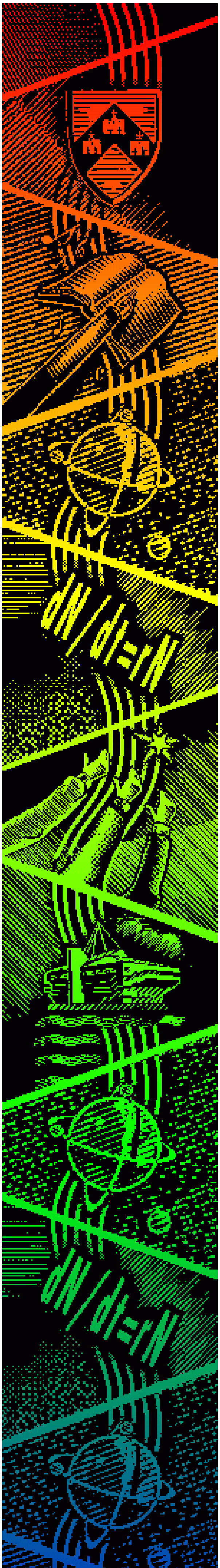

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Public debt and Financial development: A theoretical exploration

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Public debt and financial development
A theoretical exploration

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Abstract

This paper proposes an analytical framework to examine the role of public debt in financial development, which remains largely unexplored in the existing literature. We find that in countries where the banking sector extends substantial credit to government, public debt is likely to harm financial development, with unfavourable implications for economic activity. As such, our results provide an alternative explanation for the 'contractionary fiscal expansions'. We also show that the lower the financial depth, the greater the adverse effects of public borrowing on financial development and macroeconomic outcomes.

Key words: Financial sector; credit to government; public debt.

JEL classification: E52, E63, H63

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1 Introduction

Massive fiscal stimulus packages put into place in the wake of the recent global financial crisis created renewed interest in fiscal policy issues. An important aspect of fiscal policy especially during major fiscal expansions is related to the implications of budget deficits and public debt, on which there is a substantial literature. One interesting finding in this literature is that fiscal expansions may be contractionary in countries where financial depth[1] is limited (see, for example, Caballero and Krishnamurty, 2004 and Christensen, 2005). Caballero and Krishnamurty (2004) present a model of external crisis in an environment with limited financial depth. In their model a rise in government expenditure crowds out private investment since expansionary fiscal policy worsens the quality of the country's assets by reducing their liquidity and valuation. Their results overturn standard fiscal policy prescriptions, pointing to the potential contractionary effects of expansionary fiscal policy.

In this paper we offer an alternative explanation for 'contractionary fiscal expansions' by exploring a different channel through which fiscal policy influences the financial sector and economic outcomes. We show that when the government has a dominant presence as a major borrower in the domestic securities market, a rise in public debt crowds out the funds available to the private sector –a key measure of financial development– which in turn reduces economic activity.[2] Although the determinants and the implications of financial development have been extensively analyzed, the potential role of fiscal policy as a determinant of financial development has been largely ignored in the existing literature. One exception to this is Hauner (2009) who presents empirical evidence on the unfavourable impact of large fiscal deficits on financial development working through public sector borrowing from the banking sector. Our paper is the first that provides a theoretical framework on the role of public debt on financial development that may underlie such empirical evidence.

[1] Financial depth is defined as supply of funds available to the government and the private sector.

[2] Costs of financing large fiscal deficits in domestic securities markets, especially in countries where the financial depth is low and the banking sector is the dominant player in shaping the debt structure have been recently highlighted by Hauner (2008, 2009) and Emran and Farazi (2009).

2 The Basic Model

We utilize a simple, two-period policy-making model with monetary and fiscal authorities and the banking sector.[3]

2.1 Policy makers' preferences

Consider a fiscal policy-maker whose preferences can be summarized by the following loss function:

$$L_t^G = \frac{1}{2}\sum_{t=1}^{T=2}\beta_G^{t-1}[\delta_1{\pi_t}^2 + (x_t - \overline{x}_t)^2 + \delta_2(g_t - \overline{g}_t)^2] \tag{1}$$

where L_t^G denotes the welfare losses incurred by the government, δ_1 and δ_2 represent, respectively, the government's relative dislikes for the deviations of inflation (π_t) and public spending as a share of output (g_t) from their target levels (0 and $\overline{g}_t$ respectively) relative to the deviations of output (x_t) from its target level ($\overline{x}_t$) and β_G is the government's discount factor.

