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Corruption, inflation and growth☆

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ABSTRACT

We present a model in which the embezzlement of tax revenues by public officials leads the government to rely more on seigniorage to finance its expenditures. This raises inflation which depresses investment and growth via a cash-in-advance constraint.

1. Introduction

This paper presents an analysis of the effect of bureaucratic corruption on economic growth from a public finance perspective. Corruption is modelled as the embezzlement of public funds which leads to a loss of resources available to the government for financing its expenditures. As a consequence, the government is forced to rely on other sources of revenue, notably seigniorage. This raises inflation which acts as a tax on both consumption and investment by virtue of a cash-in-advance constraint. The result is a fall in capital accumulation and growth.[1] The predictions of the analysis are consistent with several empirical observations—that is, a negative correlation between growth and inflation/seigniorage (e.g. Adam and Bevan, 2005; Andrés and Hernando, 1997; Bose et al., 2007; De Gregorio, 1993), a negative correlation between tax revenues and corruption (e.g. Ghura, 1998; Imam and Jacobs, 2007; Tanzi and Davoodi, 2000), a positive correlation between inflation/seigniorage and corruption (e.g. Al-Marhubi, 2000), and a negative correlation between growth and corruption (e.g. Gyimah-Brempong, 2002; Keefer and Knack, 1997; Li et al., 2000; Mauro, 1995).[2]

2. The model

We consider an economy in which there is a constant population (normalised to one) of infinitely-lived agents. The population is divided into a fraction, $\theta \in (0, 1)$, of private individuals (or households) and a remaining fraction, $1 - \theta$, of public officials (or bureaucrats). Each agent is endowed with one unit of labour which is supplied inelastically to a particular occupation. Households work for firms in the production of output, whilst bureaucrats work for the government in the administration of public policy. A proportion, $\eta \in (0, 1)$, of bureaucrats engage in corruption by embezzling public funds which are otherwise used to

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1 A similar idea has been touched upon by others who point towards inefficiencies in the tax system (in particular, the prevalence of tax evasion) as an explanation of why less developed countries are more prone to rely on inflationary finance (e.g. De Gregorio, 1993; Gupta, 2008; Roubini and Sala-i-Martin, 1995). The present analysis focuses more on bureaucratic malfeasance in the looting of public funds using a dynamic general equilibrium model of corruption and growth.

2 Of course, there are other possible explanations for these observations. For example, high inflation, high corruption and low growth may be the common symptoms of poor quality governance and weak institutions, occurring independently of each other without the causal links that our model implies. Similarly, corruption might lead to higher inflation but its negative effect on growth may work through other channels, rather than through the inflation tax on which we focus. Finally, the observed relationships between variables may reflect reverse directions of causality that we do not consider. Further empirical work is needed to assess these possibilities.

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provide public goods and services. Firms, of which there is a unit mass, hire labour from households, rent capital from all agents and sell output to all agents in perfectly competitive markets. This set-up, elaborated upon below, shares a number of features with other models that serve to simplify the analysis in various ways.[3]

2.1. Agents

Each agent (whether a household or a bureaucrat) derives lifetime utility according to

$$U = \sum_{t=0}^{\infty} \beta^t [\log(c_t) + v(g_t)], \tag{1}$$

($\beta \in (0, 1)$) where c_t denotes consumption and g_t denotes public goods and services.[4] The agent is faced with the sequence of budget constraints,

$$c_t + \frac{M_t}{P_t} + a_{t+1} = x_t + \frac{M_{t-1}}{P_t} + (1 + r_t)a_t, \tag{2}$$

and the sequence of cash-in-advance constraints,

$$\frac{M_{t-1}}{P_t} \geq c_t + a_{t+1} - a_t, \tag{3}$$

where M_t denotes nominal money balances, a_t denotes real asset holdings, x_t denotes real income, P_t is the price level and r_t is the real interest rate. As in Stockman (1981), we assume that the cash-in-advance constraint applies to purchases of both consumption and investment goods. The decision problem for the agent is to maximise (1) subject to (2) and (3). This problem is solved by the following set of first-order and complementary slackness conditions:

$$\frac{1}{c_t} = \lambda_{1t} + \lambda_{2t}, \tag{4}$$

$$\lambda_{1t} + \lambda_{2t} = \beta[(1 + r_{t+1})\lambda_{1t+1} + \lambda_{2t+1}], \tag{5}$$

$$(1 + \pi_{t+1})\lambda_{1t} = \beta(\lambda_{1t+1} + \lambda_{2t+1}), \tag{6}$$

$$\lambda_{2t}\left(\frac{M_{t-1}}{P_t} - c_t - a_{t+1} + a_t\right) = 0, \quad \lambda_{2t} \geq 0, \ \ (\cdot) \geq 0, \tag{7}$$

where $1 + \pi_{t+1} = \frac{P_{t+1}}{P_t}$ (the gross rate of inflation) and $\lambda_{1t}(\lambda_{2t})$ is the Lagrange multiplier associated with (2) and (3).

2.2. Firms

The representative firm produces output, y_t, according to

$$y_t = \Phi l_t^{\phi} k_t^{1-\phi} z_t^{\phi}, \tag{8}$$

($\Phi > 0, \phi \in (0, 1)$) where l_t denotes labour, k_t denotes capital and z_t is an index of technical knowledge. As in other endogenous growth models, the last of these terms is approximated by the aggregate stock of capital which serves to capture the positive externality effects associated with learning-by-doing. Labour and capital are hired at the competitively-determined real wage and real rental rates, w_t and r_t, respectively. Assuming that output is taxed at the constant proportional rate $\tau \in (0, 1)$, profit maximisation implies

$$w_t = (1 - \tau)\phi\Phi l_t^{\phi-1} k_t^{1-\phi} z_t^{\phi} = \frac{(1 - \tau)\phi y_t}{l_t}, \tag{9}$$

$$r_t = (1 - \tau)(1 - \phi)\Phi l_t^{\phi} k_t^{-\phi} z_t^{\phi} = \frac{(1 - \tau)(1 - \phi)y_t}{k_t}. \tag{10}$$

2.3. Government

The government makes expenditures on public goods and services, together with bureaucrats' salaries. The former is assumed to be a fixed proportion of output, $g_t = \psi y_t (\psi \in (0, 1))$. The latter is given by $(1 - \theta)w_t$, which is the total cost of paying bureaucrats the same wage as they could earn in the private sector.[5] These expenditures are financed by tax revenues from firms, τy_t, and by printing money, $H_t - H_{t-1}$. We assume that each bureaucrat is allocated the same amount of tax revenue, $\frac{\tau y_t}{1-\theta}$, with which to provide public goods and services. Non-corrupt bureaucrats, of whom there are $(1 - \eta)(1 - \theta)$, comply with this objective, whilst corrupt bureaucrats, of whom there are $\eta(1 - \theta)$, pocket the revenues for themselves. It follows that the actual amount of public funds available is $(1 - \eta)\tau y_t$.[6] Let μ denote the rate of monetary growth so that $H_t = (1 + \mu)H_{t-1}$. Then the government's budget constraint in real terms can be written as

$$\left(\frac{\mu}{1 + \mu}\right)\frac{H_t}{P_t} = (1 - \theta)w_t + \psi y_t - (1 - \eta)\tau y_t. \tag{11}$$

3. Solution and results

We focus on the steady state balanced growth equilibrium of the model in which all markets are clearing and all real variables (except employment and the real interest rate) are growing at the same constant rate. In particular, we have $l_t = \theta$ (labour market equilibrium), $a_t = k_t$ (capital market equilibrium) and $M_t = H_t$ (money market equilibrium).[7] The balanced growth rate is denoted by γ.

