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A Generic Model of Financial Repression

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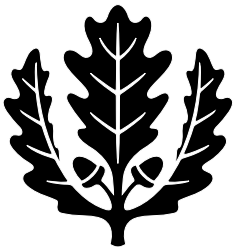

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A Generic Model of Financial Repression

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Abstract

The paper develops a growth model in an overlapping generations framework of a financially repressed small open economy, and analyzes the effects of financial liberalization. The following observations are made: An increase (decrease) of interest rate (reserve requirements) reduces (increases) the steady-state stock of capital and the trade balance, but improves (deteriorates) the level of foreign exchange reserves. However, financial liberalization, in any form, is always welfare-improving. The paper, thus, advocates financial liberalization policies to be oriented towards reduction of reserve requirements rather than interest rate deregulation, if foreign reserve holding is not in a critical position.

Journal of Economic Literature Classification: E22, E26, E44, E52

Keywords: Financial Repression; Capital Stock and Investment; Unocial Financial Markets.

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1 Introduction

This paper develops a standard neoclassical growth model in an overlapping generations framework of a small open financially repressed economy, and analyzes the effects of financial liberalization on the steady-state capital stock, trade balance, foreign reserves and welfare. Specifically, the study attempts to provide an all encompassing structure of a financially repressed economy characterized by curb markets, capital controls and crawling-pegged exchange rates, and in turn analyzes the effects of relaxing interest rate ceilings and lowering of multiple reserve requirements on capital accumulation. As an aside, we also study the effect of lower tax rate and increase in the rate of crawling on the steady-state capital stock. Once the path of the steady-state capital stock is chalked out, we can trace out the associated effects on the external balance, foreign exchange and utility of agents.

The term financial repression was originally coined by economists interested in less developed countries (LDCs). In their seminal but independent contributions, McKinnon (1973) and Shaw (1973) were the first to spell out the notion of financial repression, defining it as the set of government legal restrictions preventing the financial intermediaries in the economy from functioning at full capacity. Generally, financial repression consists of three elements. First, the banking system is forced to hold government bonds and money through the imposition of high reserve and liquidity ratio requirements. This allows the government to finance budget deficits at a low or zero cost. Second, given that government revenue cannot be extracted that easily from private securities, the development of private bond and equity markets is discouraged. Finally, the banking system is characterized by interest rate ceilings to prevent competition with public sector fund raising from the private sec-

tor and to encourage low-cost investment. Thus, the regulations generally includes interest rate ceilings, compulsory credit allocation, and high reserve requirements. The economies repressing the domestic financial sectors are typically also characterized by exchange rate controls and capital account restrictions, to the extent that all capital account transactions were prohibited.

Since the break-up of the colonial empires, many developing countries suffered from stagnant economic growth, high and persistent inflation, and external imbalances under a financially repressed regime. To cope with these difficulties economic experts had advocated what they called "financial liberalization" — mainly a high interest rate policy to accelerate capital accumulation, hence growth with lower rates of inflation (McKinnon (1973), Shaw (1973), Kapur (1976) and Matheison (1980)). Their argument that relaxation of the institutionally determined interest rate ceilings on bank deposit rates would lead to price stabilization and long-run growth through capital accumulation is based on the following chronology of events: (a) the higher deposit rates would cause the households to substitute away from unproductive assets (foreign currency, cash, land, commodity stocks, an so on) in favor of bank deposits; (b) this in turn would raise the availability of deposits into the banking system, and would enhance the the supply of bank credit to finance firms' capital requirements, and ; (c) this upsurge in investment would cause a strong supply side effect leading to higher output and lower inflation.

The above set of proposition, however, came into serious criticism from Van Wijnbergen (1982, 1983, 1985). He opposes the above argument by arguing that this line of thought has ignored the role of Unorganized Money Market (henceforth UMM). Van Wijnbergen

(1982, 1983, 1985) stressed that the UMM or popularly the "curb" markets are an integral component of the financial structure of the developing countries, and they provide more rather than less intermediation when compared to the banking system, simply because the "curb" markets are not subjected to interest rate and reserve requirement policies. Van Wijnbergen (1982, 1983, 1985) outlines the UMM as a "residual" market absorbing the excess demand for credit from the banking system and in turn clearing the entire market for credit. He argues that in a world with multiple savings options in the form of unproductive assets, interest bearing bank deposits, and UMM securities, interest rate deregulation can cause a reallocation in households portfolio in favor of bank deposits at the cost of the unproductive assets and the UMM securities. If this reallocation is mainly at the expense of "curb" market securities, then the total supply of credit would fall since since unlike the banking system subjected to reserve requirements, the UMM provides one to one intermediation. The credit-squeeze in the financial market would now push up the UMM rate and in turn create a cost-push effect on aggregate supply lowering capital accumulation, output and raising inflation.

Recently however, Nag and Mukhopadhay (1998), indicated that the claims of stagflation following financial liberalization as made by Van Wijnbergen (1982, 1983, 1985) is in fact highly sensitive to the choice of the exchange rate regime and nature of trade orientation of a LDC. They showed that stagflation is no longer the inevitable outcome once one allows for exchange rate flexibility in the current account and import substitution in the production structure. In fact, financial liberalization is observed to be successful in bringing down the inflation rate and improving the performance of the real sector.

