin A. Olken
Harvard University

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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 an autocrat tends to be followed by a substantial improvement in growth rates. 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, 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 across decades ranges between only 0.1 and 0.3 within countries (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 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 1950 and 1978 averaged 1.6% per year, while growth since 1978 has averaged 6.3%. To understand the development experience of China, one wants to know what caused this dramatic shift. The answer is not likely to be found -- for China or the

[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.

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). A modern view of leadership in the psychology literature considers the very idea of powerful leaders as 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 in fact, may 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 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 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 of

[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).

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 show that when autocrats die growth improves on average, with growth rates rising by 3% 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, 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. In particular, we show that, following the death of an autocrat, there is a marked increase in government expenditures.

Second, we investigate the impact of leaders on institutions, by examining how institutions change following the death of leaders. On average, we find that the deaths of autocrats are followed by increases in democracy, which suggests that powerful leaders also play important roles through their influence on political institutions. Using the difference between a country's level of democracy and the regional mean level of democracy at the time of the leaders' death as an instrument for institutional change, we find that modest increases in democracy following leaders' deaths lead to increases in growth, whereas dramatic transitions toward full democracy are associated with substantial 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 nation's growth. Section 4 examines the channels through which leaders impact growth, focusing on macroeconomic and institutional changes that occur when leaders die. Section 5 performs 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 define therefore the 77 leaders who died either of natural causes or in accidents as the "random" deaths that we focus on in the paper.[8] Of these, 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.

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[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 these 77 leaders, sufficient growth data to estimate the change in growth around the leader's death was available for 62 of them. As discussed in footnote 18 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.

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 marginally more likely to be autocrats. 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. Age and autocracy will be examined explicitly in the econometric analysis to follow.

Section 5 will present a number of robustness checks on the results, including investigations of whether the timing of leader deaths appear to be truly random. We show there that growth conditions do 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 is not to say that a leader's power is independent of various institutional or other features that may condition the leader's impact. But randomly-timed leader deaths allow us to focus precisely on the role of the national leader and ask whether nations undergo substantial economic change when the leadership is changed.

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 appear to affect growth, whereas democrats do not. Section 3.5 then considers the directional effects of the death of autocrats on growth, and shows that the deaths of autocrats tend to be followed by substantial 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 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 Houphouet-Boigny of Cote d'Ivoire is more ambiguous. 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. Houphouet-Boigny's death in 1993 shortly preceded a devaluation of the CFA, the regional currency shared by Cote d'Ivoire, which may have spurred growth by restoring the country's competitiveness in these products. However, one can also 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 Ayatolloh 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 trench warfare included sending waves of unarmed conscripts, often young boys, against the superior firepower of entrenched Iraqi lines (Britannica, 2003). 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 a leadership effect, one based on standard F-tests and another based on non-parametric rank tests.

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.[10] 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 $Corr(l,l') = \rho$. 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 are a valid 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:

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

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, $\theta^2 \sigma_l^2 \rho$.

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:

[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.

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

The test of whether leaders matter is a test of whether $\widehat{POST-PRE}_z$ is actually distributed $N\left(0, 2\frac{\sigma^2_{\varepsilon i}}{T}\right)$ or whether, as predicted under the alternative hypothesis that $\theta \neq 0$, $\widehat{POST-PRE}_z$ has higher variance than that due to sampling variance alone. To test this hypothesis in the following sections, we will estimate $\overline{PRE}_z$ and $\overline{POST}_z$ via OLS, and then use an F-test to test the set of restrictions that $\widehat{POST-PRE}_z$ is indistinguishable from 0 for all leader deaths.

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 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]. 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 F-test. To do so, first define:

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

$$y_z = \left(r_z - \frac{1}{2}\right)^2$$

Under the null, $E[y_z] = \frac{1}{12}$, $Var[y_z] = \frac{1}{180}$, so that one can form the test-statistic

$$K = \frac{\sum\left(y_z - \frac{1}{12}\right)}{\sqrt{\frac{N}{180}}}$$

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, 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 parametric assumptions about the error process, it is likely to have lower power than the parametric *F* 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 only be statistically 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 only 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

[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 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.

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.

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, so that leader changes affect growth in some countries but not in others. A natural way to examine this hypothesis is to split the sample of leader deaths based on some observable characteristic and compute the F 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:

$$g_{it} = \alpha_z PRE_z + \alpha_z POST_z + v_i + v_t + \varepsilon_{it} \qquad (3)$$

where g_{it} is the annual growth rate of real purchasing-power-parity per capita GDP 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 v_i and v_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, as well as to including a wide variety of other right-hand-side controls. 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 $\alpha_z = \beta_z$. That is, conditional on other regressors, we expect growth rates before and after the leader death to be similar. As discussed in Section 3.2, to answer the question of whether leaders matter for growth in general, we are interested in a pairwise F-test on all leaders collectively. The null hypothesis is:

H_0: $\alpha_z = \beta_z$ for all z

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 F-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. Second, we present results from the non-parametric "rank test" developed above.

To determine the correct error structure we first perform an array of statistical tests, including likelihood ratio and Breusch-Pagan tests for heteroskedasticity across countries and Breusch-Godfrey tests for auto-correlation within countries. The results strongly reject homoskedastic errors in favor of country-specific heteroskedasticity.

[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.

Auto-correlation is shown to be weak but present in 20% of the sample countries, with significant country and regional heterogeneity.[15] Given these results, we focus on specifications that allow for country-specific heteroskedasticity and correct for autocorrelation.[16,17]

Table 4 presents the main results—i.e., the p-values from F-tests on the null hypothesis that $\alpha_z = \beta_z$ for all random leader deaths *z*. 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 OLS results with the errors corrected for country-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.

