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Facing Socio-Political Instability

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Optimal Fiscal Policy in an Economy Facing Socio-Political Instability*

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Optimal Fiscal Policy in an Economy Facing Socio-Political Instability

Abstract

We present a model of optimal government policy when policy choices may exacerbate socio-political instability (SPI). We show that optimal policy that takes into account SPI transforms a standard concave growth model into a model with both a poverty trap and endogenous growth. The resulting equilibrium dynamics inherit the properties of government policies and need not be monotone. Indeed, for a broad set of conditions we demonstrate that government policy is unable to eliminate the poverty trap; when these conditions do not hold, "most" countries eventually reach a balanced growth path. The predictions of the model are tested by developing three new measures of SPI for a panel of 58 countries. Estimating optimal policies and the growth equation derived from the model reveals strong support for the theory. In particular, we show via simulations that optimal funding for public investment and the police cause a typical developing economy to expand on a quasi-linear growth path, with the baseline level of SPI determining whether growth is positive or negative.

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1 INTRODUCTION

An extensive theoretical and empirical literature has shown that social upheaval and political violence hinder economic development (Venieris and Gupta, 1985, 1986; Venieris and Stewart, 1987; Barro, 1991; Gupta, 1990; Alesina and Perotti, 1996; Alesina, Ozler, Roubini and Swagel, 1996; Zak, 2000, in press). The notion that sociopolitical instability (SPI) affects economic performance can be traced to Haavelmo (1954) and Adam Smith (1776). In this paper, we characterize optimal government policies to stimulate economic development when policies raise output but may exacerbate instability. Optimal policies are then embedded in a general equilibrium growth model to examine the resulting development paths.

SPI arises when the political system is unable or unwilling to mediate disputes over the distribution of income (Venieris and Gupta, 1986; Feng, Kugler and Zak, 2000).[1] Barro (2000, p7) writes "Inequality of wealth and income motivates the poor to engage in crime, riots, and other disruptive activities." Violent demonstrations materially reduce countries' resources, inhibiting development potentials. Because most developing countries have underdeveloped polities that are unable to effectively resolve distributional disputes (Feng, 1997), SPI is endemic. As a result, governments have an interest in designing policies that can counteract SPI and at the same time stimulate income growth.

The model in this paper demonstrates that the interplay between the marginal efficiency of the police at quelling SPI and the marginal sensitivity of SPI to changes in the income distribution determine a country's growth trajectory. While we find that optimal policy can lead to endogenous growth, this outcome is not guaranteed; a poverty trap exists in the model, and conditions are derived under which optimal policy is insufficient to permit the economy to escape from poverty.

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[1]On income distribution and development, see Fields (2000), Forbes (2000), and the seminal work by Kuznets (1955, 1963).

After presenting the model in Section 2, we generate three measures of SPI in Section 3 in order to test the model empirically. In Section 4, we estimate the derived optimal policies and growth equations. Statistical tests reveal robust support for the model's predictions. Further, using the estimated coefficients, we simulate the model's equilibrium dynamics. These simulations show that optimal government policies for a typical developing country generate a quasi-linear growth path. If baseline SPI is not too high, an economy with optimal policies exhibits near AK growth in the transitional dynamics and balanced growth in the limit; if baseline SPI is beyond an identified threshold, the economy's expansion path remains nearly linear, but the growth rate is negative, leading the economy into a poverty trap. Lastly, this section explores several extensions of the model, especially the role of ethnic divisions in stimulating SPI. Including ethnicity reveals interesting nonlinearities vis-à-vis SPI. Section 5 concludes with a review of our findings.

2   Government Policy and Socio-Political Instability

SPI reflects the myriad coordination failures–both economic and political–that occur during different stages of development.[2] Because income growth raises support for the government (Lewis-Beck, 1990; Fiorina, 1981; Tufte, 1978), it is a goal of nearly every politician.[3] Following a large literature in political science and economics, we model government policy-makers are being concerned with maintaining themselves

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[2]See Bardhan (1997), Easterly and Levine (1997), Bates (2000), and Zak (2000) for recent discussions of the sources of political instability.

[3]McGuire and Olson (1996) show that only predatory autocrats with short time-horizons will set policies that will cause the economy to contract rather than grow. Institutional conditions under which this obtains are derived by Bueno de Mesquita, Smith, Siverson and Morrow (2002).

in power. Government longevity is enhanced when policies are chosen that raise government resources and bolster support among constituents. A government risks raising SPI if policy choices do not take into account their effect on income inequality (Zak, 2000).

Governments monitor violent demonstrations – a component of SPI – as these reduce the tax base and thereby imperil the government's ability to implement policies of all types (Feng, Kugler and Zak, 2000). If SPI sufficiently weakens the government, the ruling regime will be overthrown (Zak and Feng, in press; Feng and Zak, 1999). Thus, the threat of SPI restricts the set of policy choices by the government – even policies to explicitly to reduce SPI. In sum, government policy choices that stimulate the economy may also exacerbate inequality and thereby raise SPI. We show below there exists an optimal policy set that balances these effects.

2.1   The Model

Consider a standard neoclassical growth model with a single good and one accumulable factor, private capital K. The government's objective is to maximize aggregate income growth which is equivalent to maximizing capital accumulation. This objective is consistent with models in which politicians set policy to increases their chances of re-election (Magee, Brock, and Young, 1989; Arbetman and Kugler, 1995; Alesina, Roubini, and Cohen, 1997; Ghate, 1999; Ghate and Zak, 2002), an approach that has substantial empirical support (Lewis-Beck, 1990). This goal is realized via two policy instruments: public investment, λ, and police expenditures, P. Policies are funded by a lump-sum tax, τ, and for simplicity, population in the model is constant and normalized to unity. Although government policies can enhance growth, taxes reduce income and thus capital accumulation. Lump-sum taxes are also regressive

which magnifies income inequality.[4]