Given such a backdrop, we present a compact analysis of financial liberalization, based on a whole set of disparate studies,[1] that tends to concentrates on one or some of the features characterizing a repressed economy. The major contribution of the study, lies in the policy front. We show that there are important trade-off issues associated with the process of liberalization. Moreover, it is shown that, the way the policy instruments are utilized to liberalize the financial system is of critical importance, and would depend on the policy makers ultimate objectives. The paper is organized in the following order: Besides the introduction and conclusion, Section 2 lays out the basic model. Sections 3 and 4 are devoted to defining the equilibrium and analyzing the effects of financial liberalization, in our case implying a higher nominal rate of interest on deposits and lower multiple reserve requirements, on steady-state per-capita capital stock, welfare, trade balance, and foreign exchange reserves.

2 The Economic Environment: Consumers, Banks, Firms, the Government and the External Sector

In this section, the overlapping generations model of Diamond (1965) is modified to depict a financially repressed structure. The economy is characterized by an infinite sequence of two period lived overlapping generations. Time is discrete and is indexed by $t = 1, 2,....$At each date t, there are two coexisting generations – young and old. N people are born at each time point $t \geq 1$. At $t = 1$, there exist N people in the economy, called the initial old, who

[1]For a detailed survey of the literature on financial repression, see Karapatakis (1992) and Gupta (2005).

live for only one period. Hereafter N is normalized to 1.

Each agent is endowed with one unit of working time when young and is retired when old. The agent supplies this one unit of labor inelastically and receives a competitively determined real wage of w_t. We assume that the agents consume only when old[2] and hence the net of tax wage earnings is allocated between bank deposits and loans in the curb market. The proceeds from the bank deposits and the curb market loans are used to obtain second period consumption. The consumption bundle comprises of a domestically produced good and an imported foreign good. We assume a separable additive log-utility function in the two goods. To allow for simultaneous holding of curb market loans and deposits in the consumer portfolio, given that the interest rate in the UMM is much higher compared to the controlled deposit rate, we assume the curb market loans to be subjected to transactions and information costs. This cost is assumed to be increasing and convex function of the amount of UMM loans. Formally, the agents problem born in period t is as follows:

$$U(c_{t+1}, c^*_{t+1}) = \sigma \log c_{t+1} + (1-\sigma) \log c^*_{t+1} \tag{1}$$

$$p_{t+1} d_{t+1} + p_{t+1} l^c_{t+1} \leq (1-\tau_t) p_t w_t \tag{2}$$

$$c_{t+1} + \left(\frac{e_{t+1} p^*_{t+1}}{p_{t+1}} \right) c^*_{t+1} \leq (1 + \bar{i}_{dt+1}) d_{t+1} + (1 + i^c_{t+1}) l^c_{t+1} - \frac{1}{2} (l^c_{t+1})^2 \tag{3}$$

where $U(\cdot)$ is the utility function, with the standard assumption of positive and diminishing marginal utilities in both goods; σ $(1-\sigma)$ is the weight the consumer assigns to the domestic (foreign) good in the utility function. The assumed additively separable log-utility function

[2]This assumption has no bearing on the results of our model. It makes computations easier and also seems to be a good approximation of the reality. For details see Hall (1988).

is a special case of the general function $U = [\sigma {c_{t+1}}^{1-\lambda} + (1-\sigma){c^*_{t+1}}^{1-\lambda}]^{\frac{1}{1-\lambda}}$, with λ=1. Note $\frac{1}{\lambda}$ is the elasticity of substitution between the domestic and the imported good. The choice of the utility function has no bearing on the results of the model we are interested in. Further, τ_t is the income tax-rate; d_{t+1} and l^c_{t+1} are the real deposits and curb market loans respectively, made in period t; c_{t+1} and c^*_{t+1} are the old age consumption of domestic and foreign good respectively; $\bar{i}_{dt+1}$ and i^c_{t+1} is the controlled nominal interest rate on bank deposits and the nominal interest rate prevailing in the UMM, with $i^c_{t+1} > \bar{i}_{dt+1}$; p_t (p^*_t), is the price of the domestic (foreign) consumption good at period t; e_{t+1} is the nominal exchange rate; and, $\frac{1}{2}(l^c_t)^2$, captures the information and transaction cost involved when making loans in the curb market. The quadratic form satisfies the assumptions of increasing and convexity of the cost in the amount of curb market loans.[3] Note utility maximization is equivalent to maximizing the old-age consumption utility function with respect to c_{t+1} and l^c_t.

The maximization problem of the consumer yields the following optimal choices:

$$l^c_{t+1} = i^c_{t+1} - \bar{i}_{dt+1} \tag{4}$$

$$d_{t+1} = (1-\tau_t)\frac{w_t}{1+\pi_{t+1}} - i^c_{t+1} + \bar{i}_{dt+1} \tag{5}$$

$$c_{t+1} = \sigma\left(\frac{(1+\bar{i}_{dt+1})}{1+\pi_{t+1}}(1-\tau_t)w_t + \frac{\left[(\bar{i}_{dt+1} - i^c_{t+1})^2\right]}{2}\right) \tag{6}$$

$$c^*_{t+1} = \left(\frac{1-\sigma}{\frac{e_{t+1}p^*_{t+1}}{p_{t+1}}}\right)\left(\frac{(1+\bar{i}_{dt+1})}{1+\pi_{t+1}}(1-\tau_t)w_t + \frac{\left[(\bar{i}_{dt+1} - i^c_{t+1})^2\right]}{2}\right) \tag{7}$$

The financial intermediaries, in this economy, behave competitively but are subjected

[3]Similar specifications of transaction and information costs are assumed in Bacchetta and Caminal (1992) and Haslag and Young (1998) in reference to foreign and non-bank financial intermediary deposits respectively.

controlled interest rates and multiple reserve requirements. The banks provide a simple pooling function, along the lines described in Bryant and Wallace (1980), by accumulating deposits of small savers and loaning it out to firms after meeting the cash reserve and government bond reserve requirements. For simplicity bank deposits are assumed to be one period contracts, guaranteeing a controlled nominal return of $\overline{i_{dt}}$ with a corresponding controlled nominal loan rate of $\bar{i}_{lt}$. Generally, in a repressed regime both the deposit and loan rates are set well below the market clearing level.

