Socio-Political Instability and Growth Dynamics

Manoel Bittencourt* Rangan Gupta† Philton Makena‡ Lardo Stander§

July 26, 2019

Abstract

We develop an overlapping generations (OLG) monetary endogenous growth model characterized by socio-political instability, with the latter being specified as a fraction of output lost due to strikes, riots and protests. We show that growth dynamics arise in this model when socio-political instability is a function of inflation. In particular, two distinct growth dynamics emerge, one convergent and the other divergent contingent on the strength of the response of socio-political instability to inflation. Since our theoretical results hinge on socio-political instability being a function of inflation, we test the prediction that inflation affects socio-political instability positively by using a panel of 170 countries for the 1980 - 2012 period, and allowing for time and fixed effects. The results indicate that inflation relates positively with socio-political instability. Policy makers should be cognisant that it is crucial to maintain long-run price stability, as failure to do so may result in high inflation emanating from excessive money supply growth, leading to high (er) socio-political instability, and ultimately, the economy being on a divergent balanced growth path.

JEL Classification: C51, E32, O42, P44
Keywords: Socio-political instability, inflation, endogenous growth, dynamics.

*School of Economic and Business Sciences, University of the Witwatersrand, Johannesburg. Email: manoel.bittencourt@wits.ac.za.

†Department of Economics, University of Pretoria, Pretoria, 0002, South Africa. Email: rangan.gupta@up.ac.za.

‡To whom correspondence should be addressed. Department of Economics, University of Pretoria, Pretoria, 0002, South Africa. Email: philton.makena@gmail.com.

§Department of Economics, University of Pretoria, Pretoria, 0002, South Africa. Email: lardo.stander@up.ac.za.

1 Introduction

"Inflation is a disease, a dangerous and sometimes fatal disease, a disease that if not checked in time can destroy a society." – Milton Friedman[1]

This paper develops an overlapping generations (OLG) monetary endogenous growth model characterized by socio-political instability (SPI) to analyse the growth dynamics in the presence of this augmentation. We endogenize growth by allowing for a Romer (1986)-type production function. In our model, money is introduced via a mandatory cash reserve requirement, set and controlled by the government and enforced on banks which operate in a perfectly competitive environment. This treatment of money is standard in literature (See Bittencourt et al. (2014) and Gupta and Stander (2018) and references cited therein).

We define SPI as the fraction of output that is lost due to crime, riots and other disruptive (labour-related) activities, with SPI being a positive function of inequality and negatively related to policing expenditures made by the government (as in Ghate et al. (2003)). In addition, unlike Ghate et al. (2003), we assume that SPI is also a positive function of inflation, as empirically suggested by Paldam (1987), Klomp and de Haan (2009), Blanco and Grier (2009), and indirectly by Aisen and Veiga (2006) and Aisen and Veiga (2008) (as they control for endogeneity when testing the impact of such instabilities on inflation). The intuition for our ad-hoc representation of SPI is very simple: inflation, emanating from growth in money supply meant to fund government expenditure, depresses the real wage and subsequently leads to strikes/riots/demonstrations. This results in output being lost, not only through the destruction of production, but also in the loss of production since time is now allocated to SPI activities instead of productive activities. Collectively, this is our definition of SPI.

With SPI being a function of inflation, we show that convergent and divergent growth dynamics arise depending on the strength of SPI's response to inflation, which is however not possible otherwise. In the process, our paper adds to the vast literature of OLG monetary endogenous growth models that analyse growth dynamics (see for example, Gupta and Vermeulen (2010), Gupta et al. (2011) and Gupta and Stander (2018) for detailed discussions in this regard), by introducing an imperfection in the form of SPI. To the best of our knowledge, this is the first theoretical model that introduces SPI to an OLG monetary endogenous growth model and analyses the growth dynamics that emerge if SPI is a function of inflation. For completeness and to motivate our specification of the SPI, we use a panel of 170 countries for the 1980 - 2012 period, and test the theoretical prediction that high(er) inflation is related to high(er) socio-political instability. This period captures enough variation in SPI, including the political-regime changes in the 1980s and 1990s in Latin America and Eastern Europe, and the Arab Spring, inflation and economic activity, which allows us to generalise the results. By allowing for time and country fixed effects, the results indicate that inflation, as predicted by the theoretical model, relates positively to SPI.

The rest of the paper is organized as follows: Section 2 defines the model's economic setting, presents our theoretical model with the optimisation solutions and details the growth dynamics. Section 3 contains the empirical evaluation of the theoretical prediction about the relation between SPI and inflation. Finally, Section 4 offers some concluding remarks and policy advice based on the findings.

[1] *Free to Choose: A Personal Statement* (1980).