In each period, a fraction π of output is destroyed by SPI, with $\pi_t(P_t, \psi(\tau_t))$: $\mathbb{R}^+ \times \mathbb{R}^+ \to [0, 1]$, where $\psi \geq 1$ is income inequality. When $\psi = 1$ there is perfect equality, while $\psi > 1$ measures the degree of income inequality. The theoretical and empirical literature on SPI robustly shows that inequality raises SPI (e.g. Venieris and Gupta, 1985, 1986; Alesina et al, 1996; Zak, 2000, in press) which we assume holds in the economy being modeled, $\frac{\partial \pi}{\partial \psi} > 0$.[5] Since taxes are regressive, a tax increase raises inequality, $\frac{\partial \psi}{\partial \tau} > 0$. For simplicity, we model inequality as increasing linearly in taxes, $\psi(\tau_t) = \tau_t$. Police expenditures have the opposite effect, reducing SPI by making it more difficult for demonstrators to destroy output during demonstrations, $\frac{\partial \pi}{\partial P} < 0$.[6]

Police expenditures, P, indirectly raise growth by preventing the destruction of output, while the second policy instrument, public investment, λ, directly raises output by complementing private capital in production. Output is produced using a Cobb-Douglas production function, $Y = K^\alpha \lambda^{1-\alpha}$ with $\alpha \in (0, 1)$, and, as in Barro (1990), public investment does not accumulate. As our purpose is to characterize the aggregate dynamics induced by fiscal policy choices, we concretize the model by choosing a functional form for π,

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[4]Many types of taxes are equivalent to lump-sum taxes. For example, a proportional tax on labor income when labor supply is indivisible (e.g. with a 40 hour work week) is equivalent to a lump-sum tax.

[5]We examine a more extensive set of determinants of SPI in Section 4.5.

[6]We model SPI as strictly decreasing in police expenditures even though Gupta, Singh, and Sprague (1993) show that high levels of police expenditures exacerbate SPI. This simplification is warranted since an optimizing government would never fund the police to such an extent that it raised SPI. Further, anti-SPI policy is not "repressive" in that the government's objective in the model is income growth which constrains the use of force (on government repression, see Bueno de Mesquita et al, 2002). Note, though, that our empirics (Section 4) include these possibilities, and also examine the role of ethnic divisions in producing SPI.

$$\pi_t = 1 - DP_t^\omega \tau_t^{-\eta}, \tag{1}$$

where $\eta > 0$, is the sensitivity of SPI to changes in income inequality, and $\omega > 0$ is the productivity of the police at reducing SPI. The constant D is restricted to keep (1) well-defined, $D \in (0, P^{-\omega}\tau^\eta]$, with related restrictions on government policies, $\tau, \lambda, P \geq 1$.[7] The value $1 - D$ is the baseline level of SPI absent government policy (i.e. when $P = \tau = 1$).

Optimal policy for the government is the solution to a modified planning problem in which policy-makers maximize capital deepening[8]

$$Max_{\lambda,P,\tau} \frac{K_{t+1}}{K_t} \tag{2}$$

s.t.

$$K_{t+1} = s[(1 - \pi)Y_t - \tau_t] + (1 - \delta)K_t \tag{3}$$

$$\tau_t = \lambda_t + P_t, \tag{4}$$

where π is defined in (1). Equation (3) is the standard stock accounting relation for capital accumulation with $\delta \in [0, 1]$ the depreciation rate. Because development policy is dynamic, choices depend on the rate of capital accumulation. We use the

[7]Minimum funding levels for P, λ, and the level of taxes, τ can be thought of as maintaining minimal institutions that specify the rules of exchange, without which economic transactions will not be undertaken. Our goal is not to model the sources of SPI, but how governments react to reduce SPI, thus, we need only specify the way in which SPI affects the government's objective. Since π depends on endogenous variables, τ, λ, and P, the solution to the government's problem is well-defined and depends on the factors affecting π.

[8]Ghate and Zak (1999) prove that, absent externalities, maximizing capital deepening is equivalent to a standard representative agent Pareto allocation problem. The advantages of this approach are that a social welfare function need not be defined, and that the objective is consistent with politicians' agendas.

Solow (1956) assumption that a constant proportion $s \in (0,1)$ of income is saved.[9] Savings in (3) are a proportion of income net of SPI and net of taxes, τ. Equation (4) is the government budget constraint in which tax revenue, τ, funds expenditures on the police, P, and public investment, λ.

Using the functional forms for production and SPI, the optimal government policies which solve (2) - (4) are

$$\lambda_t^\star = AK_t^{\frac{\alpha}{\alpha+\eta-\omega}} \tag{5}$$

$$P_t^\star = \frac{\omega A}{1-\alpha}K_t^{\frac{\alpha}{\alpha+\eta-\omega}} \tag{6}$$

$$\tau_t^\star = \frac{(1-\alpha+\omega)A}{1-\alpha}K_t^{\frac{\alpha}{\alpha+\eta-\omega}}, \tag{7}$$

where $A \equiv [D(1-\alpha)^{1-\omega+\eta}(1-\alpha+\omega)^{-\eta-1}\omega^\omega(1-\alpha+\omega-\eta)]^{\frac{1}{\alpha+\eta-\omega}}$. For this solution to be well-defined, we impose the regularity condition

ASSUMPTION 1 (A1): $1 > \alpha + \eta - \omega > 0$.

We will consider condition A1 to be satisfied throughout. Note that income levels affect SPI. As shown both theoretically and empirically by Zak (in press), as income falls, the opportunity cost of engaging in SPI also falls and, as a result, SPI rises. In the model here, SPI depends on income through its dependence on the capital stock K, i.e. optimal policies $P^\star(K_t)$ and $\tau^\star(K_t)$ are state-dependent. Indeed, it is straightforward to show that as long as $\omega > \eta$ then $\frac{\partial \pi}{\partial K} < 0$; i.e. if SPI is more sensitive to a change in police expenditures than to a change in inequality, then when capital (income) falls, SPI rises. Under this assumption, the model matches the relationship between income and SPI found in the data.

The next result characterizes optimal government policies.

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[9]Blinder and Deaton (1985) find robust support showing that savings is proportional to income; see also Deaton (1992).

Proposition 1 *Optimal policies* $\{\lambda_t^\star, P_t^\star, \tau_t^\star\}$ *are convex in* K *if* $\omega > \eta$; *are linear in* K *if* $\omega = \eta$; *and are concave in* K *if* $\omega < \eta$.

