

Trade and Domestic Financial Market  
Reform Under Political Uncertainty:  
Implications for Investment, Savings, and  
the Real Exchange Rate

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**IMF Working Paper**

Middle Eastern Department

**Trade and Domestic Financial Market Reform Under Political Uncertainty:  
Implications for Investment, Savings, and the Real Exchange Rate**

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**Abstract**

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This paper presents a model that incorporates uncertainty about trade reform and analyzes the effects of trade and financial liberalization on domestic investment and savings, the current account balance and the real exchange rate, both when the capital account is open and when it is closed. Under certain assumptions financial liberalization leads to a movement of resources in the opposite direction to that implied by trade liberalization and to real exchange rate appreciation, thus defeating one of the objectives of tariff reform, when the capital account is open. When political economy linkages are taken into account, however, the indirect effects of financial liberalization may offset the direct effects, encouraging a movement of resources in the desired direction. With a closed capital account these results should still hold unless there are strong negative income effects from trade reform.

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## I. INTRODUCTION

This paper is a sequel to Bhattacharya (1999a). As noted in that paper, there has been a lot of policy discussion and debate in the academic literature on the “sequencing” issue relating to trade liberalization and opening of the capital account—should they go hand in hand, or should one precede the other [see Bhattacharya (1997), Edwards (1984, 1989), Falvey and Kim (1992), Funke (1993), McKinnon (1982, 1991)]. Bhattacharya (1999b), Engel and Kletzer (1991), Rodrik (1989, 1991) and van Wijnbergen (1985) among others have also looked at the issue of credibility of trade reform, and in particular at the impact of uncertainty regarding trade policy on domestic investment and capital flight. However, almost all these studies assume a well-functioning domestic financial market. By contrast, despite the vast literature on financial repression/liberalization and its implications for growth [for example Cho and Khatkhate (1989), Collier and Mayer (1989), Eastwood and Durski (1992), Fry (1988, 1989) Gelb (1989), Gibson and Tsakalotos (1994), McKinnon (1973, 1981a, 1981b, 1988, 1989), Shaw (1973), van Wijnbergen (1983)], there has been relatively little discussion in the academic literature on the issue of the appropriate sequencing of trade liberalization and *domestic* financial market reform. Indeed, there are very few theoretical models analyzing how trade liberalization and domestic financial market reform interact with each other in a general equilibrium setting, particularly in the context of uncertainty regarding tariff reform.

The main exceptions to this are Kahkonen (1987) and Bhattacharya (1999a). In Bhattacharya (1999a) I look at trade liberalization and domestic financial market reform in a general equilibrium setting in the context of an economy with an importable and exportable sector and with political uncertainty regarding tariff reform. The results presented in the paper indicate that, under certain assumptions, financial liberalization leads to a movement of resources in the opposite direction to that implied by trade liberalization, thus defeating one of the objectives of tariff reform. To be more explicit, trade liberalization (not surprisingly) leads to less investment in the importable sector and to more investment in the exportable sector, while the direct effect of financial liberalization is an increase in investment in the importable sector, with the impact on investment in the exportable sector being ambiguous. When political economy linkages are taken into account, however, the indirect effects of financial liberalization may offset the direct effects and encourage a movement of resources in the desired direction.

The model presented in Bhattacharya (1999a) does not allow analysis of the implications of trade and domestic financial market liberalization for the real exchange rate or for the current account balance. This is because there is no nontraded sector in the model and the capital account is assumed to be closed, with the domestic interest rate adjusting to equate domestic savings and investment in every period. In this paper we extend the model to allow an analysis of these important issues in a general equilibrium context.

This paper looks at a two-period overlapping generations model in the context of a capital-scarce economy with two sectors producing a traded and a nontraded good

respectively. The focus of analysis is on how trade liberalization and financial sector reform interact with each other in general equilibrium, both when the capital account is open and when it is closed. In the former case we assume that there are restrictions on capital outflows in that domestic agents are not allowed to invest in foreign assets, but the capital account is open to the extent that domestic firms are allowed to borrow from abroad at the world rate of interest  $r^*$ . (Alternatively, foreign investors are free to buy shares in the “representative” domestic firm). The model presented here is quite similar to Kahkonen’s. However it introduces uncertainty about trade reform and analyzes its effects on domestic investment and savings, the current account and the real exchange rate.

Section II presents the basic model. The economy produces two goods, a capital-intensive traded good and a labor-intensive nontraded good. The traded good is used for both consumption and investment, while the nontraded good is used only for consumption. Households are assumed to live for two periods. The representative firm (which produces both goods) borrows from the “young” household in each period and decides on how much to invest in each sector for production in the next period. However, the return to the household on its savings is less than the return on investment by the firm because of a tax on household savings (or, equivalently, a tax on borrowing). When the capital account is closed the domestic interest rates adjust to equate the volume of domestic savings and investment; when the capital account is open the representative firm is allowed to borrow from abroad at the exogenously given “world” rate of interest, and invests in the domestic economy up to the point where the expected rate of return on domestic capital equals the world rate of interest. The traded good sector is subject to a tax in the first period but there is uncertainty about tariff reform in the following period.

In the second period of this two-period model the government has to pay off the interest and principal on its external debt. Part of the revenue for this comes from the proceeds of the tax on household savings. If a “workers’ government” comes to power it will raise the additional revenue through a tariff on imports of the traded good. By contrast, if a “capitalist government” comes to power it will remove the tariff, and any revenue shortfall will be met out of a tax on wage income. The tax on wage income is a non-distortionary lump-sum tax since labor supply is taken to be exogenous in this model. However, it is assumed that there are political constraints on the amount of the revenue that can be raised through lump-sum taxes on workers. Hence the government has to seek additional sources of revenue to finance its external debt. This is because the primary focus of this paper is not the issue of optimal taxation. Instead, the focus is on how uncertainty about alternative distortionary sources of financing of government spending affects the general equilibrium of the economy in a second-best setting.

Section III looks at how domestic savings and investment—and by implication the current account balance—are affected by the probability of tariff reform and by the tax on household savings when the capital account is open. It also analyzes the implications for the real exchange rate, defined as the price of the nontraded good relative to the (world) price of the traded good. Section IV compares the results when the capital account is closed.

Section V analyzes how the results are affected when the probability of tariff reform is itself a function of the tax rate on borrowing. This function could be positive if a high tax rate on savings leads to strong lobbying by firms for protection against imports on the grounds that they face “unfair” competition from abroad due to the fact that domestic producers have to pay a higher cost for capital. Conversely, the function could be negative if a low tax on savings means that more revenue must be raised through either a tax or a tariff, and this raises the required tax rate on wage income to politically infeasible levels and makes the tariff more politically attractive. The final section draws together the main results presented in this paper and discusses their policy implications.

The results presented in this paper suggest that, when the capital account is open, trade liberalization leads to less domestic investment in both the traded and nontraded sectors of the economy and to a lower capital stock in period  $(t+1)$ . This leads in general equilibrium to a lower real wage in period  $(t+1)$ —at least when real wages are measured in terms of the world price of the traded good—and a depreciation of the real exchange rate, since the nontraded sector is assumed to be the labor-intensive sector. By contrast, the direct effect of financial liberalization when the capital account is open is an increase in investment in the traded sector, with investment in the nontraded sector being unaffected, and an appreciation of the real exchange rate. This suggests that financial liberalization will tend to defeat one of the objectives of trade liberalization, at least in part, and that both trade and domestic financial market reform should not be undertaken simultaneously. Arguably trade liberalization should precede liberalization of the domestic financial market, given the likely negative effect of the latter on net exports and on the current account balance.

The analysis becomes more interesting when the probability of tariff reform is itself a function of the tax rate on borrowing. When the capital account is open the direct effects of financial liberalization will be further accentuated if the probability of tariff reform is a positive function of the tax rate on borrowing. Conversely, if the probability of tariff reform is a negative function of the tax rate on borrowing, the indirect effects of financial liberalization would tend to offset the direct effects, encouraging the expansion of the traded sector relative to the nontraded sector. The situation is somewhat more complicated when the capital account is closed, but these results should still hold unless there is a strong negative income effect from trade liberalization which generates a large shift to the right of the domestic savings function.