Note the rate of return on the government bonds is generally very low and hence the reserve requirement on them serves to generate a forced demand. For the sake of simplicity we will assume them to yield a zero rate of return.[4] Given such a structure, the real profit of the intermediary can be defined as follows:

$$\Pi_{Bt} = \bar{i}_{lt} l_t - \bar{i}_{dt} d_t \tag{8}$$

with

$$m_t + b_t + l_t \leq d_t \tag{9}$$

$$m_t \geq \gamma_{1t} d_t \tag{10}$$

$$b_t \geq \gamma_{2t} d_t \tag{11}$$

[4]This assumption allows us to avoid incorporating government bonds in the household portfolio and helps us to negate plausible multiplicity of optimal allocations of deposits and government bonds that would have cropped up, given that households would not hold government bonds unless they promised a return at least as large as the bank deposits. However, assuming that the government bonds yields a positive nominal rate of return but lower than the interest rate on deposits would have no bearing on our results and would merely change the profit function of the banks.

where Π_{Bt} is the profit of the bank in real terms at period t; l_t is the loans in real terms at period t. Equation (9) ensures the feasibility condition, and b_t and m_t, respectively, are banks holding of government bonds and fiat money in real terms. The banks are also subject to the multiple reserve requirements on cash and government bonds, given by (10) and (11).

The solution to the bank's profit maximization problem results from free entry, driving profits to zero and is given by

$$\bar{i}_{lt}(1 - \gamma_{1t} - \gamma_{2t}) - \bar{i}_{dt} = 0 \tag{12}$$

Simplifying, in equilibrium, the following condition must hold

$$\bar{i}_{lt} = \frac{\bar{i}_{dt}}{1 - \gamma_{1t} - \gamma_{2t}} \tag{13}$$

As is observed, from (13) the solution to the bank's problem yields a loan rate higher than the interest rate on the deposits, since reserve requirements tend to induce a wedge between borrowing and lending rates. Given the multiple reserve requirements and the controlled interest rate on deposits, the nominal interest rate on the loans is also controlled and determined from (13).

All firms are identical and produces a single final good using a standard constant returns to scale neoclassical production function, $F(k_t, n_t)$ where k_t and n_t denotes the capital and labor input respectively at time t. The production technology is assumed to take the Cobb-Douglas form:

$$Y = F(k, n) = Ak^{\alpha}n^{(1-\alpha)} \tag{14}$$

where A is a positive scalar, $0 < \alpha < 1$, is the elasticity of output with respect to capital. At time t the final good can either be consumed or stored. Capital is rendered useless after the production process is over. Firms operate in a competitive environment and maximize profit taking the wage rate, the rental rate on capital and the price of the consumption good as given. Given that both interest rates on deposits and loans are controlled and subject to a ceiling, there exists an excess demand for loans in the official loan market. However, the UMM serves as the "residual" market and absorbs the excess demand for loans from the banking system and in turn clears the entire market for credit. Hence, the interest cost in the unofficial market defines the true marginal cost (rental rate) of production for the firms, with the loan rate in the official market having no disciplinary effect on the behavior of the firms given the existence of credit rationing. Thus the producers convert available bank loans, l_t, and curb market loans, l_t^c, into fixed capital formation such that $p_t i_{kt} = p_t[l_t + l_t^c]$, where i_t denotes the investment in physical capital. Notice that the production transformation schedule is linear so that the same technology applies to both capital formation and the production of consumption goods and hence both investment and consumption goods sell for the same price p_t.

We follow Diamond and Yellin (1990) and Chen, Chiang and Wang (2000) in assuming that the goods producer is a residual claimer, i.e., the producer ingests the unsold consumption good in a way consistent with lifetime maximization of value the of firms. This ownership assumption avoids unnecessary Arrow-Debreu redistribution from firms to households and simultaneously maintains the general equilibrium nature.

The representative firm at any point of time t maximizes the discounted stream of profit

flows subject to the capital evolution and loan constraints. Formally, the problem of the firm can be outlined as follows

$$\max_{k_{t+1},n_t} \sum_{i=0}^{\infty} \rho^i [p_t A k_t^{\alpha} n_t^{(1-\alpha)} - p_t w_t n_t - p_{t+1}(1+i_{t+1}^c) l_{t+1}^c - p_{t+1}(1+\bar{i}_{lt}) l_{t+1}] \tag{15}$$

$$\begin{aligned} k_{t+1} &\leq (1-\delta_k)k_t + i_{kt} && (16)\\ p_t i_{kt} &\leq p_{t+1}[l_{t+1}^c + l_{t+1}] && (17)\\ l_{t+1} &\leq (1-\gamma_{1t+1}-\gamma_{2t+1})d_{t+1} && (18) \end{aligned}$$

where ρ is the firm owners discount factor, and $\delta_k = 1$, is the rate of capital depreciation. The firm solves the above problem to determine the demand for labor and investment in period t, or the gross amount of capital to be carried over to period $t+1$. Note given regulated interest rates in the official loan market and hence credit rationing, the firms obtains a fixed amount of loans supplied inelastically by the banks. The term $p_{t+1}(1+\bar{i}_{lt+1})l_{t+1}$ captures the fixed cost of the firm. The residual capital needs of the firm is satisfied by the loans obtained from the curb market and hence the interest rate in the UMM enters as the relevant variable in the loan demand function.

