



Democracy and Growth: Alternative Approaches

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This article focuses on two previously unexamined aspects of the relationship between economic growth and democracy. First, the growth experiences of countries that experience significant changes in democracy are examined directly. Countries that democratize are found to grow faster than a priori similar countries, while countries that become less democratic grow more slowly than comparable countries. These differences do not seem to be due to differences in education or investment levels. Second, regression tree analysis suggests that democracy, along with initial income and literacy, contributes to the identification of regimes of countries facing similar aggregate production functions.

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1. Introduction

It is an omission over two centuries old, but *prospérité* has not yet been added to the *liberté, égalité, fraternité* associated with democratic activists. Should it be? There are contradictory signals about the relationship between economic growth and democracy, in economic literature as well as in political circles and popular culture. This article addresses some of the reasons for this confusion.

There are a number of different predictions about the relationship between economic growth and democracy, and they are split sufficiently evenly between positive and negative correlations that no overall theoretical presumption may be claimed. Many empirical studies of the relationship incorporate some measure of democracy into conventional cross-section growth regressions,¹ effectively asking, “What is the correlation between democracy and economic growth, controlling for other variables believed to influence growth?” They generally conclude that this correlation is negative, although it is rarely statistically significant. Any causal interpretation, of course, presupposes that democracy is exogenous to growth.²

It is surprising that economists usually treat democracy as exogenous to economic growth, since there is a well-developed body of theory (in both political science and economics) predicting how income growth (or level) affects democracy.³ In addition to being highly correlated with income levels, democracy is correlated with, and may be causally related to, a number of growth-enhancing variables (education and rule of law, for example). These interrelationships make it difficult to answer such simple questions as, “Will a country that democratizes experience lower growth in the short run?” This article attempts to remedy this shortcoming.

I address two interconnected aspects of the relationship between democracy and economic growth. First, the growth experiences of countries that undergo substantial changes in levels of democracy are examined directly. Second, the possibility that democracy, interacting with income and literacy, alters a country's aggregate production function is investigated. Each of these provides an examination of the relationship between democracy and economic growth at a unique stage of political development: changes in democracy relate to transitional periods from one type of regime to another; and investigating differences in production functions between types of regimes adds to the substantial literature on the relationship between levels of democracy and economic growth. Both approaches provide information beyond what can be learned from examining (partial) correlations between democracy and growth.

Recent history illustrates the importance of looking beyond partial correlations between democracy and economic growth. In August 1991, Communist hardliners attempted to seize power in Moscow to reverse the moderate liberalizations undertaken by Mikhail Gorbachev.⁴ The coup d'état was defeated, Boris Yeltsin came to power four months later, and many aspects of democratic government have since been institutionalized in Russia. Since the official end of the Soviet Union, Russia's growth rate has plummeted. (Its 1996 to 1997 GDP growth, the first nonnegative growth rate since 1991, is estimated at only 0.2 percent.)⁵ Attributing the decline in growth to the failure of the coup or the subsequent increase in democracy, as a correlation approach necessarily does, is incorrect. The relevant comparison is not of postcoup Russia to the rest of the world, but of Russia following the defeat of the coup relative to Russia *had the coup attempt succeeded*.

Although the counterfactual event (in this illustration, the successful coup) is not observable, its effect on growth may be inferred. In the first section of the article, I analyze the growth experiences of countries that democratized and countries that became more authoritarian between 1965 and 1987. The methodology is more straightforward than the Russian example, in that the counterfactual is limited to the absence of the change. This simplification is made in order to allow the use of a priori similar countries (in terms of initial income and democracy; other specifications are also considered) to infer the growth experience had the country not experienced the change. Other studies generally focus on the relationship between levels of democracy and growth rates over a period of time, whereas this analysis focuses on the relationship between changes in democracy and subsequent growth rates, reducing the likelihood that the evidence reflects reverse causality (growth rates affecting democracy). The possibility that an omitted variable affects both the probability of a change in democracy and subsequent growth is also investigated. Additionally, several variables are examined following the changes to gauge in what ways changes in democracy affect the economies of the countries experiencing them.

Most theories and empirical studies of the relationship between democracy and economic growth have centered around variables (such as education, fiscal policy, or investment) that may be affected by democracy and that in turn influence growth rates. In addition to these effects, it seems that democracy may alter how efficiently factors of production are used—that is, the underlying function between these variables and growth may differ across levels of democracy. Using regression tree techniques that endogenously and consistently determine groups of countries facing similar aggregate production functions, I address

the possibility that aggregate production functions differ by levels of democracy. The results suggest that democracy, together with income and literacy rates, contributes to the identification of distinct growth regimes and that the conventional linear model can be rejected in favor of the multiple-regime model. This work extends that of Durlauf and Johnson (1994), who identify multiple regimes in a similar way but do not include democracy in their analysis.

Section 2 provides a brief discussion of the literature on the relationship between democracy and economic growth. Section 3 presents empirical analyses of the growth experiences of countries following substantial changes in levels of democracy, and Section 4 investigates the possibility that democracy interacts with income and literacy to determine regimes of countries facing similar aggregate production functions. Section 5 concludes.

2. Theoretical Background

The existing body of economic theory does not unambiguously predict the sign of either the full or partial correlation between democracy and economic growth. Several theories generate a positive relationship between democracy and growth, including that the checks and balances on government's power implicit in democratic regimes lead to higher growth rates in these countries and that political freedoms reinforce economic freedoms. Olson (1993, p. 572) argues that "the *same* court system, independent judiciary, and respect for law and individual rights that are needed for a lasting democracy are also required for security of property and contract rights" (emphasis in original).

A system of majority voting also affects growth in a positive direction, although it may have a negative effect as well, as discussed in Acemoglu and Robinson (1996): majority voting tends to increase a country's stock of human capital as people vote to expand education, although it may also result in growth-retarding systems of income redistribution. A related analysis is that of Persson and Tabellini (1992), who present a framework in which high inequality in democracies results in redistributive taxation, lowering growth rates; this effect is not present in nondemocracies, introducing differences in the relationship between equality and growth between the two types of regimes. In addition to these effects on fiscal policy, democracy may decrease growth rates if interest groups play a large role in attenuating the government's commitment to overall economic growth; perhaps the best known source of this argument is Olson (1982).

Authoritarian regimes generally have more centralized power with which to "orchestrate" economic growth than do democracies, particularly in developing countries. The large amounts of investment necessary for development require substitution away from current consumption; a democratic government that implemented these reforms would possibly be voted out of office (if not overthrown), as discussed by Rao (1984) and others. Rao (1984, p. 78) cites India (under emergency rule from 1975 to 1977) and Chile (following Pinochet's assumption of power), among others, as examples of countries in which governments "assumed extraordinary powers to decrease individualistic, sectarian interests," leading to substantially improved economic conditions.

In addition to the effects of democracy on economic growth, it seems plausible that growth rates and income levels affect democracy levels as well. Huntington (1991) stresses the

role of rapid economic growth in the moves toward democracy of Greece, Spain, Brazil, South Korea, and Taiwan. It is widely believed in economic and political science literature that countries with high levels of development are better suited to democratic institutions than are poor countries, an idea most frequently attributed to Lipset (1959). Lipset argues that economic development increases education and the size of the middle class, increasing democratic norms and values in the society. Moore (1996, p. 418) also emphasizes the importance of the development of a sizable middle class in promoting democracy, stating, “no bourgeois, no democracy.” An argument with similar conclusions is that of Rueschemeyer, Stephens, and Stephens (1992), who argue that capitalist development empowers the working classes, making it difficult to exclude them from political arenas; similarly, Acemoglu and Robinson (1996) propose that increasing economic power among disenfranchised groups led to the extension of the vote.

Several recent empirical economic studies have investigated the relationship between economic growth and democracy. Barro (1996) finds that, holding an array of political and economic variables constant, the coefficient on an index of democracy in a growth regression is slightly negative (although not statistically significant); he also finds evidence of a nonlinear relationship in which democracy and growth are positively related at low levels of democracy but negatively related at higher levels (those coefficient estimates are statistically significant). Helliwell (1994), using a system of simultaneous equations to control for dual causality between democracy and income, finds an estimated negative (but not statistically significant) partial effect of democracy on economic growth, but notes that this effect is offset by the positive effects of higher levels of democracy on education and investment. (The approach taken in this article differs from Helliwell’s in both the methodology employed and the specific questions addressed.) Reviews of other empirical work related to democracy and economic growth can be found in Sirowy and Inkeles (1990) and Przeworski and Limongi (1993).