## **II. TRADE LIBERALIZATION AND POLITICAL UNCERTAINTY IN A FINANCIALLY REPRESSED ECONOMY—THE MODEL**

I consider here the case of a small open capital-scarce economy producing two goods: a capital-intensive traded good, Good 1, and a labor-intensive nontraded good, Good 2. The representative firm makes all the production/investment decisions and allocates capital between the two sectors so as to maximize the present discounted value of its expected profit stream. The traded good is used for both consumption and investment, but the nontraded good is used only for consumption. The world price of the traded good is taken as numeraire.

When we consider the case of an open capital account, the firm also has to decide on how much to borrow from abroad to invest in the domestic economy.

The household in this economy is assumed to live for two periods and to inelastically supply one unit of labor to the representative firm in each period. When young the household consumes part of its wage income and lends the rest to the representative firm, earning a rate of return  $(1+r_{t+1}^D)$  in the next period. In other words,  $r_{t+1}^D$  is the deposit rate of interest for household savers in period  $t$ . When "old" the household consumes the return from its savings (and any labor income that it earns when old). However, because there is a tax on savings (or, alternatively, a tax on borrowing), the rate of return to the household is  $(1+r^D) = (1-\gamma)^*(1+r^L)$ , where  $\gamma$  is the tax rate on household savings (on borrowing). The interest rate  $r^L$  is the cost of borrowing from the viewpoint of the firm and adjusts to equate savings and investment in each period. For simplicity it is assumed that there are an equal number of young households and domestic firms in the economy, and that each representative domestic firm is risk-neutral.

The government enters period  $t$  with a certain amount of external debt,  $D_t^*$ . There is a positive tariff  $T_1$  on imports of the traded good which, together with the proceeds from the tax on savings, raises just enough revenue to pay the interest on the debt,  $r^*D_t^*$ , where  $r^*$  is the world rate of interest (assumed to be exogenous).

In period  $(t+1)$  the government has to pay back to foreign debtors the principal and the interest on its external debt,  $(1+r^*)D_t^*$ . There is a certain (known) probability  $\pi$  that a workers' government will come to power in period  $(t+1)$  and raise the necessary revenue through a tariff on imports of the traded good set at a rate  $T_2$  and the proceeds from the tax on household savings. Otherwise, with probability  $(1 - \pi)$ , a capitalist government will come to power and remove the tariff on the traded good ( $T_2=0$ ). In this case any revenue shortfall will be met out of a tax on wage income at a rate  $\tau$ .  $T_1$  and  $\gamma$  are determined historically, while  $T_2$  and  $\tau$  are set so as to meet the government's budget constraint in period  $(t+1)$  and are known in advance.

Note that the tax on wage income  $\tau$  is a non-distortionary lump-sum tax since labor supply is taken to be exogenous. However it is assumed that, whichever government is in power, there are political constraints on the amount of the revenue that it can raise through lump-sum taxes on workers. Hence the government has to seek additional sources of revenue to finance its external debt.

### A. Households

The young cohort in period  $t$  solves

$$\text{Max } U(C_t^Y) + (1+r^*)^{-1} E[U(C_{t+1}^O)] \quad (1)$$

subject to

$$C_t^Y = (1+T_1)C_{1t}^Y + p_{Nt}C_{2t}^Y = \omega_t - S_t^D \quad (2)$$

and

$$\begin{aligned} C_{t+1}^{O,T} &= (1+T_2)C_{1t+1}^{O,T} + p_{Nt+1}^T C_{2t+1}^{O,T} = \\ \omega_{t+1}^T + (1-\gamma)(1+r_{t+1}^L)S_t^D &= \omega_{t+1}^T + (1+r_{t+1}^D)S_t^D \end{aligned} \quad (3a)$$

with probability  $\pi$ ;

$$\begin{aligned} C_{t+1}^{O,NT} &= C_{1t+1}^{O,NT} + p_{Nt+1}^{NT} C_{2t+1}^{O,NT} = \\ (1-\tau)\omega_{t+1}^{NT} + (1-\gamma)(1+r_{t+1}^L)S_t^D &= (1-\tau)\omega_{t+1}^{NT} + (1+r_{t+1}^D)S_t^D \end{aligned} \quad (3b)$$

with probability  $(1-\pi)$

where  $E[.]$  is the expectations operator;  $U(.)$  is the representative household's utility function (whose arguments are its consumption of Goods 1 and 2 in periods  $t$  and  $(t+1)$ );  $C_t^Y$  ( $C_t^O$ ) is the consumption of the young (old) in period  $t$ , and the subscripts 1 and 2 refer to consumption of the traded and nontraded good respectively;  $r^*$  is the discount rate, assumed to be the same for households and firms, and to be equal to the exogenously given world rate of interest;  $p_N$  is the price of the nontraded good (relative to the world price of the traded good);  $\omega_t$  is the wage rate in period  $t$ , and  $\omega_{t+1}$  the (expected) wage rate in period  $(t+1)$ ;  $r_{t+1}^D$ ,  $r_{t+1}^L$ ,  $\gamma$  and  $\tau$  are as defined above in the text;  $S_t^D$  is the volume of household savings by the young cohort in period  $t$  that is lent to the representative firm; and the superscripts T and NT refer to the fact that consumption, real wages, and the relative price of the nontraded good will differ in general equilibrium in period  $(t+1)$  depending on whether or not there is a tariff on imports of the traded good.

The old cohort in period  $t$  consumes the return from its savings in the previous period and any wage income that it earns:

$$C_t^O = (1+T_1)C_{1t}^O + p_{Nt} C_{2t}^O = \omega_t + (1-\gamma)(1+r_t^L)S_{t-1}^D = \omega_t + (1+r_t^D)S_{t-1}^D \quad (4)$$

## B. Firms

On the production side of the economy it is assumed that the traded good is the capital good for both sectors. Capital is sector-specific in the short run but labor is fully mobile between sectors in both periods. Both sectors are competitive with constant returns to scale Cobb-Douglas production functions:

$$Q_T = F(K_1, L_1) = aK_1^\alpha L_1^{1-\alpha} = f(k_1) \quad (5)$$

$$Q_N = H(K_2, L_2) = bK_2^\beta L_2^{1-\beta} = h(k_2), \quad \alpha > \beta \quad (6)$$

$$L_1 + L_2 = 1 \quad (7)$$

where

$Q_T$  ( $Q_N$ ) is the output of the traded (nontraded) sector;  
 $K_1$  ( $L_1$ ) is input of capital (labor) in the traded sector; and  
 $K_2$  ( $L_2$ ) is input of capital (labor) in the nontraded sector.



A competitive nontraded sector with a constant returns to scale production function implies the following type of cost function:

$$C_N(\omega, p_N h'(k_2), Q_N) = c_N(\omega, p_N h'(k_2)) * Q_N \quad (8)$$

Equilibrium in the nontraded sector requires

$$Q_N = C_2^Y + C_2^O \quad (9)$$

i.e. output of the nontraded good equals the amount consumed domestically in every period. In every period, given the capital stock in each sector, the representative firm allocates the amount of labor to the nontraded sector that is required to produce the quantity of the nontraded good that is demanded in the domestic market, and the rest of the labor is allocated to production of the traded good. In equilibrium

$$p_N = c_N(\omega, p_N h'(k_2)) \quad (10)$$

i.e. price = average cost = marginal cost.

Thus, in the presence of uncertainty about domestic demand for the nontraded good, the ex post rate of return on capital in the nontraded sector is likely to differ from the (ex ante) rate of return expected at the time the investment takes place. Moreover, the ex post rates of return on capital may differ across the two sectors.

The assumption that labor is fully mobile across sectors implies that the wage rate is equalized across the two sectors in every period. The wage rate  $\omega$  in turn is determined by the equilibrium condition that

$$\omega = p_T F_L(K_1, L_1) = p_N H_L(K_2, 1-L_1) \quad (11)$$

where  $p_T$  is the domestic price of the traded good (inclusive of any tariffs). Since the world price of the traded good is taken as numeraire  $p_{Tt} = (1+T_1)$  and  $p_{Tt+1} = (1+T_2)$ , where  $T_1$  and  $T_2$  are the domestic tariff rates on the traded good in periods 1 and 2 respectively.