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

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[15] Correcting for heteroskedasticity in these regressions can be quite important. To see this, consider that the estimators of interest, each α_z and β_z, are estimated primarily using within-country data. If errors are heteroskedastic across countries, then assuming iid errors will overestimate the underlying variance in growth rates for some countries and underestimate it for others. In particular, if the correct variance for the data generating process in country *c* is σ_i^2 and the overall variance for all countries is σ^2, then the standard error on the coefficients α_z and β_z in that country will be inflated by σ/σ_i. Since the individual restrictions in the F-test compare α_z and β_z within the same country, high (low) variance countries will show improperly high (low) significance for any difference of pre-post periods. This issue suggests that estimating country-specific heteroskedasticity should be strongly favored over OLS estimation with a single σ^2.

[16] Results are robust to a large number of other error specifications. Specifications that do not allow for an AR(1) processes produce stronger results than those presented.

[17] 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 at least the country level, we have much larger numbers of observations with which to estimate the error parameters, and so the inference will be more accurate.

the *t+2* timing, we exclude the year of the transition and the two subsequent years from the analysis.[18]

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*, while insignificant effects at the timings *t+1* and *t+2*.[19] 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 results survive a number of robustness checks, which are further 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.

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. Different institutional systems and different social constraints can 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?

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[18] 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.

[19] The rank test requires that we witness a full T years of growth observations before and after leader deaths, while the parametric tests do not. Correspondingly, the rank test employs fewer observations of leader deaths, which reduces power. Using the parametric tests on the subset of leaders with a full 5 years of growth observations on either side of their death produces similar but slightly less significant results than when using the entire sample.

A simple way to answer this question is to extend the above regression framework to consider hypothesis tests on subsets of the leader deaths. We use the Polity IV data set (Marshall and Jaggers, 2000) to classify the institutional system at the time of each leader's death. We then examine whether leaders appear to matter more or less in different institutional contexts. This approach allows us to consider the basic interaction of various national characteristics with the ability of leaders to influence national growth.

We begin with Figure 3, which explores 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). 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.[20]

Figure 3 reveals two important facts. First, random leader deaths are associated with both increases and decreases in growth in equal proportion—in 28 of 57 cases (49%), the estimated change in growth after the leader death, $\beta_z - \alpha_z$, is negative. Second, the figure indicates a greater dispersion in outcomes when deaths occur in more autocratic regimes.

Formal 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".[21] 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 growth the

[20] The area of each circle is equal to the inverse of the variance of the estimate of β_z-α_z for that observation.
[21] 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.

effects last over substantial periods and are not due to immediate turbulence in the first two years after the transition.

On the other hand, the deaths of leaders in democratic regimes produce no detectable impact on growth. As discussed in Section 3.2, there are several possible explanations for the failure to reject the null. One simple explanation would be that the underlying variance of the growth process is higher in democratic regimes, so that leader effects are harder to detect statistically in autocracies than in democracies; in fact, however, the opposite is the case, which suggests a more substantive explanation.

One possibility is that leaders in democracies are substantially constrained by institutions, so that individual leaders do not influence national aggregate economic performance. That is, in the language of Section 3.2, we may fail to reject the null hypothesis in democracies because θ is small in such settings. The other possibility is that leaders who come to power following the death of a democrat are very similar to their predecessors. For example, institutional secession rules in democracies that keep power within the same political party following a leader's death may result in a high correlation (ρ) between leaders. Finally, from the perspective of the median voter theorem, even if leaders have significant executive authority in democracies, the fact that the distribution of voter preferences may not change when leaders die will create greater policy continuity in democracies—i.e., lower σ^2_l—and hence an absence of detectable leader effects.

Table 6 further explores whether the degree to which leaders matter varies according to deterministic national characteristics. One might expect that several explanatory variables used successfully in the recent growth literature might define those nations in which leaders do or do not have an impact. The first columns of the top panel of Table 6 investigate the impact of settler mortality. 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 variables which succeed strongly in Table 5 in defining where leaders do and do not tend to matter. Not surprisingly, then, Table 6 shows that leaders appear to matter in countries with high settler mortality but not in countries with low settler mortality.

Table 6 further examines the impact of ethnic fragmentation. 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 example, Tito and Milosevic could be seen as the difference between Balkan war and peace. We group countries into high and low ethnic fragmentation groups depending on whether they fall above or below the 75th percentile in 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.

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). Table 6 investigates the differences between British, French, and Spanish colonial origin. 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.

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. The second panel of Table 6 indicates that we do see strong leader effects in Sub-Saharan Africa; however, we also see effects in several other regions, including Latin America and the Middle East and North Africa, which suggests that leaders' impact is not constrained to one part of the world.

Finally, the third panel shows that leader effects are not simply a matter of poverty: when the sample is split according to the median initial GDP in 1960, we find that autocrats show significant effects in both high and low income settings.

3.5 When Does New Leadership Improve Growth?

The analysis in Section 3.4 showed that autocrats appear to matter for growth, whereas 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.[22] 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 $\beta_z - \alpha_z$.

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, in that the polity score is 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. Column (2) indicates that, when controlling for the degree of autocracy, we begin to see

[22] 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 MacKinaly 1997).

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 increasingly 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.

It is important to note that the improvement in growth seen after the death of autocrats is *unconditional* on what happens ex post. In other words, if we knew nothing else except that an autocrat has died, the results suggest that the country will experience substantial improvements in growth on average, particularly if the leader is extremely autocratic. There are several possible explanations for this result. First, as suggested by Olson (1982), 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. Evidence from Table 7 provides at most weak support for this hypothesis, as controls for tenure do not show significant growth effects when the leader dies.

A second hypothesis is that the effects of leaders are fixed over their rule, and that improvements in growth are not coming from autocrats being replaced by 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. The next section explores this hypothesis in detail as we investigate the channels through which leaders affect growth.