3. Changes in Democracy

As a measure of democracy levels, I use the annual political rights indices constructed by Freedom House (Gastil, all years). These rankings are constructed with the help of printed materials, both local and international, field visits, and other communications with informed observers and citizens. Following a checklist of various components of democracy, countries are assigned a value of political rights between one (most free politically) and seven (least free).⁶ Freedom House summarizes the philosophy behind these rankings as follows (*Freedom Review*, 1997, “Survey Methodology”, pp. 192–193):

At a minimum, a democracy is a political system in which the people choose their authoritative leaders freely from among competing groups and individuals not chosen by the government. . . . Freedom House does not score countries and territories based on governmental intentions or constitutions but on the real world situations caused by governmental and non-governmental factors. . . . A system is genuinely free or democratic to the extent that the people have a choice in determining the nature of the system and its leaders.

There are several caveats related to this index. First, the subjectivity involved in constructing such an index introduces some measurement error; the Gastil index has been criticized by several scholars for its conservative bias in classifying countries (due largely to its association with Freedom House).⁷ Second, democracy is a multifaceted subject: the Gastil index is based on a checklist that includes a wide range of tangible indicators—including limits on suffrage, freedom of the press, and restrictions on individuals running for office—but the overall ranking is nonetheless impressionistic. Additionally, the index forces a (presumably) continuous variable into a discrete ranking system.

To supplement the Gastil data, I constructed variables indicating changes in levels of democracy based on two criteria: (1) there must be an identifiable and substantial change in regime, either toward or away from democracy, and (2) the change must be reflected in the political rights indices (if the time period is covered by the rankings). Additionally, a country is excluded if it experiences a significant change in one direction followed shortly by a reversal of that change (for example, the approval of a more democratic constitution in Nigeria in 1979, followed by a military coup in 1983) or if the change takes place over an extended period of time (for example, the lengthy process of democratization in Brazil, occurring over the period 1975 to 1984). Table 1 lists the changes that are included.

3.1. Growth Regressions

To provide a preliminary look at the relationship between changes in levels of democracy and economic growth, the growth regressions in Table 2 include dummy variables indicating increases and decreases in democracy during the periods under investigation. The following equation is estimated:

$$\ln(y_{i,t+T}) - \ln(y_{i,t}) = \beta_0 + \beta_1 \mathbf{X}_i + \beta_2 \delta_i^I + \beta_3 \delta_i^D + \epsilon_i \quad (1)$$

for $T = 5$ and $T = 20$ years, where δ^I and δ^D are indicator variables reflecting increases and decreases in democracy (at any time between t and $t + T$), respectively, and the vector \mathbf{X}_i of additional explanatory variables takes on two specifications—a fairly minimal specification, consisting of initial GDP per capita, investment, education, and democracy levels; and a more extensive specification, similar to that of Barro (1996), which adds a number of other variables to these conventional variables. Equation (1) is a standard growth regression, with the addition of the dummy variables identifying changes in democracy, which have not been included in other research.

Democracy enters the model nonlinearly, in a quadratic form following Barro (1996). Of most interest are the estimated coefficients on the dummy variables indicating changes in democracy (β_2 and β_3); these estimates are highlighted in the bottom panel of Table 2. The estimates of β_2 do not differ significantly from zero, suggesting that an increase in democracy has little effect on growth, once other variables are taken into account. The estimates of β_3 , however, are negative and statistically significant in all four regressions, and these findings are fairly robust to the inclusion of regional dummy variables.⁸ Given the political and social turmoil that accompanies nearly all major changes in governmental regime, one would expect growth rates to decrease during times of major regime change;

Table 1. Changes in democracy.

Country (year of change)	Brief Description
<i>Increases in democracy</i>	
The Gambia (1970)	New constitution approved, establishing a presidential republic
Portugal (1974)	Nonviolent "Revolution of the Carnations" began transition to pluralist democracy
Greece (1975)	New constitution adopted; republic proclaimed
Spain (1977)	First elections held following Franco's death in 1976
Senegal (1978)	Constitutional reforms to increase democracy and implement multi-party system
Ecuador (1979)	Civilian government restored under new constitution
Peru (1980)	Military voluntarily restored civilian rule
Thailand (1980)	Movement toward more democratic government began
Nepal (1981) ^a	Reforms to implement popular elections, free the press, and tolerate political parties
Bolivia (1982)	End of military rule that began in 1964
Argentina (1983)	Return to civilian rule with free elections
Uruguay (1985)	Return to civilian rule
The Philippines (1986)	Ferdinand Marcos stepped aside after widespread protests and boycotts: new president Corazón Aquino ended martial law, adopted a more liberal constitution
<i>Decreases in democracy</i>	
Zaire (1965)	Became dictatorship
Tanzania (1967)	Arusha Declaration: governmental policy of one-party African socialism
Panama (1968)	Military banned political parties and dissolved legislature
Peru (1968) ^b	Armed forces seized power, nationalized firms, undertook large-scale agrarian reform
Somalia (1969)	Military coup; parties abolished, constitution suspended
Uganda (1971)	Idi Amin seized power through military coup; Parliament abolished, politicians murdered
Cameroon (1972)	Unitary state declared; abrogated freedoms of speech, press, and assembly
Ghana (1972) ^c	Acheampong banned political parties, dissolved legislature and Supreme Court
The Philippines (1972) ^b	Martial law declared; Congress closed, elections suspended, political parties restricted
Swaziland (1972)	Monarchy concentrated power; constitution, parties suspended
Chile (1973)	Pinochet took power as part of military junta, banned political parties
Ecuador (1973) ^c	Velasco Ibarro overthrown; military rule began
Rwanda (1973)	Coup; constitution suspended, legislature dissolved, etc.
Uruguay (1973) ^c	Military coup; legislature dissolved
Burma (1974)	New constitution; became socialist one-party (military) state
Niger (1974)	Constitution suspended
Argentina (1976) ^c	Military regime to power; dissolved Congress, outlawed political parties, censored press
Pakistan (1977) ^c	Army seized power, postponed elections
The Seychelles (1977)	New constitution adopted that established one-party socialist state
Nicaragua (1979)	Sandinistas came to power
Guatemala (1980) ^c	Beginning of military counterinsurgency campaign
Suriname (1980) ^c	Military takeover; constitution suspended, legislature dissolved

a. Nepal is included only for four years, due to missing data.

b. Peru and the Philippines (decreases) are included for five and ten years only, due to reversals of these changes.

c. Ghana, Ecuador, Uruguay, Argentina, Pakistan, Guatemala, and Suriname (decreases) are included for five years only, due to reversals of these changes.