Let us first look at the case where the capital account is closed and the firm cannot legally borrow from abroad. In this case the firm finances its investment by borrowing from the young household at a given rate of interest  $r^L$ , which it repays in the following period. Since  $r^L$  adjusts to equate domestic savings and investment in each period, this implies that in general equilibrium  $r^L$  is the (expected) rate of return on investment. In period  $t$  the firm (assumed to be risk-neutral) allocates its capital between the two sectors such that the expected rate of return on investment in each sector is  $r_{t+1}^L$ .

Define  $\psi_{Tt}$  and  $\psi_{Nt}$  as the marginal revenue product of capital functions in the traded and nontraded sectors respectively in period  $t$ , and  $\psi_{Tt+1}$  and  $\psi_{Nt+1}$  as the (expected) marginal

revenue product of capital functions in the two sectors in period (t+1). The functions are given by

$$\Psi_{Tt} = (1+T_1)F_K(K_{1t}, L_{1t}) = r_{t+1}^L \quad (12)$$

$$\Psi_{Nt} = p_{Nt} H_K(K_{2t}, 1-L_{1t}) = r_{t+1}^L \quad (13)$$

$$\Psi_{Tt+1} = \pi(1+T_2)F_K(K_{1t+1}, L_{1t+1}^T) + (1-\pi)F_K(K_{1t+1}, L_{1t+1}^{NT}) = r_{t+1}^L \quad (14)$$

$$\Psi_{Nt+1} = \pi p_{Nt+1}^T H_K(K_{2t+1}, 1-L_{1t+1}^T) + (1-\pi)p_{Nt+1}^{NT} H_K(K_{2t+1}, 1-L_{1t+1}^{NT}) = r_{t+1}^L \quad (15)$$

where the superscripts T, NT refer to the fact that the wage rate and labor allocation in period (t+1) will differ depending on whether or not there is a tariff in that period.  $T_1$ ,  $T_2$ ,  $\pi$ ,  $\omega_t$ ,  $\omega_{t+1}^T$ ,  $\omega_{t+1}^{NT}$ , and  $r_{t+1}^L$  are all taken as given by the firm. The marginal revenue product of capital schedule in period t for investment in production for period (t+1) is given by

$$\Psi_{Kt+1} = [K_{1t+1}/(K_{1t+1} + K_{2t+1})] \Psi_{Tt+1} + [K_{2t+1}/(K_{1t+1} + K_{2t+1})] \Psi_{Nt+1} \quad (16)$$

The other scenario we look at is where there are restrictions on capital outflows in that domestic agents are not allowed to invest in foreign assets, but the capital account is open to the extent that domestic firms are allowed to borrow from abroad at the world rate of interest  $r^*$ . (Alternatively, foreign investors are free to buy shares in the representative domestic firm.) The representative firm in turn takes the domestic savings of the young cohort and decides on how much to borrow from abroad, and on how to allocate its investment between the traded and nontraded sectors for production in the following period. Since by assumption we are considering the case of a capital-scarce economy, the rate of return on domestic capital (in the absence of foreign borrowing) cannot be less than the world rate of interest  $r^*$ . Consequently there is positive borrowing from abroad. Arbitrage activities on the part of domestic firms ensure that the expected rate of return on domestic investment equals  $r^*$ , i.e.

$$1+r^L = 1+r^* \quad (17)$$

$$1+r^D = (1-\gamma)(1+r^*) \quad (18)$$

In other words, the representative domestic firm borrows from abroad to invest in the domestic economy until the expected rate of return on domestic investment equals the world rate of interest.

The firm's maximization problem in period t is thus given by

$$\begin{aligned} \text{Max}_{K_{1t+1}, K_{2t+1}} \quad & \Psi_{Tt} K_{1t} + \Psi_{Nt} K_{2t} + \\ & (1+\theta)^{-1} * \\ & [ \Psi_{Tt+1} K_{1t+1} + \Psi_{Nt+1} K_{2t+1} ] \end{aligned} \quad (19)$$

subject to

$$(1+T_1)(K_{1t+1}+K_{2t+1}) = S_t^D + b_t^L \quad (20)$$

where  $b_t^L$  is the volume of borrowing from abroad by the representative domestic firm, and is constrained to be zero when the capital account is closed.

Note that, ex ante, the firm allocates capital in period  $t$  between the two sectors so as to equalize the expected rates of return in each sector at  $r_{t+1}^L$ . However the ex post rates of return will differ across sectors, depending on the domestic market demand for the nontraded good in period  $(t+1)$  and on whether or not there is a tariff on the traded good.

### C. Government and Market Equilibrium

In period  $t$  the government pays the interest on its external debt using the proceeds from the tax on savings and a tariff on imports. Thus, the government's period  $t$  budget constraint can be written as

$$\gamma(1+r_{t+1}^L)S_{t+1}^D + T_1 [K_{1t+1} + K_{2t+1} + C_{1t}^Y + C_{1t}^O - F(K_{1t}, L_{1t})] = r D_t \quad (21)$$

In period  $(t+1)$  the government is obliged to pay off the interest and principal on its external debt. If the workers' government comes to power it will raise the necessary revenue from the tax on household savings and a tariff on imports of the capital good. In this case the government's period  $(t+1)$  budget constraint is given by

$$\gamma(1+r_{t+1}^L)S_t^D + T_2 [K_{1t+2} + K_{2t+2} + C_{1t+1}^{Y,T} + C_{1t+1}^{O,T} - F(K_{1t+1}, L_{1t+1}^T)] = (1+r^*)D_t^* \quad (22a)$$

If instead the capitalist government comes to power in period  $(t+1)$ , its revenue requirements to pay off its external debt obligations will be met from the tax on household savings and a tax on wage income. The period  $(t+1)$  government budget constraint in this case is given by

$$\gamma(1+r_{t+1}^L)S_t^D + \tau(\omega_{t+1}^{NI}) = (1+r^*)D_t^* \quad (22b)$$

When the capital account is open there is a single balance-of-trade condition which states that the present discounted value of net exports when measured at world prices over both periods must equal the interest and principal on the foreign debt:

$$\frac{F(K_{1t}, L_{1t}) - C_{1t}^Y - C_{1t}^O - (K_{1t+1} + K_{2t+1})}{(1+r^*)} + \frac{F(K_{1t+1}, L_{1t+1}) - C_{1t+1}^Y - C_{1t+1}^O - (K_{1t+2} + K_{2t+2})}{(1+r^*)} = (1+r^*)D_t^* \quad (23)$$

When the capital account is closed the balance-of-trade conditions are given by

$$F(K_{1t}, L_{1t}) - C_{1t}^Y - C_{1t}^O - (K_{1t+1} + K_{2t+1}) = r^* D_t^* \quad (24)$$

$$F(K_{1t+1}, L_{1t+1}) - C_{1t+1}^Y - C_{1t+1}^O - (K_{1t+2} + K_{2t+2}) = (1+r^*)D_t^* \quad (25)$$

The balance-of-trade condition for period  $t$  is that the balance of trade surplus—the value of production less consumption of the traded good, all measured at world prices—must equal the interest payment on the external debt. The balance-of-trade condition for period  $(t+1)$  is that the balance-of-trade surplus must equal the principal plus interest payment on the external debt.

Substituting into the first order conditions the relevant balance-of-trade condition(s), and noting that in general equilibrium  $r_{t+1}^L$  is a positive function of  $K_{1t+1}$  and  $K_{2t+1}$  when the capital account is closed, we can use the implicit function theorem to analyze the general equilibrium effects of a change in  $\pi$ . I assume throughout that there are no “Laffer curve” type effects, so that the revenue obtained from the tax on savings and from a tariff in period  $(t+1)$  increases as  $\gamma$  and  $T_2$  respectively increases.

The optimization problem described above can be illustrated diagrammatically as in Figure I when the capital account is open. Given the expected lifetime income of the young cohort and its intertemporal consumption curve  $I^*$ , its allocation of consumption over periods  $t$  and  $(t+1)$  is shown by  $(C_{1t}^{Y*}, C_{1t+1}^{O*})$  in Figure 1. Its savings  $S_t^{D*}$  are then given by the difference between its wage income  $\omega_t$  and its consumption  $C_{1t}^{Y*}$  in period  $t$ ; these savings are then lent to the representative domestic firm. Given the marginal revenue product of capital schedule  $\psi_{K_{1t}}$ , the representative firm decides on how much to invest in the traded and nontraded sectors so that the expected rate of return in each sector is the same as the world rate of interest  $r^*$ . The firm then borrows from abroad the difference between the amount that it wishes to invest and the amount that it can borrow from the young cohort,  $S_t^{D*}$ . This situation is illustrated in Figure 2.