The firm's problem can be written in the following recursive formulation:

$$\begin{aligned} V(k_t) &= \max_{n,k'} p_t A k_t^{\alpha} n_t^{(1-\alpha)} - p_t w_t n_t - (1+i_{t+1}^c)(p_t k_{t+1} - p_{t+1} l_{t+1}) \\ &\quad -p_{t+1}(1+\bar{i}_{lt+1}) l_{t+1} + \rho V(k_{t+1}) \end{aligned} \tag{19}$$

The upshot of the above dynamic programming problem are the following first order conditions.

$$k_{t+1} \quad : \quad (1 + i^c_{t+1})p_t = \rho V'(k_{t+1}) \tag{20}$$

$$(n_t) \quad : \quad (1-\alpha)A\left(\frac{k_t}{n_t}\right)^{\alpha} = w_t \tag{21}$$

And the following envelope condition.

$$V'(k_t) = p_t \alpha A \left(\frac{n_t}{k_t}\right)^{(1-\alpha)} \tag{22}$$

Optimization, leads to the following efficiency condition, besides (16), for the production firm.

$$(1 + i^c_{t+1}) = \rho(1 + \pi_{t+1}) \left[\alpha A \left(\frac{n_{t+1}}{k_{t+1}}\right)^{(1-\alpha)}\right] \tag{23}$$

Equation (23) provides the condition for the optimal investment decision of the firm. The firm compares the cost of increasing investment in the current period with the future stream of benefit generated from the extra capital invested in the current period. Equation (21) simply states that the firm hires labor up to the point where the marginal product of labor equates the real wage.

Next, we describe the activities of an infinitely-lived government. The government purchases g_t units of the consumption good and is assumed to costlessly transform these one-for-one into what are called government good. The government good is assumed to be useless

to the agents. The government finances these purchases by income taxation, issuing government bonds, printing of fiat money, and through the depletion of foreign reserves. Let $e_t B_{t+1}$ denote stock of foreign exchange reserves at the beginning of period $t+1$, and i_t^* is the parametrically given nominal world interest rate for the small open economy. Formally, the government's budget constraint at date t can be defined as follows:

$$p_t g_t = \tau_t p_t w_t + M_{t+1} - M_t + [B_{t+1} - B_t] - [e_t B_{t+1}^* - (1 + i_t^*)(e_t B_t^*)] \tag{24}$$

Finally, the balance of payments identity of this economy is given by

$$e_t B_{t+1}^* - e_t B_t^* = p_t x_t - e_t p_t^* c_t^* + i_t^* e_t B_t^* \tag{25}$$

The left hand-side of the last equation corresponds to the reserve accumulation by the monetary authority (the overall balance of payments), and the right-hand side is the current account, with x_t as exports in real terms. Because we assume the country is subjected to restrictions to private capital flows, the capital account is zero. Given that the net intertemporal trade in goods is matched by a secular change in the consolidated government's net foreign exchange reserves, the government in this model is synonymous with a "financial intermediary" for the private sector subjected to capital controls.

We will be assuming that the Purchasing Power Parity (PPP) condition, $P = eP^*$ holds true. Since p^* is parametrically given to the small-open economy, we set it to unity without any loss of generality. Hence implying that the domestic price level and the nominal exchange rates are synonymous for the model economy with the PPP condition satisfied, i.e., $p_t = e_t$.

In this model the exchange rate regime is assumed to be characterized by a crawling peg, as a special case of a fixed-exchange rate system.[5] With the PPP the rate of the crawling peg and hence the domestic rate of inflation becomes a policy variable in the model.

3 Equilibrium

A valid perfect-foresight, competitive equilibrium for this economy is a sequence of prices $\{p_t, e_t, \bar{i}_{dt}, \bar{i}_{lt}, i_t^c\}_{t=0}^{\infty}$, allocations $\{c_t, n_t, i_{kt}\}_{t=0}^{\infty}$, stocks of financial assets $\{m_t, d_t, B_t^*\}_{t=0}^{\infty}$, exogenous sequences of $\{p_t^*, r_t^*\}_{t=0}^{\infty}$, and policy variables $\{\tau_t, \bar{i}_{dt}, \bar{i}_{lt}, \tau_t, \gamma_{1t}, \gamma_{2t}, \pi_t, g_t, B_t\}_{t=0}^{\infty}$ such that:

- Taking $\bar{i}_{dt}$, $\bar{i}_{lt}$, i_t^c, w_t, τ_t and p_t, the consumer optimally chooses c_{t+1} and l_t^c, such that (1) is maximized subject to (2) and (3) holds;

- The stock of financial assets, m_t and d_t, solve the bank's date–t profit maximization problem, (8), subject to (9), (10) and (11) given prices and policy variables.

- The real allocations solve the firm's date–t profit maximization problem, (15), subject to (16), (17) and (18) given prices and policy variables.

- The goods, money, loanable funds, labor and the bond market equilibrium condition is satisfied for all $t \geq 0$.

- The equilibrium condition in the external sector: Equation (25) holds, along with the PPP condition being satisfied.

[5] Crawling peg exchange rate system are witnessed in many developing financially repressed small open economies. See Shi (2002) for further details.

- The government budget is balanced on a period-by-period basis.

- d_t, l_t^c, $\bar{i}_{dt}$, i_t^c, i_t^*, p_t and p_t^* must be positive at all dates with $(1+\bar{i}_{lt}) > 1$.

