Financial Repression and Financial Liberalization in a Small Open Economy: A Cash-in-Advance Approach

Hong-Bum Kim and Betty C. Daniel [1]

It is widely believed that fragile domestic banks, together with their huge intermediation of foreign capital, contributed to outbreak and propagation of the 1997 Asian economic crisis. Notably, the crisis countries were those that had recently replaced their old regime of financial repression with a new regime of financial liberalization. This paper reexamines financial repression and liberalization using a cash-in-advance model, which explicitly considers capital accumulation in a small open economy. We derive and discuss the steady state in each regime. Further, we demonstrate that an economy is structurally more vulnerable to a negative real shock when it is financially liberalized than when repressed. Policy implication of this finding is also discussed.

Keywords: Financial repression, Financial liberalization, Cash-in-advance, Small open economy

JEL Classification: D90, E44, N10

*Professor, Department of Economics, Gyeongsang National University, Seoul, 660-701, Korea, (Tel) +82-55-751-5747, (E-mail) hbkim@nongae.gsnu.ac.kr; Professor, Department of Economics, State University of New York at Albany, Albany, New York 12222, U.S.A., (Tel) +1-518-442-4747, (E-mail) bd892@cnsunix.albany.edu, respectively. An earlier version of this paper was written during the first author's visit at the SUNY Albany, USA, and was presented at a seminar of the Business and Economics Research Institute, Gyeonsang National University, Korea, and at the 1999 Annual Conferences of the Korea Money and Finance Association and the Korean National Economic Association. The first author thanks Dr. Hag-Soo Kim, the seminar participants, and the two anonymous referees of this Journal for their comments. He also gratefully acknowledges the financial support from the Yonam Research Foundation, Korea.

[**Seoul Journal of Economics** 2000, Vol. 13, No. 4]

I. Introduction

The 1997 economic crisis that hit several Asian countries, including Indonesia, Malaysia, South Korea, and Thailand, has generated heated controversy regarding the causes, the policy prescriptions, and the proper role of international rescue programs. Several distinct aspects of the crisis have been highlighted. Among them is the role of the domestic banking system. According to this view, fragile banks and their huge intermediation of foreign capital are seen to have contributed to outbreak and propagation of the crisis. Notably, the crisis countries had recently replaced their old regime of financial repression with a new regime of financial liberalization. Some would argue, based on this observation, that financial liberalization should be reversed.

Issues of financial repression and liberalization have been widely discussed in development economics since McKinnon (1973) and Shaw (1973). This paper is distinct from the existing literature in two important ways. First, we adopt a cash-in-advance approach. The technique can be particularly useful in modeling a macroeconomic crisis, in that it can highlight the role of banks in magnifying a shock. Edwards and Végh (1997) have recently presented a cash-in-advance model of macroeconomic disturbances. With focus only on the short run cycles, their model does not include capital accumulation. We, however, require capital accumulation to model the huge amount of capital inflows that continued for years in some Asian countries prior to the recent crisis. Capital accumulation can be most effectively modeled in a cash-in-advance model, since the approach explicitly considers firms that are liquidity-constrained. Second, government deficits that generate inflation for seigniorage revenue, are not modeled in the present paper. This is in contrast to most models of financial repression (*e.g.* Bencivenga and Smith 1992; and Roubini and Sala-i-Martin 1992) that are primarily based on the Latin American experiences of huge government deficits and high inflation rates. Government deficits were however fairly modest in the Asian countries in question, and thus the inflation rates were quite low there.[1] Financial repression was imposed in Asia as industrial policy to allocate financial

[1] See for example Radelet and Sachs (1998), Table 8, for government budget data in those Asian countries.

resources according to the government's blueprint of long-term economic growth, rather than part of financial policy to generate seigniorage revenue. In this context, we simply abstract from government deficit and consequent inflation.

The paper contributes to methodology. It shows one possible way of incorporating the process of capital accumulation and economic growth in a small open, cash-in-advance, economy which is placed initially under financial repression and later under financial liberalization. The steady state derived in each regime is intuitive and reasonable. Using the model, we further demonstrate that a financially liberalized economy is structurally more vulnerable to a real shock than a repressed economy.

The plan of this paper is as follows. In Section II, we set up a model of financial repression in a small open economy. We consider how economic agents—households, firms, and banks—optimize under financial repression. Section III discusses how domestic agents optimally change their behavior when financial liberalization is introduced. The two financial regimes are contrasted. In Section IV, we use a cash-in-advance model to show how financial liberalization renders a financially repressed economy structurally weaker to a negative output shock. Section V concludes with a discussion of the model's policy implication.

II. Financial Repression

A. The Model: Assumptions and Equations

The world consists of two countries - a small domestic country and a large foreign country (*i.e.* the rest of the world). Each country produces one and the same good, which can be either consumed or invested. The small country adopts a fixed exchange rate system. Financial repression is in the domestic country implemented in two forms—interest rate controls and capital controls.

First, the government imposes effective ceilings on the bank loan rate of interest with a view to encouraging investment. Ceilings are set below the equilibrium rate of interest.[2] Related to these interest rates controls, we assume that funds are allocated to firms only

[2]The equilibrium rate of interest equals the rate of time preference in the model, as should be the case with a standard cash-in-advance model.

through banks and that credit rationing prevails in the bank loans market. Firms do not issue stocks or curb debts and have no other methods of financing their demand for loans in the model.[3] In addition to imposing effective ceiling rates, the government intervenes in credit allocation as well such that households have no access to bank loans in financial repression. Consumption loans are deemed undesirable by the government. Second, outflows of foreign capital are completely forbidden through capital controls.[4] This reflects the government's intention to ensure that domestic financial resources be invested domestically. Further, we assume that no domestic agents other than banks are allowed to borrow from abroad.

As a result of financial repression, no foreign debt will ever be incurred by domestic banks. Domestic banks in financial repression would not intermediate foreign funds for domestic use, since foreign funds, being market-priced at the rate of time preference,[5] are more expensive than domestic funds under the ceiling rate of interest. With no capital inflows and outflows, the capital account balance always remains at zero.

Now, we present an infinite-period cash-in-advance model of financial repression, in which the government and the three representative agents, a firm, a bank, and a household, interact in the goods, asset, and labor markets. All markets are assumed to be competitive. In the model, goods are check goods. In order to purchase goods, households and firms must issue checks against

[3]Since stock markets are relatively underdeveloped in Asia, we abstract from them. As for curb markets, we have, for simplification, not incorporated financial dualism within the model. We have previously shown elsewhere (*i.e.* Daniel and Kim 1996) that financial dualism reduces the negative effects of financial repression. We would expect some of those same results to be present here, but we would not expect its addition to change the fundamental nature of the results. In general, mathematical modeling requires simplification such that only aspects of the economy essential to understanding the problem at hand are included.

[4]When finance is repressed in a domestic economy, mobilizing savings is likely to be important, so that restrictions on capital outflows, but not on capital inflows, will be used as a means to serving that purpose. For a most recent and extensive survey of the capital controls literature, see Dooley (1996).

[5]Following Edwards and Végh (1997), we assume that one and the same rate of time preference prevails all over the world. This assumption is necessary to avoid inessential dynamics.

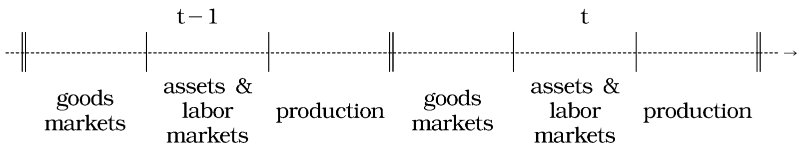

FIGURE 1
TRADING SEQUENCE

their bank deposit balances held in advance.

a) Trading Sequence

The trading sequence assumed in the model is given in Figure 1. Within each period, the goods market opens and closes at the beginning, asset and labor markets clear simultaneously in the middle, and production occurs at the end. Now we consider the behavior of the government and other domestic agents in turn.

b) The Government

The government initially creates the regulatory environment for domestic agents. It imposes an effective ceiling rate r on bank loans. The government sets the required reserve ratio at a certain level α $(0<\alpha<1)$, which is constant across periods. The government pegs the nominal exchange rate at a fixed level E, where E is defined to be the number of units of domestic currency per unit of foreign currency. We assume $E=1$ for simplicity. Both the domestic country and the foreign country produce one and the same good, and the purchasing power parity holds. In addition, there is no inflation abroad, with the foreign currency price of a unit of the good given at unity, *i.e.* $P^*=1$. Thus the following relation prevails:

$$P=P^* \cdot E=1,$$

where P denotes the domestic currency price of a unit of the good. Since $P=P^*=1$ holds in the model, all the variables are both nominal and real.

The government acts as the currency board. It holds international reserves in the form of foreign bonds (B_{gt}), against which the government supplies high-powered money (H_t) to domestic households:

$$B_{gt} = H_t. \tag{1}$$

Since households do not hold cash at all, the high-powered money ends up being bank reserves (H_{bt}) within the banking sector:

$$H_t = H_{bt}. \tag{2}$$

A foreign bond is a consol that pays each period δ units of foreign currency. Since the foreign rate of interest equals the rate of time preference δ, each foreign bond is worth unity, or one unit of good. The government earns interest income on its holdings of foreign bonds. At each period it distributes an interest income ($B_{gt} \cdot \delta$) as government transfer (τ_t) to households:

$$\tau_t = B_{gt} \cdot \delta. \tag{3}$$

Note that the subscript t is affixed to financial assets chosen in period $t-1$. It denotes that those assets are carried into period t.

c) Banks

Banks serve as financial intermediaries accepting deposits and making loans. They accept deposits (D_t) from households (D_{ht}) and from firms (D_{ft}) in asset markets. A part (α) of deposits are retained for currency reserves, and the rest are invested in loans to firms:

$$\begin{aligned} H_{bt} &= \alpha \cdot D_t = \alpha \cdot (D_{ht} + D_{ft}), \\ l_t^s &= (1-\alpha) \cdot D_t, \end{aligned} \tag{4}$$

where D_t denotes total deposits accepted by banks ($D_t \equiv D_{ht} + D_{ft}$), and l_t^s denotes the quantity of bank loans supplied to firms.

Banks operate competitively, earning zero profits at each period. In addition, they are assumed to have no excess reserves over that required by law. Thus, the following link holds between the repressed bank loan rate (r) and the bank deposit rate (q):

$$q = (1-\alpha)r, \tag{5}$$

where $q < r < \delta$ holds.

d) Households

The assets that compose the household's financial portfolio are two - bank deposits and equities. Currency, being dominated by bank deposits, finds no place in the household's asset portfolio. Equities are necessary in the model to deal with firm profits. We assume that equities, whose quantity is fixed, are evenly distributed across households. In that sense, there is no markets for equity, and equities are not traded at all. Equities cannot therefore be a source of financing for firms in the model.

