THE PATH TO PROSPERITY:

A POLITICAL MODEL OF DEMOGRAPHIC CHANGE[§]

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ABSTRACT

This paper presents a formal model that characterizes the political mechanisms of demographic change, establishing a critical link in economic development. We demonstrate that fertility decisions are determined by three fundamental political variables: political stability, political capacity and political freedom. Modeling strategic multi-objective policy setting by the government, we derive a set of equilibrium conditions that enable poor nations to escape a poverty trap and to successfully develop. Empirical tests for a sample of 100 countries from 1960 to 1990 provide strong support for the propositions of the formal model. In particular, we show that political stability, political capacity and political freedom all lead to reductions in birth rates. We conclude that politics can be either a stimulant or barrier to economic development.

1. INTRODUCTION

In this study, we investigate the political conditions that produce demographic transitions, stimulate economic growth, and allow nations to escape poverty. While the effect of fertility on economic growth has been studied, little has been said about the effects of political performance on birth rates (an exception is Organski et. al., 1984), while the politics-fertility-development nexus has not as yet been fully characterized. Using both formal theory and statistical analyses, we show that the relationship between politics and fertility is fundamental to the process of economic development. This occurs because fertility choices link the current political milieu to economic outcomes across generations. Thus, our model shows that politics is a fundamental cause of observed disparities in economic performance.

Our formal model shows – along with much of the literature – that increases in income reduce fertility (Notestein, 1945; Kuznets, 1955; Becker & Tomes; 1976; Becker & Barro, 1988; Becker, Murphy & Tamura, 1990). However, gradual income growth is unlikely to trigger the observed rapid demographic transitions that can liberate poor populations from poverty. Because large families reduce the ability of parents to transfer human capital to their offspring, high fertility is a proximate cause of low productivity and persistent poverty. Our work is motivated by the observation that a few societies, modern China, for example, have had major reductions in fertility *before* attaining significant gains in education and income. We demonstrate that political performance – including government capacity, political freedom, and political stability – is the catalyst that triggers demographic transitions. The achievement of low birth rates sets the preconditions for rapid and sustained economic development. Once the potential of a society is unlocked, further reductions in fertility are driven by income growth.

This paper is organized as follows. Section 2 presents the equilibria from our formal model which induce dynamics in population size, physical capital, and human capital. Using the equilibrium dynamics, we derive testable implications from the model, most of which are presented graphically. The model reveals that politics critically impacts birth rates by affecting expected economic outcomes. The details of the formal model are contained in the Appendix, which includes the politics of multi-objective optimal policy

setting in a dynamic environment. This derivation permits us to derive a new measure of political capacity.

Section 3 discusses the specification of the statistical model and the data used in the analysis, with the results presented in Section 4. Using thirty years of data for one hundred countries, the statistical tests provide robust support for the propositions derived from the formal model: Countries with governments that are politically capable, have low levels of instability, and protect freedoms have lower birth rates even after controlling for income and education. As a result, these counties are able to rapidly develop which futher strengthens their polities. Section 5 concludes by discussing the lessons for the politics of economic development that our findings identify.

2. FORMAL THEORY: THE POFED MODEL

In this section, we present and analyze the dynamic equilibrium of a model of POlitics, Fertility and Economic Development, the POFED model. There are three sets of actors in this model. Individuals maximize lifetime utility by choosing consumption and family size, firms maximize profits by selecting input levels, and the government optimally sets policy to maximize its longevity. Appendix 1 presents the optimization problem for each type of actor in the model and formally defines their interactions in equilibrium. Because the model contains both economics and politics, the equilibrium has both competitive and strategic aspects to it. In this section, we examine the equilibrium implications of the model. Figure 1 presents a schematic overview of the model.

[Figure 1 about here]

Consider a country with a large number of individuals who live three periods in overlapping generations. At each point in time, children, young adults, and older adults are alive. Each generation has a different level of human capital, h, while individuals within a generation are, for simplicity, identical. The economy begins at time $t=0$ and

continues indefinitely, and contains a single good that can be used for consumption or investment in physical capital, *K*.

Agents maximize utility during the two periods of adulthood, subject to a budget constraint in each period. During young adulthood, individuals work for firms paying a proportion of labor income $\tau \in (0,1)$ to the government as taxes, using the remaining income to fund their own and their children's consumption, and to save for old age. During old age, agents are retired and consume the principal and interest on their savings.

Besides choosing how much to consume and save each period, young adults also choose how many children to have.[1] In this model, children acquire human capital from their parents and make up the labor force when they are adults. Human capital, along with physical capital (plant and equipment) accumulates or decumulates endogenously over time based on choices made by individuals, firms and the government.[2]

There are three political factors that impact individual choices. The first is *political instability, S*, which is the proportion of physical capital destroyed in violent uprisings against the government (Zak, 1999a; Alesina, Ozler, Roubini & Swagel, 1997; Feng & Zak, 1999). Political instability has a random element to it corresponding to the partially unpredictable natures of demonstrations so that decisions are based on expected levels of instability.

The second political aspect in the model is *political freedom,* $\eta \geq 1$, which captures the degree of access by individuals to the government. Authoritarian governments have low values of η, while open and accessible governments have high values of η.[3] Political freedom determines the extent to which the policy preferences of the political opposition are addressed within the political process rather than erupting into violence. When political freedom is restricted, actions by the political opposition, rather than being mediated in the parliament, increase the destruction of capital by driving anti-government

[1] To keep this rather complicated model as simple as possible, children are produced by parthenogenesis (asexual reproduction). This permits us to avoid the issue of marriage matching. For a model of the search for a marriage partner, see Burdett & Coles (1997). We also ignore issues such as infertility and infant mortality, though these are reflected in our empirics.

[2] The POFED model unites the economic literatures on human capital and growth (Lucas, 1988; Galor & Zeira, 1993; and Stokey, 1996; among others), and endogenous fertility (Becker & Tomes, 1976; Becker & Barro, 1988; Becker, Murphy & Tamura, 1990; and Tamura, 1996). We extend these literatures by showing that family size affects the rate of transmission of human capital and by including the effect of politics on individual decisions.

demonstrations into the streets. The total capital stock destroyed at time t in anti-government demonstrations is $K_t S_t/\eta$. This construct shows that greater political freedom reduces the destruction of capital in political uprisings.

The third political factor, *political capacity* χ, is the effectiveness of the government in implementing policy (Arbetman & Kugler, 1997). Capable governments enhance the productivity of private firms by choosing policies that encourage economic efficiency. Arbetman & Kugler (1997) show that politically capable governments improve a variety of economic activities such as attracting investment, enhancing trade, and reducing inflation. Because our concern is with development, we restrict political capacity to have a single effect, raising labor productivity. This can occur through direct public investment, economic liberalization, or any other policy choice that raises labor productivity.

In Section A3 in the Appendix, we derive the output growth maximizing level of political capacity that a government can attain at any point in time, χ_t^*. We show that χ_t^* is increasing in economic factors (physical and human capital) as well as political freedom, and decreasing in political instability. This obtains because growth in economic factors raises tax revenue (by A.10), while political instability both reduces tax revenue and changes the optimal mix of government expenditures toward police funding to maintain public order and away from growth enhancing policies (by A.13). As shown above, greater freedom reduces the economic impact of political instability and therefore increased freedom increases the economic impact of government policies. Governments can raise their capacity by increasing the tax rate τ, but this causes a drag on the economy by reducing net-of-tax income, and therefore savings and capital formation. Thus, governments face intertemporal tradeoffs between funding policies that stabilize current political and economic environments, and policies that can shape the future of these environments. Due to additional political and economic constraints on the government we have not modeled (see for example, Bueno de Mesquita, et al, 1998), political capacity in most countries will be below its maximal value, χ_t^*.