Table 2. Growth regressions including increases and decreases in democracy.^a

	Five-Year Panel Regressions ^b		Twenty-Year Cross-Section Regressions ^c	
	(1)	(2)	(3)	(4)
ln(GDP0)	-0.012 (0.003)	-0.023 (0.005)	-0.023 (0.005)	-0.041 (0.006)
investment	0.131 (0.021)	0.088 (0.027)	0.002 (0.001)	0.001 (0.0005)
education	0.006 (0.002)	0.003 (0.002)	0.013 (0.004)	0.008 (0.004)
log(fertility)		-0.004 (0.002)		-0.006 (0.003)
log(life_exp)		0.001 (0.0004)		0.001 (0.0008)
educ_spending		0.135 (0.132)		0.316 (0.220)
gov_cons		-0.084 (0.033)		-0.139 (0.072)
democracy	0.042 (0.021)	0.015 (0.026)	0.085 (0.031)	0.094 (0.045)
democracy, sq.	-0.032 (0.018)	-0.023 (0.023)	-0.070 (0.031)	-0.092 (0.031)
civil_rights		0.002 (0.014)		-0.0004 (0.024)
terms_of_trade		0.012 (0.039)		0.052 (0.117)
black_mkt_prem		0.0003 (0.002)		-0.008 (0.009)
dem_increase	-0.004 (0.006)	-0.009 (0.006)	-0.003 (0.006)	-0.005 (0.007)
dem_decrease	-0.016 (0.008)	-0.018 (0.010)	-0.012 (0.006)	-0.018 (0.006)
Observations	485	386	96	81
R ²	0.243	0.285	0.394	0.651

a. Heteroskedasticity-consistent estimated standard errors appear in parentheses following each estimate. GLP is real per capita GDP; investment is the ratio of real domestic investment (public and private) to real GDP. Education is the mean years of secondary and higher schooling in the population over age twenty-five. Educ_spending is the ratio of total nominal government expenditure on education to nominal GDP. Gov_cons is the ratio of real government consumption (expenditure net of spending on education and defense). Civil_rights is the index of civil liberties. Data sources include Barro and Lee (1994), Gastil (1995), Summers and Heston (1994), and the author's construction (dem_increase and dem_decrease).

b. In the five-year models, the dependent variable is log growth over the periods 1965 to 1970, 1970 to 1975, 1975 to 1980, 1980 to 1985, and 1985 to 1989. GDP0 for these regressions is initial GDP per capita, instrumented by the five-year earlier value. Five-year earlier values of fertility, government consumption and spending on education, black market premium, and investment are also used. Schooling and life expectancy variables are measured at the beginning of each period. Constant terms vary by five-year period.

c. In the twenty-year models, the dependent variable is log growth 1970 to 1989. GDP0 for these regressions is initial GDP per capita, instrumented by the 1965 value. Dem_increase and dem_decrease are dummy variables equal to one if an increase or decrease in democracy, respectively, occurs during the period 1960 to 1985. All other variables are instrumented by means over the period 1965 to 1980 (with the exception of democracy and civil rights, which are available beginning in 1972). Constant terms are included.

even in the absence of social upheaval, citizens must accustom themselves to the new political climate and its accoutrements. This would likely decrease growth rates, regardless of the direction of the change in democracy; the finding that growth rates do not appear to decrease significantly following an increase suggests that this effect is less strong in the case of an increase in democracy.

An obvious drawback to this approach is potential simultaneity between economic growth and changes in democracy levels. There are a number of possible channels through which growth rates may affect the likelihood of such a change occurring: high growth rates

may indicate expanding economic freedoms, which could translate into an increased desire for political freedoms;⁹ high growth rates could also increase the estimated rewards to a potential dictator contemplating a coup d'état. Conversely, low growth rates could lead to either type of change, since low growth rates frequently frustrate both rulers and their populations, paving the way for regime changes. It is not clear in which direction economic growth is most likely to affect the probability of a regime change.

3.2. Control Group Analysis

The procedure of incorporating dummy variables indicating changes in democracy into growth regressions, as in the previous section, limits what can be learned in several ways. First, the assumption of linear relationships between the independent variables and economic growth is very strong. Incorporating a term for the democracy index squared, as was done in the regressions in Table 2, following Barro (1996), allows for some nonlinearity in the democracy index but constrains it to a strict parametric form. Second, the issue of timing is important: the dummy variables indicate only that a change occurred during a five-year period. It seems probable that a change in democracy at the beginning of the period has a different effect on growth rates than a change near the end of the period.¹⁰ I address these shortcomings by directly comparing countries that experience changes to a priori similar countries that do not undergo changes.

I construct a “control group” for each country, consisting of countries that, prior to the change in democracy, have approximately the same levels of per capita income and democracy.¹¹ They are further restricted to retain that level of democracy during the first five years under observation. For example, Greece experienced an increase in democracy in 1975 when a republic was proclaimed and a new, more democratic, constitution adopted. Its control group consists of countries with similar levels of GDP per capita and democracy in 1973, and these countries must retain (approximately) that initial level of democracy through 1980. This provides a baseline case of the growth experiences of a priori similar countries that did not undergo changes in democracy, which can be used to infer the growth experience of Greece had it not democratized. The construction of the control groups is discussed further in Appendix A.

Formally, the following equation is estimated for each country j that experiences a change:

$$\ln(y_{i,t+T}) - \ln(y_{i,t}) = \mu + \gamma\delta_{i,t-1} + \epsilon_i, \forall i \cdot \exists \cdot \rho(\mathbf{X}_i, \mathbf{X}_j) < \theta \quad (2)$$

where $\rho(\cdot, \cdot)$ is a function measuring the distance between the values of \mathbf{X}_i (the vector of control variables) and \mathbf{X}_j (the vector of control variables of the country experiencing the change, country j). The “bandwidth” θ determines the size of the control group by selecting the cutoff distance that defines whether country i is sufficiently “near” country j . (See Appendix A for details on the construction of the control groups; operationally, control groups consist of countries that fall within one rank on the seven-point democracy index, and within the same third of the income distribution, as the country undergoing the change.) In the analysis presented, \mathbf{X}_i consists of initial income and democracy; $\delta_{i,t-1}$ indicates the change in democracy. This method of estimation covers a more precisely

defined time period ($t - 1$ is defined as the year of the change, and growth covers periods beginning at time t) and does not place linear restrictions on the relationship between growth and other explanatory variables. Additionally, by focusing on changes in democracy and subsequent growth rates, concern about reverse causality (high growth rates causing changes in democracy, for example) is lessened.

Continuing the example introduced above, Greece grew 9 percent in the five years following its increase in democracy; the mean growth in its eight-country control group was 1.3 percent (with a standard deviation of 0.27) over the same period. The estimate of μ is then 0.013 (standard error 0.095); the estimate of γ is 0.077 (standard error 0.286).

Table 3 presents mean values of μ (the control group means) and of $(\mu + \gamma)$ (the growth rates of the countries undergoing changes). The entries in Table 3 are means of actual growth rates (for example, $(y_{t+5} - y_t)/y_t$); standard errors are standard errors of the means.¹² It is true that on average, countries with decreases in democracy levels experience higher growth rates (in the short run) than do the countries with increases in democracy;¹³ the relevant comparison, however, is these countries to their respective control groups (a priori similar countries). As can be seen by comparing the first and second columns of Table 3, countries that experience increases in democracy grow nearly 2 percent over five years, on average, while their control groups average growth of -1 percent. Countries experiencing decreases in democracy (the third column) grow nearly 8 percent on average, relative to a control group mean of 15 percent (the fourth column), and this difference is statistically different from zero.¹⁴ These results also hold when growth rates are smoothed (with a three-year moving average, shown in the second row in each panel of Table 3) to adjust for possible annual fluctuations, as well as when medians (not presented) are used.

Over longer horizons, the democratizing countries not only outperform their control groups but also substantially outperform the countries becoming less democratic. (Countries that experience partial reversals are excluded from this analysis.) The last panel of Table 3 shows that over fifteen years, countries that experience increases in democracy grow at an average rate of 32 percent (relative to a control group mean μ of 8 percent), while the countries that experience decreases grow at an average rate of under 8 percent (with a control group mean of 35 percent). (However, sample sizes are small, and the control groups are only restricted to retain initial levels of democracy for the first five years of the period.) The differences between the countries that become less democratic and their control groups are statistically different from zero in all but one comparison (over the ten-year period). The difference in growth rates between the countries that democratize and their control groups is not estimated to be statistically different from zero over any time period, suggesting that the findings are somewhat stronger in the case of countries that become less democratic. However, the fact that the countries that democratize grow faster than their control groups over every time period, using both smoothed and unsmoothed growth rates, and regardless of whether means or medians are compared, suggests that countries that democratize tend to grow at least as fast, on average, as do a priori similar countries.