Figure 1. Intertemporal Household Consumption in a Two-Period Setting

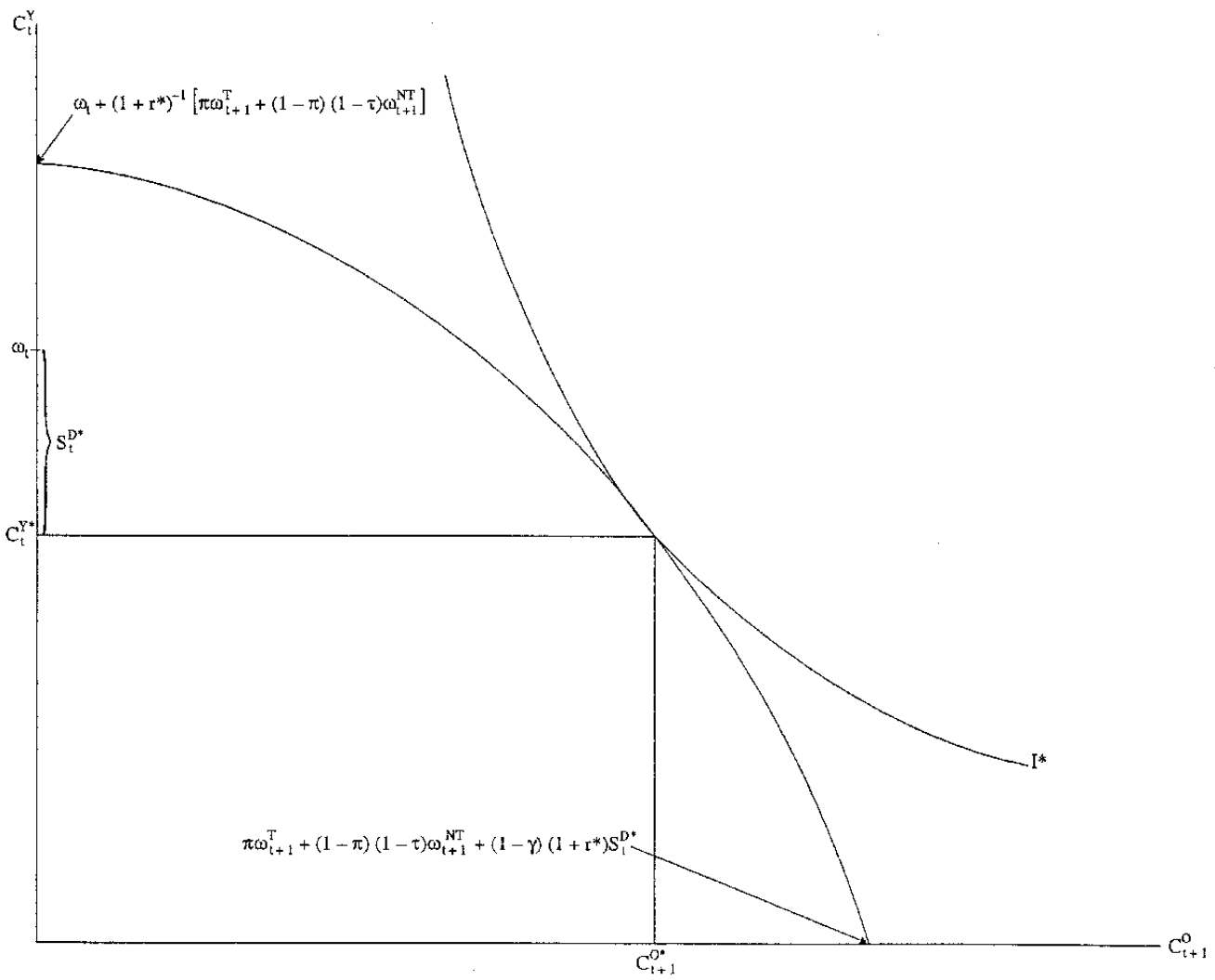
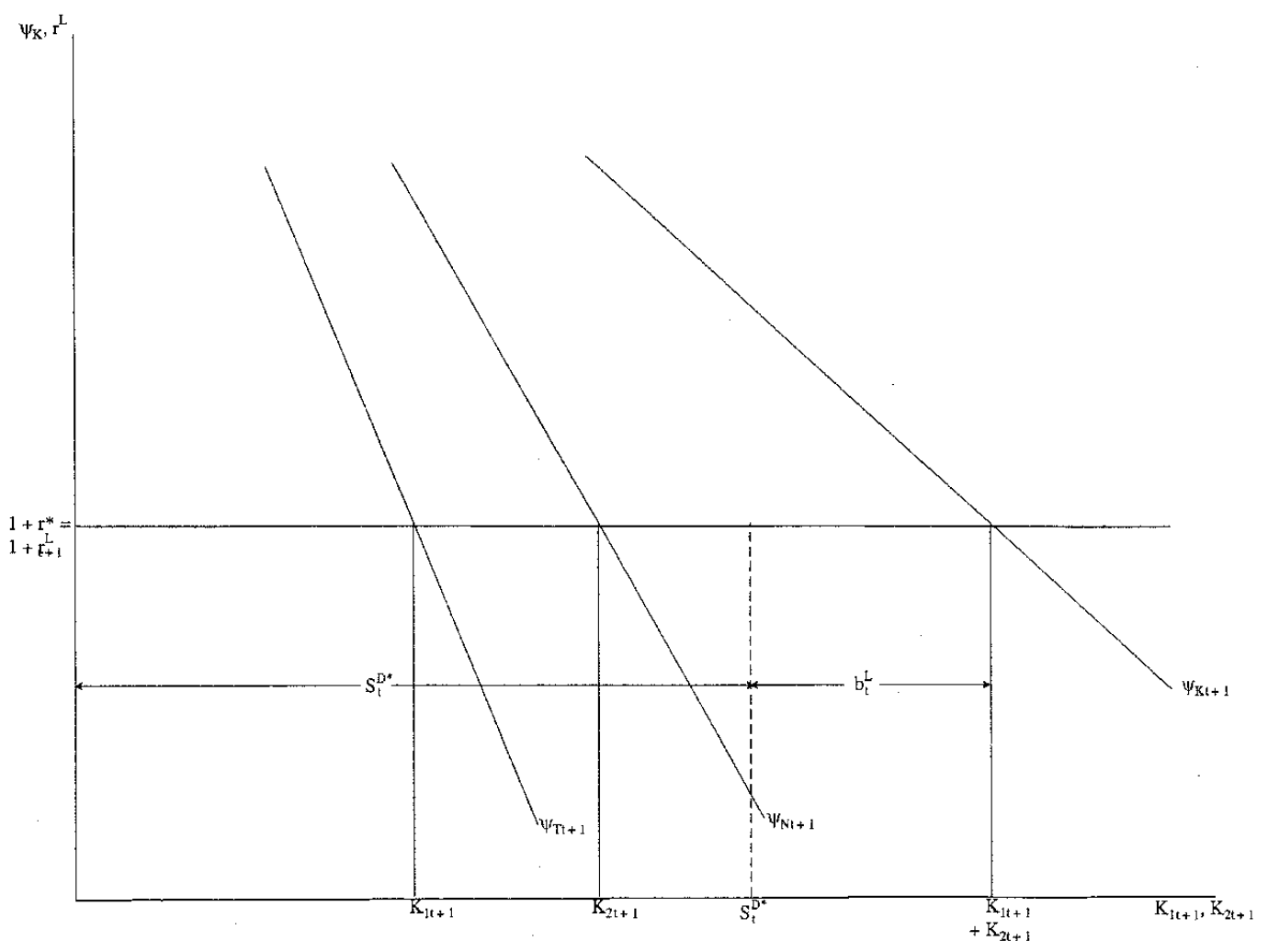


Figure 2. Allocation of Investment Between the Traded and Nontraded Sectors  
With an Open Capital Account



### III. THE RESULTS WITH AN OPEN CAPITAL ACCOUNT

#### Trade liberalization

##### *Impact on investment*

By the Stolper-Samuelson theorem, trade liberalization—removal of the tariff on imports of the traded good—will decrease the rewards to the factor used intensively in the production of the traded good (the rate of return on capital will fall), while the rewards to the factor used intensively in the production of the nontraded good will rise (the real wage rate will increase)—*for a given level of the capital stock*. The investment function will therefore shift inwards, leading to less investment in the domestic economy. Thus a higher probability of tariff reform—i.e. a lower  $\pi$ —leads to less investment in both sectors, and

$$\delta K_{1,t+1}/\delta \pi > 0 \quad (26)$$

$$\delta K_{2,t+1}/\delta \pi > 0 \quad (27)$$

The proof is given in Appendix I.