Proposition 1 shows that the interplay between the marginal efficiency of the police at suppressing SPI, ω, and the sensitivity of SPI to income equality, η, determines how optimal policies evolve during development.[10] Countries with efficient police forces optimally increase policy funding rapidly with growth in the capital stock, while inefficient police forces lead to optimal policies that increase slowly with growth. Equivalently, countries in which instability is highly sensitive to income inequality have optimal policies that grow more slowly than capital.

Observe that the *ratio* of expenditures on public investment to police expenditures is constant as the economy grows, and equals the ratio of the marginal products of each policy with respect to output growth, $\frac{\lambda_t^\star}{P_t^\star} = \frac{1-\alpha}{\omega}$. Thus, government policies remain in balance in the transitional dynamics until, as shown below, a threshold is reached after which public investment continues to grow while police expenditures remain constant.

Next, we embed optimal policies into the capital market equilibrium condition to determine the resulting dynamics. Substituting the functional forms for π and Y into (3) produces,

$$K_{t+1} = s[DP_t^\omega \tau_t^{-\eta} K_t^\alpha \lambda_t^{1-\alpha} - \tau_t] + (1-\delta)K_t. \tag{8}$$

Replacing the government policy instruments in (8) with optimal policies $\lambda_t^\star$, $P_t^\star$, and $\tau_t^\star$, the equilibrium dynamics for this economy are

$$K_{t+1} = sBK_t^{\frac{\alpha}{\alpha+\eta-\omega}} + (1-\delta)K_t, \tag{9}$$

where $B \equiv D(1-\alpha)^{\eta-\omega}\omega^\omega(1-\alpha+\omega)^{-\eta}A^{\omega-\eta+1-\alpha} - (1-\alpha+\omega)(1-\alpha)^{-1}A$, which is strictly positive under A1.

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[10]The proofs of the propositions are straightforward and are not reported to save space.

Corollary 1 demonstrates that economy (9) inherits the growth properties of optimal policies.

Corollary 1 *The economy's growth path is convex if $\omega > \eta$; is linear if $\omega = \eta$; and is concave if $\omega < \eta$.*

Further, endogenous growth obtains if SPI is insensitive to inequality relative to the police ($\omega > \eta$) and initial capital K_0 exceeds a threshold, $\overline{K}$, where

$$\overline{K} = [\frac{sB}{\delta}]^{\frac{\alpha+\eta-\omega}{\eta-\omega}}. \tag{10}$$

If initial capital is less than the threshold, $K_0 < \overline{K}$, then investment net of tax and SPI is insufficient to sustain positive growth when $\omega > \eta$ and the economy contracts permanently. This occurs because a shortage of tax revenue results in policies that are insufficient to both combat SPI and stimulate growth.

There are two other growth paths in this economy as identified in Corollary 1, one with concave policies which obtains when SPI increases rapidly in income inequality, $\eta > \omega$, producing concave growth to a steady state; the other is the knife-edge case when $\eta = \omega$ which produces an AK model where the economy grows endogenously at a constant rate $sB - \delta + 1$.[11] Figure 1 depicts all three growth paths that the model admits.

[Figure 1 here]

The next result shows that regardless of government policies, countries may be caught in a poverty trap.

Proposition 2 *There is a baseline value of SPI, $\overline{\pi} = 1 - \overline{D}$, such that if $\pi > \overline{\pi}$ then the economy is caught in a poverty trap even when government sets policy optimally.*

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[11]As long as $sB > \delta$, the economy grows rather than contracts.

This proposition demonstrates that if underlying SPI is sufficiently high, government policy is an insufficient lever to move the economy out of a poverty trap. When the growth path is convex ($\omega > \eta$) and $\pi > \overline{\pi}$, the area of attraction to the poverty trap at the origin under Proposition 2 includes the entire real line so that positive growth is unattainable for any initial condition (i.e. $\overline{K} \to \infty$). This is a disturbing result since convex government policies are the most effective at stimulating growth. Thus, even with the most effective government policy, sufficiently high baseline SPI causes an economy to be permanently trapped in poverty. When the economy's growth path is concave ($\eta > \omega$), the steady state merges to the origin if $\pi > \overline{\pi}$, also resulting in a global poverty trap. In the case of linear growth ($\eta = \omega$), an increase in baseline SPI shifts the growth path below the 45 degree line so that for any initial level of capital, the economy contracts to the origin.

The results above show that baseline SPI and the amount of initial capital significantly affect an economy's growth prospects. Thus, we have shown that SPI not only affects savings and output as in Venieris et al, and Barro, but fundamentally determines whether growth is possible at all, *even when the government sets policy optimally*. This result obtains because policy-makers are myopic in that they maximize period-to-period growth, rather than the entire sequence of capital stock. Politicians' myopia arises because they focus on the upcoming election when setting policy, i.e. a "period" is an election cycle.

In an economy that is growing (i.e. $\pi < \overline{\pi}$), in the limit SPI vanishes. Specifically, when $K_t \geq [(\frac{1}{D})\omega^\omega(1-\alpha)^{\eta-\omega}(1-\alpha+\omega)^\eta A^{\eta-\omega}]^{\frac{\alpha+\eta-\omega}{\alpha(\omega-\eta)}} \equiv \kappa$, then $\pi = 0$. With continued growth, the government simply funds the police at the fixed rate $P(\kappa)$ and uses all the remaining tax revenue for public investment.

We show in the Appendix that for growing economies with $K_t > \kappa$, optimal policy produces an economy with endogenous balanced growth. The exception to this scenario occurs for countries with concave growth paths for which steady state

capital is less than the no-SPI capital stock κ. For initial capital less than the steady state, these countries are caught at a "middle-income trap," as they reach a steady state with positive levels of SPI but are unable to reach the balanced growth path. Thus, developing countries with sufficiently low baseline SPI to escape a poverty trap typically grow rapidly in the transitional dynamics, and then exhibit long-run balanced growth. Put differently, the model predicts that SPI is less important in developed countries than in developing ones.