There is not a clear pattern between initial GDP and subsequent growth rates among either group. Among the democratizing countries, those exhibiting subsequently high growth rates include Portugal, Greece, Thailand, Uruguay, the Philippines, and Spain; of these, Portugal, Greece, and Spain are initially high-income countries. However, the worst

Table 3. Mean growth rates in countries experiencing changes in democracy and their control groups.^a

	Increases in Democracy	Control Groups: Increases ^b	Decreases in Democracy	Control Groups: Decreases ^b
Five-year growth	0.018 (0.030)	-0.010 (0.016)	0.079 (0.029)	0.149 (0.013)**
Smoothed ^c	0.019 (0.032)	0.001 (0.017)	0.080 (0.030)	0.143 (0.012)**
Sample size	12	131/106	22	232/231
Ten-year growth	0.061 (0.055)	-0.002 (0.038)	0.141 (0.063)	0.253 (0.029)*
Smoothed ^c	0.085 (0.049)	-0.010 (0.039)	0.191 (0.052)	0.246 (0.028)
Sample size	6	60/55	17	167/165
Fifteen-year growth	0.321 (0.222)	0.063 (0.087)	0.075 (0.091)	0.349 (0.051)***
Smoothed ^c			0.118 (0.084)	0.350 (0.051)**
Sample size	3	28	10	115/110

a. Countries included are listed in Table 1. Entries are percentage growth rates (such as $(y_{t+5} - y_t)/y_t$), where y_t is defined as the year following the change in democracy. Standard errors of the means appear in parentheses. Statistical significance is estimated using Welch's approximate degrees of freedom and t-statistic.

b. Means of the control groups are calculated by weighting each observation by the inverse of the number of countries in the control group; the sample size is normalized to the actual sample size. Sample sizes for the control groups are given for the smoothed and unsmoothed growth rates, respectively.

c. Smoothed growth rates are computed using a moving three-average.

* Indicates that the mean of the changes differs significantly from the mean of the control groups at the 10 percent level.

** Indicates that the mean of the changes differs significantly from the mean of the control groups at the 5 percent level.

*** Indicates that the mean of the changes differs significantly from the mean of the control groups at the 1 percent level.

performing of the new democracies are Ecuador, Peru, and Bolivia, of which Ecuador and Peru are initially high income. Of the poor countries that become more democratic, Senegal performs comparably to its control group throughout the period, and the Gambia performs well over five years but not over longer periods.

Of the countries that became less democratic, Ecuador, Pakistan, the Seychelles, and Cameroon register the highest growth rates. Of these, the Seychelles were initially a relatively high-income country; Pakistan and Cameroon were poor. Many of the new authoritarian regimes experienced low growth rates relative to their control groups during the short run, and low absolute growth rates in the longer run, including Zaire, Tanzania, Somalia, Swaziland, Argentina, Guatemala, and Suriname, and many others over ten-year periods and longer. Zaire, Tanzania, and Somalia are initially low-income countries; Argentina and Guatemala are initially high income.

Clearly, there are regional variations among how successfully new regimes are able to increase relative growth rates: European nations (all of which democratized) appear to do quite well; African and Latin American countries fare quite poorly overall. The qualitative results, however, are unchanged when control groups are restricted to countries in the same geographic region as the country undergoing the change (but control group sizes

are substantially reduced).¹⁵ Many Latin American governments have struggled with both macroeconomic instabilities and widespread illegal drug trades; remnants of colonial rule and widespread poverty no doubt affected the success of new regimes in Africa (both more and less democratic). The results confirm the observations of Wiseman (1990, 1996), who argues that, despite the shortcomings and failures of democracy in Africa, democracy compares favorably to the record of any other type of African regime.

This analysis provides some evidence of how a substantial change in democracy alters a country's growth path. The results suggest that democratization appears to increase growth rates relative to a priori similar countries, although the estimated short-run effect of an increase in democracy is negative (but not statistically significant) in full-sample growth regressions. Decreases in democracy result in growth rates lower than control group means, and the estimated coefficient on decreases in democracy is statistically significant and negative. Bias due to omitted variables is still a concern and is addressed in the following section.

3.3. *Predicted Versus Actual Growth Rates*

Although the control groups are constructed to be similar to the countries undergoing changes in democracy (in terms of GDP per capita and democracy levels, as well as educational variables and geographic location in alternative specifications), it is possible that the analysis presented in the previous section suffers from omitted variable bias—that is, some variable not controlled for in the analysis may be correlated with both the probability of a change in democracy and subsequent growth rates. The countries that democratized may have experienced higher growth rates than their control groups due to differences in initial conditions that were not captured in the construction of the control groups, and the countries that became less democratic may have grown more slowly because of initial conditions.

Table 4 presents means of predicted and actual log growth rates for the countries that experience changes and their control groups, where predicted growth rates are based on initial levels of income per capita, investment, and secondary enrollment (income and investment are measured in the year before the change; secondary enrollment is measured between zero and four years prior to the change). To control for nonlinearities across control groups, the coefficients used to compute predicted growth rates are taken from the regression estimated on the relevant control group.¹⁶ If each control group was very similar (in terms of information relevant to growth rates) to the country experiencing the change in democracy, and if that change in democracy had no effect on subsequent growth, the predicted growth rates should accurately predict actual rates.

Table 4 shows that, on average, the countries that democratized were predicted to grow more slowly than the mean of their control groups; over five years, for example, these countries were predicted to experience growth of -5 percent relative to the control group mean of -1 percent. However, the countries that became more democratic experienced faster growth rates relative to both the predicted growth rates and the control group means. The democratizing countries were expected to grow faster over ten years than their control groups (9 percent for the democratizing countries and 2 percent for the control group); however, this result is due to the inclusion of Ecuador, an outlier with predicted growth

Table 4. Actual and predicted growth rates in countries experiencing changes in democracy and their control groups.^a

	Increases in Democracy	Control Groups: Increases ^b	Decreases in Democracy	Control Groups: Decreases ^b
Five-year growth	0.029 (0.028)	-0.007 (0.020)	0.087 (0.028)	0.127 (0.012)
Predicted ^c	-0.049 (0.035)	-0.007 (0.014)	0.135 (0.058)	0.128 (0.009)
Sample size ^d	11	98	19	189
Ten-year growth ^e	0.052 (0.054) [†]	0.020 (0.039)	0.113 (0.058)	0.191 (0.024)
Predicted ^c	[0.095 (0.040)*]	[0.015 (0.044)]	0.185 (0.161)	0.180 (0.020)
Sample size ^d	6[5]	43[38]	15	128
Fifteen-year growth	0.263 (0.288)	0.040 (0.098)	0.083 (0.082) ^{***}	0.218 (0.044)
Predicted ^c	-0.184 (0.172)	0.040 (0.069)	0.466 (0.241)	0.204 (0.033)
Sample size ^d	2	17	9	77

a. Entries are mean log growth rates; standard errors of the means appear in parentheses after each estimate. None of the differences between predicted growth of countries experiencing changes in democracy and the control groups is statistically significant.

b. Means of the control groups are calculated by weighting each observation by the inverse of the number of countries in the control group; the sample size is normalized to the actual sample size.

c. Predicted growth rates are based on a regression of growth rates (measured from the year after the change) on initial levels of income per capita, investment, and secondary enrollment. This regression is estimated on the control group; predicted growth for the countries experiencing changes is computed based on the coefficients from the control group regression.

d. Sample sizes are slightly smaller than in Table 3 due to missing data (missing education data or control group sizes that are too small to estimate the regression).

e. Values in brackets represents figures when Ecuador is excluded (see discussion in text).

*** Indicates that the difference between predicted and actual growth rates is statistically significant at the 1 percent level. Statistical significance is estimated using Welch's approximate solution to the Behrens-Fisher problem.

* Indicates that the difference between predicted and actual growth rates is statistically significant at the 1 percent level.

of 69 percent relative to an actual growth rate of -16 percent. Excluding Ecuador, the ten-year growth rates of the democratizing countries were higher than predicted, and this difference is statistically significant.¹⁷ Furthermore (again excluding Ecuador), the democratizing countries were predicted to grow more slowly than the mean of their control groups (-4 percent to 1 percent), suggesting that initial conditions are not responsible for the higher growth rates of the countries that became more democratic.