##### *Impact on real wages and on the real exchange rate*

Since trade liberalization leads to less domestic investment in the economy and to a lower capital stock in general equilibrium, the implication is a lower real wage in period (t+1)—at least when real wages are measured in terms of the world price of the traded good—as a consequence of the lower capital-labor ratio. Since the nontraded good sector is assumed to be the labor-intensive sector the result is a decrease in the relative price of the nontraded good, i.e. a depreciation of the real exchange rate. Even though the real wage in period (t+1) will be lower when measured in terms of the traded good, the impact of trade liberalization on the real wage will be indeterminate when consumption of the nontraded good is taken into account and will depend on the share of the nontraded good in the consumption basket of the representative household.

##### *Impact on domestic savings and the current account*

Trade liberalization in this model will give rise to substitution effects which will tend to raise current period domestic savings. A higher probability of tariff reform will encourage consumers to postpone their consumption of the traded good and increase their savings in the current period in anticipation that the domestic market price of the traded good will fall in the near future. Since trade liberalization in this model is associated in general equilibrium with a depreciation of the real exchange rate, similar expectations regarding the future price of the nontraded good are also likely to have a positive effect on current period savings as consumers attempt to postpone their consumption of the nontraded good.

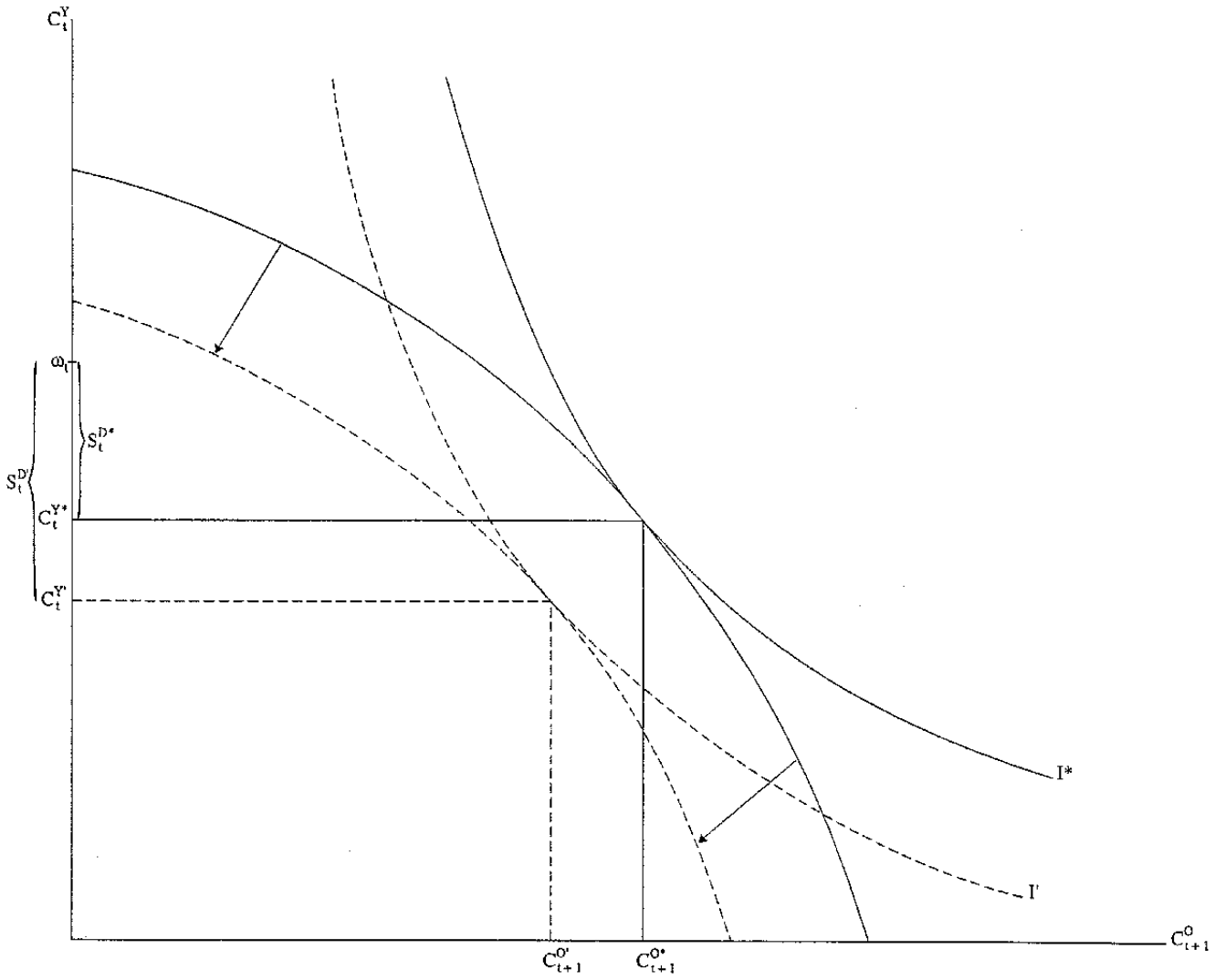
At the same time trade liberalization will give rise to various income effects. As mentioned earlier, trade liberalization (a lower  $\pi$ ) results in a lower level of domestic investment in period  $t$  and is associated with a lower expected (pre-tax) wage rate in period  $(t+1)$ —at least when real wages are measured in terms of the world price of the traded good. However, removal of the tariff and the decrease in the relative price of the nontraded good may well result in the (pre-tax) real wage in period  $(t+1)$  being higher when measured in terms of the domestic market prices of the basket of goods consumed by the representative household. In this case consumption-smoothing on the part of the young cohort would imply higher consumption (and lower savings) in period  $t$ . The situation is further complicated by the fact that a lower  $\pi$  will, for a given pre-tax wage rate in period  $(t+1)$ , imply a lower expected level of post-tax wage income in period  $(t+1)$  since there is now a higher probability that wage income will be taxed. This would tend to raise household savings in period  $t$ .

The general equilibrium effect on the overall volume of domestic savings is therefore ambiguous. Figure 3 looks at the case where these income and substitution effects lead to lower consumption and higher savings in period  $t$ , with period  $t$  consumption falling from  $C^Y_t$  to  $C^{Y'}_t$ , and household savings rising from  $S^D_t$  to  $S^{D'}_t$ . The fall in domestic capital formation and the rise in domestic savings in this scenario implies a rising current account surplus (or a declining current account deficit). If trade liberalization is instead associated with a decline in domestic savings, then the impact on the current account is ambiguous.

The experience of Mexico during 1991–93—the period immediately preceding the NAFTA agreement—provides an interesting empirical example of the opposite case to that illustrated in Figure 3, where the prospect of trade liberalization went hand-in-hand with rising consumption and declining domestic savings [see Sachs et al (1995)]. Consumption as a percentage of GDP increased slightly over this period, from 70.5 in 1991 to 71.9 in 1993, but even more important was a dramatic decline in the net domestic savings of the economy, from 9.7 percent of GDP to 6.1 percent of GDP. This decline in domestic savings mainly reflected a fall in private sector savings, while private sector investment rose from 14.9 percent of GDP to 16.6 percent of GDP. This increase in investment took place mainly in the nontraded goods sector, and more specifically in the construction sector, rather than in the traded goods sector. The consequence was a rise in the current account deficit from 4.7 percent of GDP in 1991 to 5.9 percent of GDP in 1993, financed by an inflow of capital from abroad. Thus, in the case of Mexico, an increasing probability of tariff reform was associated with a sharp decline in domestic savings and a growing current account deficit which ultimately led to the Mexican peso crisis of December 1994. It is important to note here that there were other major structural reforms taking place at the same time, particularly in the financial sector, which are important in explaining the sharp fall in national savings over this period and the increase in domestic investment (contrary to the predictions of this model); more details of these structural measures are given below. However, the expectation that trade reform would lead to stronger growth of the economy over the medium to long term probably contributed to the rise in private sector consumption and investment, and to the decline in private sector savings.