The conditions in (4)–(7) imply the following. From (4), since c_t is growing at the constant (gross) rate of $1 + \gamma$, $\lambda_{1t} + \lambda_{2t}$ must be growing at the rate $(1 + \gamma)^{-1}$ so that $\lambda_{1t} + \lambda_{2t} = (1 + \gamma)(\lambda_{1t+1} + \lambda_{2t+1})$. Substituting this into (5) gives $(1 + \gamma - \beta)(\lambda_{1t+1} + \lambda_{2t+1}) = \beta r \lambda_{1t+1}$ which shows that λ_{1t} must, itself, be growing at the rate $(1 + \gamma)^{-1}$. In turn, this means that λ_{2t} must also be growing at this rate if it is non-zero. Re-writing (6) as $[(1 + \pi_{t+1})(1 + \gamma) - \beta]\lambda_{1t+1} = \beta\lambda_{2t+1}$ reveals that, since $\lambda_{1t} > 0$ (because the budget constraint is binding), $\lambda_{2t} > 0$ which establishes that the cash-in-advance constraint is binding by virtue

[3] Two features, in particular, are worth commenting on (see, for example, Blackburn et al. (2006) and Blackburn and Forgues-Puccio (2007), and the references contained therein). The first is the decomposition of the population into a fixed fraction of households and a fixed fraction of bureaucrats. The former are agents who lack the skills necessary to become public officials, whilst the latter are agents who possess these skills and who are induced to take up public office by an allocation of talent conditions established below. The convenience of this is that we do not have to consider possible changes in the size of the bureaucracy and possible changes in the level of corruption that may result from this. The second feature is the existence of at least some bureaucrats who are never corrupt for one reason or another (e.g., a lack of proficiency at being corrupt or a moral indignation towards corrupt behaviour). The simplification in this case is that we are able to determine bureaucrats' salaries in a relatively straightforward way that does not demand further assumptions about how public sector pay is decided. In addition, the government is assured of receiving at least some tax revenues with which to finance its expenditures.

[4] We assume logarithmic preferences over consumption for simplicity. Likewise, we introduce public goods and services into the utility function, rather than the production function, to cut down on some of the analysis.

[5] This equalisation between private and public sector pay arises from the fact that, since bureaucrats are able to earn w_t by working for firms, the government knows that anyone who is willing to accept a salary less than this must be intending to obtain extra income illegally. Given a sufficient punishment for such behaviour (e.g., the confiscation of all income), no corrupt bureaucrat would ever reveal himself in this way. The upshot is that all bureaucrats are offered w_t, which is the minimum wage that induces non-corrupt bureaucrats to take up public office.

[6] Our results would not change if we were to allow the government to retrieve part of its stolen revenues through some imperfect monitoring whereby corrupt bureaucrats faced some probability of being apprehended. We abstract from this merely for simplicity.

[7] In addition, $z_t = k_t$ so that (10) reduces to $r = (1 - \tau)(1 - \phi)\Phi\theta^{\phi}$, which shows that the interest rate is, indeed, constant.

of (7). Given this, then inflation is constant and inversely related to growth according to

$$\frac{1+\mu}{1+\pi} = 1+\gamma, \tag{12}$$

which merely verifies that real money balances grow at the rate γ.[8] Finally, combining (5) and (6) yields another expression in which growth and inflation are negatively related:

$$(1+\gamma-\beta)(1+\gamma) = \frac{r\beta^2}{1+\pi}. \tag{13}$$

With a binding cash-in-advance constraint, (3) gives $\frac{M_{t-1}}{P_t} = c_t + a_{t+1} - a_t$ so that (2) reduces to $\frac{H_t}{P_t} = x_t + rk_t$ in general equilibrium. At the aggregate level, the term x_t comprises the incomes of all households, θw_t, plus the incomes of all non-corrupt bureaucrats, $(1-\eta)(1-\theta)w_t$, plus the incomes of all corrupt bureaucrats, $\eta(1-\theta)\left(w_t + \frac{\tau y_t}{1-\theta}\right)$. Thus, using (9), $x_t = \left[\frac{(1-\tau)\phi}{\theta} + \eta\tau\right] y_t$. Together with the expression for r in (10), this allows us to write

$$\frac{H_t}{P_t} = \left[\frac{(1-\tau)\phi}{\theta} + \eta\tau + (1-\tau)(1-\phi)\right] y_t. \tag{14}$$