As baseline SPI rises, but does not exceed the poverty trap threshold, $(0 < \pi < \overline{\pi})$, a higher value of initial capital is required to obtain endogenous growth in convex economies. In addition, as π rises but remains below $\overline{\pi}$, the rate of convergence to the balanced growth path is retarded. Nevertheless, barring external events, countries with convex growth that do not begin too poor $(K_0 > \overline{K})$ and in which baseline SPI is not too high $(\pi < \overline{\pi})$, eventually reach a balanced growth path. Countries with concave growth are less likely to reach the balanced growth path as baseline SPI rises.

2.2   TESTABLE IMPLICATIONS OF THE MODEL

The model of growth with optimal policy-setting generates four testable implications: *i)* optimal police and public investment expenditures are increasing and log-linear in capital, by equations (5) and (6);

ii) by Corollary 1, output growth is convex, linear, or concave if the marginal impact of police expenditures, ω, exceeds, equals, or is less than, the marginal sensitivity of SPI to income inequality, η, respectively;

iii) by equation (9), growth slows as baseline SPI rises;

iv) by Proposition 2, if baseline SPI is sufficiently high, the economy will be caught in a poverty trap.

In the following sections we test each of these predictions of the model.

3   Construction of Socio-Political Instability Indices

Human violence is arguably a universal phenomenon as it occurs throughout time and across all social and political institutions. No form of government, whether autocratic or democratic, appears immune from socio-political instability. Since SPI subsumes both domestic conflicts as well as major government crises, we attribute SPI to two types of political activities:*i)* violent and nonviolent antigovernment protests and uprisings, and *ii)* violent and nonviolent actions undertaken by the government to suppress protests and uprisings. Following Francisco (1996) and Gupta, Singh and Sprague (1993), the construction of our indices also accounts for the possibility of interactive effects between the government and agents who engage in SPI; in some situations punitive government actions exacerbate demonstrations. This section constructs a set of composite indicators reflecting different types of SPI.[12]

For robustness, we estimate three SPI indices using two different methods. The first SPI index is generated by estimating a logit equation relating major government crises to domestic conflict events following Banks (1996).[13] This measure of SPI uses assassinations $[ASSASS]$, guerrilla warfare $[GUERWAR]$, purges, $[PURGES]$, general strikes $[GSTRIKES]$, riots $[RIOTS]$, and antigovernment demonstrations $[ANTIGOVDEM]$ as explanatory variables for the incidence of major government crises, and is estimated using the following equation.

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[12]Related methods to construct SPI indices are outlined in Gupta (1990), Ozler and Tabellini (1991), Cukierman, Edwards, and Tabellini (1992), and Alesina and Perotti (1996). All these SPI indices are positively statistically correlated, but not identical.

[13]Appendix B describes of each of the variables used in the construction of the SPI indices. For statistical superiority, we use a logit model instead of discriminant analysis; see Press and Wilson (1978) for a discussion these issues. A more detailed description of SPI index construction is provided in Le (1998), with data available at http://spe.cgu.edu/spedata/research.htm.

$$
\begin{aligned}
SPIL \;=\; & \alpha_0 + \alpha_1 ASSASS + \alpha_2 GSTRIKES + \alpha_3 GUERWAR + \alpha_4 PURGES \\
+ \;& \alpha_5 RIOTS + \alpha_6 ANTIGOVDEM + \epsilon.
\end{aligned} \tag{11}
$$

All the estimated coefficients are positive and significant indicating that the explanatory variables raise the likelihood of SPI.[14] The predicted values of equation (11), which are continuous on $(0,1)$, is our first measure of SPI, $SPIL$.

Following Hibbs (1973), we use principal components analysis to generate two alternative measures of SPI. Principal components analysis categorizes coincident variation among a set of variables. This separates the types of SPI into discrete dimensions producing two factors for SPI, denoted by $SPIF1$ and $SPIF2$.[15] The first factor, $SPIF1$, includes general strikes, riots, and anti-government demonstrations. This factor captures collective protests. The second factor, $SPIF2$, includes purges, guerrilla warfare, and assassinations. This factor captures violent uprisings. The correlations of the first measure, $SPIL$, with $SPIF1$ and $SPIF2$ are 0.57 and 0.79, respectively.

4   EMPIRICAL TESTS OF THE MODEL

4.1   DATA AND SAMPLE PERIOD

The data set consists of 58 countries over the period 1980-1995.[16] The constraint on the number of countries and initial year of coverage is the availability of data on police expenditures. We utilize public order and safety expenditures from *Government Finance Statistics Yearbook* (GFS) to measure police expenditures. Tax revenue and

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[14]Table C1 in the Appendix reports the estimation results of the logit model.

[15]Table C2 in the Appendix contains the estimated principal components.

[16]There are 16 developed countries and there are 42 developing countries in the sample.

public investment data are also taken from GFS.[17] Data for GDP per capita, the growth rate of GDP per capita, and the primary education enrollment rate are taken from the World Bank's *World Development Indicators*. Government policy variables are all measured as a proportion of GDP to control for scale effects.

4.2   EMPIRICAL EVIDENCE

We test the four implications of the model using panel data. Since panel data provides more variation than cross-sectional analysis, the dynamic structure of the model is more likely to be evident. In addition, growth regressions using panel data permit unobserved country-specific heterogeneity.[18] Generalized least squares (GLS) estimates are reported for optimal policies and growth.

Table 1 presents the estimation of the optimal policy rules for public investment (5) and police expenditures (6), with GDP per capita proxying the physical capital stock. The coefficients on GDP per capita in the police and public investment equations have the predicted positive sign and are highly significant. In addition, the adjusted R^2s are very near one showing that GDP per capita explains almost all of the variation in these policies as the theory predicts. A 1% increase in GDP per capita results in a 0.09% increase in police expenditures. Furthermore, as the theory predicts, countries provide more public investment as they grow: a 1% increase in GDP per capita is associated with a 0.40% increase in public investment. This supports implication *(i)* above.[19]

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[17]Tax revenue data is contained in Table A: Revenue and Grants Consolidated Central Government. Public investment data is listed under Table B: Expenditure by Function, Consolidated Central Government. There are 14 categories in Table B, and we use education, health, social security and welfare, and transportation and communication as the constituents of public investment.

[18]See Durlauf and Quah (1998) for an excellent survey of growth empirics using panel data.