[3] See Sened (1997) on the factors that motivate governments to grant freedoms.

Not only do governments have a tax revenue constraint in choosing political capacity, but face a risk of being overthrown by the opposition if instability is sufficiently virulent. This contingency specifies a hierarchy of policy goals. The first goal of government is to remain in power. If net political instability is so high that the entire stock of physical capital is destroyed ($S/\eta = 1$), then tax revenue falls to zero and the government is considered overthrown. Thus, the first priority of the government is to suppress anti-government uprisings. This is done by choosing optimal spending on the police, p, to reduce the economic impact of instability, $dS/dp < 0$. Once a proportion of tax revenue is allocated to fund the police to maintain public order, the remainder is allocated as political capacity to productive means. Since political capacity raises productivity, it causes individual incomes to rise which increases support for the ruling regime (Lewis-Beck, 1990; Fiorina, 1981; Tufte, 1978). This is the political rationale for using of tax revenue for productive purposes. The hierarchy of political choices is formally characterized in the Appendix. Therein, we show that low freedom-high political instability countries have less discretion in setting policy and therefore lower political capacity, than economically identical high freedom-low instability countries. This occurs because the latter have a sufficient of tax revenues to allocate as they choose and therefore more political capacity.

2.1 OPTIMAL CHOICES AND DYNAMICS OF THE POFED MODEL

In this section we present the dynamics in population and economic development that are equilibria from the POFED model, and show that politics affects the evolution of both. By solving individuals' utility maximization problem, and relating individual choices to economic and political fundamentals, the choices at time t for the optimal number of children, b_t^*, and savings, a_{t+1}^*, are

$$b_t^* = \text{Max}\left\{ E\frac{\gamma}{(1+\gamma)(1-\alpha)(1-\tau)Dk_t^{\alpha}(1-S_t/\eta)^{\alpha}(\chi_t h_t)^{1-\alpha}}, 1 \right\} \tag{1}$$

$$a_{t+1}^* = \beta(1-\alpha)(1-\tau)k_t^{\alpha}(1-S_t/\eta)^{\alpha}(\chi_t h_t)^{1-\alpha}/(1+\gamma), \tag{2}$$

where $\beta \in (0,1)$ the individual's subjective patience parameter, $\gamma > 0$ is the preference for children, α is the marginal productivity of capital, and D is a proportionality constant for the cost of children. Births in (1) have as their minimum the replacement rate of one. This is done only for convenience and has no substantive effect on the model's findings.[4]

The optimal births equation (1) reveals that births

(i) *increase* when political instability, S, rises

(ii) *decrease* when freedom, η, increases;

(iii) *decrease* when political capacity, χ, rises;

(iv) *decrease* when human capital, h, increases;

(v) *decrease* when per worker physical capital, $k = K/N$, grows.

The first three implications relating politics to births are new to the fertility literature. These results reveal the interdependence of all three parts of the POFED model: politics affects the economy which affects fertility, both of which impact political choices (as we will show in a moment). In particular, as politics impacts the economy, it changes the opportunity cost of children. When political instability is high, the economy weakens causing individual incomes to fall. As a result, the relative returns to work vs. child-raising change and births increase. Similarly, freedom reduces the economic impact of instability, keeping incomes high so that individuals optimally respond by spending more time working and having fewer children. Lastly, when political capacity is high, the government has sufficient discretion to effectively set policy, stimulating the economy and unintentionally reducing fertility.

The fourth and fifth implications of the equilibrium births equation, that parents who have higher incomes--either because they themselves have high human capital, or because they live in a society that is rich in physical capital--are standard results in the modernization literature.[5] Not only do we provide a formal derivation of these results,

[4] The replacement birth rate is unity under the assumption of reproduction by parthenogenesis. Births always have a natural minimum of zero, though in most developed countries the minimum is near the replacement rate.

[5] Thompson (1929) and Notestein (1945) were the first to propose that with economic development societies will experience a reduction in birth rates, which has been verified in the empirics of Sinding,

but these implications also serve as a check of the model vis-à-vis findings in the related literature. The five implications for births taken together indicate that even after controlling for income and a measure of human capital such as education or literacy, political effects are predicted to impact fertility *as long as fertility is above its replacement rate* (i.e. for $b^* > 1$). That is, these results obtain for developing, but not developed countries. Once countries have undergone a demographic transition to replacement birth rates ($b^* = 1$), without dramatic political or economic reversals, birth rates are immune to political and economic factors. This issue is fully examined in Section 3.1 below.

Optimality conditions (1) and (2) are used to construct the sequence of equilibria of the POFED model. These equilibria are found as individual, firm, and government choices are executed (with the exception of fertility) by transactions in markets. Market transactions and fertility optima produce equilibrium dynamics for the stocks of physical and human capital, and of the demographic structure. We next construct these dynamic relations.

Multiplying the optimal births equation (1) by the number of young fecund adults at time t, N_t, generates the equilibrium population dynamics,

$$N_{t+1} = N_t \, b_t^*. \tag{3}$$

That is, the aggregate number of children born at t, $N_t \, b_t^*$, makes up the workforce of young adults at time $t+1$. Clearly, all the results that obtain for the effects that political and economic factors have on individual fertility decisions b_t^*, also hold in the aggregate.

We next characterize the relationship between fertility and economic development. Aggregating the optimal savings function (2), total savings from time t to $t+1$ is $N_t \, a_{t+1}^*$. This inflow of funds is used to finance the capital used by firms in period $t+1$, K_{t+1}. As shown in the Appendix, the resulting equilibrium specifies that the physical capital stock evolves according to

Ross, & Rosenfeld (1994), Freedman (1994), Camp (1993), Bongaarts, Mauldin & Phillips (1990), among others.

$$K_{t+1} = E\{\beta(1-\alpha)(1-\tau_t)(K_t(1-S_t/\eta))^{\alpha}(\chi_t N_t h_t)^{1-\alpha}\}/(1+\gamma). \quad (4)$$

Using the dynamics in population (3), the law of motion for the physical capital stock (4) can be written in per worker terms,

$$k_{t+1} = E\{\beta(1-\alpha)(1-\tau_t)(k_t(1-S_t/\eta))^{\alpha}(\chi_t h_t)^{1-\alpha}\}/[b_t^*(1+\gamma)], \quad (5)$$

where b^* is given by (1). Equation (5) reveals some interesting relationships. Most prominently, when birth rates exceed replacement ($b_t^*>1$), per worker capital formation falls. This occurs because the capital stock is used by more workers, reducing productivity, and therefore income and savings by (2). Capital formation also falls when children are highly valued (γ high), when political instability is high, when freedom is low, or when taxes rise. Capital formation rises with political capacity, with human capital, and with individuals' patience, β.

Two of results relating the growth in physical capital to politics are new to the literature on the political economy of economic growth, namely those relating political capacity and freedom to growth (the latter being an open issue empirically).[6] Note that politics affects capital formation directly as (5) shows, as well as indirectly via its affect on births b_t^*. Before we analyze the growth effects of the POFED model, we need to put in the last piece of the dynamics, the evolution of human capital.