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

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 a autocrat. A natural question, then, is how this effect occurs—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, growth in government expenditures, growth in investment, and growth in exports and imports. Second, we examine the effect of leaders on monetary policy, by looking at changes in inflation and in real exchange rate. All data comes from the Penn World Tables.[24] We focus on growth in government expenditures, inflation, and the real exchange rate—all variables directly

[24] Note that we calculate inflation from the Penn World Tables data by looking at the change in the price level in local currency. This is essentially the rate of change in the GDP deflator.

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 the five years before and five years after the leadership transition. 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 leaders have a strong effect on consumption growth and growth in government spending, but little detectable effect on investment growth rates. There is also a change in foreign aid, which may be related to the observed increase in government expenditures. There appears to be an effect on exports, albeit with a slight lag, but there is no effect of leaders on imports. As in the results for 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.

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 strong evidence that leaders affect monetary policy. Inflation rates change dramatically following the death of an autocrat. Similarly, there appear to be substantial changes in the real exchange rate following the death of an autocrat, though these changes appear to happen immediately following the death of the autocrat rather than in the years thereafter. This suggests that there may be one-time changes in the real-exchange rate immediately following the leader transition, but that once the new leader is established the rate of change in real exchange rates remains more or less constant.

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 is true even when controlling for other characteristics of the leader, such as the leader's age and tenure. This provides further evidence that the effect of leaders on growth is through direct government policy. There is also evidence of a statistically significant increase in exports following the death of highly autocratic leaders, which would be consistent with an increase (i.e. devaluation) in the real exchange rate. Though not statistically significant, the point estimate suggests that inflation tends to decline following the death of autocrats, which suggests an improvement in monetary policy that could help foster growth.[25]

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 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.

[25] 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.

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. We use two measures of democracy produced by Freedom House—"civil freedom" and "political freedom." However, the Freedom House data only begin in 1972, so this data is unavailable for a substantial number of leaders in our sample. We scale all variables so that 0 represents the most autocratic (least "free") and 1 represents the most democratic (most "free"), so that the results will be comparable across variables.

The results of non-directional tests for changes in institutions at leader deaths are presented in Table 10. Across all five measures of democracy examined, we find consistent evidence that institutions change following the death of autocrats but not following the death of democrats. The lack of institutional change following the death of democrats may reflect the fact that democracies tend to have clear secession rules, whereas autocracies often do not. An autocrat's death may therefore lead to a new regime, with a different set of institutions, whereas a democrat's death may simply lead to a new leader within the existing regime and set of institutions.

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 percentage points following the death of an autocrat. The increase is statistically significant (at the 10%) level on both the "autocracy" measure and the "civil freedom" measure. Results using the other measures are still positive, but slightly smaller in magnitude and not statistically significant. 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.

The results 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 virtually disappears. However, on the Polity IV variables, we find offsetting effects of degree of autocracy and tenure. More autocratic leaders tend to have a smaller increase in democracy following their death, but the death of long tenure leaders tends to be followed by a substantial increase in democracy.

Given that political institutions change following the death of autocrats, with a tendency toward increased democracy, it is worth investigating whether there is a relationship between democratization following the death of autocrats and the increase 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 democracy in the period following the leader's death, where 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 level 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 an instrument for changes in democracy following the death of a leader. One possible instrument is the level of democracy currently prevailing elsewhere in the region at the time of the transition. This instrument would make 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. In fact, when we regress the change in democracy following the death of an autocrat on the mean level of democracy in the region and the difference between the country's level of democracy and this regional mean, the F-statistic on the regression is 6.7 and the R^2 is 0.35, which suggests that this instrument has substantial explanatory power for the change in democracy following the death of an autocrat.

We use this instrumental variables strategy to examine the impact of institutional change on growth following the death of leaders. Table 12 presents directional results, where we regress the estimated change in growth, $\beta_z - \alpha_z$, on the ex-post change in democracy. The results, both from the OLS and the IV, confirm the pattern in Figure 4. Focusing on the instrumental variables results for autocrats (column 4), the results suggest that, for those autocrats whose death was followed by a small increase in democracy (specifically, an increase of between 0 and .05 on the polity measure), the result is a statistically significant increase in growth of between 1.45 and 1.9 percentage points. On the other hand, for those countries, such as Pakistan and Spain, that experienced dramatic increases in democracy (an increase of .66 and .8, respectively), the result was a statistically significant decrease in growth of between 4.0 to 6.3 percentage points. The OLS results are quite similar, and the results for all leaders, though not statistically significant, show the same negative relationship between the size of the increase in democracy and growth.

In sum, the results in this section indicate that autocrats affect political institutions, suggesting a further mechanism through which leaders affect growth. Furthermore, using (i) the deaths of autocrats as an exogenous shock to institutions and (ii) regional institutional averages to instrument for the degree of democratization that nations seek following the death of an autocrat, we identify the effect of institutional change on growth. A small amount of democratization is seen to be good for growth, whereas dramatic democratization has a negative 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]

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[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.

5. Robustness of Results

The results presented above incorporated two kinds of robustness checks. First, they considered different specifications for the error structure. Second, 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 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.

An alternative approach is to re-estimate equation (3), shifting the PRE and POST dummies 5 or 6 years backwards in time as "control timings." If the identification strategy is valid, one should not witness unusual changes in growth. In results not presented, this "control timing" strategy, as expected, fails to reject the null in nearly all cases.

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.[27] 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

[27] The main difference between these results and the main results is that, when we exclude heart attacks, growth appears to change following the death of democrats, at least using the t+1 and t+2 timings. However, this appears to be due to Hungary, where the death of the leader in 1993 captures the post-transition U-shape in growth. This effect disappears if we allow the time fixed effects to vary by region.