The household faces the deposit-in-advance constraint for goods purchased:

$$D_{ht}(1+q) \geq c_t, \tag{6}$$

where c_t is the quantity of goods purchased and consumed by the household in period t.[6]

The household's *nonequity* wealth at time period t, w_t, is given by the value of bank deposits carried into the period, together with current income, including interest on deposits, dividends on firm shares, and government transfer, and the value of today's time endowment of labor.[7] These assets and income can be used to purchase goods and leisure for current consumption and to choose bank deposits to carry into the next period, $t+1$. For simplification, the household supply of labor (L) is assumed to be inelastic. Nonequity wealth or the household's budget constraint during period t, can be expressed as

$$w_t \equiv D_{ht} \cdot (1+q) + F_t \cdot Z + W_t + \tau_t = c_t + D_{ht+1} + W_t \cdot (1-L)$$

$$\rightarrow \quad D_{ht} \cdot (1+q) + F_t \cdot Z + W_t \cdot L + \tau_t - c_t - D_{ht+1} = 0, \tag{7}$$

where F_t and Z denote the distributed shares of profit per firm and the fixed number of firm, respectively.

The domestic economy initially opens with financial repression at period 0. In the asset market in that period, the household chooses its consumption path that maximizes the present value of its

[6]Goods purchased for consumption are assumed to be perishable, not lasting beyond the current period.

[7]The time endowment of labor per period is normalized at unity.

life-time utility, subject to a budget constraint and a deposit-in-advance constraint for consumption.

e) Firms

The firm invests in its own physical capital[8] and hires labor at each period. In period $t-1$, it uses labor L and capital K_{t-1} to produce output y_t according to the Cobb-Douglas production function of the following form:

$$y_t = y(K_{t-1},\ L) = A(K_{t-1})^{\gamma} \cdot L^{1-\gamma} \qquad (0 < \gamma < 1), \tag{8}$$

where y_t denotes the domestic output that is produced at the end of period $t-1$ and for sale in period t, and A the fixed technology.[9]

We assume that the domestic economy opens initially with a very small amount of capital stock K_0,[10] at which the marginal product of capital far exceeds the rate of time preference. We also assume that capital does not depreciate and that there is no adjustment cost in the capital stock. The firm faces both the deposit-in-advance constraint and the financial constraint when it buys physical capital.[11] It uses bank loans to finance capital accumulation.

[8]Following Bencivenga and Smith (1992), we assume that the firm uses its own capital in production. The rental markets for capital do not exist in the model. In addition, we assume that goods purchased by the firm are costlessly and instantly transformed into nonperishable capital goods to be used for investment purposes.

[9]Roubini and Sala-i-Martin (1992) have specified A as a function of financial sophistication and have argued that such specification is supported by their cross-country regression results. However, their argument is controversial and is criticized by Arestis and Demetriades (1997). We abstract from this issue and assume instead that A is set at an exogenously level, regardless whether the domestic economy is financially repressed or liberalized.

[10]The assumption is necessary to start the economy given the production function specified in equation (8).

[11]The firm, by issuing checks and using bank loans that it has kept in the form of a bank deposit since the previous period's asset market, currently buys capital. This is as dictated by 'the deposit-in-advance constraint for capital.' New capital, currently bought, is to be used, together with old capital, at the end of the current period to produce output for sale in the next period. Note that the firm is supposed to repay its loans within the current period asset market before newly-purchased capital goods are used to produce output at the end of the current period. The structure of the model concerning purchase and use of the physical capital can thus be

The firm uses bank loans to finance labor as well. Regarding the financing of working capital, it faces the financial constraint that labor get paid in advance of the receipt of sales revenue.[12]

In the asset market at $t=0$, the firm chooses its investment path that maximizes the present value of profit flows over an infinite horizon, subject to the availability of bank loans, the deposit-in-advance constraint for capital, and the financial constraints for both capital and labor.

B. Optimization

a) Households

Formally, the household solves the following optimization problem:

$$\text{Maximize } PDU_0 = \sum_{t=0}^{\infty} \beta^t \cdot u(c_t), \tag{9}$$

subject to the deposit-in-advance constraint for consumption (equation (6)) and the household budget constraint (equation (7)). PDU_0 denotes the household's present discounted value of life-time utility as of period 0,[13] where β and δ is the discount factor and the time preference rate, respectively, such that $0 < \beta \equiv (1+\delta)^{-1} < 1$, and where $c_0 = 0$, $u' > 0$, and $u'' < 0$ hold. The controls are c_t and D_{ht+1}. Real wages, goods prices, interest rates, profit, and government regulation are exogenous to the household.

Let λ and μ be Lagrange multipliers on the budget constraint and on the deposit-in-advance constraint, respectively. The first-order conditions can be expressed as

construed as implying that firms make expenditures on capital input before they receive sales revenue. This is called 'the financial constraint for capital.' The notion, being based on significant production lags usually observed in most developing economies, also appears in the Bencivenga and Smith (1992)'s overlapping-generations models.

[12]The financial constraint for labor has been popularized since the new structuralist approach appeared in the early 1980s. See Buffie (1984), for example. The assumption is now usual in the literature of development economics.

[13]The intertemporal separability of utility is assumed for simplification. For justification, see Obstfeld and Rogoff (1995, p. 1744).

$$\beta^t \cdot [u'(c_t) - \lambda_t - \mu_t] = 0 \rightarrow u'(c_t) = \lambda_t + \mu_t$$

$$\beta^t \cdot [-\lambda_t] + \beta^{t+1} \cdot [\lambda_{t+1} + \mu_{t+1}](1+q) = 0 \rightarrow \lambda_t = \beta(1+q)[\lambda_{t+1} + \mu_{t+1}]$$

Using these first-order conditions, we have equation (10):

$$\mu_t = u'(c_t) - \beta(1+q) \cdot u'(c_{t+1}) = u'(c_t) \cdot [1 - \frac{u'(c_{t+1})}{u'(c_t)} \cdot \beta(1+q)]. \tag{10}$$

If μ_t were equal to 0, equation (10) would become identical to the standard Euler equation, $u'(c_{t+1})/u'(c_t) = 1/[\beta(1+q)]$. Consumption, if unconstrained, should jump up instantaneously with the introduction of financial repression in which $q < \delta$ holds, and then should continue to decrease afterwards. In our model, since the lending rate is low, the deposit rate is also low, and the household's Euler equation leads him to prefer current consumption over future consumption. However, the household consumption can never jump up in the first place, since, given rationing, the household cannot borrow to raise consumption to its desired level. Therefore, consumption is given by the non-invested current income.[14] Thus, $c_{t+1} \geq c_t$ holds, as the economy gets closer to the steady state. This is because the capital stock, being gradually accumulated over each period, will yield ever-increasing output so that $c_{t+1} < c_t$ may never occur. In equation (10), this implies that the liquidity component (μ) of marginal utility of deposits is positive[15] because both $\beta(1+q) < 1$ and $u'(c_{t+1})/u'(c_t) \leq 1$ for $c_{t+1} \geq c_t$. The deposit-in-advance constraint binds when the economy is not in steady state. It is also straightforward to show that $\mu^* = (\delta - q)(1+q)^{-1} \cdot \lambda^* > 0$ holds in steady state. An asterisk(*) denotes the steady state values of variables. Consequently, the deposit-in-advance constraint for consumption always binds as follows:

$$c_t = D_{ht} \cdot (1+q) \quad \text{and} \quad c^* = D_h^* \cdot (1+q). \tag{11}$$

[14] For derivation of the non-invested current income, see Section A in the Appendix.

[15] The value of μ_t reflects the extent to which the standard Euler equation fails.

b) Firms

Consider the firm's optimization problem at period 0. We assume that the firm is allowed to acquire more capital period by period beginning with period 0.[16] The firm maximizes the present discounted value of profit flows over infinite horizon, with the amount of bank loans demanded being constrained each period by bank loans available:

$$\text{Maximize } PDV_0 = \sum_{t=0}^{\infty} \{y(K_t, L) - (K_{t+1} - K_t) \cdot (1+q)^{-1} \cdot (1+r) - W_t \cdot L \cdot (1+r)\} \cdot (1+r)^{-(t+1)}, \quad (12)$$

subject to $l^d_{t+1} = l^s_{t+1}$ for $t \geq 0$, where l^d_{t+1} and l^s_{t+1} denote the amounts of bank loans demanded[17] by, and bank loans supplied to, the firm in period t, respectively.

Some remarks on solving this constrained optimization problem are in order. First, the firm's profit maximization and competitive labor markets together imply that wage costs, inclusive of interest, equal the labor's marginal product. That is, the following condition holds at each period:

$$MPL_t = W_t \cdot (1+r), \quad (13)$$

where W_t is the wage rate in period t. Here, the relevant rate of interest in determining the marginal productivity of an additional unit of labor is the ceiling loan rate.[18] This is because the firm gets bank loans to finance its current wage bill in the current period's asset market, whereas it is supposed to repay its loans

[16]This assumption is made to generalize the framework such that the supply constraint (*i.e.* constrained availability of funds) can be imposed on the firms at each period.

[17]Strictly speaking, l^d_{t+1} is not the amount of loans *demanded*. It is specified such that it should reflect the loan availability, the deposit-in-advance constraint for capital, and the financial constraints for capital and for labor. However, for convenience sake, we choose to call it the amount of loans *demanded*.

[18]Since equities are not a source of finance but simply a profit-distributing device in the model, the relevant discount rate to the firm should *not* be the weighted average of the cost of equities and the cost of bank loans, but the bank loan rate.

along with interest in the next period's asset market.

Second, the firm's investment $(K_{t+1}-K_t)$ to be made in period $t+1$, is constrained by the loan availability in period t. The firm has no other choice but to invest in capital goods whatever financial resources are left available under financial repression. Its investment path is not voluntarily chosen, but is imposed on it. Thus, K_{t+1} shows the maximum level of capital stock the firm is able to attain as of period $t+1$, and that should be below the desired level. Thus the following inequality should hold in the model:[19]

$$MPK_{t+1}>r(1+r)(1+q)^{-1}.$$

The preceding remarks essentially imply that the firm's constrained optimization problem effectively ends up being used, together with the competitive labor markets, to determine the wage rate only. Under financial repression financial resources are not available on demand, and the constraint of the bank loans availability predetermines the level of capital stock attainable at each period.