2 The Model

2.1 Economic Setting

Time is divided into discrete segments with $t = 1, 2, ...$ The principal economic activities are: (i) Two-period lived OLG consumers/labourers, who start with a positive young-age labour endowment of unit one, retire and consume only when old[2]. At time t, there exist two co-existing generations of young-age and old-age consumers, with N people born at each $t \geq 1$. At $t = 1$, there exist N people in the economy, say the initial old, who live for only one period. The young-age consumers supply their labour endowment inelastically to earn a wage income. The after-tax wage income earned in $t = 1$ is deposited into banks for future consumption; (ii) Infinitely-lived identical producers which use the same production technology to produce a single final good from the inelastically supplied labour, physical capital which is borrowed from the banks and economy-wide average capital. The representative firm maximizes its discounted streams of profit flows subject to the constraints it faces; (iii) There is a competitive banking sector that performs a simple pooling function [3] by collecting first-period deposits from the consumers and lending it to the firms, subject to obligatory cash reserve requirements. Furthermore, we assume that banks perform this intermediary function at zero cost [4]; and (iv) There is an infinitely-lived government which balances its budget on a period-by-period basis by collecting taxes from wage incomes and purchases g_t units of goods, assumed to be a productive input in the firms' production functions. Government also controls the setting of the reserve requirement. There is a continuum of each type of economic agent with unit mass.

2.2 Consumers

All consumers have the same preferences, hence in each period there is a representative agent. This representative consumer supplies its endowment of time inelastically, n_t, to earn a real wage, w_t and pay a lump-sum tax, T_t. The after-tax wage is wholly saved and deposited with the bank, d_t in period $t = 1$. When old, the consumer retires and consumes c_{t+1} from the total investment of young-age after-tax savings. Formally, the representative young-age consumer wants to [5]:

$$\max U\left(c_{t+1}\right) \tag{1}$$

subject to:

$$p_t d_t = p_t w_t - p_t T_t \tag{2}$$

$$p_{t+1} c_{t+1} = \left(1 + i_{dt+1}\right) p_t d_t \tag{3}$$

where U is a utility function of a general form but assumed to be twice-differentiable, such that $U^{'}(c) > 0$ and $U^{''}(c) < 0$. $1 + i_{dt+1}$ is the nominal interest rate received on deposits at $t + 1$, p_t and p_{t+1} are the price levels in periods t and $t + 1$, respectively. From the fact that $d_t = \frac{D_t}{p_t}$, it is clear that D_t is the amount of nominal deposits held by consumers. The feasibility constraint is presented by (2) (first-period budget constraint) for the young-age consumer, and (3) is the budget constraint of the old-age consumer.

[2] This assumption abstracts from the consumption-savings decision and ensures tractability as the analysis is now independent from the consumers utility function. Woodford (1984) offers a detailed discussion on this, even though it is by now a standard assumption in the OLG literature. Gupta and Stander (2018) use a similar formulation in their work on endogenous fluctuations and inflation targeting.

[3] We assume that capital is illiquid and that individual consumers cannot finance the firm's demand for investment, and it is only through the creation of large minimum denominations by the banks that the firm's minimum level of supply of capital can be met.

[4] Again a simplifying assumption, although Gupta and Stander (2018) show that it is straightforward to adapt the profit function of the bank to account for a fraction of the deposits spent as resource cost.

[5] Optimisation solutions for the different economic agents are fully set out in the Appendix

2.3 Financial Intermediaries/Banks

There exist a finite number of competitive banks in this economy, subject to an obligatory cash reserve requirement, γ_t, controlled by the government. To guarantee that all competitive banks levy the same cost on their loans, the nominal loan rate, i_{lt}, and guarantee the depositor the same nominal deposit rate, i_{dt}, we assume that operating the banking system comes at zero cost and that bank deposits are one period contracts. Banks maximize their profit function by pooling deposits [6], choosing the level of loans to be extended and the required cash reserves to hold and then extend loans to firms. Banks receive interest income from these loans to firms and subsequently meet their deposit rate obligations to consumers. The balance sheet is constrained by the mandatory reserve requirement, and is represented by $(1-\gamma_t) D_t = L_t$. Hence, all banks attempt to:

$$\max \prod\nolimits_{Bt} = i_{lt} L_t - i_{dt} D_t \tag{4}$$

subject to:

$$M_t + L_t \leq D_t \tag{5}$$

$$M_t \geq \gamma_t D_t \tag{6}$$

with $\prod_{Bt}$ the bank's net profit function [7]; M_t is the cash reserves held by the banks to meet the reserve requirement and L_t are the amount of nominal loans extended to the firms. The feasibility constraint is represented by (5) resulting from optimal financing contracts and (6) is the reserve requirement constraint. As a competitive banking sector is characterised by free entry, new entrants will drive profits to zero. Given that (5) and (6) binds, the solution to the bank's problem reduces to:

$$i_{lt} = \frac{i_{dt}}{1-\gamma_t} \tag{7}$$

It is clear that cash reserve requirements induce a wedge between the interest rate on deposits and the lending rates [8], as evident from (7). Total cash reserves M_t is rate-of-return dominated by loans, hence (5) will be binding as banks will hold just enough real money balances to satisfy the mandatory reserve requirements.