Monetary policy is made by an independent central bank (CB) whose preferences can be described as:

$$L_t^{CB} = \frac{1}{2}\sum_{t=1}^{T=2}\beta_{CB}^{t-1}[\mu_1{\pi_t}^2 + (x_t - \overline{x}_t)^2] \tag{2}$$

where L_t^{CB} denotes the welfare losses incurred by the CB, μ_1 is the CB's inflation stability weight, β_{CB} is the CB's discount factor. In addition, the CB is more conservative than the elected government; $\mu_1 > \delta_1$ and it does not discount the future at as high rate as the elected government; $\beta_{CB} > \beta_G$. Since the CB does not have any target for public spending, no terms relating to g_t enter the CB's loss function.

[3] A similar model is used by Beetsma and Bovenberg (1999) and Ismihan and Ozkan (2004) among others, though, the framework used in these studies excludes the financial sector. Our set up is closer to that of Ozkan *et al.* (2010) which examines the implications of public sector borrowing from the banking sector. However, in their model the government is the only borrower and thus crowding out and financial development issues do not arise.

2.2 Output supply

Consider the following form of the production function: $Y_t = \widehat{A}_t N_t^{\gamma}$, where Y_t, N_t, and $\widehat{A}_t$ represent output, labor, and productivity, respectively, in period t and $0 < \gamma < 1$. The representative competitive firm's problem is to maximize profits $P_t(1-\tau_t)\widehat{A}_t N_t^{\gamma} - W_t N_t$, where P_t is the price level, W_t is the wage rate and τ_t is the tax rate on the total revenue of the firm in period t. The representative firm chooses labor to maximize profits by taking P_t, W_t and τ_t as given. The resulting output supply function, utilizing $w_t = p_t^e$, where superscripts e denote expectation, is $y_t = \alpha(\pi_t + \frac{1}{\gamma} a_t - \pi_t^e - \tau_t) + z$,where π_t^e is expected inflation and lower case letters represent logs.

We now turn to establishing the link between credit availability and real economic activity, as has long been recognized (see, for example, Levine, 1997). One channel through which the availability of credit affects the functioning of an economy is through its impact on productivity (see, for example, King and Levine, 1993). It therefore follows that the productivity parameter, defined above, can be modified as follows: $\widehat{a}_t = \widehat{a}_0 + \upsilon l_t^T$, where l_t^T is the level of total bank credits to the private sector as specified below, $\widehat{a}_0$ is a constant and positive parameter and $\upsilon > 0$. Substituting $\widehat{a}_t$ into the output supply function derived above, normalizing output by subtracting the constant term $z' = z + \alpha\widehat{a}_0/\gamma$ for simplicity yields the following normalized output supply function:

$$x_t = \alpha(\pi_t - \pi_t^e - \tau_t + \kappa l_t^T) \tag{3}$$

where x_t denotes normalized output and $\kappa = \frac{\upsilon}{\gamma}$.

2.3 *Demand for borrowing*

Demand for borrowing is determined as an outcome of fiscal and monetary policy decisions taken by the government and the independent *CB*, respectively. There are three sources of finance for public spending; tax revenues, money creation and public borrowing. More formally, the budget constraint facing the government at time t is given by:

$$(1 + r_{t-1})\, d_{t-1} + g_t - \tau_t - k\pi_t = d_t \tag{4}$$

where d_{t-1} denotes the amount of single-period debt issued (as a ratio of output) in period $t-1$ and to be re-paid in period t, r_{t-1} represents the rate at which it is borrowed, d_t is the new debt issue in period t and k is the real money holdings as share of output.

It is straightforward to derive the equilibrium outcome by utilizing backwards induction. Government and the independent *CB* play a Nash game in both periods to minimize their respective losses. Equilibrium values of inflation, output and public borrowing, for given levels of r and l^T, are listed in Table 1.

Table 1- Equilibrium Outcome in $t = 1$ and $t = 2$

$\pi_2 = \frac{\delta_2}{\mu_1}\widetilde{\lambda}\Phi[(\frac{1}{\alpha}\overline{x}_2 + \overline{g}_2) + (1 + r_1)(\overline{g}_1 + \frac{1}{\alpha}\overline{x}_1 + (1 + r_0)d_0 - \kappa l_1^T)]$
$x_2 = -\frac{\delta_2}{\alpha}\widetilde{\lambda}\Phi[\overline{g}_2 + (1 + r_1)(\overline{g}_1 + \frac{1}{\alpha}\overline{x}_1 + (1 + r_0)d_0 - \kappa l_1^T)] + (1 - \frac{\delta_2}{\alpha^2}\widetilde{\lambda}\Phi)\overline{x}_2$
$d_1 = \Phi[\overline{g}_1 + \frac{1}{\alpha}\overline{x}_1 + (1 + r_0)d_0 - \kappa l_1^T - F(\overline{g}_2 + \frac{1}{\alpha}\overline{x}_2)]$
$\pi_1 = \frac{\delta_2}{\mu_1}\widetilde{D}^*\Phi[\overline{g}_2 + \frac{1}{\alpha}\overline{x}_2 + (1 + r_1)(\overline{g}_1 + \frac{1}{\alpha}\overline{x}_1 + (1 + r_0)d_0 - \kappa l_1^T)]$
$x_1 = \frac{-\delta_2}{\alpha}[\widetilde{D}^*\Phi[\overline{g}_2 + \frac{1}{\alpha}\overline{x}_2 + (1 + r_1)(\overline{g}_1 + (1 + r_0)d_0 - \kappa l_1^T)]] + (1 - \frac{\delta_2}{\alpha^2}\Theta)\overline{x}_1$