C. Steady State

It is simple to derive the steady state. In the Appendix, we have shown in detail how the values of the model's endogenous variables are determined in the steady state. We note here some of those results derived in the Appendix. Consider first the equation that defines K^*:

$$K^*=K_0+(1+q)(1+r)^{-1}\cdot\{(1-\alpha)(1+q-\delta\alpha)^{-1}-(1-\gamma)(1+r)^{-1}\}\cdot y(K^*,\ L). \quad (14)$$

We may infer from equation (14) that $K^*>K_0$ will hold in general.[20] The steady state capital stock K^* has the following implications.

[19]For an intuition for the right-hand side of the inequality, see the discussion regarding equation (24) which holds in a financially liberalized regime. Further, if there *were* no constraint on the availability of bank loans to the firm at each period, the following first-order condition should hold: $MPK_{t+1}=r(1+r)(1+q)^{-1}$.

[20]The reserve requirement α is usually less than 1/3 in Asia, and the capital share γ is safely taken to be 1/3 (or even higher, around 0.4, for most developing countries). $K^*>K_0$ is thus ensured. For reference regarding actual values of α across countries and estimated values of γ, see Brock (1989), Romer (1996), and Agénor and Montiel (1999).

Under financial repression, the marginal productivity of capital far exceeds the cost of funds. But the funds for financing the capital stock are not enough. The firm pays labor equilibrium wages,[21] repays old loans with interest, and with remaining loans it buys capital goods. Therefore, the firm can only adjust its capital stock gradually each period. As the capital accumulates, the marginal productivity of labor and thus wages also increase. The capital stock will finally reach a level at which all the bank loans available just meet the needs to finance the current wage bill and to repay old loans, with no other funds left for physical capital financing. That level of capital stock is K^*. Although y_{K^*} (or $MPK(K^*)$) the marginal productivity of capital at $K=K^*$, will still exceed the cost of capital,[22] further capital accumulation is not possible for lack of funds under financial repression. In addition, equation (14) yields the following result:

$$\frac{\partial K^*}{\partial r}=(1+q)y(K^*, L)(1+r)^{-2}\cdot\{2(1-\gamma)(1+r)^{-1}-(1-\alpha)(1+q-\delta\alpha)^{-1}\}>0, \quad (15)$$

where the inequality holds for reasonable ranges of r and γ.[23] Inequality (15) says that the higher the loan rate (r) is, the higher the steady state capital stock (K^*) will be. As the repressed loan rate of interest rises, equilibrium wages and wage bills fall. Given K^*, the amount of bank loans demanded by the firm falls. This enables firms to finance a higher level of capital stock in order to keep the amount of loans demanded equal to the unchanged amount of loans supplied. Thus, capital stock begins to rise. Increases in the capital stock raise l^{d*} by more than l^{s*} (shown in the Appendix), so that the economy finally settles to a steady state with a higher level of capital stock.

Second, the firm's steady state profit is derived in the Appendix as follows:

[21]We use equations (8) and (13) to get equilibrium wages in financial repression as follows: $W^*=(1-\gamma)(1+r)^{-1}\cdot A(K^*)^{\gamma}(L)^{-\gamma}$.

[22]The condition can be written either as $y_{K^*}>r(1+r)(1+q)^{-1}$ or as $y_{K^*}>q(1-\alpha+q)(1-\alpha)^{-2}(1+q)^{-1}$.

[23]For discussion of reasonable values of r, see footnote 29 in the paper.

$$F^* \cdot Z = \{y_{K^*} - r(1+r)(1+q)^{-1}\} \cdot K^* + r(1+r)(1+q)^{-1} \cdot K_0 > 0. \qquad (16)$$

When the economy is not in the steady state, part of profit is paid out to the household with the rest of it being retained within the firm for investment.[24] Once the economy reaches steady state, all the profits are distributed to the household. Intuitively, the steady state profit is generated based on the gap between the marginal productivity of capital and the cost of capital and on the initial capital stock which the firm had acquired freely.

Finally, the Appendix shows that the following condition should hold:

$$y^* - (r \cdot l^{d*} + W^* \cdot L) = F^* \cdot Z, \qquad (17)$$

where $l^{d*} = (K^* - K_0)(1+r)(1+q)^{-1} + (1-\gamma)(1+r)^{-1}y(K^*, L)$ holds, as shown in the Appendix.

This equation has following implications. First, the left hand side of the equality is income (output) minus expenditure, which is by definition profit. Thus, in the steady state, all profit is distributed. Second, apart from distributed profit, output is just enough to cover wage bills and interest costs of the firm's loans. Note that the firm repays loans (along with interest) that have been used to finance wage bill out of its current output. Note also that the firm pays interest on its loans that have been used to finance capital out of its current output. The firm refinances the capital stock permanently.

III. Financial Liberalization

A. Modifications

Suppose that at the opening of the period s, asset market financial liberalization replaces financial repression. We assume that the financially repressed economy has been in steady state when the government implements financial liberalization. We also assume that this policy change has not been anticipated at all. With

[24]For the derivation of distributed profits (*i.e.* dividends) and retained earnings at each period during the transition toward steady state, see Section *A* in the Appendix.

financial liberalization, most controls disappear immediately. No interest controls are in place any longer. Capital controls are lifted, and the outflow of foreign capital are permitted. In response to these changes in the economic environment, each optimizing agent behaves differently than before.

a) The Government

The government liberalizes the financial markets by removing ceilings on the bank loan rate of interest and by permitting capital outflow. Households are now allowed to have access to bank loans. However, even with financial liberalization, the government continues to allow only banks to borrow abroad in this economy. Other government regulations including the required reserve ratio[25] and the fixed exchange rate, still remain effective as before.

b) Banks

Banks continue to receive deposits from households (D_{ht}) and from firms (D_{ft}). Part of total deposits (α) are retained for currency reserves, and the rest ($1-\alpha$) are now invested as loans both to households (l^s_{ht}) and to firms (l^s_{ft}):

$$H_{bt}=H_t=\alpha\cdot D_t=\alpha\cdot(D_{ht}+D_{ft}),$$
$$l^s_t=l^s_{ht}+l^s_{ft}=[(1-\alpha)\cdot D_t+B^F_t]_h+[(1-\alpha)\cdot D_t+B^F_t]_f=[(1-\alpha)\cdot D_t+B^F_t],$$

where $D_t\equiv D_{ht}+D_{ft}$, $l^s_{ht}=[(1-\alpha)\cdot D_t+B^F_t]_h$, and $l^s_{ft}=[(1-\alpha)\cdot D_t+B^F_t]_f$, hold, and where B^F_t denotes foreign debt that domestic banks incur abroad. Banks issue internationally-traded bonds that have the same attributes as foreign bonds. An internationally-traded bond is denominated in foreign currency and is worth one unit of foreign currency. We can interpret $-B^F_t$ as foreign bonds held by domestic banks (*i.e.* $B_{bt}=-B^F_t$).

It is straightforward to show how interest rates are determined in equilibrium under financial liberalization. Banks pay interest on their liabilities (domestic deposits and foreign debt) and receive interest on their assets (loans to households and firms). Bank profits can be expressed as $[D_t\cdot\{(1-\alpha)i^1-i^d\}+B^F_t\cdot(i^1-\delta)]$. First,

[25]Policy measures of financial liberalization may include decreased reserve requirements. Incorporating a decrease in reserve requirements within the present setup of a financially liberalized regime, would not however affect the fundamental results anyway.

suppose $(i^1-\delta)<0$ holds. In this case, banks will use up all their deposit funds available to invest in foreign bonds. Since the present model is so structured that firms and households will need to get loans from banks, this no-bank-loans case has no relevance at all to our context. Second, suppose $(i^1-\delta)>0$ holds. Banks will borrow abroad and lend domestically infinitely ($B_t^F \rightarrow \infty$), as long as $(i^1-\delta)>0$. Since banks operate competitively, their attempts to extend loans will drive i^1 down to equal δ in equilibrium. Then the zero-profit condition for banks ensures that $i^d=(1-\alpha)\delta$ should hold.

c) Households

The deposit-in-advance constraint for goods consumption is given as:

$$D_{ht}\cdot(1+\delta-\delta\alpha)\geq c_t. \tag{18}$$

When we allow for the changes introduced by financial liberalization, the household's nonequity wealth w_t and the resulting budget constraint for the household in period t, are respectively given as follows:

$$\begin{aligned} w_t &\equiv D_{ht}\cdot(1+i^d)+F_t\cdot Z+W_t+\tau_t-\{l_{ht}^d\cdot(1+i^1)-B_{ht}\cdot(1+\delta)\} \\ &=c_t+D_{ht+1}+W_t\cdot(1-L)-(l_{ht+1}^d-B_{ht+1}) \\ \rightarrow\ 0&=D_{ht}\cdot(1+i^d)+F_t\cdot Z+W_t\cdot L+\tau_t-(l_{ht}^d-B_{ht})\cdot(1+i^1) \\ &\quad -c_t-D_{ht+1}+(l_{ht+1}^d-B_{ht+1}), \end{aligned} \tag{19}$$

where B_{ht} is households' holdings of foreign bonds, and $(l_{ht+1}^d-B_{ht+1})$ is households' holdings of net borrowings. Note that B_{ht} cannot be negative. The household can only lend abroad, whereas it cannot borrow abroad directly but only through domestic banks.

d) Firms

Since the firm, being equipped with the capital stock K^*, has been in a steady state in which the marginal productivity of capital exceeds the cost of capital, it considers building up capital stock when financial liberalization replaces repression. Since banks raise foreign debt to finance whatever loans are demanded in the financially liberalized regime, the gap between the current level (K^*) of capital stock and the long-run equilibrium level (K^{**}) should be closed in a period. In the period s, asset market, the firm chooses its investment path that maximizes the present value of profit flows over infinite horizon, subject to the deposit-in-advance constraint for capital and the financial constraints for capital and for labor. Note that the firm is no longer constrained by the loan availability.