Gary Becker (1993) identifies both innate ability and environmental influences as the constituents of human capital. Using the generational structure of the model, we allow parents to transmit some of their human capital to their children. Since children's inherited traits are more fully expressed when parental nurturing is high, family structure is a primary environmental influence on the intergenerational transmission of human capital. Hanushek (1994) and Downey (1995) show that as the number of siblings in a

[6] Formal models showing that political instability reduces growth include Venieris & Gupta (1986), Zak (1997), Ghate, Le & Zak (1999) ; see Campos, Nugent & Robinson (1999) for a model in which instability

family increases, adult income and educational attainment of each child falls. That is, when family size is small, parental nurturing per child is higher and resulting adult productivity is enhanced. Combining the effects of household environment with the inheritability of human capital, a child's human capital is, on average, increasing in his or her parent's human capital and decreasing in the number of children in a family.[7] Equation (6) captures this structure where the human capital h_{t+1} of each child is related to her parent's human capital, h_t, and the number of siblings in her family, b_t,

$$h_{t+1} = \frac{\omega h_t}{b_t^{\theta}} \tag{6}$$

The parameter $\omega > 1$ in (6) is the maximum rate of intergenerational human capital transmission, while $\theta > 0$ is the dilution effect resulting from multiple siblings ($b > 1$) vying for their parent's attention.

The equilibrium dynamics of this model are given by the evolution of per worker physical capital (5) (which subsumes population growth), and for human capital (6) where births, b, is given by its optimal value in (1). The growth effects of the POFED model, as well as implications regarding government policy to stimulate development are contained in the next section, and are primarily presented graphically.

3.1 A GRAPHICAL PRESENTATION OF POFED EQUILIBRIUM DYNAMICS

raises output growth. On the relationship between freedom and growth, see Feng (1998), Zak & Feng (1999), Barro (1996), Sirowy & Inkles (1990), and Przeworski, & Limongi (1993).

[7] This argument is fully developed in Zak (1999b). Because Behrman & Taubman (1989) show that 81% of educational attainment is attributable to one's innate ability, we abstract from modeling the effect of formal education on human capital. The law of motion for human capital (6) accords well with that used by Lucas (1988), and collapses to match Lucas' exactly when the chosen number of children is one. A more general human capital accumulation function is contained in Bond, Wang, & Yip (1996). Galor & Tsiddon (1997) and Tamura (1996) include nonconvexities in the accumulation of human capital, and several of the predictions that come from these models match those that come from ours, as the dilution effect in (6) induces a nonconvexity.

The POFED model produces two types of development paths, a poverty trap and a balanced growth path, as Figure 2 illustrates. If physical or human capital is sufficiently low, or the polity has low political capacity, the economy will be caught in a low-income stationary equilibrium, or *poverty trap*. This occurs because when labor income is low the birth rate is high, and, as a result, human capital decumulates over generations by (6). In this case, output per worker contracts and the economy reaches a low-income stationary point.

[Figure 2 about here]

A second equilibrium trajectory, a *balanced growth path*, emerges if both types of capital are above the thresholds that lead to a poverty trap. On this trajectory, economic growth is endogenous–that is, it continues indefinitely without reaching a stationary point. The long-run growth rate in output is ω, the maximum rate of transmission of human capital.[8] The threshold that determines if the economy grows or contracts is found by solving for the stationary point shown in Figure 2.[9] The threshold that determines if the economy grows or contracts is,

$$h^* = [\gamma/D\chi][\omega^{(1-2\alpha)/\theta}\beta^{\alpha}(1-\alpha)(1-\tau)(1-S/\eta)^{\alpha}]^{-1/(1-\alpha)}. \quad (7)$$

When human capital is below h^* the economy contracts, while if human capital exceeds h^*, the economy grows endogenously, expanding rapidly during the early period of *transitional dynamics*, and then growing at the constant geometric rate ω. On a balanced growth path, output growth is driven by new ideas that follow from the accumulation of human capital. At this stage, the country is a developed "information" economy.

[8] This long-run growth rate is derived by assuming the political capacity and political instability are constant, as Arbetman & Kugler (1997) show is the case for developed countries.
[9] For simplicity, physical capital is not shown in Figure 2. The full dynamics of this model are analyzed in Zak (1999b).

The growth threshold for human capital (7) shows that this threshold (unlike the threshold for physical capital), depends on political factors.[10] Indeed, the threshold falls as political capacity rises, indicating that high political capacity countries will be caught in poverty only if their human capital is quite low; *viz*. high political capacity countries are less likely to be trapped in persistent poverty. Similarly, the growth threshold falls as political freedom rises. Countries with greater civil liberties have less conflict, higher incomes and are therefore less likely to be caught in a poverty trap. Conversely, the human capital threshold rises with political instability. Highly unstable countries must have more human capital if they are to escape poverty.

The derived relationship between politics and a country's prospects for development is one of the remarkable implications of the POFED model. The model identifies ways that policy-makers can influence the trajectory of their economies, and this mechanism works primarily by impacting choices regarding family size and therefore investment in children. Developing countries that have high levels of political capacity, sufficiently protect civil liberties, and have low levels of political instability are most likely to successfully develop. Political factors stimulate development by opening up opportunities for individuals and initiating a demographic transition to a low birth rate regime. Once an economy is growing, political factors also affect the incentives to invest in physical capital as equation (5) shows, revealing two pathways through which politics impacts the development process.

Of the three political aspects in the model, the one that politicians have the most control over is political capacity. Rearranging (7) provides a threshold of political capacity that determines if this economy grows or contracts,

$$\chi^{**} = [\gamma/Dh][\omega^{(1-2\alpha)/\theta}\beta^{\alpha}(1-\alpha)(1-\tau)(1-S/\eta)^{\alpha}]^{-1/(1-\alpha)}. \quad (8)$$

Equation (8) indicates that if political capacity remains below χ^{**}, then positive growth will not occur in this economy. This threshold falls (i.e. successful development is more likely) when human capital is higher, political instability is lower, and when a country has more political freedom. In fact, we show in the Appendix that political capacity rises

[10] The growth threshold for per worker physical capital from (5) is $k^* = \gamma\beta/[\omega^{2/\theta}D(1+\gamma)^2]$.

as instability falls and as freedom increases. Therefore, adequate political capacity is a necessary condition for successful economic development.

Changes in political capacity can radically alter a country's development trajectory. Observe that as political capacity becomes small ($\chi \to 0$), births become large by (1), and therefore by the law of motion of human capital (6), human capital is surely below the growth threshold h^* given by (7).[11] Thus, an *extended* reduction in political capacity causes a country to fall into a poverty trap. Furthermore, a *temporary* change in political capacity for a country which is growing ($h_t > h^*$) alters a country's growth path, and can cause it to contract into poverty. This occurs if a reduction in political capacity from its base level χ_t, to the new level $\chi_t - \eta$ satisfies,

$$\eta > \chi_t - h^{*1/(\theta(1-\alpha))} A^{-1/(1-\alpha)} \; k_t^{-\alpha/(1-\alpha)} (1 - S_t/\eta)^{-\alpha/(1-\alpha)} \; h_t^{-1-1/(\theta(1-\alpha))} > 0, \qquad (9)$$

where $A = [\omega^{1/\theta} \bar{\gamma}^{-1} (1+\gamma)(1-\alpha)(1-\tau)D]$. A one-time decrease in political capacity that satisfies inequality (9) is more likely when physical or human capital is low, when political instability is high, and when freedoms are curtailed. A government that is politically incapable, therefore, causes the economy to falter, which further weakens the government by depriving it of tax revenues by (A.11), initiating a vicious circle of persistent political fragility, rising birth rates and eventual poverty. Moreover, equation (A.15) shows that rising birth rates reduce political capacity as public goods are shared among a larger population, further dimming the prospects for economic development.

When political capacity falls, but not enough to satisfy (9), the economy continues to grow in the transitional dynamics, but converges to the balanced growth path (i.e. becomes a developed economy) more slowly. As depicted by the dashed curve in Figure 2, a growth slow-down occurs in response to a one-time reduction in political capacity since births increase and the accumulation of both human and physical capital slows. A country facing these circumstances will eventually develop, but without a politically capable government, the development process is retarded. In addition, such a reduction in political capacity also increases the range of human capital for which a country's

[11] A similar result obtains for physical capital. In this derivation, time $t+1$ per worker physical capital (5) is surely less than the growth threshold level k^* as political capacity becomes small.

development trajectory leads towards the poverty trap as shown by the dashed line in Figure 2.