2.4 Firms

In this economy, we consider infinitely-lived identical firms that each produce a single final good, y_t, using the same Romer (1986)-type production technology. The firms employ physical capital, k_t, labour, n_t, and economy-wide average capital, $\bar{k}_t$, to produce the single good, such that:

$$y_t = A k_t^{\alpha} \left(n_t \bar{k}_t\right)^{1-\alpha} \tag{8}$$

where $A > 0$ is a technology parameter, $0 < \alpha(1-\alpha) < 1$ represents the elasticity of output with respect to capital and labour or publicly-provided infrastructure, respectively. At time t, the

[6] See Gupta and Stander (2018) and the references cited therein for a clear description of this solitary function of the banks.

[7] The cash reserves, M_t only forms part of the bank's gross profit function as in Haslag and Young (1998) and Basu (2001), even though it is part of the bank's total portfolio.

[8] The simplifying assumption that banks operate at zero cost, could also be replaced with an assumption that banks spend a portion of the deposits as resource cost in operating the bank system. This would imply that the bank's net profit function would be $\max \prod_{Bt} = i_{lt}L_t - i_{dt}D_t - cD_t$, with c being the fraction of deposits banks spend on its operations. The optimisation solution (with the same constraints) would become $i_{lt} = \frac{i_{dt}}{1-\gamma_t - c}$. It is evident that our results would not be affected if we redefined $\gamma_t^c = (\gamma_t + c)$.

final good can either be allocated for consumption, c_t, or stored. Firms' investment in physical capital, i_{k_t}, is constrained by the availability of funding to the firms, which they can access from banks as loans. This is so since we assume that firms are able to convert borrowed funds, L_t, into fixed capital formation such that $p_t i_{k_t} = L_t$. We follow Diamond and Yellin (1990) and Chen et al. (2008), in assuming that firms are residual claimers in that they use up the unsold consumption good in a way that is consistent with lifetime value maximization of the firms. The representative firm therefore maximizes its discounted stream of net profit flows subject to the evolution of capital and the loan constraints.

Formally, the firm's problem is outlined as follows:

$$\max_{k_{t+1},n_t} \sum_{i=0}^{\infty} \rho^i \left[p_t(1-\lambda_t)y_t - p_t w_t n_t - (1+i_{lt})L_t\right] \tag{9}$$

subject to:

$$k_{t+1} \leq (1-\delta_k)k_t + i_{k_t} \tag{10}$$

$$p_t i_{kt} \leq L_t \tag{11}$$

$$L_t \leq (1-\gamma_t)D_t \tag{12}$$

where ρ is the firm owners' (constant) discount rate and δ_k is the (constant) rate of capital depreciation. λ_t is the socio-political instability (SPI) factor, defined as the fraction of output lost due to crime, riots and other disruptive (labour-related) activities (Ghate et al., 2003). The SPI is explicitly expressed as

$$\lambda_t = 1 - B\frac{\frac{g_{1t}}{w_t}}{\frac{T_t}{w_t}(\Pi_t)^{\phi}} \tag{13}$$

where g_{1t} is policing expenditure directed at restoring or maintaining law and order, hence making it more difficult for rioters to destroy output during demonstrations. B is a constant that is restricted and meant to keep (13) well-defined, hence $B \in \left(0, \frac{\frac{T_t}{w_t}(\Pi_t)^{\phi}}{\frac{g_{1t}}{w_t}}\right)$. Π_t is the gross inflation rate, expressed as the growth in annual consumer price index (CPI) plus one. Note that $\Omega_t \Pi_t = \mu_t$, with Ω_t defined as the gross growth rate of the economy at time t and μ_t is the money growth rate while ϕ is the responsiveness of SPI to inflation. The infinitely-lived government purchases $g_t = g_{1t} + g_{2t}$ units of the consumption good, with $g_{1t} = \theta_1 g_t$, $g_{2t} = (1-\theta_1)g_t$ and $\frac{g_t}{w_t} = \theta_t$. g_{2t} is an input into the firms' production function. These relationships entail that $\frac{g_{1t}}{w_t} = \theta_1\theta_t$ and that $\frac{T_t}{w_t} = \tau_t$ such that we can then express (13) as

$$\lambda_t = 1 - B\frac{\theta_1\theta_t\Omega_t^{\phi}}{\mu_t^{\phi}\tau_t} \tag{14}$$

The firm solves the following recursive problem in order to determine the demand for labour and investment:

$$V(k_t) = \max\left[p_t(1-\lambda_t)Ak_t^{\alpha}\left(n_t\bar{k}_t\right)^{1-\alpha} - p_t w_t n_t - p_t(1+i_{lt})(k_{t+1} - (1-\delta_k)k_t) + \rho V(k_{t+1})\right] \tag{15}$$

yielding the following first order conditions:

$$n_t : w_t = (1-\lambda_t)(1-\alpha)A(\frac{k_t}{n_t})^{\alpha}\bar{k}_t^{1-\alpha} \tag{16}$$

This represents the optimal hiring decision for a firm, in that the firm will hire labour up to a point whereby the marginal product of labour is equal to the real wage.