B. Optimization

a) Households

The household's optimization problem in period s is:

$$\text{Maximize} \quad PDU_s = \sum_{t=s}^{\infty} \beta^{t-s} \cdot u(c_t), \tag{20}$$

subject to equations (34) and (36). Note that $c_s = c^*$ holds. The controls are now c_t, D_{ht+1}, and $l^d_{ht+1} - B_{ht+1}$. The first-order conditions are derived as follows:

$$\beta^{t-s} \cdot [u'(c_t) - \lambda_t - \mu_t] = 0 \;\rightarrow\; u'(c_t) = \lambda_t + \mu_t,$$
$$\beta^{t-s} \cdot (-\lambda_t \pi) + \beta^{t+1-s} \cdot \{\lambda_{t+1} + \mu_{t+1}\} \cdot \pi(1+i^d) = 0 \;\rightarrow\; \lambda_t = \beta(1+i^d)\{\lambda_{t+1} + \mu_{t+1}\},$$
$$\beta^{t-s} \cdot \lambda_t - \beta^{t+1-s} \cdot \lambda_{t+1}(1+i^l) = 0 \;\rightarrow\; \lambda_t = \beta \cdot \lambda_{t+1}(1+i^l).$$

From these first-order conditions, it is easy to show that $u'(c_{t+1})/u'(c_t) = 1$ holds. This is in contrast to the condition $u'(c_{t+1})/u'(c_t) < 1$ in financial repression. The difference arises because agents in financial liberalization are free to borrow and lend, whereas agents in financial repression are not. Using the first-order conditions again, we get the following:

$$\mu_t = (i^l - i^d) \cdot (1+i^d)^{-1} \cdot \lambda_t > 0, \text{ and } \mu^{**} = \alpha\delta(1+\delta-\delta\alpha)^{-1} \cdot \lambda^{**} > 0, \tag{21}$$

where the values of variables in a financially liberalized steady state are denoted with a double asterisk(**). Note that $\mu_t > 0$ holds as long as reserve requirements as a distortion puts a wedge($\alpha\delta$) between the loan rate of interest and the deposit rate of interest. As a result, the deposit-in-advance constraint always binds as follows:

$$D_{ht} = c_t \cdot (1+\delta-\delta\alpha)^{-1}, \quad \text{and} \quad D_h^{**} = c^{**} \cdot (1+\delta-\delta\alpha)^{-1}. \tag{22}$$

b) Firms

We continue to assume that there are no adjustment costs[26] and that capital does not depreciate. The firm solves the following constrained optimization problem to derive its demand for capital:

$$\begin{aligned} \text{Maximize } PDV_s = & [\{y_{K^*} - r(1+r)(1+q)^{-1}\} \cdot K^* + r(1+r)(1+q)^{-1} \cdot K_0] \\ & + [y(K_s,\ L) - W_s \cdot (1+i^1) \cdot L - (K_{s+1} - K_s) \cdot (1+i^1) \cdot (1+i^d)^{-1}] \cdot (1+i^1)^{-1} \\ & + \sum_{t=s+1}^{\infty} [\{y(K_{s+1},\ L) - W_t \cdot (1+i^1) \cdot L\} \cdot (1+i^1)^{-(t+1-s)}] \end{aligned}$$

$$\text{subject to} \quad l^d_{ft} = l^s_{ft} \quad \text{for} \quad t \geq s+1, \tag{23}$$

where PDV_s denotes the present discounted value of profits over infinite horizon as of period s, and l^d_{ft} and l^s_{ft}, the amount of bank loans demanded[27] by, and bank loans supplied to, the firm in period t-1, respectively. In addition, $K_{s-1} = K_s = K^* > 0$, $i^1 = \delta$, and $i^d = \delta - \delta\alpha$, hold. Note that the old loan rate (r) applies when the firm repays its old loans in period s. As of period s, the control variable is K_{s+1}.

The first-order condition is:

$$MPK_{s+1} = MPK^{**} = i^1 \cdot (1+i^1) \cdot (1+i^d)^{-1} = \delta \cdot (1+\delta) \cdot (1+\delta-\delta\alpha)^{-1}. \tag{24}$$

Equation (24) characterizes the firm's demand for capital. Interpreting the equation is straightforward. Suppose that the firm gets bank loans in the current asset market, for investment purposes. The firm is supposed to deposit them for use in the next period's goods market in which it will buy capital. The firm is also supposed to pay back its current loans along with interest in the

[26]This assumption enables the capital stock to jump up to the long-run equilibrium level in period $s+1$, with steady state beginning in period $s+2$. However, if we relax this assumption, steady state will be attained later than that. In the transition toward steady state, capital stock will increase more slowly and the marginal product of capital will deviate from $\delta \cdot (1+\delta) \cdot (1+\delta-\delta\alpha)^{-1}$ for some time.

[27]The firm's demand for capital already reflects such structurally-imposed constraints in the model as the deposit-in-advance constraint for capital and the financial constraints for capital and for labor.

next period's asset market. As long as the loan rate of interest and the deposit rate are not equal to each other, the standard result, $MPK=i^1$, will never hold. Instead, MPK should be related to the deposit rate of interest i^d as well.

Note that, as with financial repression, profit maximization and competitive labor markets together imply that real wage costs, inclusive of the loan rate of interest, equal the marginal product of labor:

$$MPL_{s+1}=MPL^{**}=W^{**}\cdot(1+i^1)=W^{**}\cdot(1+\delta). \tag{25}$$

C. Steady State

Derivation of the steady state is in the Appendix. Some of the results derived are briefly considered here. First, the firm has optimal capital stock in steady state, $K_{s+1}=K^{**}$, which is computed using equations (8) and (24):

$$K^{**}=L\cdot[\delta(1+\delta)A^{-1}\gamma^{-1}(1+\delta-\delta\alpha)^{-1}]^{1/(\gamma-1)},\text{ given } L. \tag{26}$$

Second, the steady state profit is computed in the Appendix as follows:[28]

$$\begin{aligned}F^{**}\cdot Z=&[\{(1+\delta-\delta\alpha)^{-1}(1+\delta)\,\delta\}-\{\delta(1+r)(1+q)^{-1}\}]\cdot K^{*}\\&+[\delta(1+r)(1+q)^{-1}]\cdot K_0.\end{aligned} \tag{27}$$

This is easy to understand. For $(K^{**}-K^{*})$ of the whole capital stock K^{**}, the cost of capital equals the marginal product of capital at $K=K^{**}$ or $(1+\delta-\delta\alpha)^{-1}(1+\delta)\,\delta$, whereas for $(K^{*}-K_0)$ the cost of capital does not. This is because, when the firm permanently refinances the capital stock, the liberalized lending rate of interest δ applies to the old bank loans that *were* already made in financial repression. Note that K_0 is initially given free. Using equations (16) and (27), we get:

[28]For derivation of the distributed profits and retained earnings at each period during the transition toward the steady state, see Section *B* in the Appendix.

$$F^{**}\cdot Z - F^{*}\cdot Z = -(K^{*}-K_0)(\delta - r)(1+r)(1+q)^{-1}$$
$$-K^{*}\cdot[y_{K^{*}} - (1+\delta-\delta\alpha)^{-1}(1+\delta)\,\delta] < 0, \qquad (28)$$

where $y_{K^{**}} = (1+\delta-\delta\alpha)^{-1}(1+\delta)\,\delta < y_{K^{*}}$ holds for $K^{**} > K^{*}$. The difference between firm profits in each regime basically arises from the fact that the cost of capital falls short of the marginal product of capital under financial repression whereas the former equals the latter under financial liberalization.

Third, the steady state consumption c^{**} is derived in the Appendix as follows:

$$c^{**} = c^{*} + (1+\delta)^{-1}\cdot[(y^{**}-y^{*}) - \delta(K^{**}-K^{*})] > c^{*}. \qquad (29)$$

Here it is clear that $[(y^{**}-y^{*}) - \delta(K^{**}-K^{*})]$ should be positive. As the economy is financially liberalized, the firm would not undertake an investment of $(K^{**}-K^{*})$ if it knew that the cost of financing capital accumulation could not be covered. Turn to the discount factor. The trading sequence imposed by the model is such that as of period $s+1$ the firm, being now equipped with capital stock K^{**}, should produce output y^{**} for use in period $s+2$. This is the reason why the discount factor $(1+\delta)^{-1}$ appears in the second term.

Fourth, using equation (29) and the country budget constraints derived in the Appendix for the respective financial regimes, we have the following:

$$B^{**} - B^{*} = -(1+\delta)^{-1}\cdot[(y^{**}-y^{*}) + (K^{**}-K^{*})] < 0, \qquad (30)$$

where $B^{*} = B_g^{*}$, and $B^{**} = B_g^{**} + B_h^{**} - B^{F**}$. This makes sense because foreign debt is used to finance an increase in output and an increase in capital.

Finally, note that the following equation holds in the steady state (see the Appendix):

$$y^{**} - (\delta\cdot l_f^{d**} + W^{**}\cdot L) = F^{**}\cdot Z, \qquad (31)$$

where $l_f^{d**} = (K^{**}-K^{*})(1+\delta-\delta\alpha)^{-1}(1+\delta) + \pi W^{**}\cdot L + (K^{*}-K_0)(1+r)(1+q)^{-1}$. This equation has the same implications as what equation (17) has in the financially repressed regime. The left hand side of the equality is profit by definition. Thus, in steady state, all profit is distributed. Apart from distributed profit, output is just enough to cover the wage bill and the interest cost of the firm's loans. The firm's debt is rolled over permanently beginning in period $s+1$.[29] This is an optimal outcome in the sense that the permanent refinancing of capital contributes to the household consumption smoothing.

IV. Is the Financially Liberalized Economy More Vulnerable to a Real Shock?

Suppose that there occurs an unanticipated, one-time, negative productivity shock (*i.e.* a decline in the fixed technology A) to a financially repressed economy which has been in steady state. The shock will reduce firm profits, and there should be a level of technology (A') that reduces firm profits to zero. That critical level A' is important because firms have no other choice but to default when the shock makes technology fall below A'. We can also think of a similar concept A'' for a financially liberalized economy. Note that in the model A does not depend on the degree of financial sophistication. That is, A is constant regardless whether the economy is financially repressed or liberalized as long as there is no productivity shock. We will henceforth denote that constant value of A as A_0.