Conversely, for a country in which the economy is contracting ($h_t < h^*$), a sufficient increase in political capacity, $\chi_t+\eta < \chi_t^*$, changes its development trajectory to one with positive and self-sustaining economic growth, where χ_t^* is maximal political capacity at time t. The route that permits a country to escape poverty via political means requires a sufficient increase in political capacity, with the increase being larger when physical and human capital are low, and political instability is high. Further, the new level of political capacity must not exceed the growth maximizing level, χ_t^*. If $\chi_t+\eta > \chi_t^*$, an increase in political capacity reduces growth as the economic drag from higher taxes exceeds the benefit of increased production efficiency. Thus, there is a limited range of actions that governments can take to stimulate economic development.

As Figure 2 suggests, and equation (9) demonstrates, changes in the direction of a country's development trajectory due to a change in political capacity are most likely for "middle income" countries--those with h_t near h^*. In these countries, political capacity is typically moderate and a change in capacity can fundamentally alter economic performance. Poor countries, on the other hand, have very little latitude to increase political capacity as they are constrained by low tax revenues. For this reason poor countries are more likely to remain trapped in poverty as their political capacity is less than the threshold value χ^{**} given by (8). On the other hand, high-income countries have large stocks of physical and human capital and therefore high political capacity so that a change in capacity has little impact on the economy.

The most important implication of these findings is that politics can provide a means to alter the path of economic development. Unlike economic factors, which evolve gradually, political factors often change rapidly, and we have shown that such short-term fluctuations affect a country's development trajectory. Political capacity is not the only prerequisite for development. As equation (9) shows, high levels of per worker human or physical capital provide a sufficient "push" to sustain development and can, over a range, offset the effects of low political capacity. Unfortunately, as the experience of aid donors to developing societies attests, the stocks of human and physical capital are typically low

in developing countries, and their augmentation is difficult.[12] Thus, adequate political capacity is among the necessary conditions for economic development, and the one over which policy-makers have the most control.

That the POFED model's dynamics produce both a poverty trap and a transition to balanced growth is consistent with empirical findings showing that there are "convergence clubs" in cross-country data (Quah, 1997; Pritchett, 1997). As predicted by the POFED model, the data show that poor countries tend to stay poor. What we provide is a new political explanation for this finding, and a means for an exit. Consistent with the transitional dynamics of the POFED model, empirical studies show that middle income countries either contract into poverty or grow rapidly and join wealthy countries. Our analysis provides an explanation for this pattern and demonstrates that political capacity in part determines whether a country is above or below the growth threshold. Finally, the empirical evidence indicates that developed countries grow at a roughly constant rate over time (e.g. Razin & Yuen, 1993; and Barro & Sala-i-Martin, 1997). These results match the balanced growth dynamics in the model in which political factors have little effect on fertility or economic growth. Thus, including politics and fertility into a model of economic growth consistently accounts for the range of development experiences within a single model. It is worthwhile to reemphasize that the dramatic impact of politics on economic development in the POFED model obtains because politics affect fertility decisions. Because of this dependence, even a one-time change in the political environment affects economic factors over many generations. Furthermore, freedom acts as a buffer, protecting economies from descending into a poverty trap due to high levels of political instability. Thus, the POFED model demonstrates that politics is a key constituent to development.

3. STATISTICAL MODEL SPECIFICATION

The POFED model shows that politics is connected to economic performance through fertility. In this section, we test the propositions regarding fertility deduced from the POFED model since fertility is the key to all the other results: The novel testable

[12] In addition, Knack & Zak (1999) show that foreign aid inflows cause the quality of institutions to deteriorate.

implications of the model all depend on the derived relationship between politics, economics and fertility. In order to perform the most rigorous tests the theory, we directly estimate the derived equilibrium births equation (1) after taking logarithms. Because of measurement problems arising when using physical capital in empirical analyses, we substitute per worker income, *y*, for per worker capital, *k*, in (1), noting from the production function (A.7) that capital and output vary in direct proportion to each other. Following this transformation, the testable equation is[13]

$$ln(b_{it}) = \beta_0 + \beta_1 ln(1-S)_{it} + \beta_2 ln(\chi_{it}) + \beta_3 ln(\eta_{it}) + \beta_4 ln(y_{it}) + \beta_5 ln(h_{it}) + \varepsilon_{it}, \quad (10)$$

where *i* indicates the country, *t* indicates the year, and ε is a white noise error term. As above, *(1-S)* is political stability, χ is political capacity, η is political freedom, and *y* and *h* are income per capita and human capital, respectively. The POFED model predicts that the signs on these political variables are negative. The constant β_0 is an agglomeration of parameters in the theoretical model, including the preference for children γ, the opportunity cost parameter for child-raising, *D*, and the subjective discount factor for utility, β.

3.1 MEASURING VARIABLES

Equation (10) is estimated for a panel of one hundred counties with data from 1960 to 1990. We use lagged values of the right-hand side variables as instruments since the formal theory shows that these variables and births are jointly endogenous.

BIRTHS

We use a common measure of births, the crude birth rate (CBR), defined as the number of children born per thousand of the population, as the dependent variable. The source of the data is Global Data Manager 3.0 (World Game Institute, 1997).

[13] We approximate $ln(1-S/\eta)$ by $ln(1-S) + ln(\eta)$ which is valid since S/η is small.

POLITICAL STABILITY

Political stability is derived from a measure of political instability. Political instability is latent in the social and political system of a country. As measures of political instability, Feng (1997) distinguishes between unconstitutional government change, major constitutional government change, and minor constitutional government change. He finds that unconstitutional government change (such as a military coup d'état) has a pronounced negative consequence for economic growth. It is this type of government change that is utilized in the empirical tests.

Similar to Cukierman, Edwards, & Tabellini (1992) and Feng (1997), we first measure political instability using a limited dependent variable model. The probability of unconstitutional government change is a function of (i) economic variables measuring the recent economic performance of the government (e.g., previous levels of inflation, consumption, and income), (ii) political events accounting for significant political incidents that may signal an imminent government change (e.g., riots, assassinations, general strikes, and revolutions), (iii) political structures indicating systemic stability (e.g., the selection of the effective executive of the state, parliamentary responsibility, and the effectiveness and selection of the legislature), and (iv) dummy variables grouping countries according to their continents to control for the systemic effects not explained by the model. From the fitted values of the logit model using pooled time-series cross-national data, the probability of unconstitutional government change for each country in any given year in the dataset is estimated. Political stability is then calculated by subtracting the estimated probability of unconstitutional government change from one.

POLITICAL CAPACITY

Government political capacity reflects the ability of political elites to tap into material resources and allocate them to government ends. Government elites mobilize resources to promote their objectives within the limits imposed by competing domestic political actors and by pressures from the external environment (Organski & Kugler, 1980, p.69). Political capacity is approximated by a government's ability to collect revenues given the existing economic base. Taxes are indirect indicators of governmental presence. The implementation of governmental operations depends upon the availability of

resources extracted from the population, as policies and priorities cannot survive without funding. In this study, we utilize the relative political extraction (RPE) measure proposed by Organski & Kugler (1980) and refined by Arbetman & Kugler (1997). This relative indicator is based on the ratio between actual and expected tax revenue, given economic conditions.