4 Financial Liberalization and the Steady-State Capital Stock

We will assume the government to follow time invariant policy rules, which means that the institutionally determined nominal interest rate on deposits and loans, $\bar{i}_{dt}$ and $\bar{i}_{lt}$ respectively, the cash reserve–ratio, γ_{1t}, the bond reserve–ratio, γ_{2t}, the rate of crawling peg, π_t, and the tax–rate, τ_t are constant over time. Using equations (4), (5), (21), and (23) evaluated at the steady-state, the loan, money and the labor market equilibrium conditions and realizing that $k_{t+1} = k_t = k^{ss}$, we obtain the following non-linear equation, which needs to be solved to derive the optimal value of k^{ss}.

$$(1+\pi)\left(\frac{\frac{k^{ss}}{1+\pi} - (\gamma_1+\gamma_2)[(1+\pi)A\alpha\rho k^{ss\alpha-1}] + (1+\bar{i}_d)(\gamma_1+\gamma_2)}{(1-\tau)(1-\gamma_1-\gamma_2)A(1-\alpha)}\right)^{\frac{1}{\alpha}} = k^{ss} \qquad (26)$$

To solve for the optimal steady-state value we plot the right hand and the left hand side of the above equation as a function of k^{ss}. The right-hand side of the equation would imply a straight line through the origin with a slope of 1, while it is easy to show that the left hand side of the equation is an upward sloping function with a slope greater than 1, given that $0<\alpha<1$, which intersects the 45 degree line from below. To see this clearly, we impart values to the production and policy parameters of our model. We set A =1.00,

α=0.40, ρ=0.98, μ=0.10, $\bar{i}_d$=0.10, τ=0.30, $\frac{g}{Y}$=0.20 and r^*=i^*=0.02. Since the real effect of reducing the reserve requirement on cash and bond would be identical we define, $\gamma_1+\gamma_2=\gamma$, and set γ=0.15. The parameters have been chosen to replicate average values, encountered widely across the business cycle and growth literature[6]. Moreover, the results obtained below are robust to choice of alternative parameter values. These values, however, ensures that $i_t^c > \bar{i}_l > \bar{i}_d$, holds in equilibrium.

The resulting equations are plotted in Figure 1 in the (k^{ss}, X) plane, where $X=(L, R)$. The right hand side of the equation is denoted by the R curve and the left hand side by the L curve. The steady-state value of the economy is obtained at point E. As measured from Figure 1, the steady-state value of the capital stock, k^{ss} is found to be 0.195, given the parameters.

[INSERT FIGURE 1]

Recall, financial liberalization would imply an increase in the nominal interest rate on deposit and lower reserve requirements. The effects of an increase in the interest rate on deposits on steady-state capital stock is studied in Figure 2. Note the higher deposit rates would also result in higher interest rate on bank loans. However, in this model, changes in the lending rate cannot affect the volume of outstanding loans. Moreover, following Van Wijnbergen (1983), Buffie (1984), Kohsaka (1984), and Karapatakis (1992), we assume that interest rates are not raised to the extent that the excess demand for credit in the official market is completely eliminated. Note an increase in $\bar{i}_d$ from 10 percent to 13 percent, causes the L curve to move upward and hence the new steady-state per-capita capital stock

[6]For example, see, Zimmermann (1998), Basu (2001) and Gupta (2005).

obtained from point E^1 is lower than that corresponding to E. Such an effect is intuitive since an increase in the deposit rate in the official market would cause the loan supply in the unofficial market to go down, as is evident from equation (3). However, the corresponding increase in deposits fail to increase the aggregate loan supply since the official market is still subjected to reserve requirements. The fall in the loan supply reduces the availability of investible funds and hence the capital stock and output at steady state. The model thus corroborates, the idea conveyed by Van Wijnbergen (1983, 1984), that the sole deregulation of the interest rate on deposits affects output adversely.

[INSERT FIGURE 2]

Next, we study the effects of lowering the reserve requirements[7] on the steady state capital stock. Intuitively, one would believe that lowering the multiple reserve requirements would increase the availability of loans from the official market and hence increase the steady-state level of capital stock. We reduce reserve requirements to 10 percent, given an initial value of 15 percent. The results support our intuition. As is seen from Figure 3, starting from an initial equilibrium at E, the reduction of the reserve requirement shifts the L-curve downwards to L^1 causing the steady-state capital stock to increase, corresponding to the new equilibrium at E^1.

[INSERT FIGURE 3]

[7]Note in this model the dual reason for which the reserve requirements exists are to generate the seigniorage base and forced demand for government bonds. However, it must be realized that in a stochastic world reserve requirements may be imposed to prevent bank-runs. Countries with higher probabilities of banking-crisis might resort to imposition of higher reserve requirements to finance not only the bailout costs but also to prevent indiscriminate lending by banks. See Gupta (2005) for a detailed analysis along this line of thought.

4.1 Effects of Inflation and Tax-Rate on Steady-State Capital Stock

We start off by analyzing the effect of increases in the domestic rate of inflation or the rate of the crawling peg on the steady-state per-capita capital stock. As can be seen from Figure 4, the increase in the domestic rate of inflation from 10 percent to 13 percent enhances the equilibrium steady-state stock of per-capita capital stock. Starting from an initial equilibrium at E, the increase in the rate of crawling, shifts the L-curve rightwards to L^1 causing the per-capita capital stock to rise at the new steady-state E^1. Intuitively, an increase in the domestic inflation rate would raise the nominal rates of interest in the curb market, given the initial stock of capital, which in turn would increase the supply of loans in the curb market, but decrease the supply of deposits. But given that the official market is subjected to reserve requirements the fall in the supply of loans in the formal market would be outweighed by the increase in loans in the curb market causing the aggregate supply of loans to increase. The aggregate increase in the supply of loan enhances the accumulation of per-capita capital stock in the new equilibrium. The model thus, predicts a Tobin-type effect.