According to equation (17), $F^* \cdot Z$ falls to zero if output produced is of the amount $(r \cdot l^{d*} + W^* \cdot L)$. Using this fact and equation (8), we can find A'/A_0. Likewise, we can use equations (8), (24), (25), and (31), to find A''/A_0. Now, we compute the difference between the two ratios, $(A''/A_0 - A'/A_0)$, as follows:

[29]Without the permanent debt roll-over, it would not be generally possible for a small open economy, endowed initially with only a small amount of capital, to increase its capital to an optimal level. This is because the marginal productivity of capital is usually of the same order of magnitude as the interest rate. As capital stock increases, the debt outstanding increases. Output will however rise enough to sustain the increased interest burden of the debt. With an increase in the stock of capital, the marginal productivity of capital will fall and the economy will reach a steady state level of the capital stock.

$$\frac{A''}{A_0}-\frac{A'}{A_0}=(1+r)(1+q)^{-1}\left(\frac{K^*}{y^*}\right)\left(1-\frac{K_0}{K^*}\right)\left(\frac{\delta y^*}{y^{**}}-r\right)+\gamma\left(1-\frac{K^*}{K^{**}}\right). \quad (32)$$

We are interested in checking whether this is greater than zero. Plugging $\gamma=1/3$, $K_0=0$,[30] and $y^*/y^{**}=(K^*/K^{**})^{\gamma}$ into equation (32), we have the following equation:

$$\frac{A''}{A_0}-\frac{A'}{A_0}\approx G\left(\frac{y^*}{y^{**}}\right)=-\frac{1}{3}\cdot\left(\frac{y^*}{y^{**}}\right)^3+\delta(1+r)(1+q)^{-1}\left(\frac{K^*}{y^*}\cdot\frac{y^*}{y^{**}}\right)$$

$$+\frac{1}{3}-r(1+r)(1+q)^{-1}\left(\frac{K^*}{y^*}\right).$$

Note that $0<y^*/y^{**}<1$ holds. When $(y^*/y^{**})=[\delta(1+r)(1+q)^{-1}(K^*/y^*)]^{1/2}$, the function G reaches its maximum. It is straightforward to show that $0<[\delta(1+r)(1+q)^{-1}(K^*/y^*)]^{1/2}<1$ holds and that both $G(1)>0$ and $G(0)>0$ hold.[31] Hence $(A''/A_0-A'/A_0)>0$ holds. This implies that the critical level of technology that reduces firm profits to zero, is higher in financial liberalization than in repression. Therefore, a

[30]Recall that the assumption of $K_0>0$ is conceptually necessary to make the model work at the very beginning. In that context, we may think of K_0 in the model as being an infinitesimally small amount, *i.e.* $K_0=\varepsilon\rightarrow 0^+$. Now for our present purpose of determining the sign of $(A''/A_0-A'/A_0)$, we may safely set K_0 at zero.

[31]These three inequalities are found to hold, with no exception, for quite plausible and broad ranges of parameter values specified. In the exercise, we have assumed such ranges for q and (K^*/y^*) as $0.67r\leq q\leq 0.99r$ and $0.5\leq(K^*/y^*)\leq 2.5$. The former range is so specified based on a usual observation $\alpha<1/3$, while the latter based on the data reported in Tables A1 and A3 in Armstrong *et al.* (1991). As for the time preference rates and the repressed bank loan rates, use of these rates in the cash-in-advance model requires that they be converted to a higher frequency with a period corresponding to the time frame over which a cash-in-advance constraint would apply. Accordingly, we have first posited $0.01\leq r\leq 0.09$ and $0.02\leq\delta\leq 0.10$ for the respective annual rates. We have converted these rates to quarterly and monthly frequencies as well, by dividing them by 4 and 12, respectively. Using each pair of ranges for r and δ that are specified according to the three different frequencies, and imposing the condition $r<\delta$, we have found that the qualitative results reported in the form of inequalities in the text are perfectly robust. In doing this exercise, we have benefited from the discussion with Dr. Hag-Soo Kim.

given negative productivity shock which reduces technology to some level between A' and A'', should result in default under financial liberalization, whereas the same size shock should not under repression. This implies that the financially liberalized economy is structurally more vulnerable to the same negative size real shock than the repressed economy. Note that this finding does not depend on our assumption that the repressed bank loan rate of interest is lower than the liberalized rate.[32] Intuitively, the bank loan rate under financial repression is lower than the marginal product of capital, and thus firms would rarely default on bank loans, even in recession. However, under liberalization, when bank loan rates are closer to the marginal product of capital, firms are likely to default in times of recession.

V. Concluding Remarks

A general equilibrium cash-in-advance model of a small open economy operating under a fixed exchange rate has been developed. Fully specified steady state, respectively in the financially repressed regime and in the liberalized regime, is derived and discussed. The model clearly shows that financial liberalization promotes capital accumulation and economic growth.

We have been interested in the concern that many Asian government officials have over whether financial liberalization should be reversed in the light of the financial crises which followed it. Concerning this, our model, though a certainty model, suggests a structural problem which financial liberalization might cause, given the stochastic nature of the real world environment. In fact, the model implies that financial liberalization is probably an important factor contributing to the financial crises. We consider the implications of a negative output shock. Under financial repression, the lower output is still likely to be sufficient for firms to

[32] In the real world, compensating balances or financial dualism which we have not modeled in the paper, may prevail. If we incorporated such circumstances within our present cash-in-advance setup, the cost of capital under financial repression could be as high as that under liberalization. Even so, our finding remains valid as long as the stylized fact holds that in repressed economies the gap between the marginal product of capital and the cost of capital is larger than that in liberalized economies.

repay bank loans with interest. However, under financial liberalization, the interest rate is closer to the marginal product of capital, such that the same size negative productivity shock could imply default. Therefore, without changes to the structure of banking to provide the resources to deal with default, normal recession could result in a banking crisis under liberalization, but not under repression.

Our policy recommendation would not be to reverse the liberalization power. A reversal would probably end, and even reverse, the economic growth which accompanied the liberalization. Instead, our research suggests that banks must have sufficient equity to remain viable in the event of recessionary defaults. Governments should focus on helping the banking systems acquire the level of equity they would need to get through normal recessions without failure. Recession and the accompanying defaults in the absence of a sufficient equity cushion could have been responsible for the 1997 Asian economic crisis.

Appendix

A. Financial Repression

a) Country Budget Constraint

The flow budget constraints of the household, the firm, the bank and of the government, are as follows.

Household: $D_{ht+1}-D_{ht}=D_{ht}\cdot i^d-c_t+W_t\cdot L+F_t\cdot Z+\tau_t$

Firm: $\{K_t+D_{ft+1}-(1-\alpha)D_{t+1}\}-\{K_{t-1}+D_{ft}-(1-\alpha)D_t\}$
$=y(K_{t-1},\ L)-(1-\alpha)D_t\cdot i^1+D_{ft+1}\cdot i^d-F_t\cdot Z-W_t\cdot L$

Bank: $[\{(1-\alpha)D_{t+1}+\alpha D_{t+1}\}-D_{t+1}]-[\{(1-\alpha)D_t+\alpha D_t\}-D_t]$
$=(1-\alpha)D_t\cdot i^1-D_t\cdot i^d$

Government: $(B_{gt+1}-\alpha D_{t+1})-(B_{gt}-\alpha D_t)=B_{gt}\cdot\delta-\tau_t$

Aggregating these sectoral constraints gives the country budget constraint (*i.e.* the current account balance condition). If we use the definition $D_t\equiv D_{ht}+D_{ft}$ and the condition $i^d=q=(1-\alpha)r=(1-\alpha)i^1$, aggregation gives the following current account balance condition:

$$c_t=y(K_{t-1},\ L)+B_{gt}\cdot\delta-(B_{gt+1}-B_{gt})-(K_t-K_{t-1}).$$

In steady state, the condition becomes

$$c^* = y(K^*,\ L) + B_g^* \cdot \delta . \tag{A.1}$$

b) Bank Loans Demand and Supply

In the financially repressed regime, the firm faces at each period the financial constraint for labor (that is, for funding the new wage bill, $\pi W_t \cdot L$). The firm is also subject to both the deposit-in-advance constraint and the financial constraint for capital (that is, for funding the new capital stock, $\pi D_{ft} = (K_{t+1} - K_t) \cdot (1+q)^{-1}$). In addition, the firm repays its old bank loans and interest, $l_t^d \cdot (1+r)$. Consequently, the amount of bank loans demanded by the firm in period t, l_{t+1}^d, can be (tentatively) expressed as the sum of the three components mentioned above minus the output, $y(K_{t-1},\ L)$, that is produced for sale in period t:

$$l^{\tilde{d}}_{t+1} = W_t \cdot L + (K_{t+1} - K_t) \cdot (1+q)^{-1} + l_t^d \cdot (1+r) - y(K_{t-1},\ L). \tag{A.2}$$

The amount of loans demanded by the firm depends on how the firm distributes its profit. Since we have not considered the distributed profit yet, the expression for l_{t+1}^d should be tentative. This tentative nature is indicated by a tilde (*i.e.* $l^{\tilde{d}}_{t+1}$).

The reduced-form equation for the amount of bank loans demanded by the firm in period t, l_{t+1}^d, can be derived in the following way. Consider first l_1^d, the amount of bank loans demanded in the period 0 asset market. When the economy begins with financial repression in period 0, there is no output ready to be used for consumption or for investment in that period. There is no profit to be distributed. There are no old loans to be repaid, either. Based on the discussion regarding equation (A.2), l_1^d is then given as:

$$l_1^d = (K_1 - K_0) \cdot (1+q)^{-1} + W_0 \cdot L.$$

Based on equation (A.2), we suggest that l_2^d, the amount of bank loans demanded by the firm in period 1, will be as follows:

$$l^{\tilde{d}}_2 = (K_2 - K_1) \cdot (1+q)^{-1} + W_1 \cdot L + l_1^d \cdot (1+r) - y(K_0,\ L).$$

Since the firm produces according to Cobb-Douglas, $y(K_0, L)=y_{K_0}\cdot K_0+\pi W_0\cdot L(1+r)$ holds, where $y_{K_0}\equiv MPK$ when $K=K_0$. Using this fact and the above equation, we have:

$$
\begin{aligned}
l^{d\sim}_2 &= (K_2-K_1)\cdot(1+q)^{-1}+W_1\cdot L+\{(K_1-K_0)\cdot(1+q)^{-1}+W_0\cdot L\}\cdot(1+r) \\
&\quad -\{y_{K_0}\cdot K_0+W_0\cdot L(1+r)\} \\
&= K_2\cdot(1+q)^{-1}+K_1\cdot r(1+q)^{-1}-K_0\cdot\{(1+r)(1+q)^{-1}+y_{K_0}\}+W_1\cdot L.
\end{aligned}
$$

Assume that $y_{K_0}\cdot K_0$ is paid out as dividends to those who initially hold the capital endowment K_0. That is, $F_1\cdot Z$ (*i.e.* distributed profit)$=y_{K_0}\cdot K_0$. In the model, part of profit is distributed to the household with the rest of profit retained within the firm. We, therefore, need to distinguish between distributed profit and profit as a whole. Then l^d_2 becomes:

$$l^d_2=K_2\cdot(1+q)^{-1}+K_1\cdot r(1+q)^{-1}-K_0\cdot(1+r)(1+q)^{-1}+W_1\cdot L.$$