Figure 3. Impact of Trade Liberalization on Domestic Savings and Consumption  
With an Open Capital Account



## **Financial liberalization**

### ***Impact on investment***

Financial liberalization has no direct impact on the overall level of domestic investment when the capital account is open. However, there is an indirect effect: as the tax rate on savings falls, and assuming no Laffer curve type effects, for any given  $\pi$  the tariff rate  $T_2$  must rise in general equilibrium in order to meet the government's budget constraint in period  $(t+1)$ . Thus, for any given  $\pi$ , the marginal revenue product of capital function for the traded sector shifts out, leading to an increase in investment in that sector and

$$\delta K_{1t+1}/\delta\gamma < 0 \quad (28)$$

$$\delta K_{2t+1}/\delta\gamma = 0 \quad (29)$$

The proof is given in Appendix I.

### ***Impact on real wages and on the real exchange rate***

Since the indirect effect of financial liberalization is an increase in domestic capital formation, this will imply a rise in the real wage rate in general equilibrium. Given our assumption that the nontraded sector is labor-intensive, the implication is a rise in the relative price of the nontraded good and an appreciation of the real exchange rate—in direct contrast to the case of trade liberalization. The real wage will be higher when measured in terms of the world price of the traded good, but the overall impact of financial liberalization will be indeterminate when consumption of the nontraded good is taken into account. Thus, the effect on the real wage depends on the extent of the rise in the price of the nontraded good and on the share of the nontraded good in the consumption basket of the representative household.

### ***Impact on domestic savings and the current account***

In theory, the impact of financial liberalization on domestic savings should be ambiguous. The higher real (deposit) interest rates that liberalization brings should encourage economic agents to save more of their income rather than spend it today (the substitution effect). On the other hand, as they receive a higher return on their savings, they may feel richer and so decide to save less (the income effect). Whether domestic savings rises or not depends on which effect dominates.

Despite this theoretical ambiguity, many development economists have long believed that financial sector reform would raise overall domestic savings. In the early 1970s McKinnon (1973) and Shaw (1973) argued that not only were savings likely to rise in response to an increase in interest rates, but that agents would save more through the formal financial system rather than in other ways (such as hoarding cash), thereby allowing domestic

savings to be put to their most productive use. As a consequence the quality of investment would increase.

However, in the late 1970s a group of neo-structuralists led by Lance Taylor launched a strong attack on the McKinnon-Shaw hypothesis. The crux of their argument lies in the existence of informal curb markets in many financially repressed economies in which money-lenders intermediate between savers and investors. The neo-structuralists view these markets as competitive and efficient. By contrast, it is argued that reserve requirements constitute a leakage in the process of financial intermediation through commercial banks. For this reason neo-structuralists claim that banks cannot intermediate as efficiently as curb markets between domestic savers and investors [see Taylor (1983)].

As Fry (1989) points out, the main conclusion to be drawn from a survey of financial development models for developing countries is that, at the macroeconomic level, the effects of financial liberalization depend entirely on the initial assumptions that are made. If one assumes that the official banking system is more efficient at allocating investible funds than the curb market, and that households substitute mainly out of unproductive tangible assets (inflation hedges) when the real deposit rate of interest increases, financial liberalization raises the total real supply of credit, the quantity and quality of investment, and the rate of economic growth. On the other hand, if one assumes that the official banking system cannot intermediate between savers and investors as efficiently as the curb market because of reserve requirements, and that households substitute mainly out of curb market loans when the deposit rate of interest is raised, then financial liberalization reduces the total real supply of credit, the quantity of investment and the growth rate. In practice curb markets take different forms in different countries, and even in different regions within a country, and are not necessarily as competitive and efficient as the neo-structuralists assume. Detailed empirical evidence in this area is rather scarce.

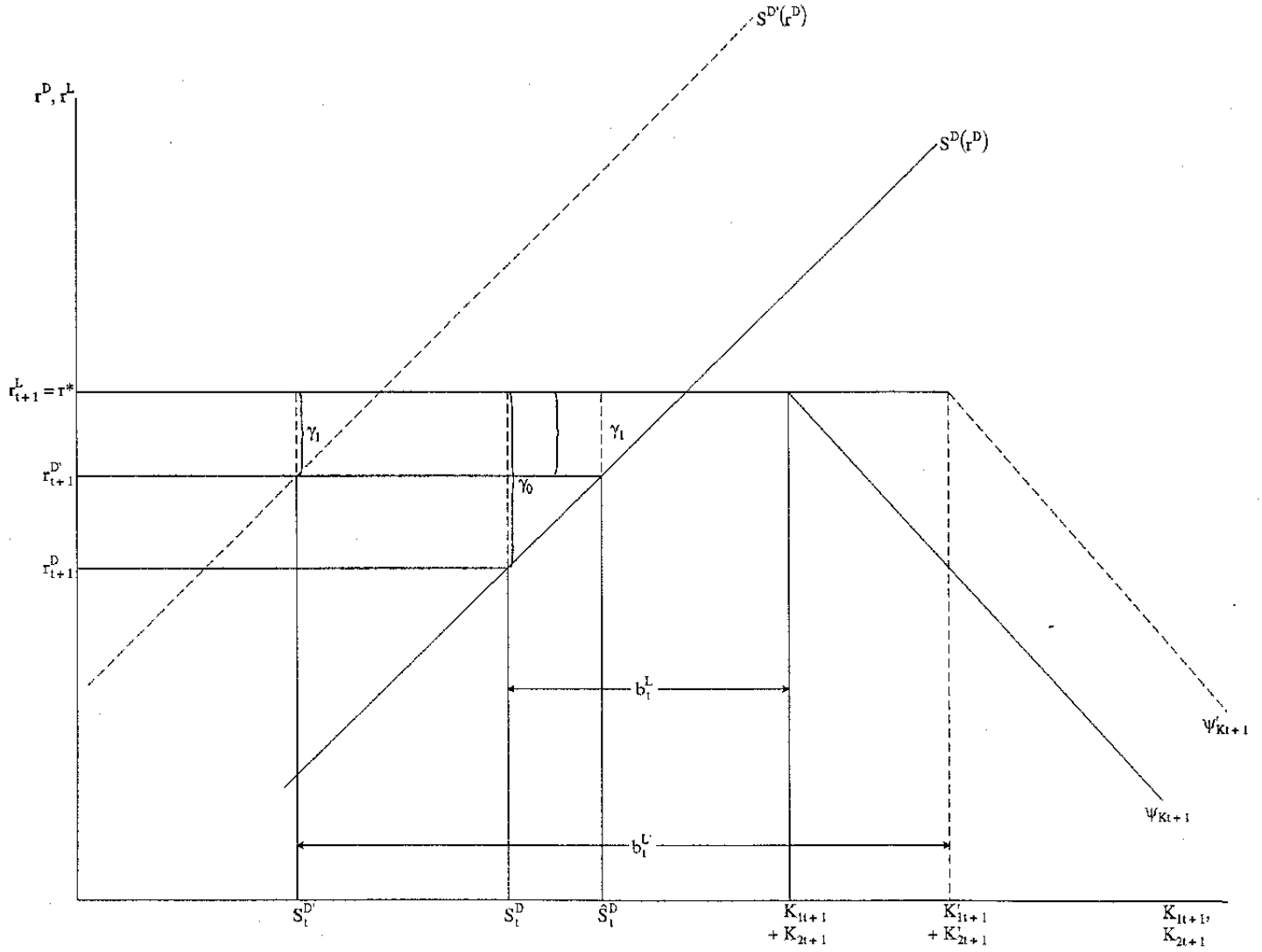
Whatever empirical evidence exists on the relationship between interest rates and savings/investment is, at best, mixed. Positive real interest rates are now the norm in most emerging economies, but there has been no clear trend towards increased savings. Although some researchers have found a significant relationship between higher real interest rates and higher savings in Asian countries, there is no convincing evidence that this holds across all developing countries. Indeed, a review of the Asian experience by Cho and Khatkhate (1989) suggests that the level of savings appears to be determined more by institutional factors, and in particular accessibility to banks or other financial institutions in which to deposit savings, than by the level of real interest rates.