[19]Dividing the data into developed and developing countries and estimating each policy separately, tests for differences in estimated coefficients reveal at the 1% significance level, developing countries

[Table 1 here]

Next, we test the model's predictions relating SPI to growth using panel regressions with each SPI index described above. We estimate a log-linear approximation of (8) where SPI enters the growth equation directly and output proxies capital. The regressions control for primary education enrollment rates as well as initial per capita GDP.[20]

Table 2A shows that two of the three SPI measures have negative and significant impacts on growth revealing support for implication *(iii)*. $SPIF1$, which measures strikes and demonstrations, has a negative, but not statistically significant effect on growth. This indicates that violent uprisings ($SPIF2$), not collective protests, are the aspect of SPI that has the strongest impact on the economy. Moreover, the estimation results indicate that SPI has a substantial quantitative effect on growth: a 1% increase in $SPIL$ decreases annual per capita output growth by 0.44%, while a 1% increase in $SPIF2$ has nearly twice this impact.

As the theory predicts, public investment has a positive, highly statistically significant, and quantitatively relevant impact on growth in all three specifications. A 1% increase in public investment increases annual per capita output growth by 0.70%. Conversely, taxes have a negative and significant impact on growth. A 1% increase in taxes decreases annual per capita output growth by just under 0.70% in each specification – interestingly roughly the same elasticity for public investment.

The third government policy the theory predicts affects economic growth is police spending. Since the optimality conditions (5) and (6) show that public investment and police expenditures are collinear, we drop public investment from equation (3)

spend less on police but more on public investment as income rises than do developed countries.

[20]We use three lags for the control variables primary education enrollment rate and initial GDP to instrument these potentially endogenous variables. An F-test indicates that there is no significant difference between using one, two or three lags.

and replace it with police expenditures. For this specification, reported in column (4) of Table 2B, and utilizing the measure of violent uprisings, $SPIF2$, the estimated coefficient on police expenditures is positive but insignificant. The same result obtains for the other measures of SPI. This suggests that police expenditures may have other uses besides securing public order and thus are only weakly related to growth in this sample.

The final estimation investigates the existence of an SPI-caused poverty trap. Recall that the theory demonstrates that SPI has only a small impact on developed countries but can be quite pernicious in poor countries. We therefore examine countries that have SPI 20% above the mean, using the measure of SPI that has the largest impact on growth from the full sample, that being the measure of violent uprisings, $SPIF2$. We re-estimate growth equation (3) for the sample of 18 countries with high SPI, as reported in Table 2B column (5). The coefficient on SPI doubles in size and remains highly significant. Surprisingly, public investment for these countries has a large negative and significant estimated coefficient, while the estimated coefficient on education is also large, positive, and significant. Most importantly, the estimated coefficient on initial GDP becomes insignificantly different than zero. Thus, when SPI is high, countries lose the growth advantage from being poor. This is indirect evidence for implication *(iv)* of the theory, the existence of a poverty trap.

The results in this section taken as a whole show solid support for the theory relating SPI and government policy to growth.

[Table 2 here]

4.3   GROWTH REGRESSIONS: ROBUSTNESS TESTS

The preceding section estimated the growth equation derived directly from the model. More generally, the impact of political variables on economic growth has been investigated following the approach introduced by Barro (1991). Barro-style growth re-

gressions control for a set of variables presumed to affect the rate of economic growth including inflation, population growth, and terms-of-trade. In this section, we re-estimate our growth regressions using additional control variables to investigate the robustness of our results. Data for inflation, population growth, and terms-of-trade (measured by the growth rate of the ratio of export prices to import prices) are taken from the World Bank's *World Development Indicators.*

The estimation results reported in Table 3 confirm the findings in the preceding section. Two of the three SPI measures continue to have negative and significant impacts on growth with the additional controls. Further, the coefficients of the significant SPI measures *increase* compared to the preceding results: a 1% increase in $SPIL$ decreases annual per capita growth by 0.48%, while a 1% increase in $SPIF2$ decreases growth by almost 1%. As above, the collective protests variable ($SPIF1$) is not statistically significant. Also supporting the previous results, public investment has a positive and highly statistically significant impact on growth with each of the three SPI measures, while taxes are negative and significant. With the additional controls, the elasticity of taxes on growth is about three times the elasticity for public investment. Lastly, the control variables all have the expected signs and are statistically significant: inflation and population growth are negative and significant at the 1% level; terms-of-trade is positive and significant at 5% or better.

[Table 3 here]

4.4   ESTIMATION OF ω AND η, AND SIMULATIONS OF GROWTH TRAJECTORIES

Our next task is to estimate ω and η in order to examine the model's predictions for the slope of economy's growth trajectory. Recall that by Corollary 1, the dynamics of the economy are determined by the relative values of the marginal efficiency of the

police at reducing SPI, ω, and the sensitivity of SPI to income equality, η. Taking logs of equation (1) produces the estimable equation

$$\ln(1 - \pi_t) = D_0 + \omega \ln(P_t) - \eta \ln(\tau_t), \tag{12}$$

where $D_0 \equiv \ln(D)$ is a constant.

Table 4 reports the estimation of ω and η via (12) using each measure of SPI to generate a measure of socio-political *stability*, $1 - \pi$. In two of the three cases, $\omega < \eta$, indicating that optimal policies and output growth are generally concave for the average country. The exception occurs when (12) is estimated using $SPIF1$. As in the growth regressions above, we discount this result as $SPIF1$ does not appear to capture the impact of SPI on the economy well. The estimation results show that political stability is relatively sensitive to both police expenditures and taxes. Using the average estimated value of η, a 10% increase in taxes causes political stability to decrease by 0.13%. On the other hand, a 10% increase in police expenditures raises political stability by 0.12%.

[Table 4 here]

Next, we determine the growth path induced by the estimated government policies for police spending and public investment found above. We do this by simulating the economy's dynamics via the capital market equilibrium condition (9) using the average estimates of ω and η from Table 4, $\omega = 0.0122$ and $\eta = 0.0125$. Additional parameter values in (9) are: savings rate, $s = 0.10$, capital depreciation rate, $\delta = 0.10$; capital's share of output, $\alpha = 0.40$ (Cooley, 1995).