Following the same procedure and assuming that shareholders are paid marginal product of capital less interest costs, *i.e.* that $F_2\cdot Z=[\{y_{K_1}-r(1+r)(1+q)^{-1}\}\cdot K_1+r(1+r)(1+q)^{-1}\cdot K_0]$ holds, we get l^d_3 as follows:

$$l^d_3=K_3\cdot(1+q)^{-1}+K_2\cdot r(1+q)^{-1}-K_0\cdot(1+r)(1+q)^{-1}+W_2\cdot L.$$

To get the final expression for l^d_4, we repeat the same procedure and assume that $F_3\cdot Z=[\{y_{K_2}-r(1+r)(1+q)^{-1}\}\cdot K_2+r(1+r)(1+q)^{-1}\cdot K_0]$:

$$l^d_4=K_4\cdot(1+q)^{-1}+K_3\cdot r(1+q)^{-1}-K_0\cdot(1+r)(1+q)^{-1}+W_3\cdot L.$$

Generalizing, we have the following reduced-form equation for the firm's demand for bank loans in period t, l^d_{t+1}, as follows:

$$l^d_{t+1}=K_{t+1}\cdot(1+q)^{-1}+K_t\cdot r(1+q)^{-1}-K_0\cdot(1+r)(1+q)^{-1}+W_t\cdot L.$$

Since $K_{t+1}=K_t=K^*$ holds in the steady state, and since $W^*\cdot L=(1-\gamma)(1+r)^{-1}\cdot y(K^*, L)$, the firm's steady state demand for bank loans is given as:

$$
\begin{aligned}
l^{d*} &= (K^*-K_0)(1+r)(1+q)^{-1}+W^*\cdot L \\
&= (K^*-K_0)(1+r)(1+q)^{-1}+(1-\gamma)(1+r)^{-1}\cdot y(K^*, L). \qquad \text{(A.3)}
\end{aligned}
$$

Now we turn to the supply of bank loans available to the firm in period t, l^s_{t+1}:

$$l^s_{t+1}=(1-\alpha)D_t=(1-\alpha)\cdot(K_{t+1}-K_t+c_t)\cdot(1+q)^{-1} \text{ for } t\geq 0,$$

where c_t is the goods consumption in period t. In steady state, the supply of bank loans is as follows:

$$l^{s*}=(1-\alpha)(1+q)^{-1}c^*. \tag{A.4}$$

c) Capital stock

Using equations (1), (2), (3), (4), (11), and the fact that $D_f{}^*=0$ in steady state, we get:

$$B_g{}^*=\alpha\cdot D_h{}^*=\alpha\cdot(1+q)^{-1}c_t{}^*. \tag{A.5}$$

If we use equations (A.1) and (A.5), we have the following steady state relations:

$$c^*=(1+q)(1+q-\delta\alpha)^{-1}\cdot y^*,$$
$$B_g{}^*=\alpha(1+q-\delta\alpha)^{-1}\cdot y^*,$$
$$D_h{}^*=(1+q-\delta\alpha)^{-1}\cdot y^*,$$

where $y^*\equiv y(K^*,\ L)=A(K^*)^{\gamma}(L)^{1-\gamma}$. Using equations (A.1), (A.4), and (A.5), we have

$$l^{s*}=(1-\alpha)(1+q-\delta\alpha)^{-1}\cdot y^*. \tag{A.6}$$

Using equations (A.3) and (A.6), and imposing the bank loans equilibrium condition (*i.e.* $l^{d*}=l^{s*}=l^*$) on the bank loans market, we get the following equation which defines K^*:

$$K^*=K_0+(1+q)(1+r)^{-1}\cdot\{(1-\alpha)(1+q-\delta\alpha)^{-1}-(1-\gamma)(1+r)^{-1}\}\cdot y(K^*,\ L). \tag{A.7}$$

Again using equations (A.3) and (A.6), we can show that $\Delta l^{d*}>\Delta l^{s*}$ holds for reasonable values of parameters and variables:

$$\Delta l^{d*}=[(1+r)(1+q)^{-1}+(1-\gamma)(1+r)^{-1}y_{K^*}]\cdot\Delta K^*$$
$$>\Delta l^{s*}=[(1-\alpha)(1+q-\delta\alpha)^{-1}\cdot y_{K^*}]\cdot\Delta K^*,$$

where Δ implies 'a change in.'

d) Profit

Profit is defined as income minus expenditure. Since there is no output that is produced previously and ready to be consumed or invested in period 0, profit is negative in that period. Thus, in period 0, profit is:

$$-\{(K_1-K_0)\cdot(1+q)^{-1}+W_0\cdot L\}=-l_1^d,$$

where the distributed profit $F_0\cdot Z$ is zero. In period 1, profit is:

$$y(K_0,\ L)-\{(K_2-K_1)\cdot(1+q)^{-1}+W_1\cdot L+l_1^d\cdot r\}=l_1^d-l_2^d+y_{K_0}\cdot K_0,$$

where the distributed profit is $F_1\cdot Z=y_{K_0}\cdot K_0$, and where $(l_1^d-l_2^d)$ denotes retained earnings to be invested in the goods market in period 2. In period 2, profit is:

$$\begin{aligned}&y(K_1,\ L)-\{(K_3-K_2)\cdot(1+q)^{-1}+W_2\cdot L+l_2^d\cdot r\}\\&\quad=l_2^d-l_3^d+[\{y_{K_1}-r(1+r)(1+q)^{-1}\}\cdot K_1+r(1+r)(1+q)^{-1}\cdot K_0],\end{aligned}$$

where the distributed profit is $F_2\cdot Z=[\{y_{K_1}-r(1+r)(1+q)^{-1}\}\cdot K_1+r(1+r)(1+q)^{-1}\cdot K_0]$. Since K_0 is initially endowed with the firm for free, that portion of capital entails no interest cost. This is why we add the second term $[r(1+r)(1+q)^{-1}\cdot K_0]$ to the first term $[\{y_{K_1}-r(1+r)(1+q)^{-1}\}\cdot K_1]$ in the equation for $F_2\cdot Z$. Similarly, profit in period 3 is:

$$\begin{aligned}&y(K_2,\ L)-\{(K_4-K_3)\cdot(1+q)^{-1}+W_3\cdot L+l_3^d\cdot r\}\\&\quad=l_3^d-l_4^d+[\{y_{K_2}-r(1+r)(1+q)^{-1}\}\cdot K_2+r(1+r)(1+q)^{-1}\cdot K_0],\end{aligned}$$

where the distributed profit is $F_3\cdot Z=[\{y_{K_2}-r(1+r)(1+q)^{-1}\}\cdot K_2+r(1+r)(1+q)^{-1}\cdot K_0]$.

Generalizing, profit at each period can be expressed as the sum of retained earnings (the change in the firm's demand for bank loans) and the distributed profit (the amount paid out as dividends). Thus, profit in the period t (≥ 1) is:

$$\begin{aligned}&y(K_{t-1},\ L)-\{(K_{t+1}-K_t)\cdot(1+q)^{-1}+W_t\cdot L+l_t^d\cdot r\}\\&=l_t^d-l_{t+1}^d+[\{y_{K_{t-1}}-r(1+r)(1+q)^{-1}\}\cdot K_{t-1}+r(1+r)(1+q)^{-1}\cdot K_0],\qquad \text{(A.8)}\end{aligned}$$

where the distributed profit is $F_t \cdot Z = [\{y_{K_{t-1}} - r(1+r)(1+q)^{-1}\} \cdot K_{t-1} + r(1+r)(1+q)^{-1} \cdot K_0]$.

In steady state all profit is distributed to households, since $l_t^d = l_{t+1}^d = l^{d*}$. Using equation (A.8), the steady state profit is given as:

$$F^* \cdot Z = \{y_{K^*} - r(1+r)(1+q)^{-1}\} \cdot K^* + r(1+r)(1+q)^{-1} \cdot K_0 > 0, \qquad \text{(A.9)}$$

where the inequality holds because K^* is below its long-run equilibrium level so that $y_{K^*} > r(1+r)(1+q)^{-1}$ results. Note that $K^* > K_0$ usually holds as discussed in the text.

Finally, using equations (A.3) and (A.9), we can show the following steady state relation to hold:

$$y^* - (r \cdot l^{d*} + W^* \cdot L) = F^* \cdot Z. \qquad \text{(A.10)}$$

B. Financial Liberalization

a) Country Budget Constraint

We aggregate the following flow budget constraints of each sector to get the country budget constraint in financial liberalization:

Household: $\{D_{ht+1} - (l_{ht+1}^d - B_{ht+1}) - \{D_{ht} - (l_{ht}^d - B_{ht})\}$
$= D_{ht} \cdot i^d - (l_{ht}^d - B_{ht}) \cdot i^1 - c_t + W_t \cdot L + F_t \cdot Z + \tau_t$

Firm: $\{K_t + D_{ft+1} - l_{ft+1}^d) - (K_{t-1} + D_{ft} - l_{ft}^d)$
$= y(K_{t-1}, L) - l_{ft}^d \cdot i^1 + D_{ft} \cdot i^d - F_t \cdot Z - W_t \cdot L$

Bank: $(l_{t+1}^d + \alpha D_{t+1}) - (D_{t+1} + B_{t+1}^F) - (l_t^d + \alpha D_t) + (D_t + B_t^F)$
$= l_t^d \cdot i^1 - D_t \cdot i^d - B_t^F \cdot \delta$

Government: $(B_{gt+1} - \alpha D_{t+1}) - (B_{gt} - \alpha D_t) = B_{gt} \cdot \delta - \tau_t$.

By aggregating all these sectoral budget constraints and by using $i^d = \delta(1-\alpha)$, $i^1 = \delta$, $l_t^d \equiv l_{ht}^d + l_{ft}^d$, $D_t \equiv D_{ht} + D_{ft}$, and $K_t = K_{t-1} = K^{**}$, for $t \geq s+2$, we get the country budget constraint as follows:

$$(B_{t+1} - B_t) + (K_t - K_{t-1}) = y(K_{t-1}, L) - c_t + B_t \cdot \delta \quad \text{for } t \geq s+2,$$

where B_t denotes the net foreign asset position, and $B_t \equiv B_{gt} + B_{ht} + B_{bt}$ and $B_{bt} \equiv -B_t^F$. The steady state country budget constraint becomes:

$$B^{**}\cdot\delta+y(K^{**},\ L)-c^{**}=0\ \rightarrow\ (B_g{}^{**}+B_h{}^{**}-B^{F**})\cdot\delta+y(K^{**},\ L)-c^{**}=0. \quad (B.1)$$

b) Demand for Bank Loans and Profit

Bank loans demanded by the firm in the period s asset market can be tentatively expressed as follows:

$$l^{d\sim}_{fs+1}=l^*(1+r)+(K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}+W_s\cdot L-y^*,$$

where $l^*(1+r)=$ old loans (with interest) to be repaid in period s,
$(K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}=$ deposit to be used for investment in period $s+1$,
$W_s\cdot L=$ wage bill to be financed in period s, and
$y^*=$ output produced in period $s-1$ (or equivalently, output for sale in period s).