The countries that became less democratic were predicted to grow at approximately the same level as the mean of their control groups (13.5 percent to 13 percent). The actual growth rates of these countries over the five-year period were lower than predicted (9 percent). (By construction, the control groups grew at approximately the predicted rate.) Over ten years, these countries were also predicted, on average, to grow at approximately the same rate as their control groups (18.5 percent to 18 percent); in fact, they grew more slowly (11 percent). This result is even stronger over fifteen years; the countries that became less democratic

were predicted to grow at twice the rate of their control groups (47 percent to 20 percent), but their actual growth rates were less than half of the average of the control groups (8 percent to 21 percent).¹⁸

Of the three variables used to predict growth rates, initial levels of income and education may affect the probability of a country experiencing a change in its level of democracy; economists and political scientists have argued that economic development (including education) is a prerequisite to democracy at least since Lipset (1959). It seems unlikely that levels of investment would directly affect the probability of a change in democracy, although low levels of investment may indicate a weak economy, which would tend to increase pressure for change. A country with high levels of foreign investment may be exposed to pressure to become more (or less) democratic; during the period under observation, the Soviet Union as well as the United States and Europe were influential in shaping many countries' types of governments.

To summarize the findings of this section, the countries that democratized were predicted to grow more slowly than their control groups; in fact, they tended to grow faster. The countries that became less democratic were predicted to experience comparable or higher growth rates than their control groups, yet grew more slowly than predicted and more slowly than their control groups. Although the results are generally not statistically significant, they are in the direction that suggests that the differences in growth rates observed in the previous section are *not* due to differences in initial levels of investment, income, or education.

Three possible explanations for the differences in growth rates observed in Section 3.2 remain. First, there may be some factor not controlled for in the analysis that is influencing both the probability of a change and subsequent growth rates. As an example, consider a poor, authoritarian country in which a reserve of natural resources are discovered. To extract the maximum surplus from the resource, the leader knows that foreign advisors are necessary. Western governments are, in some cases, unwilling to cooperate with authoritarian regimes, so the leader undertakes democratic reforms in order to placate the foreign government(s).¹⁹ Clearly, there are factors other than a discovery of natural resources that could affect both the probability of a change and subsequent growth rates. Further research should attempt to determine the extent to which these changes in democracy were exogenous to economic factors.

The other two possibilities are addressed in the following sections. Changes in economic variables may follow changes in democracy; the predicted growth rates in Table 4 are based on *initial* levels of investment, education, and income. The next section investigates this possibility. Alternatively, democracy may change the underlying relationship between these variables (investment and education) and growth. This is addressed in Section 4.

3.4. *Indirect Effects*

Section 3.2 provided evidence that countries that democratize grow faster than a priori similar countries, while countries that become less democratic grow more slowly. The previous section concluded that, in general, these differences were not due to differences in initial conditions. This section of the article investigates another possibility—namely,

Table 5. Changes in democracy: Effects on education and investment.^a

	Increases in Democracy	Control Groups: Increases ^b	Decreases in Democracy	Control Groups: Decreases ^b
<i>Secondary enrollment^c</i>				
At time of change ^d	0.470 (0.066)	0.407 (0.021)	0.246 (0.045)	0.306 (0.014)
Observations	13	155	19	263
Five-year change	0.038 (0.018)	0.071 (0.006)*	0.063 (0.018)	0.054 (0.004)
Ten-year change			0.127 (0.026)	0.111 (0.007)
Observations	11	119	12	158
<i>Investment</i>				
At time of change ^d	16.61 (2.58)	18.38 (0.77)	12.06 (1.36)	17.22 (0.55)***
Observations	13	180	22	296
Five-year change	-4.89 (1.50)	-0.85 (0.70)**	1.92 (1.16)	-0.41 (0.43)*
Ten-year change	-3.74 (2.07)	-2.28 (0.79)	0.69 (1.16)	-0.71 (0.54)
Observations	9	123	16	237

a. Table entries are means; standard errors of the means appear in parentheses.

b. Control group means are calculated by weighting each observation by the inverse of the number of countries in the control group; the sample size is normalized to the actual sample size.

c. The education data for each period are within two years of that indicated (data are available at five-year intervals).

d. "At the time of the change" refers to the year immediately preceding the change.

*** Indicates that the difference between the means of the countries experiencing changes in democracy and the means of the control groups is statistically significant at 1 percent level based on Welch's approximate solution to the Behrens-Fisher problem.

** Indicates statistical significance at the 5 percent level.

* Indicates statistical significance at the 10 percent level.

that the differences in growth rates are due to the (in)ability of new regimes to increase investment and education levels.

Any number of intermediate variables could be investigated in this context. A thorough examination of the many possible channels between democracy and economic growth is left to other research;²⁰ the effects of changes in democracy on investment and education are examined here. These two variables seem to be those most commonly accepted as affecting growth rates;²¹ additionally, data are widely available for both. Economic freedoms and the enforceability of contracts are among the other variables no doubt correlated with democracy; however, data on these are neither objective nor readily available. Means of first differences (measured from the time of the change) of investment and education for the countries experiencing changes in democracy and their control groups as constructed in Section 3.2 are presented in Table 5.

Because of the time-series nature of Table 5, only countries with data available (and relevant; countries that experience reversals of their change and their control groups are omitted) for each period are included in the first difference columns. The upper half of the table shows the changes in secondary enrollment following a change in democracy. On average, the countries that democratize have higher enrollment rates (47 percent) than their

control groups (40 percent) prior to the change in democracy; this gap decreases after the change (average enrollment rates among the democratizing countries increase by nearly four percentage points, while those of the control groups increase by approximately seven percentage points). This suggests that the difference in growth rates observed in Section 3.2 is not due to the ability of the new democracies to increase enrollment rates further, relative to their control groups. It is unlikely that this difference would have much effect in the short run, since returns to increased secondary enrollment rates are not immediately observed. Unfortunately, education data are not available for most of the democratizing countries more than five years after the change.

The gap in secondary enrollment between the countries becoming less democratic and their control groups remains fairly constant throughout the period. On average, the countries that experience decreases in democracy have lower levels of education prior to the change than their control groups (25 percent for the countries experiencing decreases in democracy and 30 percent for the control group means); this decline decreases slightly over time.

The bottom half of Table 5 contains the results for investment. The countries that become more democratic have slightly lower levels of investment prior to the change in democracy, on average, than their control groups (16.6 percent of GDP to 18.4 percent). This gap widens over time, with the investment ratio in the new democracies declining by nearly five points over five years, while that of the control groups declines by less than one point. The difference over ten years (also measured from the time of the change) is smaller, suggesting that investment in the new democracies increases (relative to the control groups) in the period five to ten years after the change in democracy.

After five years, the gap in investment between the countries experiencing decreases in democracy and their control groups narrows somewhat (the new authoritarian regimes increase investment ratios by nearly two percentage points, while the control group means decline by 0.4 percentage points). This difference is smaller after ten years, and the average levels of investment for the countries that became less democratic are substantially below the means of their control groups over the entire period. Lower levels of investment may explain some of the differences in growth rates observed in Section 3.2

How should these results be interpreted? Within each group of a priori similar countries, one country experienced a substantial increase or decrease in democracy. The subsequent growth experiences of these groups was compared in Section 3.2; Section 3.3 determined that the differences in initial conditions could not fully explain the observed differences in growth rates. This section provides an investigation into how the differences in growth may have been achieved. Although the democratizing countries had higher levels of secondary enrollment before the change, they seem to have lost some of this initial advantage during the first five years of the new regime. Furthermore, these countries had lower average levels of investment prior to the change in democracy than their control groups, and this difference increased over time. The countries that became less democratic had lower levels of both education and investment prior to the changes; the gap in education remained fairly constant following the change, while the gap in investment narrowed somewhat. These differences do not seem strong enough to generate the differences in growth rates seen in Section 3.2. Additionally, the differences in growth rates between the countries experiencing changes and their control groups increased over time, while the differences in investment

and education narrowed. This suggests that some of the difference in subsequent growth experiences between new democracies and new authoritarian regimes is due to factors other than education and investment. The following section addresses one such possibility.