[INSERT FIGURE 4]

Finally, we study the effect of a lower tax rate on the steady-state stock of capital. As can be seen from Figure 5, a lower tax rate of 27 percent from the initial level of 30 percent, will shift the L curve rightwards to L^1. Thus starting from an initial equilibrium of E, the economy moves to E^1, corresponding to a higher steady-state capital stock. Intuitively, a lower tax-rate would increase the supply of deposit, and hence the loan-supply, given the reserve requirement. The resulting higher investment leads to a higher level of steady-state capital stock in the new equilibrium.

[INSERT FIGURE 5]

To quantify the effects of policy changes and to understand the impact of combination of policies on the steady-state capital stock, we apply the implicit function theorem on equation (26) to obtain the partial derivatives of k^{ss} with respect to $\bar{i}_d$, γ, μ and τ. The obtained absolute values for the partial derivatives, given the parameter specifications, are 0.1368, 0.1366, 0.1492 and 0.2212 respectively. The values imply that an increase in the controlled deposit rate, coupled with a reduction in the reserve requirements by equal percentage would cause the steady-state capital stock to fall marginally. Clearly, the effect of a change in the tax rate has the strongest impact on the steady-state stock of capital. Note the positive impact of the higher inflation rate on the steady-state stock of capital tends to suggest that we have the Tobin-effect to be operative here.[8]

4.2 Financial Liberalization and Movements in Welfare, Foreign Exchange Reserves and Trade Balance

Using the fact that k^{ss}=0.195, and the parameters outlined above, the corresponding steady-state values for the output (Y^{ss}) and the foreign exchange reserves are found to be 0.520 and 0.207, respectively. Note to obtain these values we use equation (14) (the production function), equation (24) (the government budget constraint) and equations (5) and (21), evaluated at the steady-state along with the fact that $\frac{g}{Y}$=0.20, implying that g=0.104.

[8]See Tobin (1965) for further details.

Specifically, the foreign reserves at steady-state, $b^{*ss}=\frac{B^{*ss}}{p^*}$, is given by the following equation:

$$b^{*ss} = \frac{g - \tau w - \gamma \pi d}{r^*} \tag{27}$$

To quantify the effects of policy changes and to understand the impact of combination of policies on the steady-state foreign exchange reserves (b^{*ss}), we derive the derivatives of equation (27) with respect to $\bar{i}_d$, γ, μ and τ. The obtained values for the partial derivatives, given the parameter specifications, are 0.3872, 0.3889, -0.8277 and -5.0438 respectively. The values imply that an increase in the controlled deposit rate and lower tax rate would improve the size of the steady-state foreign exchange reserve. However, a reduction in the reserve requirements and an increase in the rate of crawling would deteriorate the same. The impact of the tax rate on the foreign exchange reserves is clearly the dominant one.

Note, we can also obtain the change in the trade balance (TB^{ss}), from equation (25), following changes in the policy parameters. Using the values for the change in b^{*ss} due to changes in $\bar{i}_d$, γ, μ and τ, the corresponding values for the change in steady-state trade balance are -19.36, -19.45, 41.39 and 252.19 respectively. The values indicate that interest rate deregulation and lower tax rate will worsen the trade balance, while lower reserve requirements and increases in the rate of crawling will improve it.

Finally, using equation (1) and the fact that $c^* = \left(\frac{1-\sigma}{\sigma}\right) c$, we have the steady-state value of the utility of agents to be given by the following equation:

$$U(c^{ss}, c^{*ss}) = \log c + (1-\sigma)\log(\frac{1-\sigma}{\sigma}) \tag{28}$$

As is evident from equation (28), the movement in the utility, following changes in $\bar{i}_d$, γ, μ, and τ will be perfectly mirrored by the changes in the steady-state level of domestic consumption corresponding to the changes in the same set of policy variables. Using equations (6), (21) and (23), and given the parameter values, it can be showed that the values of the partial derivatives of the welfare of agents with respect to the nominal interest rate on deposits, reserve requirements and the rate of crawling are 0.5077, -0.1688, -0.4821 and -1.6939. So financial liberalization, either because of interest rate deregulation or lower reserve requirements, and lower tax rates positively affects welfare, while higher rate of inflation reduces it.

It must be pointed out at this juncture that, just like the movements in the steady-state capital stock following changes in $\bar{i}_d$, γ, μ and τ are robust to alternative parameter values, so are the movements in the foreign exchange reserves, trade balance and the welfare of agents, corresponding to the changes in the the policy parameters.

We can summarize the impact of changes in $\bar{i}_d$, γ, μ and τ on $k^{ss}(Y^{ss})$, b^{*ss}, TB^{ss} and $U(c^{ss}, c^{*ss})$, through Table 1.

[INSERT TABLE 1 HERE]

In Table 1, a '$+$' or a '$-$', within the brackets indicate the direction in which the particular endogenous variable moves corresponding to a change in the policy parameter concerned. While the numbers '1', '2', '3' or '4' in the brackets, following the sign, ranks the strength of the corresponding effect on that particular endogenous variable. Note '1' stands for the strongest effect while '4' corresponds to the weakest one.