A country with high relative political extraction (RPE > 1.0) has a strong and capable government that implements policy effectively. Conversely, a weak government extracts less than anticipated (RPE < 1.0) to advance its goals and fails to implement desired policies. These data were generated using annual averages for 1970 through 1995, updating estimates provided in Arbetman & Kugler (1997).

POLITICAL FREEDOM

For the measure of political freedom, we turn to the institutionalized democracy index provided by Gurr and his associates (See Jaggers & Gurr, 1995). The data set offers a wide range of annualized variables, including centralization of political authority, identification of major shifts in polity or political regime, and other measures. Most significantly, Gurr offers a composite index of institutionalized political freedom, which is conceived as three essential, interdependent elements. One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. The second is the existence of institutionalized constraints on the exercise of power by the executive. The third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Other aspects of democracy, such as the rule of law, systems of checks and balances, freedom of the press, and so on, are means to, or specific manifestations of, these general principles. There is no necessary condition for characterizing a political system as being free or unfree; rather, political freedom is treated as a continuous variable. The value of this variable ranges from zero to ten, with ten representing the most free.

INCOME PER CAPITA

The source for real GDP per capita is the Penn World Tables (Summers & Heston, 1995). This dataset adjusts national income levels for purchasing power parity, so that the

cost basis of expenditures is comparable across countries and over years. The level of real GDP per capita is obtained from an equation based upon the relationship between a country's real domestic absorption relative to the United States and an estimate of its domestic absorption.

HUMAN CAPITAL

Human capital is proxied by data on literacy. Literacy provides a measure of the quality of education, as opposed to, for example, years in school. The source of the literacy data is the Cross-National Time-Series Archive (Banks, 1996).

4. EMPIRICAL RESULTS

In this section we estimate equation (10) to test the propositions relating political and economic changes to birth rates derived from the theory. The estimation reported in Table 1 regresses stability *(1-S),* capacity *(χ),* freedom *(η),* income *(y),* and human capital *(h)* on crude birth rates.[14] In order to capture the dynamic effects of politics on fertility decisions, we use annual data and lag the independent variables. The asterisks * and ** indicate that the parameter estimates are statistically significant at the error levels of 0.01 and 0.05, respectively.

The regression results support all the implications for fertility from the POFED model. All of included variables have the correct sign and are statistically significant. In particular, the estimates show that birth rates decline as political stability, capacity, and freedom increase. Economic determinants of births in the POFED model also find strong support in the data. Per capita income and education are both highly significant and powerful factors affecting births. Our findings are robust to variations in the lag structure used to instrument endogenous variables, with lags varying from zero to three. These results confirm the formal theory linking politics and births.

[14] Figures in parentheses in Table 1 are the standard errors of the parameter estimates, which are corrected for heteroskedasticity using the method of White (1980). Because the theory specifies the sign for each coefficient, the hypothesis tests examining if the estimated coefficients are significantly different than zero utilize a one-tail test.

[Table 1 about here]

The estimates in Table 1 show that economic factors have the most powerful impact on births. Indeed, a ten-percent increase in income results in 3.6 percent reduction in the birth rate. Consistent with our model and modernization theory, increases in income are strongly associated with declines in births. Literacy works in a similar fashion. A ten-percent increase in literacy results in a 1.2 percent reduction in the birth rate. These results should not surprise demographers and economists. However, it is unlikely that demographic transitions can be prompted and sustained by economic and educational improvement alone, which generally change quite slowly. Indeed, the theory in Section 4 shows that a demographic transition will not occur if political capacity is low.[15] Seen in this light, political capacity, along with political stability and freedom, are prerequisites for economic growth. The evidence supports this view. A ten-percent improvement in political stability reduces the birth rate by about 2.5 percent. Similar improvement in political capacity and political freedom reduce the birth rate by 0.6 percent and 0.3 percent, respectively.

The standardized coefficients shown in the last column of Table 1 estimate the change in the standard deviation of the dependent variable, given one unit change in the standard deviation of the independent variable. This set of statistics is based on the first-order lag structure (Column 2). As a result, it reflects the predictive importance of the independent variables. By this criterion, the economic variables GDP per capita and literacy are more "important" than political variables. However, for countries that lack sufficient levels of income and education, which is typical of many developing nations, political reforms "short-cut" the long process of development, and can lift them out of a poverty trap.

The implications regarding the relationship between sustained growth and political changes cannot be overstated. The statistical results support the POFED model's prediction that a strong government favoring political freedom raises private productivity

and triggers a demographic transition. A decrease in family size increases the rate of transmission of human capital across generations, raising productivity when the young generation enters the workforce and, as a result, increasing output and labor income. The theory and empirics show that increasing income further reduces birth rates and sustains output growth.

The joint inclusion of political capacity and freedom in the model is telling. Politically capable nations generate reductions in population growth and prompt output growth, but politically capable nations that are *also* free gain far more. We have shown for the first time the consequences of political capacity and political freedom on fertility. Capable or free governments can prompt change, but it is a both capable and free government that sustains change.

6. CONCLUSION

This paper presented a formal theory of fertility, economic development, and politics. Fertility decisions are shown to connect government policy and subsequent rates of economic growth. We demonstrate that effective government policy propels fertility declines, which increases the transmission of human capital, raises productivity, and produces a demographic transition. The demographic transition, in turn, sets the stage for sustained economic growth. Our research shows that political changes can induce fertility declines, providing a mechanism to liberate poor nations from poverty traps. A fundamental result of our analysis is that the key to sustained development is held by domestic political actors, rather than in the hands of foreign leaders. Increasing the capacity of governments, allowing populations to freely exercise their options, reducing political instability, and enhancing human capital and productivity can attain self-sustaining growth.

Free and capable governments prompt sustained growth more effectively than their counterparts. While capable authoritarian regimes – like those in Mao's China, Stalin's Russia, or Hitler's Germany – can also achieve the preconditions for economic growth, they have difficulties maintaining economic growth. Though efficient authoritarian

[15] For example, China drastically reduced population growth during Mao's mobilization, a decade before the introduction of population planning that eventually sustained low birth rates (Organski, Kugler, and

governments are capable of prompting demographic transitions, they rely on coercive means to maintain low levels of fertility. The competition between a desire to preserve political leadership and the need to sustain growth places authoritarian regimes in a dilemma that often escalates to instability in succession crises, reversing their growth trajectories. By contrast, free, capable, and stable governments provide the means for nations to prevent political instability, reduce population growth, and raise productivity. The path to escape a poverty trap is open to all polities, but it is wider for free capable democracies.

Arbetman, 1997)

APPENDIX: POFED MODEL FORMAL THEORY

This appendix presents and solves the individual's lifetime utility maximization problem, the firm's profit maximization problem, and the government's optimal policy problem that are the components of the POFED model. Subsequently, a political-economic equilibrium is defined. POFED is a dynamical general equilibrium model, which means that given a utility function, a specified production process, and initial conditions, all aspects of the model are evolve endogenously and are jointly dependent on each other. For example, we show that political capacity affects production decisions by firms, the utility maximization problem for individuals, and thus the process of economic development. The model itself has an overlapping generations structure, as discussed in the text, in which individuals live for three periods: childhood, young adulthood and old age.[16] We append to this basic structure production decisions by firms, fertility choices by individuals, the transmission of human capital from parents to children, and a government that has multiple policy objectives.

A.1 INDIVIDUAL DECISIONS

Agents maximize lifetime utility during the two periods of adulthood, subject to a budget constraint in each period. Since parents fund a child's consumption, no utility accrues to children. The budget constraint for a young adult, equation (A.2) below, equates consumption c_1 to after-tax labor income $wh(1-\tau)$ [wage, w, times human capital, h, less taxes, $\tau \in (0,1)$], after paying eb for children's consumption [b children (births) which each cost e to raise], and save a for old age. The budget constraint for an old agent, equation (A.3), shows that consumption c_2 is funded by the principal and interest on savings from young adulthood $R\,a$, where R is one plus the net interest rate. Restriction (A.4) limits minimum fertility to be the replacement rate. Lastly, all agents have identical logarithmic and temporally separable utility functions.