4. Regression Tree Analysis: Democratic and Nondemocratic Regimes

The analysis thus far provides evidence that increases in democracy have some favorable effects on rates of economic growth but is not designed to investigate the ways in which economies differ across levels of democracy. While democracy may have some direct effects on growth, it is also possible that a country's level of democracy affects its growth performance indirectly. This could occur in two ways. Democracy may affect variables, such as investment or education, that in turn influence growth rates—for example, democracies are frequently assumed to have more egalitarian education policies than authoritarian regimes, since mass political participation translates into more people voting for better education for their children (see Acemoglu and Robinson, 1996). Section 3.4 analyzes these differences in the context of changes in democracy; there is not much evidence that a change in democracy affects investment or education substantially in the short run.

Alternatively, countries with different levels of democracy may utilize the factors of production available to them in distinct ways; that is, aggregate production functions may vary across countries based on levels of democracy. As an intuitive illustration, consider two countries that receive identical amounts of foreign aid or investment. In the totalitarian regime, the dictator allocates it to the building of a presidential palace, while in the democracy, the government channels the funds toward investment in infrastructure.²² Similarly, political and economic culture may be linked; the Athenian economy was stronger than that of Sparta, and this difference is often attributed to the flexibility of Athens' democracy. This section of the article investigates whether aggregate production functions differ between types of regimes, incorporating the hypothesis (following models such as Azariadis and Drazen, 1990) that threshold levels of human and physical capital exist, beyond which productivity of those variables is altered. The analysis tests the combination of these effects, investigating how aggregate production functions differ across types of regime and stocks of both physical and human capital.

Although theories such as those mentioned above suggest that variables (levels of physical and human capital, or type of government) may affect the aggregate production functions faced by a regime, they are unlikely to determine precisely the points at which to divide countries based on any of these variables. For example, are "high literacy" or "high human capital" countries those with literacy rates above the median, or over 50 percent, or over 75 percent? To address this, regression tree analysis is employed to identify distinct regimes and the differences between them. This is a data-sorting procedure that identifies an unknown number of sample splits over multiple control variables.²³ Estimation of a regression tree involves sequentially identifying the best possible splits of the data for a given regression (here, the production functions estimated in Mankiw, Romer, and Weil, 1992) and control variables (in this case, initial income, literacy, and democracy).

The regression tree procedure is as follows. The data are indexed by each control variable, and all possible binary data splits based on each control variable are examined. For each

possible split, the regression is estimated on both subsamples, and the sum of squared residuals over all observations for each split is computed. The data split that minimizes the total sum of squared residuals is considered the first split of the data. It should perhaps be emphasized that each split variable (initial income, literacy, and democracy) is considered for each sample split. This process is repeated on each of the subsamples until the data cannot be split further. The tree to this point has been constructed with no cost associated with additional data splits; the tree is then “pruned” by introducing a cost to eliminate splits that yield only small decreases in error variance.

The penalty function is defined as

$$\Psi = SSR + \alpha(\#(N) - 1), \quad (3)$$

where SSR is the total sum of squared residuals over all terminal node observations²⁴ and $\#(N)$ is the number of terminal nodes in the tree. Beginning with the full tree identified by the original procedure, data splits are eliminated sequentially as α is increased from zero. Increasing α from zero to infinity yields a series of trees, from the full tree identified by the original procedure ($\alpha = 0$) to the OLS regression on the full sample ($\alpha = \infty$). This procedure allows all possible costs to data splits to be considered. The final specification is selected based on cross-validation (“leave-one-out” method). For each of the trees in the series identified by the pruning procedure, the cross-validated sum of squared residuals is calculated; the tree with the smallest cross-validated sum of squared residuals produces the piecewise linear approximation that converges (in mean-squared error) to the best nonlinear predictor (see Breiman et al., 1984).²⁵

Durlauf and Johnson (1994) also use regression tree analysis to identify different regimes in cross-country growth analysis and reject the conventional linear model in favor of the multiple-regime specification identified by their analysis. They also estimate the production function of Mankiw, Romer, and Weil (1992); their control variables are initial levels of GDP per capita and literacy. Adding democracy as a third potential control variable allows for comparisons to these two more conventional measures of development.²⁶

Figure 1 illustrates the pruned regression tree for these data, and Table 6 lists the countries in each terminal node. The first data split²⁷ of the full sample isolates a relatively small number of exceptionally poor countries from the bulk of the sample. The remaining seventy-eight countries (node 1R) are subsequently split on a level of literacy rates close to the median. Similar splits to these occur in Durlauf and Johnson (1994). The higher-literacy countries in node 2R are then split based on democracy levels during the 1970s. This split is very different from that in Durlauf and Johnson (1994), which splits on a fairly high value of initial income, resulting in approximately equal numbers of countries in the equivalents of node 3L and 3R. The difference is important: because democracy is chosen over income and literacy as the split variable for the third split,²⁸ democracy appears to be a more significant determinant of different growth processes among these countries than either initial income or literacy. Further splits of nodes 3L and 3R are not significant; these nodes are considered terminal. Two additional significant splits occur. The low-literacy countries in node 2L are split further on literacy rates, and the node of the poorest countries (node 1L) is split on democracy levels, at a very low level of democracy.

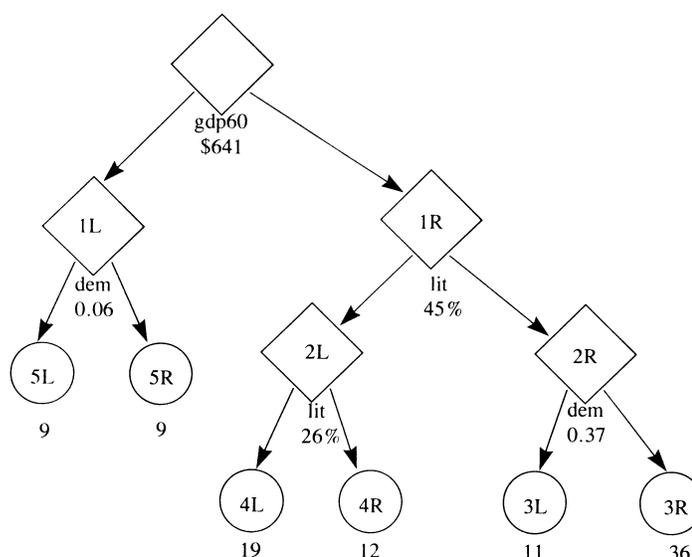


Figure 1. Regression tree. Notes: Diamonds denote nonterminal nodes; the variable below each nonterminal node determines the split, at the level indicated. Nodes to the left consist of observations with values of the split variable less than or equal to the relevant split value. Circles denote terminal nodes; the number below each terminal node indicates the number of observations in that node. Node names (1L, 1R, etc.) appear in each node. Countries in each terminal node are listed in Table 6.

The estimated growth regressions for each terminal node are presented in Table 7,²⁹ and descriptive statistics for each terminal node, including the split variables and dependent variables, are presented in Table 8. Table 8 illustrates the correlation between the split variables: the value of each increases fairly steadily, reading across the columns.

The very poor, extremely totalitarian countries (democracy levels less than 0.06 on a scale from zero to one) in terminal node 5L seem unable to utilize factors of production in an efficient way: the coefficient estimates on both investment and education are negative. This may be due to the kleptocratic tendencies of some of the regimes in this node; it seems unlikely that resources could be allocated optimally under such repressive regimes. Although it is likely that the extreme poverty of these countries also contributed to their economic difficulties, the more democratic but equally poor countries in terminal node 5R have positive coefficient estimates on both investment and education. Furthermore, as shown in the last panel of Table 8, had the countries in node 5L been democratic enough to have been in node 5R, their growth rates would have been predicted to be (on average) approximately twice as high as their actual growth rates (predicted log growth rates of 0.35 relative to actual log growth of 0.17).

The differences between nodes 3L and 3R are of particular interest since democracy is the variable that divides these nodes.³⁰ Investment appears to have a stronger effect among the less democratic countries, although the coefficient estimate is positive for both groups.

Table 6. Regression tree: Terminal nodes.