$$k_{t+1} : (1+i_{lt}) = \rho \left(\frac{p_{t+1}}{p_t}\right) \left[(1-\lambda_{t+1})\alpha A \left(\frac{n_{t+1}\bar{k}_{t+1}}{k_{t+1}}\right)^{1-\alpha} + (1+i_{lt+1})(1-\delta_k)\right] \quad (17)$$

The above expression is an efficiency condition that provides for the optimal investment decisions of the firm. The firm compares the cost of increasing investment in the current period with the future stream of benefits generated from the additional capital invested in the current period. If we go by the assumption that there is full depreciation of capital between periods such that $\delta_k = 1$, then, without any loss of generality, (17) simplifies to

$$(1+i_{lt}) = \rho \left(\frac{p_{t+1}}{p_t}\right) \left[(1-\lambda_{t+1})\alpha A \left(\frac{n_{t+1}\bar{k}_{t+1}}{k_{t+1}}\right)^{1-\alpha}\right] \quad (18)$$

2.5 Government

As pointed above, we assume an infinitely-lived government that purchases g_t units of the consumption good such that $g_t = g_{1t} + g_{2t}$ where g_{1t} and g_{2t} are policing and unproductive expenditures respectively. These expenditures are financed through taxes on income and seigniorage (inflation tax). The government's budget constraint at time t can be written in real per-capita terms as follows:

$$g_t = T_t + \frac{M_t - M_{t-1}}{p_t} \quad (19)$$

with $M_t = \mu_t M_{t-1}$, where μ_t is the money growth rate. $T_t = w_t\tau_t$ is the tax revenue, with τ_t being the tax rate. It is the consolidated government that coordinates operations of treasury and the central bank, both of which serve the government's interests. The government implements fiscal policy: raising revenue through income taxes and managing government expenditures. Given that $T_t = w_t\tau_t$, $M_t = \mu_t M_{t-1}$, $m_t = \gamma_t d_t$ from (6), $d_t = w_t - T_t$ from (2) and that $\Omega_t \Pi_t = \mu_t$, the government's budget constraint, in real terms, can be expressed as

$$g_t = T_t + \gamma_t d_t \left(1 - \frac{1}{\Omega_t \Pi_t}\right) \quad (20)$$

where Ω_t is the gross growth rate of the economy at time t and Π_t is the gross inflation rate at time t.

2.6 Equilibrium

A competitive equilibrium for this economy is characterised as a sequence of prices $\{p_t, i_{lt}, i_{dt}\}_{t=0}^{\infty}$, allocations $\{c_{t+1}, n_t, i_{kt}\}_{t=0}^{\infty}$, stocks of financial assets $\{m_t, d_t\}_{t=0}^{\infty}$, and policy variables $\{\gamma_t, \tau_t, \mu_t, g_t\}_{t=0}^{\infty}$ such that:

- The consumer maximizes utility given by (1) subject to (2) and (3);
- Banks maximize profits, taking i_{lt}, i_{dt} and γ_t as given and such that (7) holds;
- The real allocations solve the firm's date t profit maximization problem, given prices and policy variables, such that (16) and (17) hold;
- The money market equilibrium conditions: $m_t = \gamma_t d_t$ is satisfied for all $t \geqslant 0$;

- The loanable funds market equilibrium condition: $p_t i_{kt} = L_t$ where the total supply of loans $L_t = (1-\gamma_t)D_t$ is satisfied for all $t \geqslant 0$;
- The goods market equilibrium condition require: $c_t + i_{kt} + g_t = Ak_t^{\alpha}\left(n_t\bar{k}_t\right)^{1-\alpha}$ is satisfied for all $t > 0$;
- The labour market equilibrium condition: $(n_t)^d = 1$ for all $t > 0$;
- The government budget constraint in (20) is balanced on a period-by-period basis;
- d_t, p_t, i_{lt}, i_{dt} and A are positive for all $t > 0$.