Combining the elements above, the expected lifetime utility maximization problem for an individual born at time $t-1$ is

$$Max_{\ c1,t;\ c2,t+1;\ bt}\ E\{(1-\beta)\ ln\ (c_{1,t})\ +\ \beta\ ln(c_{2,t+1})\ +\ \gamma\ ln\ (b_t)\} \qquad (A.1)$$

s.t.

$$c_{1,t} = w_t h_t\ (1-\tau_t) - e_t\ b_t - a_{t+1} \qquad (A.2)$$

$$c_{2,t+1} = R_{t+1}\ \tilde{a}_{t+1} \qquad (A.3)$$

$$b_t \geq 1 \qquad (A.4)$$

where $\beta \in (0,1)$ denotes the preference for consuming when middle-aged versus old-aged, $\gamma > 0$ is the preference for children, and E is the expectations operator.[17] Note that principal invested, a_{t+1}, may differ from the principal one has returned, $\tilde{a}_{t+1}$, due to political instability, with losses of assets being proportional to savings, $\tilde{a}_{t+1} = a_{t+1}\ (1- S_t/N_t\ \eta)$. Agents maximize expected utility because, due to political effects described below, income and the return on savings are stochastic. Further, because there is a large number of atomistic agents in the model, the actions of a single individual have no effect on aggregates. As a result, individuals take political instability, S, freedom, η, and political capacity, χ, as given in solving their utility maximization problem (A.1)-(A.4).

We use a parameterization of the cost of children, e, that reflects the income foregone for the time spent with children, which is the primary cost of child-rearing (Birdsall, 1988). In particular, let the cost of children be quadratic in net labor income, $e_t = D\ (w_t h_t(1-\tau_t))^2$, with the constant $0 < D < 1/b_t w_t h_t(1-\tau_t)$.[18]

Solving for the optima from (A.1)-(A.4), the solutions for the number of children b_t*, and savings, a_{t+1}*, are[19]

[16] The overlapping generations model was developed by Samuelson (1958) and Diamond (1965). The most extensive reference to the overlapping generations model is Azariadis (1993).

[17] Note that as is standard, we ignore the integer constraint on children. In addition, problem (A)-(A3) is written in *per effective worker* terms, i.e. economic variables are written relative to working agents' human capital, h. For this reason, labor income is given by wh, that is, the wage times human capital, h, rather than simply w.

[18] The restriction in D simply guarantees that consumption is positive for all finite values of k and h.

[19] Note that with logarithmic preferences, individual optima from problem (A.1)-(A.4) are unique and strictly positive. As a result, the Lagrange multiplier method to solve a constrained optimization problem is not necessary, and problem (A.1)-(A.4) is solved by substituting out middle-age and old-age consumption using each period's budget constraint and maximizing over a_{t+1} and b_t.

$$b_t^* = Max\{E\frac{\gamma}{(1+\gamma)Dw_t h_t(1-\tau_t)},1\} \tag{A.5}$$

$$a_{1,t+1}^* = E\frac{\beta w_t h_t(1-\tau_t)}{(1+\gamma)} \tag{A.6}$$

Equation (A.5) shows that an individual's optimal number of children is positively related to the preference for children, γ, and negatively related to net-of-tax labor income $wh(1-\tau)$. Optimal old-age savings (A.5) is a constant proportion of net-of-tax labor income, with this proportion increasing as agents become more patient (β rises), and falling as the preference for children (γ) becomes stronger. Observe that government policy affects individual decisions since taxes τ increase births in (A.5), and reduce savings in (A.6).

Next, we relate labor income and the return to savings to political and economic fundamentals.

A.2 POLITICS AND PRODUCTION

As discussed in the text, *political instability* is a mapping $S_t = S(Y_{t-1},p_t,\varepsilon_t)$: $R^3 \rightarrow [0,1]$ which is the proportion of the physical capital stock that is destroyed by during anti-government uprisings, where Y is aggregate income, p is government funding for the police which reduces the ability of demonstrators to destroy capital, and $\varepsilon \sim G$ is a random variable that denotes the level of discontent with the political milieu, where G is a CDF with finite mean and variance. Following Zak (1997), we assume that S is decreasing in lagged output, Y, is decreasing police spending, p, and increasing in ε. Note that S is not the *number* of demonstrations, but the impact of demonstrations on the economy.

Because of violent demonstrations, the physical capital available for production at time t is $K_t(1-S_t/\eta)$. Firms produce output, Y, with a modified Cobb-Douglas production function,

$$E\{Y_t\} = E\{(K_t(1-S_t/\eta))^{\alpha}(\chi_t N_t h_t)^{1-\alpha}\}, \quad \text{(A.7)}$$

with the productivity parameter $\alpha \in (0,1)$. Equation (A.7) shows that political instability reduces stock of productive capital and therefore the output that is produced. The effect of political instability is mitigated by access to political institutions which we call political freedom, $\eta \geq 1$. Net capital in production is $K_t(1-S_t/\eta)$ since proportion S/η of the capital stock is destroyed in anti-government demonstrations. Note that the expected value operator appears because S_t has a random element to it at time t. The third political factor in the model, *political capacity*, χ, raises the productivity of labor in (A.7).

A representative firm chooses physical capital per effective worker, $\underline{K}_t \equiv K_t(1-S_t/\eta)/L_t$, to maximize profits, where effective labor supply is $L_t \equiv N_t h_t \chi_t$, by solving

$$Max_{\underline{K}_t} E\{Y_t\} - r_t \underline{K}_t, \quad \text{(A.8)}$$

where r_t is the cost of financing capital investments which is taken as given by firms, and markets are perfectly competitive. Solving (A.8) after substituting in the production function (A.7) produces the firm's demand function for per effective worker physical capital, $\underline{K}$. Noting that the production function is homogeneous of degree one, permits one to solve for the demand for effective labor L. Given these demand schedules and supply decisions made by consumers, the market clearing wage for labor, w, and return on savings, $R = 1 + r - \delta$ are found. The return to savings takes into account the rate of depreciation of physical capital in production, $\delta \in [0,1]$, with $r - \delta$ the net interest rate. Using (A.7) and (A.8), wage w_t the and return R_{t+1} are the marginal product of effective labor and the marginal product of capital plus one minus depreciation,

$$w_t = (1-\alpha)E\{(K_t(1-S_t/\eta))^{\alpha}\chi_t^{1-\alpha}(N_t h_t)^{-\alpha}\}, \quad \text{(A.9)}$$

$$R_{t+1} = 1 + \alpha E\{(K_{t+1}(1-S_{t+1}/\eta))^{\alpha-1}(\chi_{t+1} N_{t+1} h_{t+1})^{1-\alpha}\} - \delta. \quad \text{(A.10)}$$

Conditions (A.9) and (A.10) show that net political demonstrations, S/η, reduces both wages and the return to savings, while political capacity raises both w and R. Note by that (A.7) and (A.9), aggregate wages paid to labor are a fixed proportion of expected output, $w_t h_t N_t = (1-\alpha)E\{Y_t\}$.

Substituting wage (A.9) into the first order condition for births (A.5) produces the equilibrium births equation (1) in the text. Similarly, putting (A.9) into the savings relation (A.6), we obtain the equilibrium savings function (2).