Figure 2 shows that optimal policies result in quasi-AK growth for an economy with low baseline SPI ($D = 0.95$). Increasing the marginal efficiency of the police, ω, shifts the line upward, while increasing the sensitivity of SPI to inequality, η, shifts the line downward, toward the 45 degree line. Thus, supporting and extending prediction

(ii), the model shows that optimal policies that internalize their effect on SPI result in near balanced growth in the transitional dynamics with concave production and absent technological change.

Figure 3 also displays the economy's growth path when baseline SPI is high ($D = 0.10$). As before, a quasi-AK growth also obtains, but in this case growth is negative and the economy contracts to a poverty trap. Raising the marginal efficiency of the police, ω, does not have a significant impact on the growth path; in particular, for high levels of SPI, positive growth is unattainable even with an effective police force. On the other hand, increasing the sensitivity of SPI to inequality, η, shifts the line further downward, while decreasing it shifts the line upward.

[Figure 2 here]

The simulations show that countries with high levels of SPI cannot escape a poverty trap – even with optimal government policies that take into account SPI. Put differently, public investment alone is not enough to generate endogenous growth when taxes raise SPI: *both* the maintenance of public order and public investment are required for poor countries to successfully develop.

4.5   SPI, ETHNICITY, AND INEQUALITY

In the theory and empirics, SPI was defined independent of its relation to ethnicity, yet there are many examples of ethnic strife fomenting violence as discussed in Bardhan (1997), Easterly and Levine (1997), and Rodrik (2000). Bates (2000) shows that there are "inflection points" where protest escalates into ethnic violence. As a further robustness test of our theory, in this section we explore the direct role of ethnicity and income inequality at generating SPI by estimating an augmented version of the determinants-of-SPI-equation (1).

The SPI relation (1) is estimated using both collective protests, $SPIF1$, and violent uprisings, $SPIF2$, along with a new variable $ETHNIC$ which measures ethno-linguistic fractionalization.[21] We also use a direct measure of income inequality, $GINI$, from Deininger and Squire (1996) rather than use the indirect measure, taxes, used earlier. Following Bates (2000) we enter $ETHNIC$ as a quadratic. Lastly, we also control for policy choices as Easterly and Levine (1997) show that ethnically divided countries have trouble implementing public policies. For this reason, we include the two public policies from the model, police expenditures and public investment, in the estimation of (1). Policies are lagged to control for the endogeneity identified in the theory. Lastly, lagged GDP and primary education enrollment are included as controls.

Table 5 reports the estimation results. Ethnic divisions have a substantial impact on SPI, especially on collective protests. Column 2 in Table 5 shows that the linear coefficient on $ETHNIC$ has positive and significant impact on $SPIF1$ (collective protests), and its squared term is also positive and significant. This indicates that collective protests increase at an increasing rate as ethnic divisions rise. Income inequality also has the expected positive impact on collective protests and is highly significant. The coefficient on police expenditures is negative and significant, consistent with the theory, while the coefficient on public investment is insignificant.

Column 3 in Table 5 shows that ethnic divisions are also associated with fewer violent uprisings. The linear coefficient on $ETHNIC$ has a negative and significant impact on $SPIF2$, while its squared term is also negative and significant. Thus, violent revolts strictly decrease as ethnic divisions intensify in this sample, unlike the inflection points found by Bates (2000), though similar to the findings of Bardhan

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[21]We utilize the same measure of ethno-linguistic fractionalization as Easterly and Levine (1997) and many others, from *Atlas Norodow Mira* (Moscow:Miklukho-Maklai Ethnological Institute at the Department of Geodesy and Cartography of the State Geological Committee of the Soviet Union, 1964).

(1997). The coefficient on income inequality remains positive and is significant at better than 1%, consistent with the theory. As we find with collective protests, the coefficients on police expenditures and public investment are negative with only the former being significant.

[Table 4 here]

These results show that the government policy model (2)-(4) has ignored an important factor affecting SPI, ethnic divisions. We leave it for future research to examine the role of government policy in reducing ethnic uprisings. Nevertheless, the totality of the empirics show robust support for the role of public policy aimed at reducing SPI as part of the process of economic development.

5   CONCLUSIONS

The model of optimal policy-setting in a growing economy presented in this paper shows that raising taxes to fund policies may have an unintended effect – raising SPI. We demonstrate theoretically and empirically that even when government policy takes into account its impact on SPI, for example funding policies to directly reduce SPI, positive growth still may not occur. Simulating the model using the estimated coefficients for optimal government policies demonstrates that a typical country will grow on a quasi-linear trajectory in the transitional dynamics as long as the baseline level of SPI is not too high. In the long run, all countries with positive growth are predicted to reach a balanced growth path, while economies that are contracting will continue to do so absent outside intervention.

The primary lesson to be drawn from this analysis is that government development policy is seldom neutral vis-à-vis SPI. Policies meant to stimulate the economy can significantly impact a country's growth trajectory, indicating the delicate balance that governments in developing countries face when setting policy.

6 Appendix

6.1 Appendix A: Optimal Policy without SPI

Consider the case when the capital stock is so high ($K_t \geq \kappa$) that there is no SPI ($\pi = 0$), and police spending is therefore constant ($P_t = P(\kappa) > 0$ for all t such that $K_t \geq \kappa$). In this case, the government's policy problem is to choose values for λ and τ that solve

$$Max_{\lambda,\tau} \frac{K_{t+1}}{K_t} \tag{13}$$

s.t.

$$K_{t+1} = s[K_t^\alpha \lambda_t^{1-\alpha} - \tau_t] + (1-\delta)K_t \tag{14}$$

$$\tau_t = \lambda_t + P(\kappa). \tag{15}$$

The solution to (13)-(15) is $\lambda_t^\star = (1-\alpha)^{\frac{1}{\alpha}} K_t$, and $\tau_t^\star = \lambda_t^\star + P(\kappa)$. Note that these are linear in K. Embedding these optima into a constant savings rate growth produces an AK model,

$$K_{t+1} = [s\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}} + 1 - \delta]K_t - sP(\kappa).$$

As long as the savings rate is not too low, $s > \frac{\delta}{\alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}}}$, and $K_t > sP(\kappa)$, balanced endogenous growth obtains.

This derivation shows the marked difference that optimal policies have on the dynamics of developing versus developed economies: optimal policy in developing economies produces various growth paths depending on local factors, while in developed economies optimal policy always results in balanced growth.