5L	5R	4L	4R	3L	3R
Very Poor, Authoritarian	Very Poor, Democratic	Low Literacy	Moderate Literacy	High Literacy, Authoritarian	High Literacy, Democratic
Burundi	Botswana	Algeria	Bolivia	Chile	Argentina
Malawi	Burkina Faso	Angola	Ghana	Ecuador	Australia
Mali	Cameroon	Bangladesh	Guatemala	Korea	Austria
Myanmar	Ethiopia	Benin	Honduras	Nicaragua	Belgium
Niger	Indonesia	C.A.R.	India	Paraguay	Brazil
Rwanda	Nepal	Chad	Jordan	Panama	Canada
Togo	Nigeria	Congo	Madagascar	Peru	Columbia
Uganda	Pakistan	Cote	P.N.G.	Philippines	Costa Rica
Zaire	Tanzania	Egypt	Syria	Singapore	Denmark
		Haiti	Turkey	Thailand	Dom. Rep.
		Kenya	Zambia	Uruguay	El Salvador
		Liberia	Zimbabwe		Finland
		Mauritania			France
		Morocco			Germany
		Mozambique			Greece
		Senegal			Ireland
		Sierra Leone			Israel
		Somalia			Italy
		Tunisia			Jamaica
					Japan
					Malaysia
					Mauritius
					Mexico
					Netherlands
					New Zealand
					Norway
					Portugal
					South Africa
					Spain
					Sri Lanka
					Sweden
					Switzerland
					Trinidad
					U.K.
					U.S.
					Venezuela

a. See Figure 1 for actual splits in the data.

This could be due partly to fewer concessions to special interests and lobbying groups among less democratic countries, leading to fewer “pork” projects and more productive investment. The coefficient estimate on the population growth term is larger in absolute value for the less democratic countries in node 3L. Since labor mobility seems likely to increase the ability of the labor force to adjust to a large influx of additional workers, this result is consistent with authoritarian regimes restricting the mobility of their populations more than democracies. The African National Congress was founded largely as a response

Table 7. Regression tree: Regressions by terminal node.^a

	Node 5L Very Poor, Authoritarian	Node 5R Very Poor, Democratic ^b	Node 4L Low Literacy	Node 4R Moderate Literacy	Node 3L High Literacy, Authoritarian	Node 3R High Literacy, Democratic ^b
ln(GDP60)	-1.438 (0.556)	0.286 (0.326)	-0.065 (0.176)	0.769 (0.281)	-1.106 (0.207)	-0.331 (0.072)
Investment	-0.070 (0.167)	0.431 (0.183)	0.136 (0.069)	0.184 (0.096)	1.229 (0.271)	0.402 (0.121)
Population growth	0.162 (0.326)	0.698 (0.426)	-0.335 (0.158)	-0.219 (0.312)	-0.906 (0.236)	-0.408 (0.066)
Education	-0.093 (0.110)	0.244 (0.137)	0.624 (0.069)	0.492 (0.133)	-0.372 (0.273)	0.276 (0.132)
Constant	8.901 (3.469)	-1.457 (2.203)	1.727 (1.281)	-4.767 (2.045)	4.727 (1.881)	2.268 (0.714)
R ²	0.797	0.863	0.905	0.842	0.909	0.560
Observations	9	9	19	12	11	36

a. The dependent variable is $\ln(\text{GDP85}) - \ln(\text{GDP60})$. Following Mankiw, Romer, and Weil (1992), investment is the log of the average investment ratio; population growth is the log of the sum of the population growth rate, an exogenous growth rate of knowledge, and depreciation; and education is the log of the percentage of the population in secondary school. As in Mankiw, Romer, and Weil (1992), the sum of the growth rate of knowledge and depreciation is assumed constant across countries and is set equal to 0.5; further details appear in their paper. Conventional standard errors appear in parentheses below each estimate. See Table 6 for a list of the countries in each terminal node; see Figure 1 for the actual regression tree.

b. *Democratic* in the column heading should be interpreted as more democratic than the authoritarian regimes.

to the South African government's "pass laws," which restricted where blacks could live, work, and travel.³¹ The result may also be due partly to the lower population growth rates of the countries in node 3R. (The mean growth in population 1960 to 1985 for the countries in node 3L is 80 percent, while for those in node 3R it is 46 percent.) Higher levels of development (that is, node 3R) could be better able to sustain a given level of population growth than lower levels of development, perhaps due to economies of scale in agriculture and manufacturing. (*Development* is intended here as an unobservable variable proxied for jointly by income, literacy, and democracy levels.) Education appears to have a positive effect in democratic countries, while its effect is estimated to be negative in less democratic countries. One possible explanation is that democratic countries arguably provide more opportunities for their citizens, increasing the returns to education. Somewhat surprisingly, given the very high average growth rates of the countries in node 3L, the predicted growth rates of these countries if they had been democratic enough to be in node 3R are slightly higher than the actual rates they experienced, as shown in the last panel of Table 8 (predicted log growth of 0.71, relative to actual log growth of 0.65).

Of course, there is a high correlation between income, literacy, and democracy. Even an observer well versed in such matters could probably not identify which variables split the data into the groups in Table 6; as shown in Table 8, the values of all three variables increase fairly steadily across nodes. This correlation is precisely one of the reasons behind employ-

Table 8. Regression tree: Descriptive statistics by terminal node.^a

	Node 5L Very Poor, Authoritarian	Node 5R Very Poor, Democratic ^c	Node 4L Low Literacy	Node 4R Moderate Literacy	Node 3L High Literacy, Authoritarian	Node 3R High Literacy, Democratic ^c
<i>Split variables</i>						
GDP, 1960	488.2 (110.5)	519.9 (145.9)	968.2 (244.9)	1,187.2 (292.6)	1,757.2 (921.9)	4,495.4 (2502.5)
Democracy 1970s	0.031 (0.024)	0.331 (0.218)	0.172 (0.135)	0.408 (0.261)	0.291 (0.078)	0.837 (0.195)
Literacy, 1960	21.33 (18.49)	15.00 (10.77)	10.89 (6.65)	33.92 (5.81)	71.6 (10.8)	84.64 (16.88)
<i>Regression variables^b</i>						
Growth 1960–1985	0.235 (0.392)	1.039 (1.008)	0.323 (0.651)	0.505 (0.725)	1.218 (1.437)	0.976 (0.583)
Investment	7.11 (4.71)	9.96 (4.82)	8.65 (5.77)	14.90 (7.00)	17.97 (5.49)	22.90 (7.06)
Population Growth	0.940 (0.196)	0.909 (0.201)	0.928 (0.324)	0.964 (0.243)	0.800 (0.281)	0.461 (0.356)
Secondary Enrollment	0.079 (0.067)	0.107 (0.058)	0.131 (0.089)	0.225 (0.133)	0.400 (0.132)	0.577 (0.218)
<i>Decomposition: Predicted growth if more democratic</i>						
Log actual Growth	0.168 (0.306)				0.652 (0.546)	
Predicted Growth ^d	0.348 (0.353)				0.710 (0.227)	

a. Values are means for the countries in each terminal node. (Sample) standard deviations appear in parentheses. Sample sizes are 9, 9, 19, 12, 11, and 36 by column, respectively.

b. Per capita GDP and population are percentage growth rates 1960 to 1985. Investment (ratio of public and private to GDP) and (secondary) educational enrollment rates are means over 1960 to 1985.

c. *Democratic* in the column headings indicates more democratic than the authoritarian regimes.

d. Predicted log growth rates are computed using the coefficient estimates of the regression in the more democratic terminal node (node 3R for the countries in 3L, and node 5R for those in 5L).

ing regression tree techniques, which permit the researcher to exploit the data to identify distinct regimes, as well as the most relevant variable(s) in determining those regimes. Levels of democracy appear to be a significant, and commonly overlooked, variable in such studies.

5. Concluding Remarks

Two straightforward questions have motivated this research. First, what happens after a country experiences a change in its level of democracy? If the change is toward increased democracy, the country grows faster than a priori similar countries that did not experience democratization. Countries that became less democratic, on the other hand, grow more

slowly than a priori similar countries, and the estimated effect of a decrease in democracy on growth in both the short run and long run is negative and statistically significant. Although the countries that democratized seem to have been slightly more advantaged prior to the change than their control groups, the difference does not seem large enough to explain the subsequent divergence in growth rates. The countries that become less democratic are somewhat worse off before the change, which may explain more of the subsequent (relative) growth rates.