A.3 THE POLITICS OF POLICY-SETTING

Every government has as its goal self-perpetuation (Alesina, Roubini, & Cohen, 1997; Arbetman & Kugler, 1995; Magee, Brock, & Young, 1989). Since political instability increases the likelihood that the government will be overthrown, the maintenance of public order is the highest priority when setting government policy.[20] The second policy goal is to use tax revenue to increase political support for the regime. This occurs when political capacity raises individuals' incomes. Combating political instability is *reactive*; that is, when the stochastic portion of political instability, ε, is observed, the government reacts by varying police funding. On the other hand, enhancing growth is *proactive*. Policies that enhance growth require an expenditure plan prior to implementation.

Aggregating the taxes paid by working agents shows that the government receives tax revenue, τwhN. Using the production function (A.7) and equilibrium wage (A.9), tax revenue can be written as $\tau(1-\alpha)Y$, which shows it is a proportion of aggregate output. The reactive portion of government policy, police expenditures, is a fixed proportion $\sigma \in [0,1)$ of tax revenue. The remaining tax revenue is spent on proactive policies that enhance income growth. Growth is a natural goal of politicians in democracies and autocracies because increasing output raises government revenues and individuals'

[20] See Zak & Feng (1998) for a model in which the equilibrium dynamics include optimal government policy to maintain public order and regime change.

incomes.[21] Tax revenues and expenditures balance at each time *t*, producing the government budget constraint[22]

$$(1-\sigma)(1-\alpha)\tau_t Y_t = \chi_t, \tag{A.11}$$

where Y_t is given by (A.7).

Since output is increasing in physical capital, we model politicians as choosing the tax rate τ and spending χ to maximize expected *capital deepening*,[23]

$$Max_{\tau} E\frac{K_{t+1}}{K_t} \tag{A.12}$$

This maximization is subject to two constraints, the government budget balance relation (A.11) and the equilibrium law of motion for physical capital (4).

The solution to (A.12), which holds in expected value, generates a spending plan for political capacity, $E\chi_t^*$,

$$E\chi_t^* = [E(1-\sigma)(1-\alpha)^2 K_t^{\alpha}(1-S_t/\eta)^{\alpha}(N_t h_t)^{1-\alpha}]^{1/\alpha}. \tag{A.13}$$

After this plan and the tax rate are determined, the stochastic portion of political instability ε is observed, establishing the potential impact of anti-government demonstrations on the economy as well as tax revenue. Spending on the police, which is nonstochastic, is given implicitly by

$$p_t^* = \sigma(1-\sigma)^{(1-\alpha)/\alpha}(1-\alpha)^{2/\alpha} K_t (1-S(Y_{t-1}, p_t^*, \varepsilon_t)/\eta)(N_t h_t)^{(1-\alpha)/\alpha} \tag{A.14}$$

[21] McGuire & Olson (1996) show that only predatory autocrats with short time-horizons will set policies that will cause the economy to contract rather than grow.
[22] For simplicity, government borrowing is ignored.
[23] A full discussion of this method of setting government policy can be found in Zak (1999a), and Ghate & Zak (1999).

Police expenditures – the highest priority spending – follow rule (A.14), while spending on growth-enhancing policies is the residual of actual tax revenue after funding the police, which, on average, follows proactive spending rule (A.13). Under a technical condition, optimal police spending (A.14) increases when political discontent ε increases, and decreases when the economy grows such that physical and/or human capital increases.[24]

Because maintenance of public order is the government's top priority, the proactive spending plan (A.13) holds in expectation, but will not hold at every point in time. The actual amount of political capacity is $\chi_t^* = E\chi_t^* + \Delta_t$, where the difference between actual and expected tax revenues $\Delta_t = (1-\sigma)^{1/\alpha}(1-\alpha)^{2/\alpha}K_t(N_t h_t)^{(1-\alpha)/\alpha}[1-S_t/\eta - \{E(1-S_t/\eta)^{\alpha}\}^{1/\alpha}]$.[25] Loosely speaking, the term Δ is positive or negative if the effect of political instability on the economy exceeds or falls below its expected value.[26]

Equation (A.13) is the maximal value of government programs that stimulate capital accumulation, which takes into account both the increase in output as well as the impact on the future level of the capital stock from the taxes that fund government programs. The derivation shows that political capacity is increasing in physical capital, *K*, and in aggregate human capital, *Nh*. Observe that when the production function parameter α, is less than ½, political capacity increases faster than linearly in aggregate human capital.[27] Thus, the accumulation of human capital, typically measured by education or literacy, is an important contributor to a nation's political strength. Relation (A.13) also reveals two effects through which political instability, *S*, affects political capacity, χ^*. First, political instability directly reduces a country's productive capacity by destroying part of the physical capital stock. By this *income effect*, an increase in political instability reduces output and thus tax revenue by (A.11), which reduces the government's ability to fund

[24] The technical condition is $-d(S/\eta)/dP > 1/[\sigma(1-\sigma)^{(1-\alpha)/\alpha}(1-\alpha)^{2/\alpha}K_t(N_t h_t)^{(1-\alpha)/\alpha}]$ which we assume holds throughout the analysis.

[25] Because the government budget constraint holds with certainty, the tax rate can be shown to be a constant, $\tau^* = 1-\alpha$.

[26] Due to the nonlinearly of the expression for Δ, the condition for $\Delta>0$ requires that $1-S_t/\eta > [E(1-S_t/\eta)^{\alpha}]^{1/\alpha}$. Interestingly, this derivation shows that the variance of government spending is proportional to the variance in political violence.

[27] The parameter α is the share of output paid to physical capital which is typically measured at 1/3; see Cooley (1995, Ch. 1).

productivity enhancing projects. Second, by the *substitution effect*, when political instability rises the government's first priority is to raise expenditures on the police by (A.15). For a given tax rate τ, such preemptive reallocation decreases policy discretion of the government. Thus, unstable governments are less politically capable because of the combined impact of the income and substitution effects. It is clear that political freedom, η, reduces the impact of political instability on the economy, such that tax revenue, wages and the return to capital are all higher when freedom is high.

We now relate political capacity to demography. Using the condition for the desired number of children (A.5) (assuming $b_t^* > 1$) and equilibrium wages (A.9), we can write political capacity as a function of births,

$$\chi_t^* = \gamma(1-\sigma) N_t/[(1+\gamma) D b_t^*]. \qquad \text{(A.15)}$$

Equation (A.15) shows that optimal political capacity falls as births increase because, as the population grows, the demand for public goods supplied by the government rises. Meeting this demand stretches the resources of the government, reducing political capacity.

The derivation of political capacity via (A.12) shows that government policy is strategic. Because the derivation of optimal government policy uses the equilibrium law of motion for physical capital which is based on optimal individual behaviors, the resulting policy takes into account how individuals will react to changes in government actions τ, p, and χ. That is, the solution to (A.12) is a Nash equilibrium of the Stackelberg game played by the government and citizens, with the government being the first mover. Once the government has chosen the optimal tax rate τ^*, police spending, p^*, and political capacity χ^*, individuals execute their optimal choices for births and savings as given by (A.5) and (A.6).

The derivation of optimal political capacity reveals its dependence on economic factors, births, freedom, and political instability. In practice, it is unlikely that governments can reach maximum political capacity because of additional political constraints that we have not modeled. In particular, a government needs to consider various coalitions whose support is required to maintain power when setting policy.

When $\chi_t < \chi_t^*$, the specification of the production function (A.7), and of the law of motion for physical capital (4), shows that output net of taxes is increasing in political capacity. Moreover, the ratio χ_t/χ_t^* can be viewed as a measure of the political constraints on policy-setting, which is inversely related to a government's discretion.[28] That is, a government with political capacity χ_t^* has maximal discretion in setting policy.