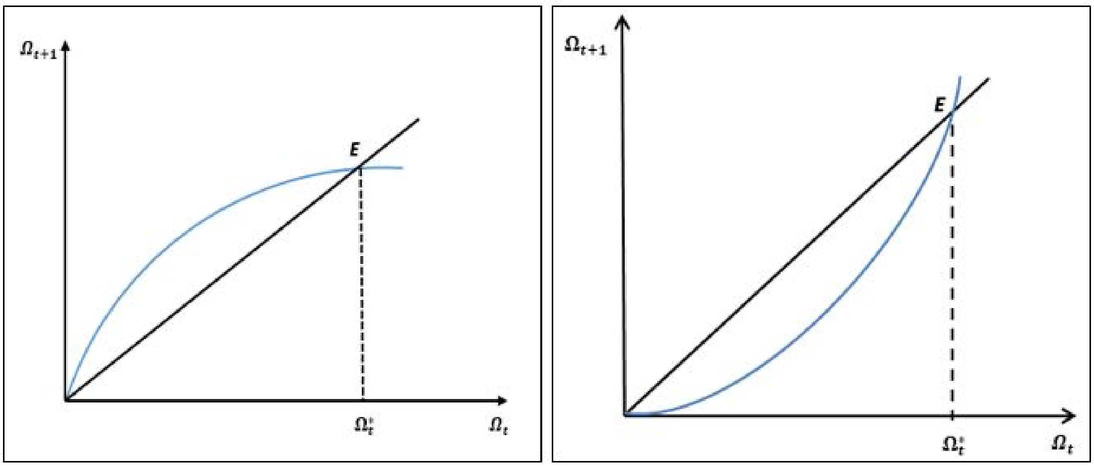
2.7 Growth Dynamics

We analyse the possible growth dynamics for our model using (2), (10), (11), (12) and (20) and the fact that in equilibrium, $n_t = 1$ and $k_t = \bar{k}_t$. We obtain an expression for the relationship between the gross growth rate in time $t+1$, Ω_{t+1} and the gross growth rate in time t, Ω_t. In other words, we obtain $\Omega_{t+1} = f(\Omega_t)$, which is expressed as:

$$\Omega_{t+1} = A(1-\gamma_t)(1-\alpha)B\frac{\theta_1\theta_t\Omega_t^{\phi}}{\mu_t^{\phi}\tau_t}\left[1-\tau_t\right] \tag{21}$$

where $\theta_t = \tau_t + \gamma_t(1-\tau_t)\left(1-\frac{1}{\mu_t}\right)$. Depending on the values of A, α, γ, θ_1, τ, μ and ϕ, we can have two different types of balanced growth paths. In particular, ϕ, the responsiveness of the SPI, λ_t, to inflation, Π_t, is the one that determines the two different growth paths. On one hand, the economy's growth path is concave, and hence convergent to the optimal gross growth rate, Ω_t^*, if $\phi < 1$, as shown in Figure 1. On the other hand, the growth path is convex, and hence divergent from the optimal gross growth rate, Ω_t^*, if $\phi > 1$ (See Figure 1). In other words, stronger the influence of inflation on SPI, the more likely the economy can end up on a divergent growth path.

Figure 1: Model Growth Dynamics



(a) Convergent Growth Path ($\phi < 1$) (b) Divergent Growth Path ($\phi > 1$).

3 Data and Results

3.1 Data

To test the theoretical prediction that inflation relates positively to social-political instability, upon which our results of growth dynamics depend on completely, we use annual data from 170 countries over the 1980 - 2012 period.

Social-political instability (SPI) is an index that consists of six political variables collected from the Cross–National Time–Series (CNTS) database published by Databanks International (DI). DI compiles a comprehensive database containing different political, conflict, legislative and economic variables. The DI database defines SPI differently to the index we use here: whereas DI provides a broad SPI index comprising eight social–political variables, our SPI index excludes the two most–heavily weighted variables, 'Guerilla Warfare' and 'Revolutions'. The DI assigned weighting to each of these excluded variables is 100 and 150. This implies that within the DI SPI index, these two 'radical' variables account for almost 68 percent of the total SPI index. Given that our theoretical interest is on labour decisions such as 'riots', 'strikes' and 'anti-government demonstrations' that might lead to reductions in output, we use a re–weighted index that is more consistent with our theoretical prediction.

To capture the gross inflation rate, the variable inflation is the growth in the annual consumer price index plus one, which is consistent with the SPI function of the theoretical model. The data on inflation rates are provided by the World Bank.

3.2 Results

To illustrate how both variables relate to each other over time, Figure two depicts the OLS regression line between inflation and SPI. The correlation between inflation and SPI are, as predicted, positive.

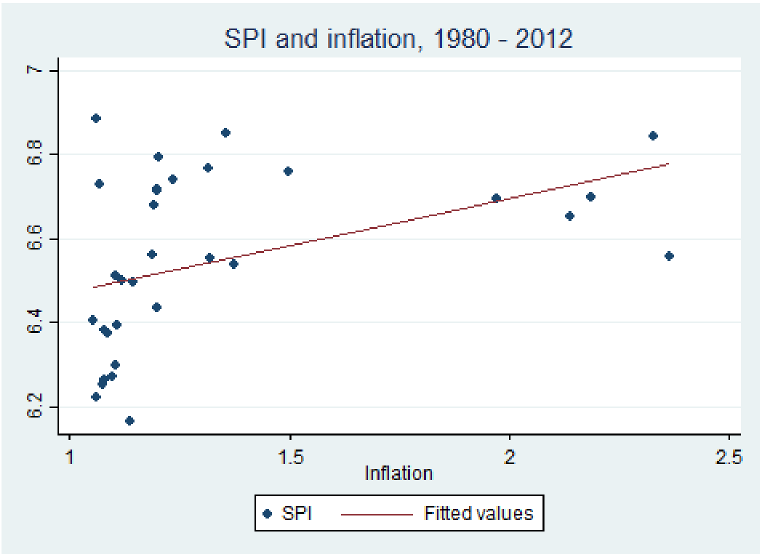


Figure 2: SPI and Inflation. Sources: Databanks International and World Bank.