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.[28] These different control strategies do not substantially affect the main results.

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.

The directional growth results are also robust to all of the different specifications presented here. While the point estimates and statistical significance vary to a modest extent, we find that, regardless of the length of the observation window, the set of right-

[28] 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.

hand side controls, the type of death, or the decades included, the death of autocrats leads to substantial improvements in growth rates, with the death of the most autocratic leaders producing the largest positive changes.

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, while no leader effects are detected in the presence of democratic institutions. Moreover, the deaths of autocrats lead on average to substantial, sustained 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. We identify the causative effect of institutional change on growth, finding that a small amount of democratization is beneficial, whereas dramatic democratization has 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 autocrats may have a first-order economic basis. 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.[29]

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.

[29] 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 are used often with leadership change in mind; recent examples include Robert Mugabe in Zimbabwe, Charles Taylor in Liberia, 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, by type:

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	8	4	79

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.

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	0.517*	0.412
	(0.504)	(0.492)
Age	64.536***	56.373
	(11.362)	(11.242)
Tenure	10.722	11.057
	(12.001)	(10.843)
Log Real GDP Per Capita	8.150	8.181
	(0.922)	(1.020)
WestEur	0.116	0.115
	(0.323)	(0.319)
Transition / Eastern Europe	0.043	0.126
	(0.205)	(0.332)
Latin America	0.232	0.192
	(0.425)	(0.394)
Sub-Saharan Africa	0.232	0.249
	(0.425)	(0.433)
Asia	0.217**	0.117
	(0.415)	(0.322)
Middle East/North Africa	0.101	0.062
	(0.304)	(0.241)
Year 1945 - 1950	0.101***	0.035
	(0.304)	(0.185)
Year 1951 - 1960	0.116	0.180
	(0.323)	(0.384)
Year 1961 - 1970	0.217	0.188
	(0.415)	(0.390)
Year 1971 - 1980	0.217	0.193
	(0.415)	(0.395)
Year 1981 - 1990	0.188	0.200
	(0.394)	(0.400)
Year 1991 - 2000	0.159	0.204
	(0.369)	(0.403)

Notes: Standard deviations in parenthesis. Asterisks report results of a two-sample t-test of differences in means between the random leaders and all leader-year observations.
* indicates 90% significance; ** indicates 95% significance; *** indicates 99% significance.

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) OLS	(2) OLS	(3) Rank	(4) OLS	(5) OLS	(6) Rank
Timing						
t	.0216**	.0143**	.0893*	.0145**	.0090***	.0445**
t+1	.0182**	.0219**	.1960	.0141**	.0163**	.1168
t+2	.0172**	.0339**	.2491	.0063***	.0145**	.1400
Number of leaders (t)	57	57	47	47	47	37
Number of observations (t)	5567	5567	5567	5567	5567	5567
Country-specific heteroskedasticity	Yes	Yes	N/A	Yes	Yes	N/A
AR(1) error structure:	Common	Region	N/A	Common	Region	N/A

Notes:
(i) The table reports p-values, indicating the probability that the null hypothesis is true. Under the null hypothesis, growth is the same before and after randomly-timed leader transitions. P-values in columns (1) and (2) 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 column (3) is via the rank-method described in the text. Regional AR(1) estimates a separate AR(1) coefficient for each of the following regions: Asia, Latin America, Western Europe, Eastern Europe/Transition, Middle East/North Africa, Sub-Saharan Africa, and Other. Asterisks are used to indicate the significance with which the null is rejected:
* indicates 90% significance; ** indicates 95% significance; *** indicates 99% significance.
(ii) 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.

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

P-values: Probability that average growth does not change across randomly-timed leader deaths

	(1) OLS	(2) OLS	(3) Rank	(4) OLS	(5) OLS	(6) Rank
	Autocrats			Democrats		
Timing						
t	.0175**	.0063***	.072*	.2969	.3656	.393
t+1	.0184**	.0145**	.076*	.1813	.2457	.740
t+2	.0547*	.0613*	.055*	.0937*	.1752	.740
Number of leaders (t)	29	29	25	22	22	19
Country Hetero.	Yes	Yes	N/A	Yes	Yes	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		Ethnic Fragmentation		Colonial Origin		
	High	Low	High	Low	British	French	Spanish
t	.0144**	.2050	.0242**	.1233	.0295**	.7643	.5319
t+1	.0437**	.1848	.0178**	.2534	.0993*	.8999	.1150
t+2.	.1691	.4565	.0548*	.4270	.7204	.6969	.0906*
Number of leaders (t)	7	22	13	37	20	11	6

	Region					
	Asia	Latin America	M.E. / North Africa	Sub-Saharan Africa	Trans. / East. Europe	Western Europe
t	.8704	.1929	.0593*	.0174**	.1235	.2994
t+1	.6042	.0758*	.1494	.0496**	.0999*	.5019
t+2	.2692	.0589*	.4781	.2048	.0465**	.3834
Number of leaders (t)	12	14	7	14	2	6

	Low Income in 1960			High Income in 1960		
	All	Autocrats	Democrats	All	Autocrats	Democrats
t	.1237	.0322**	.7252	.1132	.0409**	.3630
t+1	.1185	.0988*	.2833	.1584	.0267**	.4920
t+2	.5035	.7689	.1577	.0679*	.0034***	.6742
Number of leaders (t)	28	18	8	26	11	12

Notes: See Notes to previous tables. "High" settler mortality and ethnic fragmentation refer to the top quartile of each variable among all countries in the sample. Low Income and High Income split the sample by median per-capita income in 1960. The table reports p-values for the F-test of the null hypothesis that growth 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 country-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 Autocracy		0.00904*			0.01112**
		(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 in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