A *political-economic equilibrium* for this model is a set of prices $\{w_t, R_{t+1}\}$ for $t=0, 1, 2, \ldots$, such that given these prices, the law of motion for human capital (6), a sequence of government policies $\{\tau_t, \chi_t, p_t\}$ for $t=0, 1, 2, \ldots$, initial values of physical capital $K_0>0$, human capital $h_0>0$, and population $N_0>0$, consumers maximize utility by solving (A.1)-(A.4), firms maximize profits by solving (A.8), the government sets policy to maximize capital deepening and security using (A.13) and (A.14), and all markets clear. At each time t, an equilibrium exists and is unique because the objective functions of consumers and firms are strictly concave and all constraints are linear.

[28] The derivation of χ/χ^* provides a formal basis for the *relative political capacity* measure of Arbetman & Kugler (1997).

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FIGURE 1: SCHEMATIC PRESENTATION OF THE FORMAL MODEL

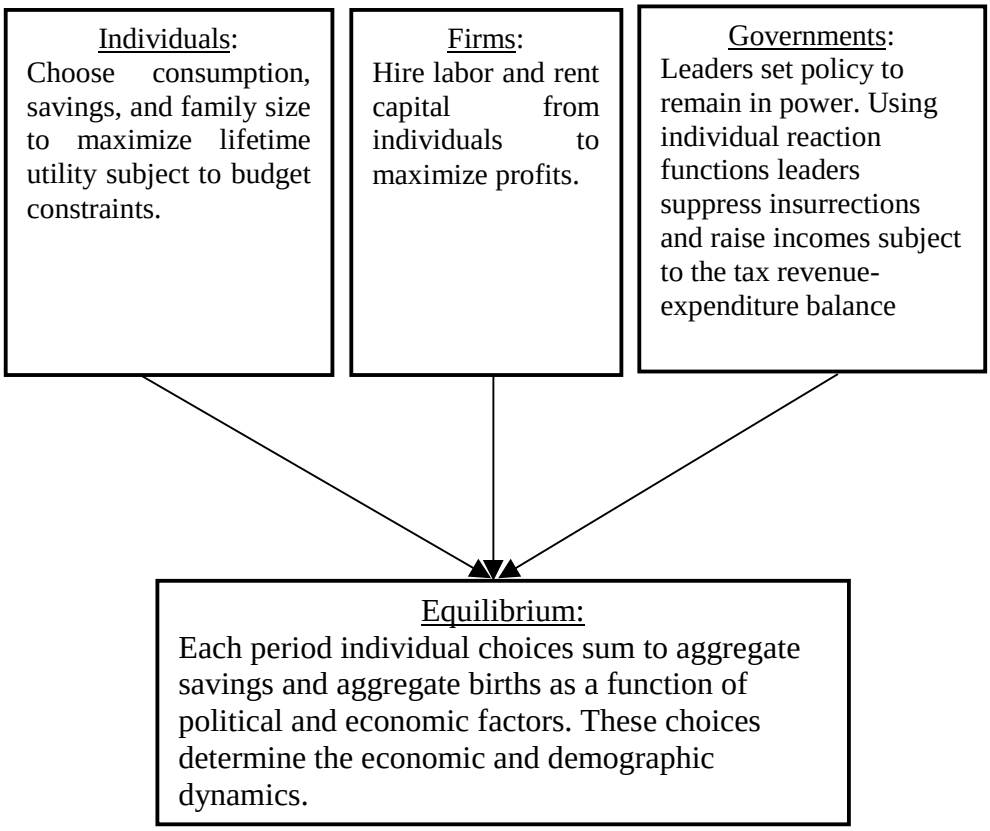

FIGURE 2 GROWTH PATHS WITH HIGH AND LOW POLITICAL CAPACITY

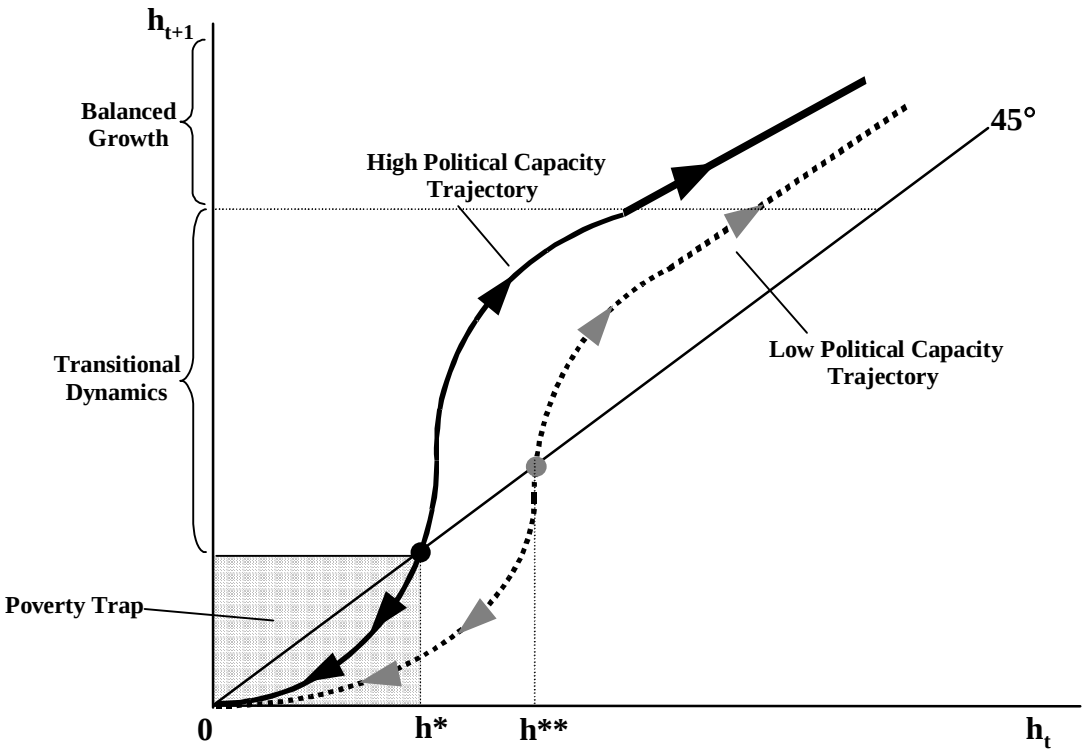

Table 1 Regression Analysis (annual data from 1960 to 1990)

	Lag=0	*Lag = 1*	*Lag = 2*	*Lag = 3*	Beta
Intercept	6.779*	6.779*	6.761*	6.733*	0.000
	(0.092)	(0.093)	(0.092)	(0.093)	
Political Stability	-0.221**	-0.241**	-0.276*	-0.269*	-0.040
	(0.104)	(0.104)	(0.105)	(0.104)	
Political Capacity	-0.061*	-0.059*	-0.055**	-0.050**	-0.046
	(0.021)	(0.021)	(0.022)	(0.023)	
Political Freedom	-0.035*	-0.035*	-0.032*	-0.034*	-0.069
	(0.011)	(0.012)	(0.012)	(0.012)	
Real GDP per capita	-0.367*	-0.366*	-0.364*	-0.359*	-0.708
	(0.014)	(0.014)	(0.014)	(0.014)	
Literacy Rate	-0.114*	-0.120*	-0.123*	-0.127*	-0.151
	(0.020)	(0.020)	(0.019)	(0.019)	
$\bar{R}^2$	0.794	0.791	0.789	0.788	
σ	0.217	0.218	0.219	0.220	

Notes:

Numbers in parentheses are standard errors.

*: Significant at the 1% error level, one-tail.

**: Significant at the 5% error level, one-tail.

Number of observations: 816