About the method: given the dimension of the dataset, $N = 170$ countries and $T = 33$ years, we use the one- and two-way Fixed–Effects (FE) estimator that allows for unobserved heterogeneity and unexpected events affecting SPI, with and without instrumental variables, to further test our theoretical prediction. In such a panel, idiosyncratic characteristics and shocks that can drive some of the differences in SPI across countries and over time include institutional quality, legal frameworks, central bank independence, fiscal regimes, end of the cold war, *etc.*

For robustness, we include in the FE regressions some controls. First, 'Cabinet Changes' counts the number of times in a year in which a new premier or president is named and/or 50 percent of the cabinet posts are occupied by new ministers, and the data are from the CNTS database. This variable captures internal political turnover and is usually used to control for the effect that political turnover may have on the economy. We expect a positive relation between cabinet changes and SPI. Second, real income *per capita* (GDP_PC) controls for the effect of development on SPI, and the data are from the World Bank. It is expected that richer countries have lower SPI. And the Gini coefficient of income inequality are obtained from the World Bank as well. In this case it is expected that higher inequality is related to higher SPI. The estimated equation is as follows:

$$SPI_{it} = \alpha_i + \eta_t + \beta Inflation_{it} + \gamma CabChanges_{it} + \delta GDP\_PC_{it} + \epsilon Gini_{it} + u_{it} \qquad (22)$$

where α_i and η_t are country and time effects.

We first report the statistical correlations in Table 1. Consistent with the OLS regression line depicted in Figure 2, inflation and SPI are positively correlated to each other at the five percent level. The correlations between the controls and SPI are also consistent with *a priori* predictions.

Table 1: Correlation Matrix

	SPI	Inflation	CabChanges	GDP_PC	Gini
SPI	1				
Inflation	0.071*	1			
CabChanges	0.112*	0.001	1		
GDP_PC	-0.101*	-0.038*	-0.051*	1	
Gini	0.0263	0.018	-0.032	-0.282*	1

$*p < 0.05$

The FE estimates are reported in Table 2. Yet again, for our main variable of interest, inflation, the effects are consistently positive and statistically significant on SPI. Moreover, in column five we run a regression only with those countries with above the average inflation. Interestingly enough, in this case inflation is not significant, suggesting that the results are not being driven by high-inflation episodes/countries.

Although the Davidson and Mackinnon (D-M) test for exogeneity suggests that endogeneity is not a problem here, for completeness in column six we instrument inflation with the lags of all right-hand side variables. Reassuringly, the estimates in column six are consistent with all other estimates. Also, the Sargan test does not indicate that the instruments are not valid.

Perhaps also worth mentioning, given the differences in scale and units of measurement between the variables, the size of the estimates is not necessarily important. The direction, however, is consistent with our theoretical prediction. About the controls: Cabinet Changes is, as expected, positively related to SPI; income, or development, is mostly negatively related to SPI and inequality is essentially zero.

All in all, the upward-sloping OLS regression lines, the positive and significant correlations between inflation and SPI, and the positive and significant FE estimates of inflation on SPI are consistent across the board and therefore reassuring for the specification of the SPI function of the theoretical model, and the growth dynamics that emerge thereafter.

At this stage, it is probably important to highlight that the way SPI is measured in the empirical part, does not necessarily has one-to-one correspondence with the SPI function specified in the theoretical part. Hence, while we are able to provide evidence that SPI relates positively with inflation, as suggested in the theoretical model, it is not possible for us to say with certainty, that the coefficient of less than one on the gross inflation rate obtained from the empirical exercise corresponds to ϕ being less than one as well. In other words, this result does not necessarily translate into convergent growth dynamics.

Table 2: Fixed Effects Regressions

VARIABLES	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE-IV
Inflation	0.0141***	0.0137**	0.0122**	0.0190***	0.0136	0.0358**
	(0.00493)	(0.00564)	(0.00557)	(0.00587)	(0.0152)	(0.0174)
CabChanges		0.506***	0.483***	0.669***	1.284**	0.398
		(0.140)	(0.153)	(0.224)	(0.535)	(0.350)
GDP_PC			-0.837**	-0.216	2.083	-1.176*
			(0.361)	(0.496)	(1.473)	(0.615)
Gini				-0.333	0.0559	-1.216
				(0.701)	(1.947)	(1.148)
Constant	6.539***	6.569***	13.12***	9.905**	-11.04	
	(0.00771)	(0.0168)	(2.832)	(4.323)	(10.93)	
Observations	1,516	595	570	373	68	121
R-squared	0.005	0.034	0.068	0.171	0.573	0.147
Number of i	156	131	127	94	28	30
Country FE	YES	YES	YES	YES	YES	YES
Rob SE	YES	YES	YES	YES	YES	YES
Instruments						YES
D-M p-value						.6538
Sargan p-value						.5163
Time FE				YES	YES	
Above mean					YES	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4 Conclusion

We develop an overlapping generations (OLG) monetary endogenous growth model characterized by socio-political instability (SPI), and analyse the resulting growth dynamics when SPI is a positive function of inflation. We define SPI as the fraction of output that is lost due to disruptive activities which include crime, riots and other labour-related activities. The model produces two distinct growth dynamics, one convergent and the other divergent, informed by the responsiveness of SPI to inflation. And by using a dataset covering 170 countries during the $1980-2012$ period, and allowing for time and country fixed effects, we show that higher inflation relates positively with socio-political instability, and hence, corroborates the theoretical prediction of the SPI function in our theoretical set-up.