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	.0204**	.0022***	.2146	.5262	.4504	.7546	.0258**	.0477**
t+1	.0009***	.0125**	.1704	.2390	.6079	.5073	.7070	.0143**
t+2	.0880*	.1352	.0304**	.0101**	.3086	.7076	.4919	.0075***
Autocrats								
t	.0013***	.0002***	.2950	.4112	.6833	.0776*	.0020***	.0141**
t+1	.0000***	.0056***	.1202	.1898	.7612	.0479**	.7614	.0072***
t+2	.2305	.1894	.1470	.0105**	.901	.1889	.7959	.0043***
Democrats								
t	.7913	.5741	.0946*	.4305	.3138	.9760	.6850	.1175
t+1	.5834	.4795	.3145	.3693	.3754	.8176	.5114	.1163
t+2	.0603*	.4946	.2310	.2006	.0514**	.7650	.3948	.1519
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 F-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 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. Estimated 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
All Leaders					
t	.0048***	.0009***	.0308**	.0007***	.0166**
t+1	.0382**	.0089***	.1888	.0030***	.0018***
t+2	.0069***	.0013***	.0678*	.0061***	.0079***
Autocrats					
t	.0000***	.0000***	.0001***	.0001***	.0159**
t+1	.0001***	.0000***	.0018***	.0003***	.0019***
t+2	.0000***	.0000***	.0004***	.0008***	.0049***
Democrats					
t	.9817	.8723	.9994	.2929	.4059
t+1	.9983	.9947	.9996	.3195	.3353
t+2	.9891	.9739	.9974	.2989	.4991
Num of leaders	52	52	52	34	34

Notes: See notes to Table 4. The table reports p-values for the F-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 region-specific heteroskedasticity.

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	0.081	0.080	0.094*	0.125*	0.060
	(0.051)	(0.057)	(0.048)	(0.062)	(0.071)
Autocrat * Degree of	-0.046	-0.055	-0.038	0.018	-0.004
Autocracy	(0.039)	(0.043)	(0.038)	(0.039)	(0.043)
Tenure/Age Controls					
Autocrat	-0.018	-0.020	-0.006	0.056	0.007
	(0.057)	(0.064)	(0.054)	(0.079)	(0.093)
Autocrat * Degree of	-0.081**	-0.093**	-0.068*	0.024	0.002
Autocracy	(0.038)	(0.043)	(0.037)	(0.039)	(0.044)
Tenure	0.012***	0.012***	0.011***	0.005	0.004
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Age	-0.003	-0.003	-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) All Leaders OLS	(2) All Leaders IV	(3) Autocrats OLS	(4) Autocrats IV
Change Towards Democracy	-0.039	0.054	-0.064*	-0.090**
	(0.025)	(0.074)	(0.031)	(0.043)
Constant	0.003	-0.003	0.015*	0.019*
	(0.005)	(0.007)	(0.009)	(0.010)
Observations	52	52	27	27

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 regional democracy level and pre-period difference from regional democracy level. 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

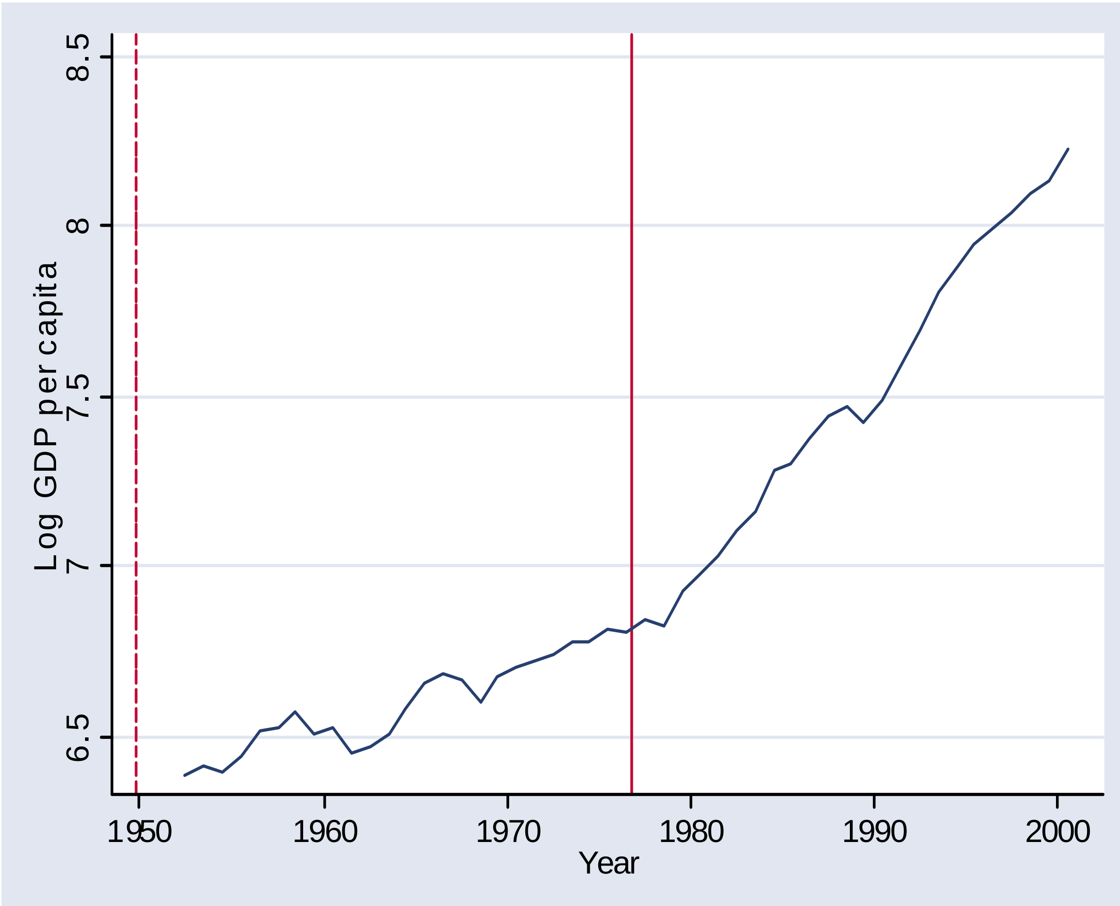
	Excluding Air Crashes			Excluding Heart Attacks		
	All	Autoc.	Democ.	All	Autoc.	Democ.
t	.0265**	.0146**	.4473	.0682*	.0988*	.2208
t+1	.1104	.0411**	.6036	.0498**	.1354	.0952*
t+2	.2130	.1984	.4774	.0084***	.0553*	.0466**
Number of leaders (t)	49	25	20	39	20	14