Note: $\widetilde{\lambda} = \frac{1}{(1+\widetilde{\varphi})}, \widetilde{\varphi} = \frac{\delta_2}{\alpha^2} + \frac{k\delta_2}{\mu_1}, \widetilde{D} = (\frac{\delta_2}{\alpha^2} + \frac{\delta_2\delta_1}{\mu_1^2} + 1)\widetilde{\lambda}^2, \widetilde{D}^* = (1+r_1)\beta_{FA}\widetilde{D}$, $F = (1 + \widetilde{\varphi})\widetilde{D}^*, \Phi = \frac{1}{1+(1+r_1)F}, \Theta = \widetilde{D}^*\Phi(1 + r_1)$. Also, $(1 - \Theta) > 0$, $(1 - \frac{\delta_2}{\alpha^2}\Theta) > 0$ and $(1 - \frac{\delta_2}{\alpha^2}\widetilde{\lambda}\Phi) > 0$.

2.4 *Supply of loanable funds*

We now consider the determination of the supply of loanable funds available to the government and the private sector in this economy. Consider a financial sector that is composed of n banks. Banks compete with each other both in collecting deposits and in lending the collected funds. In the deposit market, the relationship between the deposit rate offered by bank i and the supply of deposits facing the bank is summarized by the following:

$$z_t^i = \frac{1}{n}(A + \eta r_t^{zi}) + \omega \sum_{j=1, j \neq i}^{n} (r_t^{zi} - r_t^{zj}) \tag{5}$$

where z_t^i is the deposit supply facing bank i, r_t^{zi} is the deposit rate offered by bank i, r_t^{zj} is the vector of deposit rates paid by all other banks and A, η and ω are positive parameters characterizing the structure of the deposit market. The parameter η measures the sensitivity of deposit supply with respect to the deposit rate. The parameter ω measures the competitiveness of the banking sector; the higher is ω, the more competitive is the banking sector in the deposit market.

The banking industry also competes for private sector borrowers. The demand function for loans facing bank i among the private sector borrowers is given by

$$l_t^i = \frac{1}{n}(A_l - \varepsilon r_t^{li}) - \psi \sum_{j=1, j\neq i}^{n} (r_t^{li} - r_t^{lj}) \tag{6}$$

where l_t^i denote the private sector demand for borrowing from bank i, r_t^{li} is the loan rate charged by bank i, r_t^{lj} is the vector of loan rates charged by all other banks and A_l, ε and ψ are positive parameters that relate to the structure of the credit market.

Bank i's profit function can be written as

$$V_t^{Bi} = r_t^{li} l_t^i + r_t b_t^i - r_t^{z_i} z_t^i - \frac{c}{2}\left(l_t^i + b_t^i - \phi z_t^i\right)^2 \tag{7}$$

where V_t^{Bi} is bank i's profit function at time t, b_t^i is the bank i's bond holdings of government securities, r_t is the rate of interest on these securities and c is the cost associated with illiquidity (see, Cukierman, 1991). These costs are assumed to increase at an increasing rate as illiquidity increases. The maximum that a bank can lend is then the difference between the amount of deposits that it collects and the amount that it needs to hold as required reserves, as captured by ϕ in equation (7).

Bank i chooses the deposit rate, $r_t^{z_i}$, the loan rate, r_t^{li}, and the demand for public sector bonds, b_t^i, to maximize its profits in (7).