5 Conclusion

In the words of Roubini and Sala-i-Martin (1992):

> "Before the 1970's many economists favored policies of financial repression on several grounds. First, it was argued that the government needed to impose anti-usury laws thereby intervening in the free determination of interest rates. Second, strict control and regulation of the banking system was said to give the monetary authorities a better control over the money supply. Third, it was thought that governments knew better than markets and private banks that optimal allocation of savings was or what kinds of investments were more or less desirable from the social perspective. Fourth, financial repression was identified with interest rates below markets rates, which reduced the cost of servicing debts."

But since the break-up of the colonial empires, many developing countries were observed to suffer from stagnant economic growth, high and persistent inflation, and external imbalances under the financially repressed regime. To cope with these difficulties economic experts had advocated what they called "financial liberalization" — mainly a high interest rate policy to accelerate capital accumulation, hence growth with lower rates of inflation. The current paper develops a standard neoclassical growth model in an overlapping generations framework of a financially repressed small open economy, and analyzes the effects of financial liberalization on steady-state capital stock. The repression is assumed to be severe enough to generate an unofficial money market.

In such a world, we study the effects of interest rate deregulation, reserve requirements reduction and increase in the rate of inflation on the steady state capital stock. We make the following observations: (i) deregulation of interest rate on deposit reduces the steady-state stock of capital and the trade balance, but improves the level of foreign exchange reserves and welfare ; (ii) reduction in the multiple reserve requirements increases the steady-state capital stock, trade balance and welfare, but reduces foreign exchange reserves; (iii) increase in the rate of crawling has a positive impact on the steady-state stock of capital and trade balance and a negative impact on foreign exchange reserves and welfare, and finally; (iv) a lower tax rate is accompanied with higher capital accumulation, welfare and foreign reserves but, the policy worsens the trade balance.

The most interesting aspect of the paper is the trade-offs the policy maker faces when deciding how to go about liberalizing the financial sector . Evidently, the way the government decides to change the nominal interest rate on deposit and the reserve requirements will hinge critically on the objective(s). Note interest rate deregulation and lower reserve requirements, both enhances the welfare, but the former policy reduces output. On the other hand, with respect to the external sector, the policies have opposite effects. While lower reserve requirements improves trade balance but deteriorates the reserves of foreign exchange, interest rate deregulation deteriorates the trade balance but improves the reserve holdings. So clearly, the policy makers cannot improve simultaneously, the output level, trade balance, reserve situation and welfare, by pursuing a specific kind of financial liberalization policy. Moreover, given the ranking of the strength of the policies, it is also impossible to adapt a combination of interest rate deregulation and lower reserve requirement that would improve

the output level, trade balance, foreign reserves and welfare at the same time. The analysis yields similar ambiguity with respect to tax rate and the rate of crawling. However, lower reserve requirements and lower tax rate seems to be an ideal choice if the trade balance situation is not a concern. If, the foreign reserve holdings of the economy is not in a weak state, the paper advocates a financial liberalization policy to be oriented towards reduction of reserve requirements rather than interest rate deregulation, given the existence of a "competitive" curb market clearing the credit market.

Given that, in such a set-up capital mobility can have important policy implications, an immediate extension of the current paper would be to incorporate capital account transactions. Moreover, it would be interesting to endogenize the growth process and, in turn, analyze the effects of financial liberalization on growth and inflation in the presence of curb markets. An alternative extension of the existing open economy model, would be to allow for currency substitution and capital or intermediate goods import.

References

[1] Bacchetta, P. and Caminal, R. (1992). Optimal Seigniorage and Financial Liberalization, Journal of International Money and Finance, 11, 518-538.

[2] Bhattacharya, J. and Haslag, J. H. (2001). On the Use of Inflation Tax When Nondistortionary Taxes Are Available, Review of Economic Dynamics, 4, 823-841.

[3] Chen. B.L. (2003). Tax Evasion in a Model of Endogenous Growth, Review of Economic Dynamics, 6, 381-403.

[4] Diamond, P. and Yellin, J. (1990). Inventories and Money Holdings in a Search Economy, Econometrica, 58, 929-950.

[5] Fung, M.K.Y., Ho, W.M. and Zhu, L. (1999). Effects of Government Policy Changes on the Private Sector Development of a Transitional Economy: A long-run Analysis, Journal of Economic Development, 24, 19-41.

[6] Gupta, R. (2005). Essays on Financial Repression, Ph.D. Dissertation, University of Connecticut.

[7] Hall, R.E. (1988). Intertemporal Substitution in Consumption, Journal of Political Economy, 96, 339-357.

[8] Haslag, J.E. and Young, E.R. (1998). Money Creation, Reserve Requirements, and Seigniorage, Review of Economic Dynamics, 1, 677-698.

[9] Kapur, B.K. (1976). Alternative Stabilization Policies For Less Developed Economies, Journal of Political Economy, 84, 777-795.

[10] Karapatakis, A.G. (1992). Financial Liberalization and Inflation in a Small Open Financially Repressed Economy: Theory, and Evidence from Cyprus, Dissertation, University of Connecticut.

[11] Mathieson, D.J. (1980). Financial Reform and Stabilization Policy in a Developing Economy, Journal of Development Economics, 7, 359-395.

[12] Mckinnon, R.I. (1973). Money and Capital in Economic Development. Washington, D.C.: The Brookings Institution.

[13] Nag, R.N. and Mukhopadhyay, M. (1998). Macro-Economic Effects of Stabilization under Financial Liberalization, Indian Economic Review, 33, 1-17.

[14] Shaw, E. S. (1973). Financial Deepening in Economic Development. New York: Oxford University Press.

[15] Shi, J. (2002). The Economic Effects of Inflation Tax Instruments in an Overlapping-Generations Economy with Production, Annals of Economics and Finance, 3, 433-451.