	3 Year Dummies			7 Year Dummies		
	All	Autoc.	Democ.	All	Autoc.	Democ.
t	.0195**	.0098***	.1562	.0058***	.0023***	.2933
t+1	.0181**	.0041***	.2809	.0042***	.0052***	.1559
t+2	.0345**	.0381**	.1916	.1125	.1130	.3836
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	.0036***	.0155**	.1029	.0224**	.0107**	.6673	.0218**	.0064***	.3425
t+1	.0186**	.0277**	.1578	.0246**	.0056***	.7377	.0472**	.0249**	.2428
t+2	.0188**	.0585*	.0883*	.0331**	.0372**	.3616	.0531*	.0771*	.1269
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



(source: Penn World Tables)

Figure 2: Growth and Random Leader Deaths

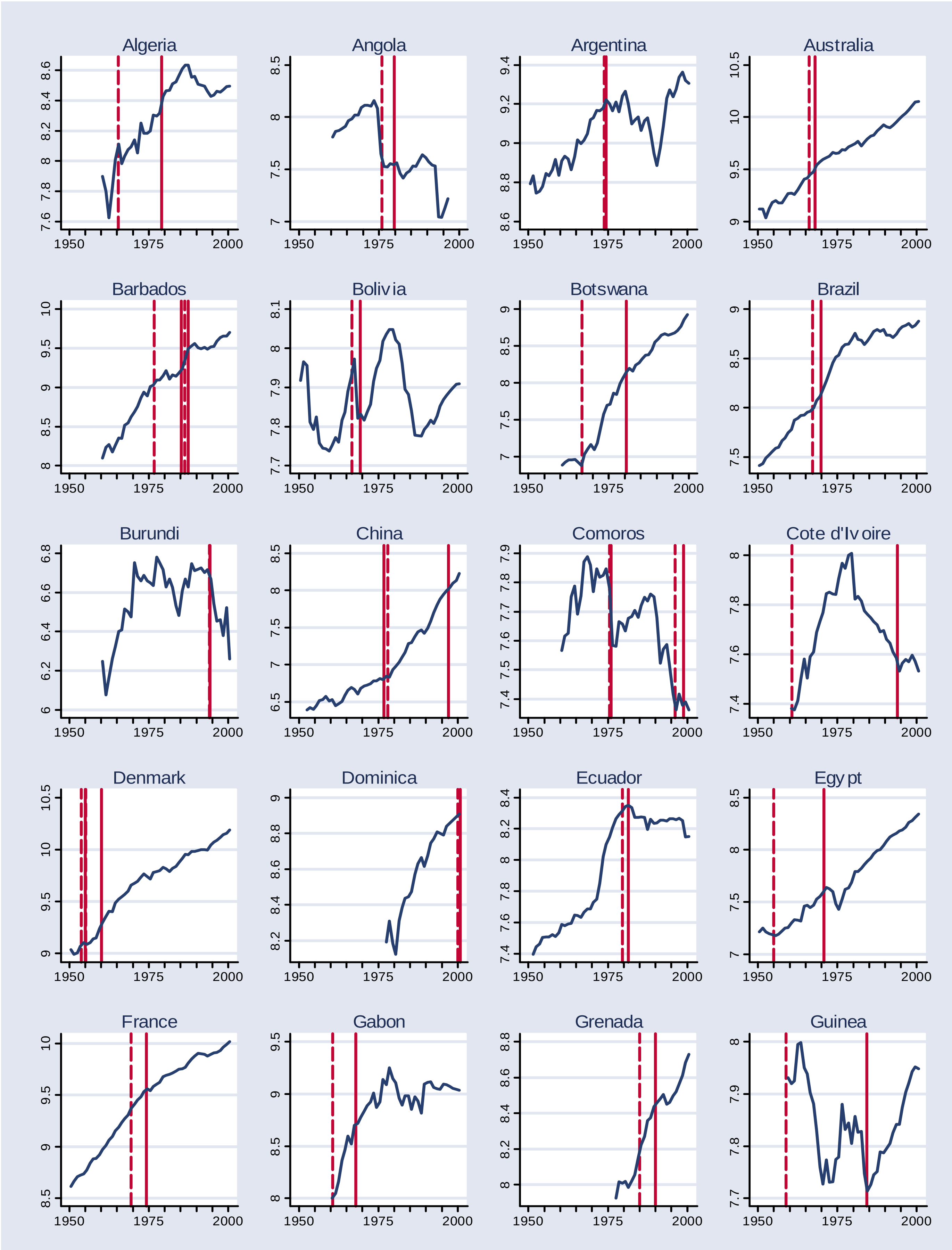


Figure 2 (continued)