Second, does democracy affect growth in ways other than through intermediary variables? Regression tree analysis indicates that democracy, along with initial income and literacy, is a significant variable in determining multiple-growth regimes. Among nonpoor, fairly high-literacy countries, human capital accumulation seems to have a more significant effect on growth in more democratic countries, while the estimated effect of physical investment is stronger in the less democratic countries.

There are several possible avenues for further research in this area. Examining more closely the economic circumstances surrounding each of the changes in democracy included in this research should provide a more accurate indication of to what extent these changes were exogenous to the economic situation. Additionally, the 1990s have witnessed many changes in democracy and widespread democratic movements. Once economic data become available for this period, the inclusion of these events and the extension of the time period for the events already included should strengthen the conclusions that can be drawn.

Acknowledgments

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Appendix A: Construction of Control Groups

For each year, countries were divided into three categories of GDP per capita, with divisions at the 33rd and 67th percentile. Control groups are limited to countries falling within the same range of income as the country under investigation. For countries whose income falls within 10 percent of the 33rd or 67th percentile, the income range is between the midpoints of the relevant quartiles (for example, from the 17th percentile to the median if income is within 10 percent of the 33rd percentile). Income is measured in the year prior to the change.

Table A1 presents the guidelines used to restrict control groups based on the democracy index. As with the income variable, the democracy index is restricted the year before the change. It is additionally restricted in the years following the change, since the appropriate comparison is to similar countries that did not undergo changes in their levels of democracy. For the four years following the change, the countries in the control group cannot experience

Table A1. Guidelines for democracy levels of control groups.

Country's Democracy Level Before Change	Control Group's Democracy Level	Country's Level After Change	Control Group's Democracy Level Level
<i>Increases in democracy</i>			
7 (not free)	5-7	4	5-7
6 (not free)	4-7	3	5-7
5 (partly free)	3-7	2	4-7
4 (partly free)	3-7	1	4-7
<i>Decreases in democracy</i>			
4 (partly free)	1-5	7	1-5
3 (partly free)	1-5	6	1-5
2 (free)	1-4	5	1-3
1 (free)	1-3	4	1-3

substantial changes (more than one ranking) in democracy in the same direction as the country under investigation.

Since the Freedom House rankings were first issued in 1972, the rankings of Bollen (1990) are used to construct control groups for countries experiencing changes in democracy prior to 1973. Since Bollen's rankings only apply to 1960 and 1965, these groups are constructed less precisely on democracy during the year preceding the change. (The 1965 values are used for countries that change between 1966 and 1973.)

An alternative construction based on standardized standard deviation from the main country's income level was also employed, without significantly altering the results. Other alternative constructions included limiting the control groups to countries in the same region as the country undergoing the change and including additional variables, primarily educational variables such as literacy rates; the results did not differ substantially and the control groups were much smaller.

Notes

1. Summaries of empirical findings appear in Sirowy and Inkeles (1990) and Przeworski and Limongi (1993); more recent examples include Hadenius (1992), de Haan and Siemann (1995), and Barro (1996).
2. Helliwell (1994) accounts for simultaneity between democracy and economic growth.
3. This literature includes Lipset (1959), Rustow (1970), Huntington (1991), and Barro (1997), among others.
4. Steele (1994) provides a reporter's view of events before and after the coup.
5. *The Economist*, June 28, 1997. The figure is year-on-year growth from the first quarter.
6. In the regressions, these variables are recoded to range from zero (Gastil's value seven, indicating least free) to one (Gastil's value one).
7. Bollen (1993) discusses these criticisms in more detail and tests several similar rankings; the Freedom House index performs better on his measure of validity than do the others. Also see the special edition of *Human Rights Quarterly* (1986) on measures of human rights.
8. With regional dummy variables, the estimates on dem_decrease are no longer statistically significant in Regressions 2 and 3, although they are significant in all regressions except Regression 3 when OLS standard errors are used. The estimates on dem_increase are not statistically significant in any regression.

9. Minier (1998) examines this possibility and finds that lagged growth rates have a negative (but not statistically significant) effect on the probability of a democratic movement occurring, controlling for other factors.
10. This is similar to the problem of aliasing in time series analysis; see Hamilton (1994, p. 161) on aliasing.
11. Including educational variables (school attainment and literacy) in the construction of control groups and restricting the control groups to countries in the same region did not substantially alter the results.
12. Each control group observation is weighted by the inverse of the number of countries in that control group; the weights are scaled to the actual sample size.
13. However, most of the decreases in democracy occurred during the late 1960s and early 1970s (a period of high growth worldwide), while most of the increases occurred a decade later. To the extent that the difference in worldwide growth is due to a factor other than the changes in democracy, it may be desirable to control for worldwide growth. Weighting growth rates by the global mean of the relevant time period yields growth of 97 percent of the global rate over five years for both increases and decreases, and 95 percent of the global rate over ten years.
14. Because the samples being compared (the countries experiencing changes in democracy and the control groups) are drawn from populations with possibly different variances (the Behrens-Fisher problem), statistical significance is estimated using Welch's approximation (see Bickel and Doksum, 1977, pp. 218–219; Scheffé, 1970).
15. The specific outcomes mentioned do not change when control groups are restricted to the same geographical region, with the exceptions of the increases in Senegal and Peru, both of which grow faster than their (geographically restricted) control groups. These control groups cannot be constructed for Argentina, the Philippines, and Ecuador (increases) and Pakistan, the Seychelles, and Swaziland (decreases) due to the lack of countries in the relevant regions with similar income and democracy levels prior to the changes. The overall results are similar to those presented.
16. Results were comparable when predicted growth rates were based on full-sample regression coefficient estimates, and medians also yield qualitatively similar results.
17. There is no comparable outlier that underpredicts growth rates. During the period after it became more democratic, Ecuador's economy was affected extremely adversely by oil shocks.
18. Initial levels of several variables were also examined directly. Differences in initial levels of income, investment, and education should be captured by the predicted growth rates; levels of these variables were comparable between countries that became more democratic and their control groups, while countries that became less democratic had lower levels of these variables. The countries that became more democratic were very similar to their control groups in terms of inequality and previous growth; the countries that became less democratic were comparable in terms of inequality but had lower average levels of previous growth.
19. There are two arguments against this example—first, that Western governments have often been willing to work with authoritarian regimes; and second, that during the period under observation, Soviet advice was a reasonable alternative in those cases where Western advisors would have required some democratic reforms.
20. Perotti (1996), for example, investigates how democracy affects the relationship between inequality and economic growth but does not find a robust effect of democracy.
21. The empirical importance of these variables is confirmed by Levine and Renelt (1992).
22. Of course, the opposite is also plausible—for example, a dictator may be able to direct funds to primary education, while a democratic government feels obligated to reward supporters or court potential votes with nonproductive assistance. The following analysis places no prior restrictions on the ways in which production functions differ.
23. Breiman, Friedman, Olshen, and Stone (1984) and Härdle (1990) provide more complete expositions of regression tree analysis.
24. Terminal nodes are those nodes that are not split further.
25. Durlauf and Johnson (1994) discuss the pruning procedure in more detail.
26. This analysis is exactly the Durlauf and Johnson exercise, with the addition of democracy as a split variable. This article includes some literacy data that were missing in their paper.
27. The order of the splits is determined by the (recursive) pruning process.
28. For the reader unfamiliar with regression tree procedures: note that it is not necessary for a split to occur on each variable; all splits could have occurred based on the same variable.

29. The analysis was repeated with 1989 as the end date of the period; the only change to the pruned tree was that the third split occurred on a slightly higher level of democracy, moving Argentina, Brazil, and South Africa to node 3L. Additionally, the analysis was repeated with initial investment instrumenting for the period average of investment; the final specification differs somewhat, but data splits in the final specification do occur based on democracy levels.
30. Because these nodes together comprise a group of nonpoor, high-literacy countries, the differences between these nodes should not be interpreted as the differences between high and low democracy countries overall.
31. South Africa is actually in the *more* democratic node, node 4. However, South Africa and Argentina are the least democratic countries in node 4, and the split occurs on a fairly low level of democracy (0.39).

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