6.2   APPENDIX B: DESCRIPTION OF VARIABLES USED TO CONSTRUCT SPI INDICES

We use Banks' (1996) data set on domestic conflict events to construct the SPI indices. A sample of 142 countries are included in the data set, of which, 57 countries have data available for the entire period 1948-1995. Banks does not include years prior to a country's independence, and many countries begin to have records on domestic conflicts only several years after gaining independence. For this reason, the data for many countries begin after 1948.

The following domestic conflict variables are included in the data set. Banks uses the variable definitions from Rummel (1963). These definitions are:

- Assassinations [$ASSASS$]: Any politically motivated murder or attempted murder of a high government official or politician.

- General Strikes [$GSTRIKES$]: Any strike of 1,000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority.

- Guerrilla Warfare [$GUERWAR$]: Any armed activity, sabotage, or bombing carried out by independent bands of citizens or irregular forces and aimed at the overthrow of the present regime.

- Purges [$PURGES$]: Any systematic elimination by jailing or execution of political opposition within the ranks of the regime or the opposition.

- Riots [$RIOTS$]: Any violent demonstration or clash of more than 100 citizens involving the use of physical force.

- Anti-Government Demonstrations [$ANTIGOVDEM$]: Any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing

their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature.

6.3 Appendix C: Estimation Results for the SPI Indices Using the Logit Model and Principal Components Analysis

[Table C1 here]

[Table C2 here]

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Table 1. Police Expenditures and Public Investment

INDEPENDENT VARIABLE	LN(POLICE)	LN(PUBINV)
LN(GDP)	0.091**	0.379**
	(0.001)	(0.004)
CONSTANT	-5.298**	-5.364**
	(0.013)	(0.031)
ADJUSTED R-SQUARED	0.997	0.955
NO. OF PANEL OBSERVATIONS	578	578

Notes: White heteroskedasticity-consistent standard errors are in parentheses. ** Statistically significant at the 1% level.

Table 2. Per Capita Growth Rate and SPI

TABLE 2A			
INDEPENDENT VARIABLE	(1)	(2)	(3)
LN(SPIL)	-0.437**		
	(0.156)		
LN(SPIF1)		-0.072	
		(0.102)	
LN(SPIF2)			-0.786**
			(0.124)
LN(PUBINV)	0.697**	0.704**	0.689**
	(0.055)	(0.052)	(0.059)
LN(TAX)	-0.681**	-0.676**	-0.618**
	(0.253)	(0.253)	(0.252)
LN(GDP$_{LAGGED}$)	-0.133	-0.118	-0.173*
	(0.101)	(0.101)	(0.096)
LN(EDU$_{LAGGED}$)	1.963**	1.943**	1.916**
	(0.443)	(0.454)	(0.447)
CONSTANT	-3.359	-3.446	-2.699
	(2.150)	(2.196)	(2.137)
ADJUSTED R-SQUARED	0.437	0.431	0.441
NO. OF PANEL OBSERVATIONS	364	364	364

Notes: White heteroskedasticity-consistent standard errors are in parentheses. ** Statistically significant at the 1% level. * Statistically significant at the 5% level.

Table 2 (Continued)

TABLE 2B		
INDEPENDENT VARIABLE	(4)	(5)
LN(SPIF2)	-0.917**	-1.322**
	(0.127)	(0.184)
LN(POLICE)	0.175	
	(0.144)	
LN(PUBINV)		-1.693**
		(0.593)
LN(TAX)	-0.252	-0.404
	(0.317)	(1.434)
LN(GDP$_{LAGGED}$)	-0.091	-0.328
	(0.134)	(0.197)
LN(EDU$_{LAGGED}$)	2.013**	6.587**
	(0.466)	(0.904)
CONSTANT	-3.798	-27.081**
	(2.143)	(6.216)
NO. OF PANEL OBSERVATIONS	364	112
ADJUSTED R-SQUARED	0.451	0.700

Notes: White heteroskedasticity-consistent standard errors are in parentheses. ** Statistically significant at the 1% level. * Statistically significant at the 5% level.

Table 3. Per Capita Growth Rate and SPI: Further Tests

INDEPENDENT VARIABLE	(1)	(2)	(3)
LN(SPIL)	-0.481**		
	(0.200)		
LN(SPIF1)		0.026	
		(0.121)	
LN(SPIF2)			-0.944**
			(0.154)
LN(PUBINV)	0.545**	0.553**	0.419**
	(0.087)	(0.081)	(0.117)
LN(TAX)	-1.556**	-1.604**	-1.635**
	(0.300)	(0.301)	(0.330)
LN(INF)	-0.940**	-0.953**	-1.081**
	(0.135)	(0.132)	(0.140)
LN(POP)	-0.349**	-0.350**	-0.290**
	(0.121)	(0.122)	(0.117)
LN(TRADE)	0.031*	0.031*	0.037**
	(0.014)	(0.015)	(0.015)
LN(GDP$_{LAGGED}$)	-0.857**	-0.823**	-1.020**
	(0.133)	(0.131)	(0.126)
LN(EDU$_{LAGGED}$)	2.490**	2.993**	4.239**
	(0.581)	(0.607)	(0.644)
CONSTANT	-0.835	-1.491	-5.439
	(2.907)	(2.987)	(3.025)
ADJUSTED R-SQUARED	0.489	0.478	0.519
NO. OF PANEL OBSERVATIONS	323	323	323

Notes: White heteroskedasticity-consistent standard errors are in parentheses. ** Statistically significant at the 1% level. * Statistically significant at the 5% level.

Table 4. Estimation of ω and η

PARAMETER	ω	η
STABL	0.0109**	0.0164**
STABF1	0.0215*	0.0099
STABF2	0.0042	0.0111**
AVERAGE	0.0122	0.0125

Notes: White heteroskedasticity-consistent standard errors are in parentheses. ** Statistically significant at the 1% level. * Statistically significant at the 5% level.