Our theoretical results have importnt policy implications. Notably, policy makers in economies where government consumption expenditures are financed by income taxes and seigniorage and in which the government coordinates operations of the central bank through setting the level of reserve requirements, should be cognisant that it is crucial to maintain long-run price stability. Failure to do so may results in episodes of high inflation emanating from excessive money supply growth, and high (er) socio-political instability, which in turn, would put the economies in a divergent balanced growth path.

References

Aisen, A. and Veiga, F. J. (2006). Does political instability lead to higher inflation? a panel data analysis. *Journal of Money, Credit and Banking*, pages 1379–1389.

Aisen, A. and Veiga, F. J. (2008). Political instability and inflation volatility. *Public Choice*, 135(3-4):207–223.

Basu, P. (2001). Seigniorage, reserve ratio and growth. *Journal of Macroeconomics*, 23:397–416.

Bittencourt, M., Gupta, R., and Stander, L. (2014). Tax evasion, financial development and inflation: Theory and empirical evidence. *Journal of Banking & Finance*, 41:194–208.

Blanco, L. and Grier, R. (2009). Long live democracy: the determinants of political instability in latin america. *The Journal of Development Studies*, 45(1):76–95.

Chen, B.-L., Chiang, Y.-Y., Wang, P., et al. (2008). Credit market imperfections and long-run macroeconomic consequences. *Annals of Economics and Finance*, 9(1):151–175.

Diamond, P. and Yellin, J. (1990). Inventories and money holdings in a search economy. *Econometrica: Journal of the Econometric Society*, pages 929–950.

Ghate, C., Le, Q. V., and Zak, P. J. (2003). Optimal fiscal policy in an economy facing sociopolitical instability. *Review of Development Economics*, 7(4):583–598.

Gupta, R. et al. (2011). Production lags and growth dynamics in an overlapping generations endogenous growth model. *Journal of Applied Business Research*, 27(2):13.

Gupta, R. and Stander, L. (2018). Endogenous fluctuations in an endogenous growth model: An analysis of inflation targeting as a policy. *The Quarterly Review of Economics and Finance.*

Gupta, R. and Vermeulen, C. (2010). Private and public health expenditures in an endogenous growth model with inflation targeting. *Annals of Economics & Finance*, 11(1).

Haslag, J. H. and Young, E. R. (1998). Money creation, reserve requirements, and seigniorage. *Review of Economic Dynamics*, 1(3):677–698.

Klomp, J. and de Haan, J. (2009). Political institutions and economic volatility. *European Journal of Political Economy*, 25(3):311–326.

Paldam, M. (1987). Inflation and political instability in eight latin american countries 1946-83. *Public Choice*, 52(2):143–168.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, 94(5):1002–1037.

Woodford, M. (1984). Indeterminacy of equilibrium in the overlapping generations model: A survey. *Unpublished manuscript (IMSSS, Stanford University, Stanford, CA).*

A Appendix

A.1 Optimisation solutions for economic agents

Note that from the solution to the consumer's problem, we have:

$$d_t = w_t - T_t \tag{A.1}$$

$$c_{t+1} = (1 + i_{dt+1})d_t \tag{A.2}$$

from (2) and (3). The bank's solution follows directly from its net profit function, and the fact that (5) and (6) holds. We also obtain, from putting (6) into (5) that:

$$l_t = (1 - \gamma_t)d_t \tag{A.3}$$

Recall the firm's optimisation problem, in recursive form:

$$V(k_t) = \max \left[p_t(1 - \lambda_t)Ak_t^{\alpha} \left(n_t\bar{k}_t\right)^{1-\alpha} - p_t w_t n_t - p_t(1 + i_{lt})(k_{t+1} - (1 - \delta_k)k_t) + \rho V(k_{t+1}) \right] \tag{A.4}$$

which yields the following first order conditions (FOC):

$$n_t : w_t = (1 - \lambda_t)(1 - \alpha)A(\frac{k_t}{n_t})\bar{k}_t^{1-\alpha} \tag{A.5}$$

$$k_t : p_t(1 + i_{it}) = \rho V^{'}(k_{t+1}) \tag{A.6}$$

with the solution to the FOC for k_{t+1} found in the derivative of the value function with respect to k_t, updated for one period. Formally:

$$V^{'}(k_{t+1}) = p_{t+1}(1 - \lambda_{t+1})\alpha A \left(\frac{n_{t+1}\bar{k}_{t+1}}{k_{t+1}}\right)^{1-\alpha} + (1 + i_{lt+1})(1 - \delta_k) \tag{A.7}$$

which results in (17). Simply substituting $\delta_k = 1$ and n_{t+1} into (17), yields

$$(1 + i_{lt}) = \rho \left(\frac{p_{t+1}}{p_t}\right) \left[(1 - \lambda_{t+1})\alpha A \left(\frac{n_{t+1}\bar{k}_{t+1}}{k_{t+1}}\right)^{1-\alpha}\right] \tag{A.8}$$