Here again the experience of Mexico is interesting. The late 1980s and early 1990s saw a big increase in capital inflows from abroad, a significant proportion of which was short term, as private sector savings fell from 15.6 percent of GDP in 1989 to 10.7 percent of GDP in 1994 [see Sachs et al (1995)]. There were major structural changes going on in the economy over this period, particularly relating to financial liberalization and tariff reform associated with the signing of NAFTA in November 1993. The financial markets were

deregulated in the 1980s and a number of banks were privatized between 1991 and 1993. However there was insufficient prudential supervision and regulation of commercial banks, with the result that these relatively inexperienced banks over-lent in a period of stiff competition in the banking sector. Moreover, with respect to the capital account, the Mexican government changed the law in 1990 to allow foreigners to hold government bonds and to buy (non-voting) shares in almost all sectors of the economy. All these structural changes no doubt contributed to the decline in the private sector savings rate, as they made it easier for households to borrow from banks. In addition, the expectation that these reforms would generate higher economic growth over the medium to long term may have led households to anticipate strong growth of their real (post-tax) disposable incomes, and this in turn may have had a negative income effect on current household savings.

The general equilibrium impact of financial liberalization on the current account is indeterminate in this model, since the overall effect on domestic savings is ambiguous. Figure 4 illustrates the case where, as in Mexico, financial liberalization is associated with a decline in domestic savings, an increase in domestic capital formation and a growing current account deficit. Financial liberalization is depicted by a reduction in the tax rate on borrowing from  $\gamma_0$  to  $\gamma_1$ . The indirect effects of financial liberalization shift the marginal revenue product of capital function to the right, from  $\psi_{K_{t+1}}$  to  $\psi'_{K_{t+1}}$ , while the domestic savings function shifts to the left from  $S^D_t(r^D)$  to  $S^{D'}_t(r^D)$ . The real lending rate of interest remains unchanged at the world interest rate, but the real deposit rate of interest rises from  $r^D_{t+1}$  to  $r^{D'}_{t+1}$ . The net result is an increase in domestic capital formation, a reduction in domestic savings from  $S^D_t$  to  $S^{D'}_t$ , and an increase in the current account deficit from  $b^L_t$  to  $b^{L'}_t$ .

Figure 4. Impact of Financial Liberalization on Domestic Savings and Investment  
With an Open Capital Account



#### IV. THE RESULTS WITH A CLOSED CAPITAL ACCOUNT

With an open capital account, the link between domestic savings and investment is broken since foreign borrowing is allowed to finance any excess of domestic investment over domestic savings at the given world rate of interest. The results in the previous section showed that trade liberalization unambiguously leads to less investment in both sectors of the economy, while financial liberalization results in more investment in the traded sector but has no effect on investment in the nontraded sector. With a closed capital account, however, the equilibrium interest rate has to adjust to equate domestic savings and domestic investment in every period. This gives rise to various effects (discussed below) which make the general equilibrium effects of trade and financial liberalization more complex and ambiguous than is the case with an open capital account.

##### Trade liberalization

When the capital account is open a higher probability of tariff reform (a lower  $\pi$ ) leads to less investment in both sectors. This is no longer necessarily the case when the capital account is closed; it is shown in Appendix I that

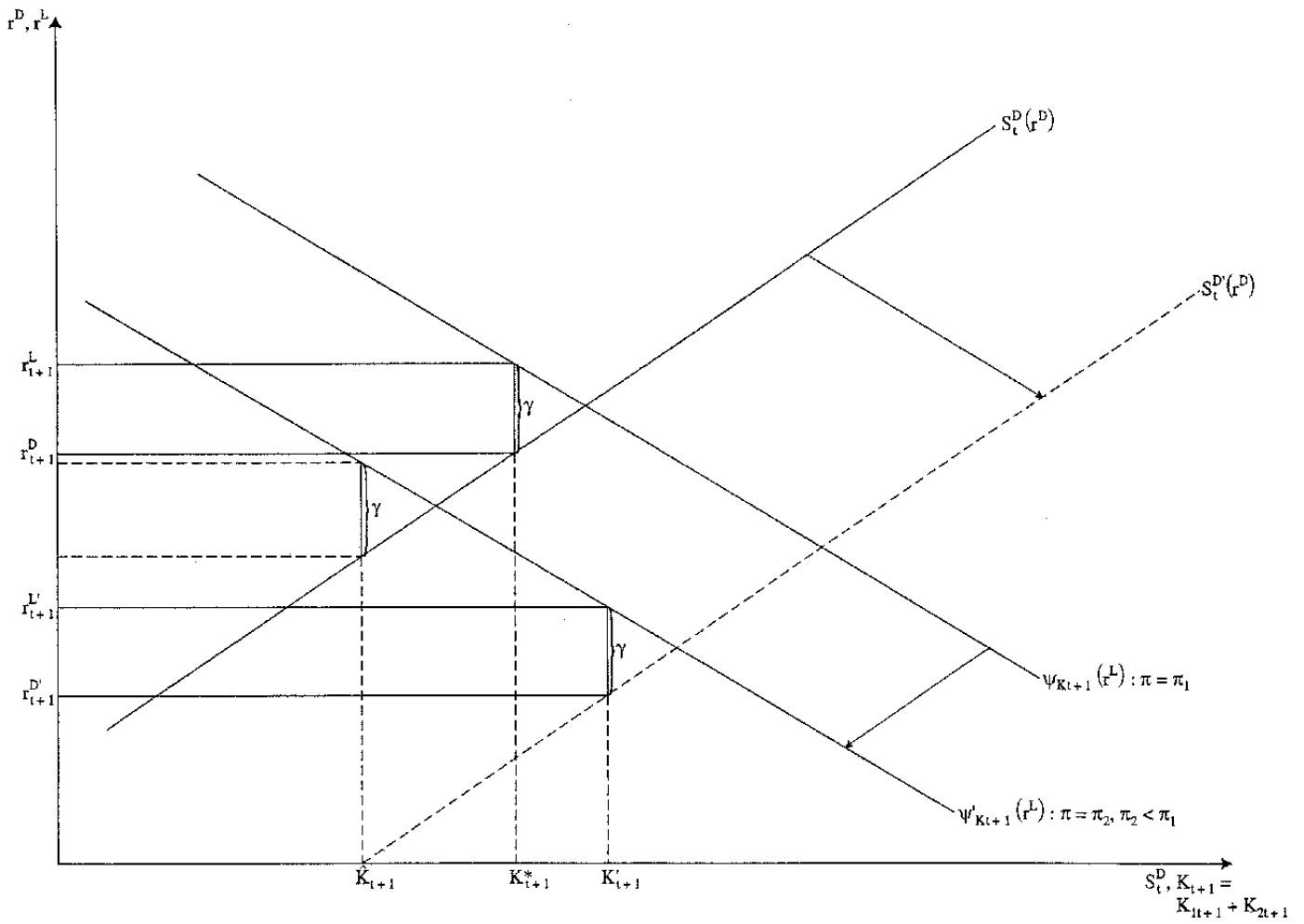
$$\delta K_{1t+1}/\delta \pi \text{ is ambiguous} \quad (30)$$

$$\delta K_{2t+1}/\delta \pi \text{ is ambiguous} \quad (31)$$

in the case where the capital account is closed. This also means that the general equilibrium impact on real wages and on the real exchange rate is indeterminate.

This ambiguity arises because, with a closed capital account, the interest rate adjusts to equate the level of investment with the volume of domestic savings in general equilibrium, and the general equilibrium impact of trade liberalization on the latter is ambiguous—as explained in the previous section. It is thus theoretically possible that a higher probability of tariff reform generates a strong negative income effect which leads to a large outward shift of the domestic savings function. The resulting fall in the lending rate of interest could be sufficient to generate a higher level of domestic capital formation in general equilibrium. Figure 5 illustrates this case diagrammatically. Here a higher probability of tariff reform leads to a shift in the marginal revenue product of capital function from  $\Psi_{K_{t+1}}$  to  $\Psi'_{K_{t+1}}$ , while the savings function shifts outward from  $S^D(r^D)$  to  $S^{D'}(r^D)$ . The net result is a fall in the lending rate of interest from  $r^L_{t+1}$  to  $r^{L'}_{t+1}$ , with a consequent increase in domestic investment from  $K^*_{t+1}$  to  $K'_{t+1}$ .