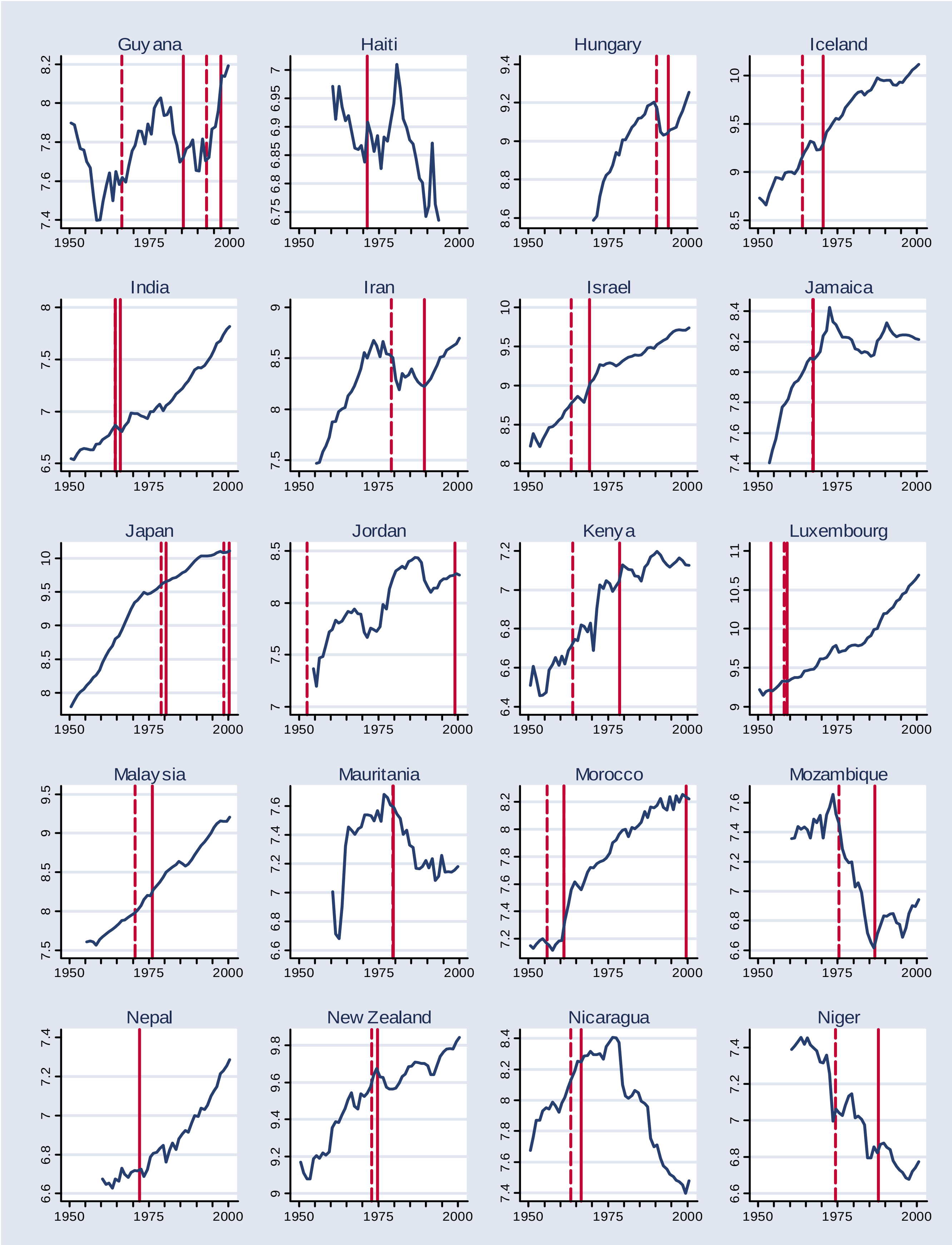


Figure 2 (continued)