[16] Tobin, J. (1965). Money and Economic Growth, Econometrica, 33, 671-684.

[17] Van Wijnbergen, S. (1982). Stagflationary Effects of Monetary Stabilization Policies: A Quantitative Analysis of South Korea, Journal of Development Economics, 10, 133-169.

[18] Van Wijnbergen, S.(1983). Interest Rate Management in LDCs', Journal of Monetary Economics, 12, 433-452.

[19] Van Wijnbergen, S.(1985). Macro-economic Effects of Changes in Bank Interest Rates: Simulation Results for South Korea, Journal of Development Economics, 18, 541-554.

[20] Zimmermann, C. (1997). Technology Innovations and the Volatility of Output: An International Perspective, CREFE Working Paper, 34.

Table 1: Impact of Policy Changes

Variables	$\bar{i}_d$	γ	μ	τ
$k^{ss}(Y^{ss})$	(–, 3)	(–, 4)	(+, 2)	(–, 1)
b^{*ss}	(+, 4)	(+, 3)	(–, 2)	(–, 1)
TB^{ss}	(–, 4)	(–, 3)	(+, 2)	(+, 1)
$U(c^{ss}, c^{*ss})$	(+, 2)	(–, 4)	(–, 3)	(–,1)
Note: See Section 4.				

Figure 1: Steady-state Capital Stock

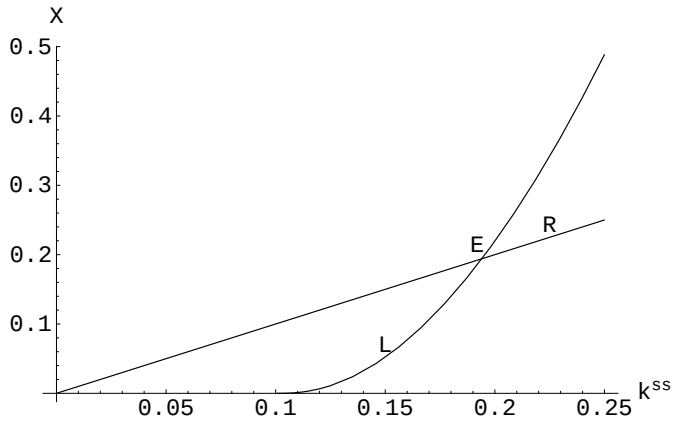

Figure 2: Interest Rate Deregulation and Steady-state Capital Stock

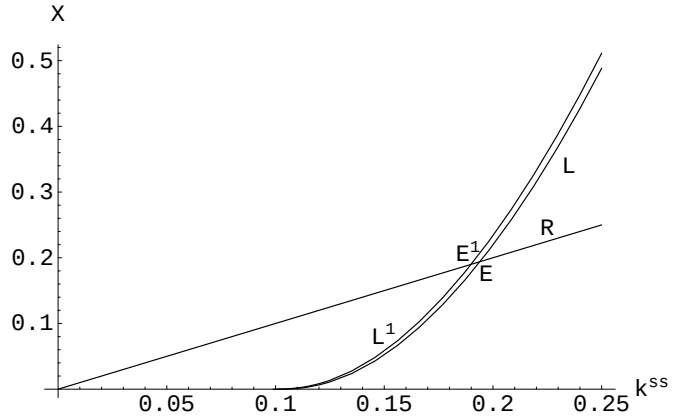

Figure 3: Reduction in Reserve Requirements and Steady-state Capital Stock

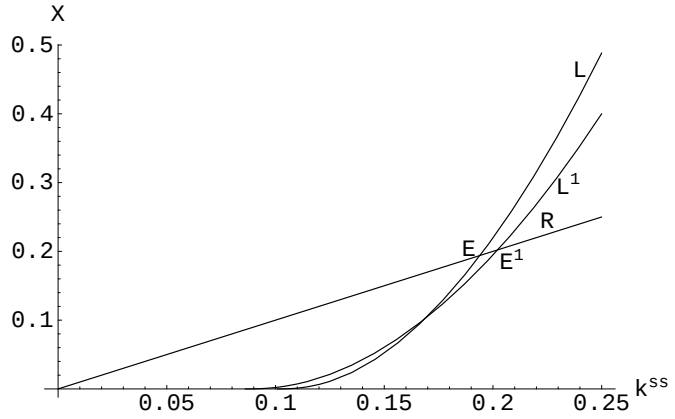

Figure 4: Increase in the Rate of Crawling Peg and Steady-state Capital Stock

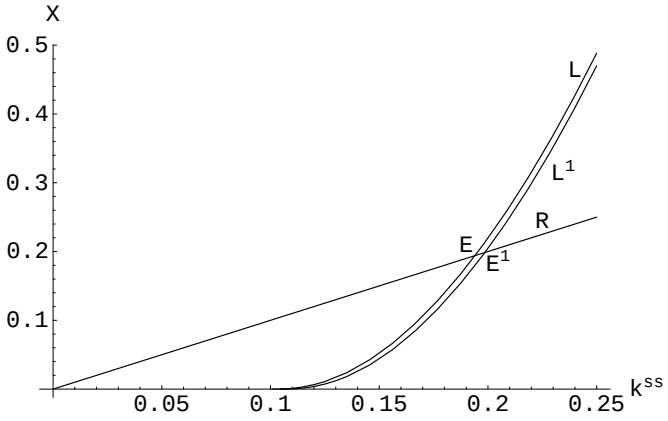

Figure 5: Reduction in the Tax Rate and Steady-state Capital Stock