A.2 Derivation of the balanced growth path (BGP) of gross growth rate

Note that from the solution to the consumer's problem, we have, in real terms:

$$d_t = w_t - T_t \tag{A.9}$$

and from the solution of the banks' problem, we have

$$l_t = (1 - \gamma_t)d_t \tag{A.10}$$

From (11), we have

$$l_t = l_{kt} \tag{A.11}$$

Given the assumption that capital fully depreciates between periods such that $\delta = 1$, then (10) reduces to

$$k_{t+1} = i_{kt} \tag{A.12}$$

such that (A.11) can then be expressed as

$$l_t = k_{t+1} \tag{A.13}$$

We can also express (A.13) as

$$k_{t+1} = (1 - \gamma_t)d_t \tag{A.14}$$

Given that $d_t = w_t - T_t$, we have

$$k_{t+1} = (1 - \gamma_t)(w_t - T_t) \tag{A.15}$$

From (16), we have $w_t = (1 - \lambda_t)(1 - \alpha)A(\frac{k_t}{n_t})^\alpha \bar{k}_t^{1-\alpha}$. In equilibrium, $n_t = 1$ and $k_t = \bar{k}_t$ such that

$$w_t = (1 - \lambda_t)(1 - \alpha)Ak_t \tag{A.16}$$

Thus, (A.15) can then be expressed as:

$$k_{t+1} = (1 - \gamma_t)\left[(1 - \lambda_t)(1 - \alpha)Ak_t - T_t\right] \tag{A.17}$$

Since $T_t = w_t\tau_t$ and $w_t = (1 - \lambda_t)(1 - \alpha)Ak_t$, we can proceed as follows:

$$k_{t+1} = (1 - \gamma_t)\left[(1 - \lambda_t)(1 - \alpha)Ak_t - ((1 - \lambda_t)(1 - \alpha)Ak_t)\tau_t\right]$$

and dividing the above expression both sides by k_t, we have

$$\frac{k_{t+1}}{k_t} = \frac{(1 - \gamma_t)(1 - \alpha)A(1 - \lambda_t)k_t}{k_t}\left[1 - \tau_t\right]$$

$$\Omega_{t+1} = (1 - \gamma_t)(1 - \alpha)A(1 - \lambda_t)\left[1 - \tau_t\right]$$

The SPI, denoted by λ_t, is explicitly expressed as $\lambda_t = 1 - B\frac{\frac{g_{1t}}{w_t}}{\frac{T_t}{w_t}(\Pi_t)^\phi}$ where $B \in \left(0, \frac{\frac{T_t}{w_t}(\Pi_t)^\phi}{\frac{g_{1t}}{w_t}}\right)$. Note that $\Omega_t\Pi_t = \mu_t$, with Ω_t defined as the gross growth rate in time t, Π_t is time t gross inflation and μ_t is the money growth rate. ϕ is the responsiveness of SPI to inflation. We have that the infinitely-lived government purchases $g_t = g_{1t} + g_{2t}$ units of the consumption good, with $g_{1t} = \theta_1 g_t$, $g_{2t} = (1 - \theta_1)g_t$ and $\frac{g_t}{w_t} = \theta_t$. These relationships entail that $\frac{g_{1t}}{w_t} = \theta_1\theta_t$ and that $\frac{T_t}{w_t} = \tau_t$ such that we can then express λ_t as

$$1 - \lambda_t = 1 - B\frac{\theta_1\theta_t\Omega_t^\phi}{\mu_t^\phi\tau_t} \tag{A.18}$$

Given (A.18), we have

$$\Omega_{t+1} = A(1 - \gamma_t)(1 - \alpha)B\frac{\theta_1\theta\Omega_t^\phi}{\mu_t^\phi\tau_t}\left[1 - \tau_t\right] \tag{A.19}$$

From the government's budget constrain in (19), and that in equilibrium, $\delta_k = 1$ and $n_t = 1$ we have:

$$g_t = T_t + \frac{M_t - M_{t-1}}{p_t} \tag{A.20}$$

We have that $T_t = w_t \tau_t$ and $M_t = \mu_t M_{t-1}$ such that (A.20) can be expressed as

$$= \tau_t w_t + m_t - \frac{M_{t-1}}{M_t} \frac{M_t}{p_t}$$

$$= \tau_t w_t + m_t - \frac{1}{\mu_t} m_t$$

$$= \tau_t w_t + m_t \left(1 - \frac{1}{\mu_t}\right)$$

From (6), we have $m_t = \gamma_t d_t$, $d_t = w_t - T_t$ and $\frac{T_t}{w_t} = \tau_t$, such that

$$g_t = \tau_t w_t + \gamma_t (w_t - T_t) \left(1 - \frac{1}{\mu_t}\right)$$

and dividing the above expression both sides by w_t, we have

$$\theta_t = \tau_t + \gamma_t (1 - \tau_t) \left(1 - \frac{1}{\mu_t}\right) \tag{A.21}$$