The following relations hold, based on equations (8) and (13):

$$W_s\cdot L=[MPL(K^*)](1+\delta)^{-1}\cdot L=[W^*(1+r)](1+\delta)^{-1}\cdot L,$$
$$y^*=y_{K^*}\cdot K^*+W^*(1+r)\cdot L,$$

where $MPL(K^*)$, the marginal productivity of labor when $K=K^*$, equals $W^*(1+r)$, and $W_s=[MPL(K^*)](1+\delta)^{-1}$ because $i^1=\delta$ holds now. Using these relations and equation (A.3), we have:

$$l^{d\sim}_{fs+1}=(K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}+W^*(1+r)(1+\delta)^{-1}\cdot L+(K^*-K_0)(1+r)(1+q)^{-1}$$
$$-K^*[y_{K^*}-r(1+r)(1+q)^{-1}]-K_0[r(1+r)(1+q)^{-1}].$$

Let the distributed profit be $F_s\cdot Z=K^*[y_{K^*}-r(1+r)(1+q)^{-1}]+K_0[r(1+r)(1+q)^{-1}]$. Then, the amount of bank loans demanded by the firm in period s becomes,

$$\begin{aligned}l^d_{fs+1}&=(K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}+W^*(1+r)(1+\delta)^{-1}\cdot L+(K^*-K_0)(1+r)(1+q)^{-1}\\&=(K^{**}-K_0)(1+\delta-\delta\alpha)^{-1}+W^*(1+r)(1+\delta)^{-1}\cdot L\\&\quad+(K^*-K_0)[(1+r)(1+q)^{-1}-(1+\delta-\delta\alpha)^{-1}]. \quad (B.2)\end{aligned}$$

Now we consider the amount of bank loans demanded by the firm in period $s+1$, l^d_{fs+2}. In the period $s+1$ asset market, the capital stock will have attained its long-run equilibrium level, so that the firm will no longer need to keep deposit for further investment. Thus, our reasonable guess for l^d_{fs+2} is:

$$l^{d\sim}_{fs+2} = l^d_{fs+1}(1+\delta) + W^{**} \cdot L - y^*,$$

where $l^d_{fs+1}(1+\delta) =$ old loans (with interest) to be repaid in period $s+1$,
$W^{**} \cdot L =$ wage bill to be financed in period $s+1$, and
$y^* =$ output produced in period s (or equivalently, output for sale in period $s+1$).

Using the relation $y^* = y_{K^*} \cdot K^* + W^*(1+r) \cdot L$, the reasonable guess for $l^{d\sim}_{fs+2}$ above, and equation (B.2), we get

$$\begin{aligned} l^{d\sim}_{fs+2} &= (K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}(1+\delta) + W^{**} \cdot L \\ &\quad + (K^*-K_0)(1+\delta)(1+r)(1+q)^{-1} - y_{K^*} \cdot K^* \\ &= (K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}(1+\delta) + W^{**} \cdot L + (K^*-K_0)(1+r)(1+q)^{-1} \\ &\quad + K^*(1+r)(1+q)^{-1}\delta - K_0(1+r)(1+q)^{-1}\delta - y_{K^*} \cdot K^*. \end{aligned}$$

Letting the distributed profit be $F_{s+1} \cdot Z = [y_{K^*} - \delta(1+r)(1+q)^{-1}] \cdot K^* + [\delta(1+r)(1+q)^{-1}] \cdot K_0$, we get

$$\begin{aligned} l^d_{fs+2} &= (K^{**}-K^*)(1+\delta-\delta\alpha)^{-1}(1+\delta) + W^{**} \cdot L \\ &\quad + (K^*-K_0)[(1+r)(1+q)^{-1} - (1+\delta-\delta\alpha)^{-1}(1+\delta)]. \end{aligned} \tag{B.3}$$

We follow the same procedure to find the amount of bank loans demanded by the firm in period $s+2$, l^d_{fs+3}, as follows:

$$l^{d\sim}_{fs+3} = l^d_{fs+2}(1+\delta) + W^{**} \cdot L - y^{**},$$

where $l^d_{fs+2}(1+\delta) =$ old loans (with interest) to be repaid in period $s+2$,
$W^{**} \cdot L =$ wage bill to be financed in period $s+2$, and
$y^{**} = (1+\delta-\delta\alpha)^{-1}(1+\delta)\delta \cdot K^{**} + W^{**}(1+\delta) \cdot L$
$=$ output produced in period $s+1$ (or output for sale in period $s+2$).

By using the guess for l^d_{fs+3} and equation (B.3), and by letting the distributed profit be $F_{s+2} \cdot Z = [(1+\delta-\delta\alpha)^{-1}(1+\delta)\delta - \delta(1+r)(1+q)^{-1}] \cdot K^* + [\delta(1+r)(1+q)^{-1}] \cdot K_0$, we end up with the firm's demand for loans in period $s+2$:

$$l^d_{fs+3} = (K^{**} - K_0)(1+\delta-\delta\alpha)^{-1}(1+\delta) + W^{**}\cdot L$$
$$+ (K^* - K_0)[(1+r)(1+q)^{-1} - (1+\delta-\delta\alpha)^{-1}(1+\delta)]. \tag{B.4}$$

Therefore, we have the following in steady state:

$$\begin{aligned} l^{d**}_f &= (K^{**} - K_0)(1+\delta-\delta\alpha)^{-1}(1+\delta) + W^{**}\cdot L \\ &\quad + (K^* - K_0)[(1+r)(1+q)^{-1} - (1+\delta-\delta\alpha)^{-1}(1+\delta)] \\ &= (K^{**} - K^*)(1+\delta-\delta\alpha)^{-1}(1+\delta) + W^{**}\cdot L \\ &\quad + (K^* - K_0)(1+r)(1+q)^{-1}, \end{aligned} \tag{B.5}$$

where the distributed profit is

$$\begin{aligned} F^{**}\cdot Z &= [(1+\delta-\delta\alpha)^{-1}(1+\delta)\delta - \delta(1+r)(1+q)^{-1}]\cdot K^* + [\delta(1+r)(1+q)^{-1}]\cdot K_0 \\ &= [(1+\delta-\delta\alpha)^{-1}(1+\delta)\delta]\cdot K^* - [\delta(1+r)(1+q)^{-1}](K^* - K_0). \end{aligned}$$

Finally, we use equation (B.5) and the fact that $y^{**} = (1+\delta-\delta\alpha)^{-1}(1+\delta)\delta\cdot K^{**} + W^{**}(1+\delta)\cdot L$ to find the following steady state relation:

$$y^{**} - (\delta\cdot l^{d**}_f + W^{**}\cdot L) = F^{**}\cdot Z, \tag{B.6}$$

where, by using equations (8), (25), and (26), the steady state wage rate W^{**} is given as:

$$W^{**} = (1-\gamma)\{A(1+\delta)^{-1}\}^{1/(1-\gamma)}\cdot\{\gamma\delta^{-1}(1+\delta-\delta\alpha)^{\gamma/(1-\gamma)} > W^*.$$

c) Consumption

First, we consolidate the budget constraints for the household and for the firm:

$$\begin{aligned} &K_t - K_{t-1} + (D_{ft+1} + D_{ht+1}) - \{(l^d_{ft+1} + l^d_{ht+1}) - B_{ht+1}\} - (D_{ft} + D_{ht}) + \{(l^d_{ft} + l^d_{ht}) - B_{ht}\} \\ &= y(K_{t-1},\ \mathrm{L}) - \{(l^d_{ft} + l^d_{ht}) - B_{ht}\}\cdot i^l + (D_{ft} + D_{ht})\cdot i^d - c_t + \tau_t, \end{aligned}$$

where $i^l = \delta$ and $i^d = \delta - \delta\alpha$. This equation can be arranged to give an expression for the total amount of net bank loans demanded by the firm and by the household, $(l^d_{t+1} - B_{ht+1})$:

$$\begin{aligned} (l^d_{t+1} - B_{ht+1}) &= K_t - K_{t-1} + \{D_{t+1} - D_t(1+\delta-\delta\alpha)\} \\ &\quad + (l^d_t - B_{ht})\cdot(1+\delta) - y(K_{t-1},\ \mathrm{L}) + c_t - \tau_t. \end{aligned} \tag{B.7}$$

Note that we can only determine the total amount of *net* bank loans demanded (*i.e.* $l^d - B_h$, bank loans demanded net of household holdings of foreign bonds). As long as we do not rule out the possibility that the household may borrow from domestic banks to invest abroad, the total amount of *gross* bank loans demanded (l^d) cannot be determined within the model.