Differentiating (7) w.r.to $r_t^{z_i}, r_t^{li}$ and b_t^i, re-arranging the relevant first order conditions and imposing $r_t^{zi} = r_t^{zj}$ and $r_t^{li} = r_t^{lj}$ yield the following equilibrium values for b_t^i, r_t^{li} and r_t^{zi} :

$$\begin{aligned} b_t^i &= \frac{(\eta + n_1)\phi}{n(n_1 + 2\eta)} A - \frac{(\varepsilon + n_2)}{n(n_2 + 2\varepsilon)} A_l + \\ &\quad [\frac{[(c\eta^2 + c\eta n_1)\phi^2 + nn_1 + 2n\eta]}{cn(n_1 + 2\eta)} + \frac{(\varepsilon + n_2)\varepsilon}{n(n_2 + 2\varepsilon)}] r_1 \end{aligned} \tag{8}$$

$$r_t^{li} = \frac{A_l}{(n_2 + 2\varepsilon)} + \frac{(\varepsilon + n_2)}{(n_2 + 2\varepsilon)} r_1 \tag{9}$$

$$r_t^{zi} = -\frac{A}{(n_1 + 2\eta)} + \frac{(n_1 + \eta)\phi}{(n_1 + 2\eta)} r_1 \tag{10}$$

where $n_1 = \omega(n-1)n$ and $n_2 = \psi(n-1)n$.

2.5 *Equilibrium in the bonds market*

It is now straightforward to determine the bond rate, r_t, by combining the banks' total demand for bonds, $b_t = nb_t^i$, with the government's demand for borrowing (supply of bonds), d_t. The bond rate adjusts till the demand for bonds is exactly matched by its supply thereby eliminating any excess demand for borrowing and thus any excess supply of bonds. More formally, in equilibrium

$$E_t^d(r_t) = d_t(r_t) - b_t(r_t) = 0 \tag{11}$$

where $E_t^d(r_t)$ denotes excess demand for borrowing expressed in terms of the bond rate; and $d_t(r_t)$ and $b_t(r_t)$, are, respectively, the demand for borrowing (supply of bonds) and the demand for bonds. It follows from above that $\partial r_t/\partial d_t > 0$ and $\partial r_t/\partial b_t < 0$.

3 Discussion

Let us now turn to the impact of public borrowing on the availability of credit to the private sector and the macroeconomic implications of this relationship. The framework developed above highlights the possibility of a financial crowding-out where government borrowing replaces private borrowing in the banking sector's loan portfolios. Given that bank credit to private sector is widely viewed as an important indicator of financial development, we can now establish the link between public debt and financial development.

Result 1. A rise in public sector borrowing from the banking sector reduces the scope of bank lending to the private sector and is therefore harmful for financial development. Moreover, the lower the financial depth, the greater the degree of public borrowing's crowding out of credit to the private sector.

Proof 1 By imposing $r_t^{li} = r_t^{lj} = r_t^l$ in (6) and utilizing $l_t^T = n\ l_t^i$ we can establish that the total bank credits to the private sector amounts to $l_t^T = A_l - \varepsilon r_t^l$. It therefore follows that a rise in d_t reduces the total bank credits to the private sector, l_t^T since both $\partial r_t^l / \partial r_t = \frac{\varepsilon + n_2}{n_2 + 2\varepsilon}$ and $\partial r_t / \partial d_t$ are unambiguously positive and $\partial l_t^T / \partial r_t^l = -\varepsilon$ is unambiguously negative; thus $\partial l_t^T / \partial d_t < 0$. Also, in economies with lower financial depth, a given rise in public borrowing is expected to bring about a greater rise in interest rates, that is both $\partial r_1 / \partial d_1$ and $\partial r_1^l / \partial d_1$ are greater in size. Hence, the fall in private sector lending will be greater in such economies.

An interesting question relates to the macroeconomic implications of the deterioration in financial development following a rise in public borrowing, as established under *Result* 1. The relationship between credit availability to the private sector and the macroeconomic performance is formalized by *Result* 2.

Result 2. A fall in credit availability to the private sector is associated with a worse economic outcome in terms of higher inflation and lower output both in current and future periods.

Proof 2. It is straightforward to show $\partial \pi_1 / \partial l_1^T = -\kappa(1 + r_1)\frac{\delta_2}{\mu_1}\widetilde{D}^* \Phi$ and $\partial \pi_2 / \partial l_1^T = -\kappa(1+r_1)\frac{\delta_2}{\mu_1}\widetilde{\lambda}\Phi$ are both unambiguously negative and $\partial x_1 / \partial l_1^T = \kappa(1 + r_1)\frac{\delta_2}{\alpha}\widetilde{D}^* \Phi$ and $\partial x_2 / \partial l_1^T = \kappa(1 + r_1)\frac{\delta_2}{\alpha}\widetilde{\lambda}\Phi$ are both unambiguously positive.

4 Concluding remarks

This paper has explored the role of public debt on financial development that has so far remained unexplored in the existing literature. We have shown that in countries where credit to government makes up a major share of total bank lending, public debt is likely to harm financial development, with unfavourable implications for economic activity. As such, our results establish a potential contractionary effect of fiscal expansions especially in countries with limited financial depth and financial development, likely to be the case in emerging markets and other developing countries.

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