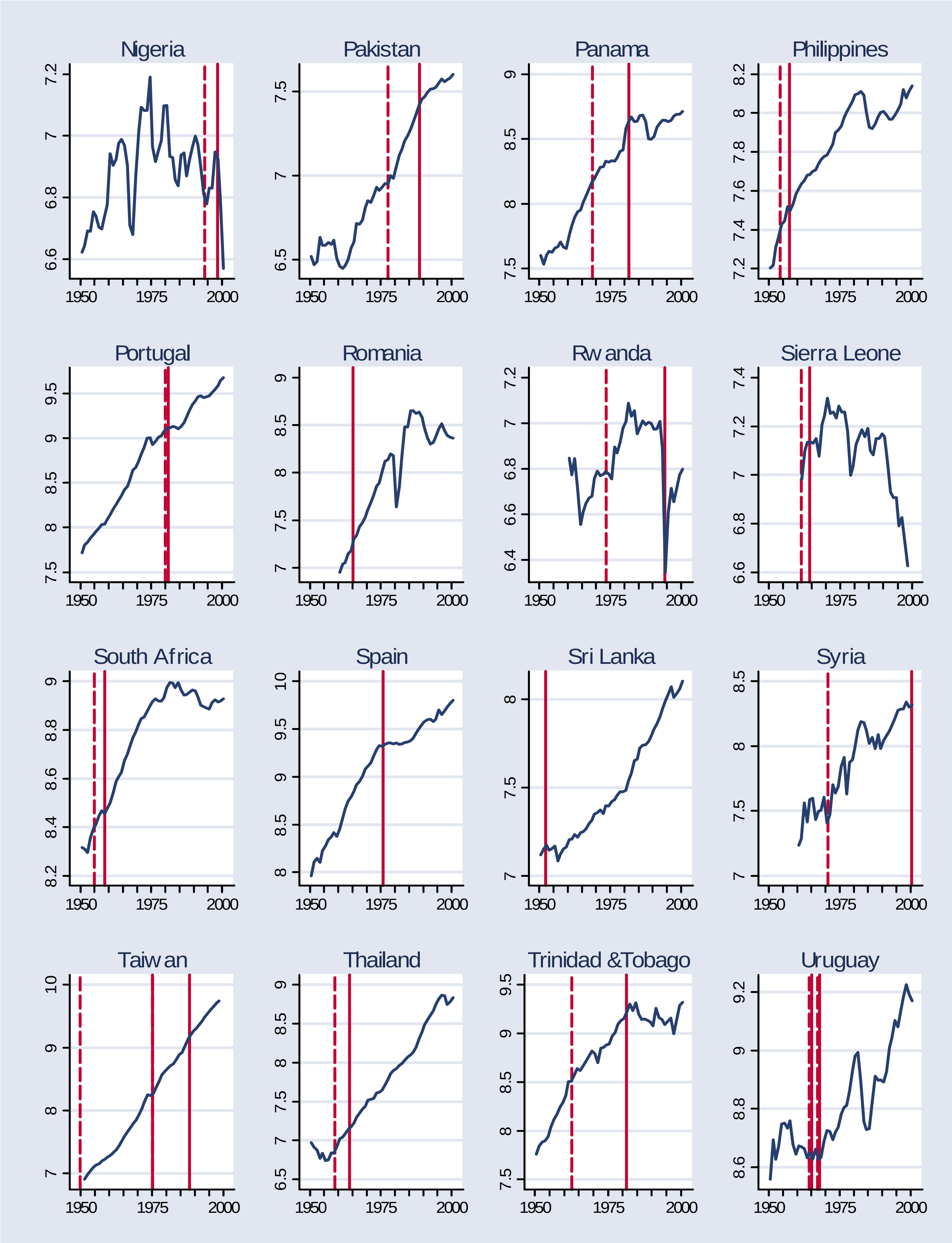


Figure 3: Changes in Growth vs. Political Institutions Prior to Death

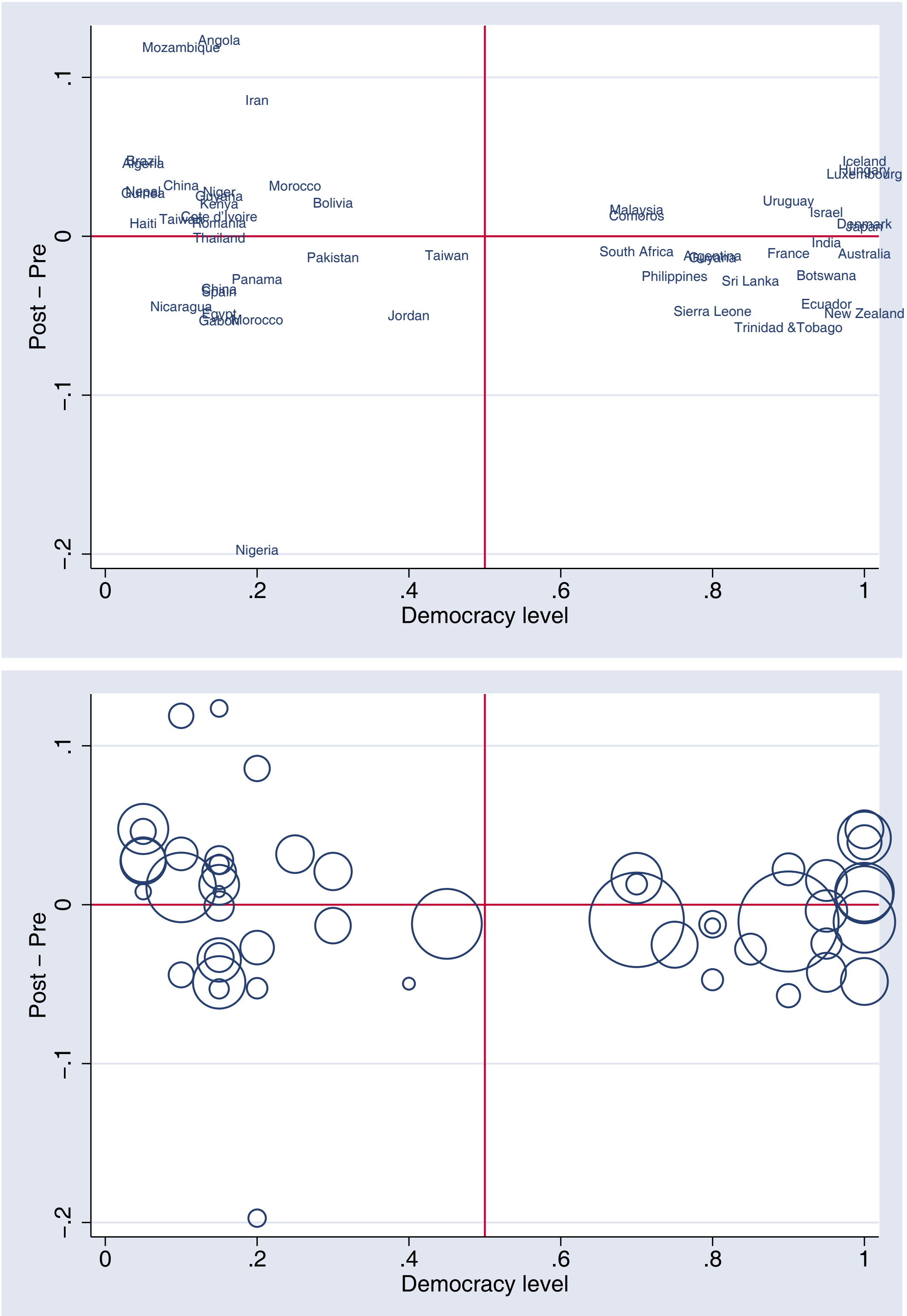


Figure 4: Institutional Changes after Leader Changes