Table 5. SPI, Ethnicity, and Inequality

INDEPENDENT VARIABLE	LN(SPIF1)	LN(SPIF2)
LN(ETHNIC)	0.168***	-0.058**
	(0.070)	(0.027)
LN(ETHNIC)^2	0.025*	-0.010*
	(0.014)	(0.006)
LN(GINI)	0.350***	0.253***
	(0.110)	(0.089)
LN(POL$_{LAGGED}$)	-0.050***	-0.021***
	(0.015)	(0.009)
LN(PUBINV$_{LAGGED}$)	-0.019	0.007
	(0.012)	(0.011)
LN(GDP$_{LAGGED}$)	0.034**	-0.011
	(0.017)	(0.013)
LN(EDU$_{LAGGED}$)	0.344***	0.066**
	(0.059)	(0.031)
CONSTANT	-3.052***	-1.209***
	(0.466)	(0.368)
ADJUSTED R-SQUARED	0.102	0.014
NO. OF PANEL OBSERVATIONS	138	138

Notes: White heteroskedasticity-consistent standard errors are in parentheses.*** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level.

Table C1. Logit Estimation Results of SPI

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES				
INDEPENDENT VARIABLE	PARAMETER ESTIMATE	STD. ERROR	WALD CHI-SQUARE	PR > CHI-SQUARE
CONSTANT	-2.1822*	0.0443	2422.7568	0.0001
ASSASS	0.1557*	0.0351	19.6826	0.0001
GSTRIKES	0.5266*	0.0604	76.0393	0.0001
GUERWAR	0.3583*	0.0527	46.2777	0.0001
PURGES	0.3519*	0.0468	56.5297	0.0001
RIOTS	0.0790*	0.0220	12.9245	0.0003
ANTIGOVDEM	0.0266	0.0213	1.5592	0.2118

Notes: N_1, N_0 pairs=5069200, -2 log likelihood=423.074 with 6 DF (p=0.0001), Concordant/Discordant (%)=66.5/18.1. * Statistically significant at the 0.001 level. The criterion for significance is the Wald Chi-Square.

Table C2. Principal Components Analysis of SPI

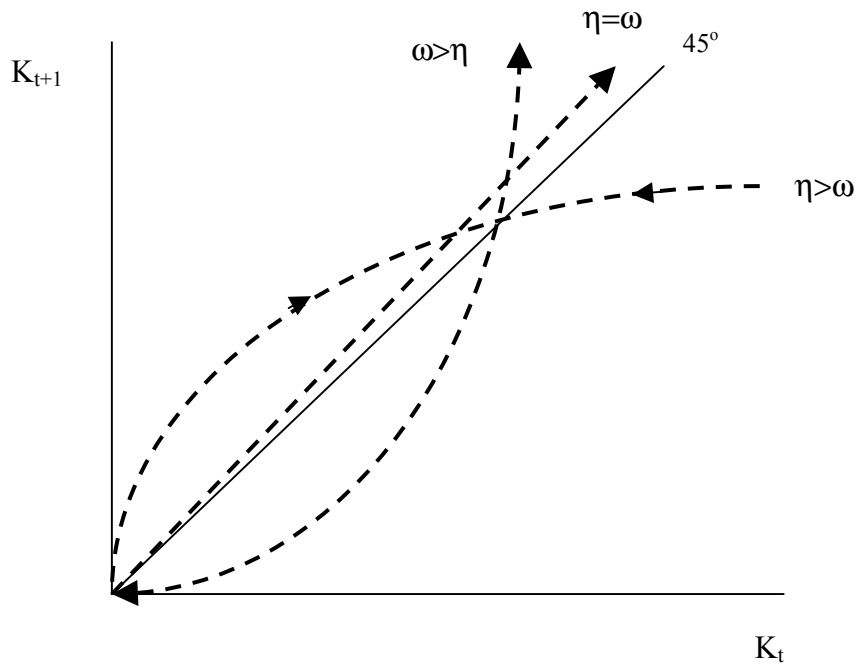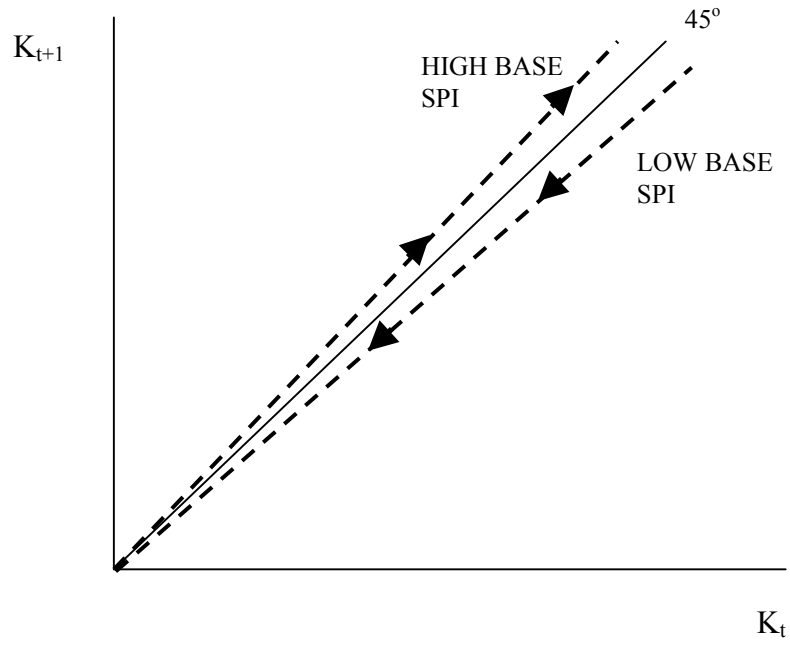| STANDARDIZED SCOING COEFFICIENTS		
VARIABLE	SPI FACTOR 1	SPI FACTOR 2
ASSASS	0.09013	**0.27712**
GSTRIKES	**0.26878**	0.09436
GUERWAR	-0.06418	**0.60154**
PURGES	-0.10442	**0.55828**
RIOTS	**0.48578**	-0.06464
ANTIGOVDEM	**0.49074**	-0.12342
VARIANCE EXPLAINED BY EACH FACTOR		
SPI FACTOR 1		SPI FACTOR 2
1.989431		1.179004

Figure 1. Growth Paths of an Economy with SPI

Figure 2. Growth Paths of an Economy with Low and High Base SPI