As a second step toward finding the level of consumption in the steady state, we consider in a dynamic context how the total demand for net bank loans looks like as the period *s* asset market opens with financial liberalization. Replacing subscript *t* with *s* in equation (B.7), and noting that $(l^d_s - B_{hs}) = l^*$, $B_{hs} = 0$, $i^1_s = r$, $i^1_{s+1} = \delta$, $i^d_s = q$, and $i^d_{s+1} = \delta - \delta\alpha$, we get equation (B.8) for the total amount of net bank loans demanded in period *s*:

$$(i^d_{s+1} - B_{hs+1}) = l^* \cdot (1+r) + (K_s - K_{s-1}) + \{D_{s+1} - D_s(1+q)\} - y(K_{s-1},\ L) + c_s - \tau_s, \qquad \text{(B.8)}$$

Using equations (B.7) and (B.8), we get the expression for the total amount of net loans demanded in period $s+1$, $i^d_{s+2} - B_{hs+2}$:

$$\begin{aligned}(i^d_{s+2} - B_{hs+2}) = l^* &\cdot (1+r)(1+\delta) \\ &+ (K_{s+1} - K_s) + (K_s - K_{s-1})(1+\delta) \\ &+ \{D_{s+2} - D_{s+1}(1+\delta - \delta\alpha)\} + \{D_{s+1} - D_s(1+q)\}(1+\delta) \\ &- y(K_s,\ L) - y(K_{s-1},\ L)(1+\delta) + c_{s+1} + c_s(1+\delta) \\ &- \tau_{s+1} - \tau_s(1+\delta). \qquad \text{(B.9)}\end{aligned}$$

Using equations (B.7) and (B.9), we get equation (B.10) for $i^d_{s+3} - B_{hs+3}$:

$$\begin{aligned}(i^d_{s+3} - B_{hs+3}) = l^* &\cdot (1+r)(1+\delta)^2 \\ &+ (K_{s+2} - K_{s+1}) + (K_{s+1} - K_s)(1+\delta) + (K_s - K_{s-1})(1+\delta)^2 \\ &+ \{D_{s+3} - D_{s+2}(1+\delta - \delta\alpha)\} + \{D_{s+2} - D_{s+1}(1+\delta - \delta\alpha)\}(1+\delta) \\ &+ \{D_{s+1} - D_s(1+q)\}(1+\delta)^2 \\ &- y(K_{s+1},\ L) - y(K_s,\ L)(1+\delta) - y(K_{s-1},\ L)(1+\delta)^2 \\ &+ c_{s+2} + c_{s+1}(1+\delta) + c_s(1+\delta)^2 \\ &- \tau_{s+2} - \tau_{s+1}(1+\delta) - \tau_s(1+\delta)^2. \qquad \text{(B.10)}\end{aligned}$$

Following the same procedure, we get equation (B.11) for $i^d_{s+4} - B_{hs+4}$:

$$
\begin{aligned}
(i^d_{s+4}-B_{hs+4}) = {} & l^* \cdot (1+r)(1+\delta)^3 \\
& +(K_{s+3}-K_{s+2})+(K_{s+2}-K_{s+1})(1+\delta)+(K_{s+1}-K_s)(1+\delta)^2 \\
& +(K_s-K_{s-1})(1+\delta)^3+\{D_{s+4}-D_{s+3}(1+\delta-\delta\alpha)\} \\
& +\{D_{s+3}-D_{s+2}(1+\delta-\delta\alpha)\}(1+\delta) \\
& +\{D_{s+2}-D_{s+1}(1+\delta-\delta\alpha)\}(1+\delta)^2 \\
& +\{D_{s+1}-D_s(1+q)\}(1+\delta)^3-y(K_{s+2}, \mathrm{L}) \\
& -y(K_{s+1}, \mathrm{L})(1+\delta)-y(K_s, \mathrm{L})(1+\delta)^2-y(K_{s-1}, \mathrm{L})(1+\delta)^3 \\
& +c_{s+3}+c_{s+2}(1+\delta)+c_{s+1}(1+\delta)^2+c_s(1+\delta)^3 \\
& -\tau_{s+3}-\tau_{s+2}(1+\delta)-\tau_{s+1}(1+\delta)^2-\tau_s(1+\delta)^3. \qquad \text{(B.11)}
\end{aligned}
$$

Although the capital stock is adjusted to its optimal level in period $s+1$, the economy does not fully reach steady state before period $s+2$ begins. Beginning in period $s+2$, output produced by the adjusted capital stock (and inelastic labor) is ready for sale each period. This implies that the total amount of net bank loans demanded should be the same for each period beginning in period $s+2$. Using equations (B.10) and (B.11), we equate $(i^d_{s+3}-B_{hs+3})$ and $(i^d_{s+4}-B_{hs+4})$ to get:

$$
\begin{aligned}
0 = {} & l^* \cdot (1+r)(1+\delta)^2\delta \\
& +(K_{s+3}-K_{s+2})+(K_{s+2}-K_{s+1})\delta \\
& +(K_{s+1}-K_s)(1+\delta)\delta+(K_s-K_{s-1})(1+\delta)^2\delta \\
& +\{D_{s+4}-D_{s+3}(1+\delta-\delta\alpha)\}+\{D_{s+3}-D_{s+2}(1+\delta-\delta\alpha)\}\delta \\
& +\{D_{s+2}-D_{s+1}(1+\delta-\delta\alpha)\}(1+\delta)\delta \\
& +\{D_{s+1}-D_s(1+q)\}(1+\delta)^2\delta \\
& -y(K_{s+2}, \mathrm{L})-y(K_{s+1}, \mathrm{L})\delta-y(K_s, \mathrm{L})(1+\delta)\delta \\
& -y(K_{s-1}, \mathrm{L})(1+\delta)^2\delta+c_{s+3}+c_{s+2}\delta+c_{s+1}(1+\delta)\delta+c_s(1+\delta)^2\delta \\
& -\tau_{s+3}-\tau_{s+2}\delta-\tau_{s+1}(1+\delta)\delta-\tau_s(1+\delta)^2\delta. \qquad \text{(B.12)}
\end{aligned}
$$

Based on the context of our discussion so far, the following set of relations (B.13) hold:

$K_{s-1}=K_s=K^*$,

$K_{s+1}=K_{s+2}=K^{**}$,

$$
\begin{aligned}
&y(K_{s-1},\ L)=y(K_s,\ L)=y^*,\\
&y(K_{s+1},\ L)=y(K_{s+2},\ L)=y^{**},\\
&c_s=c^*,\ c_{s+1}=c_{s+2}=c_{s+3}=c^{**},\\
&\tau_s=\tau^*=\delta\alpha D^*,\\
&\tau_{s+1}=\delta\alpha D_{s+1}=\delta\alpha(c^{**}+K^{**}-K^*)\cdot(1+\delta-\delta\alpha)^{-1}\\
&\tau_{s+2}=\tau_{s+3}=\tau^{**}=\delta\alpha D^{**},\\
&D_{s+4}=D_{s+3}=D_{s+2}=D^{**}=c^{**}(1+\delta-\delta\alpha)^{-1},\\
&D_{s+1}=(c^{**}+K^{**}-K^*)\cdot(1+\delta-\delta\alpha)^{-1}=D^{**}+(K^{**}-K^*)\cdot(1+\delta-\delta\alpha)^{-1},\\
&D_s=D^*=c^*(1+q)^{-1},\\
&l^*=(1-\alpha)D^*,\\
&1+r=(1-\alpha)^{-1}(1-\alpha+q),\\
&y^*=(1+q-\delta\alpha)D^*,\quad \text{and}\\
&c^*=(1+q)D^*. \qquad\qquad (B.13)
\end{aligned}
$$

Using (B.12) and (B.13), we find the reduced-form solution for steady state consumption c^{**}:

$$c^{**}=c^*+(1+\delta)^{-1}\cdot[(y^{**}-y^*)-\delta(K^{**}-K^*)]. \qquad (B.14)$$

In addition, we use equations (1), (2), (3), (4), (22), and (29), to find the steady state values of some variables as follows:

$$
\begin{aligned}
&D_h{}^{**}=D^{**}=c^{**}\cdot(1+\delta-\delta\alpha)^{-1},\\
&H^{**}=B_g{}^{**}=\alpha c^{**}\cdot(1+\delta-\delta\alpha)^{-1},\\
&\tau^{**}=\delta\alpha c^{**}\cdot(1+\delta-\delta\alpha)^{-1}. \qquad (B.15)
\end{aligned}
$$

d) Net Loans

In the steady state, the amount of net loans supplied (*i.e.* the amount of bank loans supplied net of household holdings of foreign bonds) should be:

$$(l^{S**}-B_h{}^{**})=(B^{F**}-B_h{}^{**})+(1-\alpha)D^{**}. \qquad (B.16)$$

We use equations (B.15) and (B.16) to find an expression for $(B^{F**}-B_h{}^{**})$:

$$B^{F**} - B_h^{**} = \alpha(1+\delta-\delta\alpha)^{-1}\cdot c^{**} - \delta^{-1}\cdot(c^{**}-y^{**}). \quad \text{(B.17)}$$

Using equations (B.1), (B.15), (B.16), and (B.17), we get net loans, $(l^{**} - B_h^{**})$:

$$l^{**} - B_h^{**} = (1+\delta-\delta\alpha)^{-1}\cdot c^{**} - \delta^{-1}\cdot(c^{**}-y^{**}) = D^{**} - B^{**}. \quad \text{(B.18)}$$

(*Received 27 April 2000; Revised 20 March 2001*)

References

Agénor, Pierre-Richard, and Montiel, Peter J. *Development Macroeconomics*, Second Edition. Princeton, USA: Princeton University Press, 1999.

Arestis, Philip, and Panicos, Demetriades. "Financial Development and Economic Growth: Assessing the Evidence." *The Economic Journal* 107 (No. 442 1997): 783-99.

Armstrong, Philip, Glyn, Andrew, and Harrison, John. *Capitalism since 1945.* Oxford, UK, and Cambridge, USA; Blackwell, 1991.

Bencivenga, Valerie R., and Smith, Bruce D. "Deficits, Inflation, and the Banking System in Developing Countries: the Optimal Degree of Financial Repression." *Oxford Economic Papers* 44 (No. 4 1992): 767-90.

Brock, Philip L. "Reserve Requirements and the Inflation Tax." *Journal of Money, Credit, and Banking* 21 (No. 1 1989): 106-21.

Buffie, Edward F. "Financial Repression, the New Structuralists, and Stabilization Policy in Semi-Industrialized Economies." *Journal of Development Economics* 14 (No. 3 1984): 305-22.

Daniel, Betty C., and Hong-Bum Kim. "Financial Dualism in a Cash-in-Advance Economy." *Journal of Macroeconomics* 18 (No. 2 1996): 213-34.

Dooley, Michael. "A Survey of Literature on Controls over International Capital Transactions." *IMF Staff Papers* 43 (No. 4 1996): 639-87.

Edwards, Sebastian, and Végh, Carlos A. "Banks and Macroeconomic Disturbances under Predetermined Exchange Rates."

Journal of Monetary Economics 40 (No. 2 1997): 239-78.

McKinnon, Ronald I. *Money and Capital in Economic Development.* Washington, D.C.: The Brookings Institution, 1973.

Obstfeld, Maurice, and Rogoff, Kenneth. *Foundations of International Macroeconomics.* Cambridge, Massachusetts: The MIT Press, 1996.

Radelet, Steven, and Sachs, Jeffrey. *The Onset of the East Asian Financial Crisis.* Mimeograph, February 1998.

Romer, David. *Advanced Macroeconomics.* McGraw-Hill, 1996.

Roubini, Nouriel, and Sala-i-Martin, Xavier. "Financial Repression and Economic Growth." *Journal of Development Economics* 39 (No. 1 1992): 5-30.

Shaw, Edward. *Financial Deepening in Economic Development.* Oxford University Press, 1973.