In turn, (14) may be used in conjunction with (9) and (11) to obtain

$$\frac{\mu}{1+\mu} = \frac{(1-\theta)(1-\tau)\phi + \theta\psi - \theta(1-\eta)\tau}{(1-\tau)\phi + \theta(1-\tau)(1-\phi) + \theta\eta\tau}. \tag{15}$$

It is straightforward to show that the right-hand-side of (15) is increasing in η (the fraction of bureaucrats who are corrupt). Since the left-hand-side of (15) is obviously increasing in μ (the rate of monetary growth), then η and μ are positively related. There are two effects at work here, one of which dominates the other. First, the more corrupt bureaucrats there are, the lower is the amount of public funds available to finance public expenditures and so the greater is the need to print money: this is reflected in the numerator of (15). Second, the higher is the incidence of corruption, the larger is the inflation tax base (i.e., aggregate real money holdings) and so the less is the need for inflationary finance: this is reflected in the denominator of (15). It turns out that the former effect dominates the latter with the result that higher levels of corruption lead to higher rates of monetary growth.[9]

Given the above, it is a short step to deduce the implications of corruption for the long-run performance of the economy. By virtue of (12) and (13), we have $(1+\gamma-\beta) = \frac{r\beta^2}{1+\mu}$. This shows that an increase in monetary growth reduces real growth. It does so by causing an increase in inflation which depresses capital accumulation. As in Stockman (1981), inflation discourages investment by acting like a tax on both consumption and capital goods, purchases of either of which require sufficient liquidity in accordance with the cash-in-advance constraint.[10] Now, to the extent that higher monetary growth rates are due to higher levels of corruption, there is an obvious inference to be drawn — namely, that corruption has an adverse effect on the long-run development of the economy. In summary, corruption impedes real economic growth by forcing the government to rely more on inflationary finance which reduces capital accumulation through the tax that it imposes on investment.[11]

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8 To be sure, note that (3) (under strict equality) can be written as $\frac{M_{t-1}}{P_t} = c_t + \gamma a_t$, implying $\frac{M_t}{P_{t+1}} = (1+\gamma)(c_t + \gamma a_t)$. Dividing one by the other gives the result in (12).

9 In general, of course, a government could compensate for lost revenues in other ways, such as increasing taxes and/or reducing public expenditures. One reason why countries may wish to rely more on seigniorage is that it is seen as an easier option than fiscal adjustments which may be hindered by prior commitments, delayed through administration and disliked because of political sensitivities. Nevertheless, there is an interesting question as to the optimal combination of measures that would minimise the adverse impacts on growth and welfare. To the extent that some inflationary finance is part of this combination, the basic message of our analysis would not be changed: higher levels of corruption would imply higher rates of inflation with the consequences described below.

10 Effectively, there is a double taxation of investment (or future consumption) — the first when money is used initially to purchase assets through which agents save, and the second when money is used subsequently to purchase consumption goods out of this savings.

11 Partly for this reason, seigniorage is unlikely to be an effective long-term solution to government financing problems. High rates of inflation may bring other problems as well (e.g., capital flight) and may turn out to worsen the deficit if taxes are specified in nominal terms (the Tanzi effect). The long-term solution when corruption is the culprit is an improvement in the quality of governance. Nevertheless, seigniorage is an instrument which many countries appear to exploit, perhaps due to the reasons alluded to above and the difficulties in fighting corruption. And since temporary events can have permanent effects when growth is endogenous, even a short-term bout of inflationary finance may have long-term consequences.