Figure 5. Impact of Trade Liberalization on Domestic Savings and Investment  
With a Closed Capital Account



### Financial liberalization

When the capital account is closed a lower tax rate on borrowing results in higher investment in the traded sector—as is the case when the capital account is open. However, the impact on investment in the nontraded sector is now ambiguous and depends on the general equilibrium effect of financial liberalization on the real lending rate of interest. That is,

$$\delta K_{1t+1} / \delta \gamma < 0 \quad (32)$$

$$\delta K_{2t+1} / \delta \gamma \text{ is ambiguous} \quad (33)$$

The proof is given in Appendix I. As is the case with trade liberalization, the general equilibrium impact on real wages and on the real exchange rate is therefore also indeterminate.

Figure 6 illustrates the case where a fall in the tax rate on borrowing, from  $\gamma_0$  to  $\gamma_1$ , leads to higher investment in both sectors. This is because we assume that financial liberalization leads to an outward shift of the domestic savings function, from  $S^D_t(r^D)$  to  $S^{D'}_t(r^D)$ , although as explained in the previous section this may not necessarily be the case. The marginal revenue product of capital function shifts from  $\psi_{Kt+1}$  to  $\psi'_{Kt+1}$  as a consequence of the indirect effect of financial liberalization through the government budget constraint; the higher equilibrium level of  $T_2$  consistent with a lower level of  $\gamma$  results in the marginal revenue product of capital function in the traded good sector moving to the right, from  $\psi_{Tt+1}$  to  $\psi'_{Tt+1}$ . However, the impact on the rate of interest is more than outweighed by the outward shift in the domestic savings function, so that the equilibrium real lending rate of interest falls from  $r^L_{t+1}$  to  $r^{L'}_{t+1}$ . Thus investment in the traded sector rises from  $K^*_{1t+1}$  to  $K'_{1t+1}$ , and in the nontraded sector from  $K^*_{2t+1}$  to  $K'_{2t+1}$ .





## V. ENDOGENIZING THE PROBABILITY OF TARIFF REFORM

The story becomes more interesting when the probability of tariff reform becomes a function of the tax rate on savings, either positive or negative.

$\pi$  could be a negative function of  $\gamma$  if, for example, a low tax on household savings means that more revenue must be raised through either a tax or a tariff, and this raises the required tax rate on wage income to politically infeasible levels and makes the tariff more politically attractive. This is likely to be the case in countries where labor (trade unions) are politically powerful.

On the other hand  $\pi$  could be a positive function of  $\gamma$  if a high tax rate on savings leads to strong lobbying by firms for protection against imports on the grounds that they face “unfair” competition from abroad due to the fact that domestic producers have to pay a higher cost for capital. How are the results in the previous sections affected when  $\pi$  becomes a function of  $\gamma$ ?

To answer this note that

$$\delta K_{it+1}/\delta \gamma = \delta K_{it+1}/\delta \gamma_{\pi=\pi^*} + (\delta K_{it+1}/\delta \pi) * (\delta \pi/\delta \gamma) \quad i = 1,2 \quad (34)$$

The first part of these expressions represent the direct effects of financial liberalization on domestic capital formation, while the second part of the expressions represent the indirect effects which arise from  $\pi$  being a function of  $\gamma$ .

In Section III it was shown that, when the capital account is open, both  $\delta K_{1t+1}/\delta \pi$  and  $\delta K_{2t+1}/\delta \pi$  are positive as long as the traded sector is the capital-intensive sector. From this it follows that, if  $\pi$  is a positive function of  $\gamma$ , the indirect effects of financial liberalization would be to raise domestic investment in both sectors. Conversely if  $\pi$  is a negative function of  $\gamma$ . In other words, if the probability of tariff reform is a positive function of the tax rate on borrowing the indirect effects of financial liberalization, when the capital account is open, are higher domestic investment in the economy, higher real wages (at least when measured in terms of the traded good), and further appreciation of the real exchange rate. If the probability of tariff reform is instead a negative function of the tax rate on borrowing the indirect effects of financial liberalization are the opposite: less domestic capital formation, lower real wages, and a depreciation of the real exchange rate in general equilibrium.

The situation is more complex when the capital account is closed. Absent a strong negative income effect leading to a significant rise in household savings, a higher probability of tariff reform (a lower  $\pi$ ) will be associated with a decrease in domestic capital formation and  $\delta K_{it+1}/\delta \pi$  will be positive. The indirect effects of financial liberalization will then be the same as in the case where the capital account is open. Only if there is a strong negative income effect from trade liberalization (which generates a large shift to the right of the domestic savings function and a significant reduction in the equilibrium lending rate of

interest) will  $\delta K_{t+1}/\delta\pi$  be negative (such that an increased probability of removal of the tariff on the trade good will coincide with more investment in the domestic economy). Under this scenario the indirect effects of financial liberalization will be directly opposite to the case when the capital account is open.

The next (and final) section draws together the main results presented in this paper and discusses their policy implications.

## VI. CONCLUSION

The results presented in this paper suggest that, when the capital account is open, trade liberalization leads to less domestic investment in both the traded and nontraded sectors of the economy and to a lower capital stock in period (t+1). This leads in general equilibrium to a lower real wage in period (t+1)—at least when real wages are measured in terms of the world price of the traded good—as a consequence of the lower capital-labor ratio. The result is a decrease in the relative price of the nontraded good, i.e. a depreciation of the real exchange rate, since the nontraded sector is assumed to be the labor-intensive sector. Even though the real wage in period (t+1) will be lower when measured in terms of the world price of the traded good, the impact of trade liberalization on the real wage will be indeterminate when consumption of the nontraded good is taken into account and will depend on the share of the nontraded good in the consumption basket of the representative household.

By contrast the direct effect of financial liberalization (i.e. a lowering or removal of the tax on household savings) when the capital account is open is an increase in investment in the traded sector, with investment in the nontraded sector being unaffected. In general equilibrium there will be an appreciation of the real exchange rate, and the real wage will be higher when measured in terms of the world price of the traded good. However, the overall impact of domestic financial market liberalization on the real wage depends on the extent of the rise in the price of the nontraded good, and on the share of the nontraded good in the consumption basket of the representative household.

What are the policy implications? One of the objectives of trade liberalization is usually to encourage expansion of the traded sector relative to the nontraded sector and to promote expansion of the exports through depreciation of the real exchange rate. Even though financial liberalization in this model results in more investment in the traded sector, it is also associated with appreciation of the real exchange rate which is likely to have a negative impact on net exports and on the current account balance. This suggests that financial liberalization will tend to defeat one of the objectives of trade liberalization, at least in part, and that both trade and domestic financial market reform should not be undertaken simultaneously. Arguably, trade liberalization should precede liberalization of the domestic financial market, given the likely negative effect of the latter on net exports and on the current account balance. Indeed, there is a case for arguing that the results presented in this paper suggest that domestic financial market reform should be delayed until the traded sector is strong enough (competitive enough) to withstand appreciation of the real exchange rate.

The situation is somewhat more complicated when the capital account is closed, but the results discussed above should still hold unless there is a strong negative income effect from trade liberalization which generates a large shift to the right of the domestic savings function and a significant reduction in the equilibrium real lending rate of interest. In the absence of this type of strong negative income effect a closed capital account should lead to less domestic investment in both sectors of the economy and to a decrease in the relative price of the nontraded good (a depreciation of the real exchange rate), thus reinforcing the effects of trade liberalization. This in turn suggests that tariff reform is likely to be more effective if carried out in the context of a closed capital account.

It is interesting, however, to look at the case where the probability of tariff reform is itself a function of the tax rate on borrowing. When the capital account is open the direct effects of financial liberalization will be further accentuated if the probability of tariff reform is a positive function of the tax rate on borrowing. Conversely, if a lower tax rate on borrowing implies a smaller probability that the tariff on the traded good will be removed in the next period: in this case the indirect effects of financial liberalization will tend to offset the direct effects and lead to less capital investment in the economy, lower real wages (when wages are measured in terms of the traded good), and a depreciation of the real exchange rate in general equilibrium. Thus the indirect effects of financial liberalization would tend to reinforce the effects of trade liberalization when the probability of tariff reform is a negative function of the tax rate on borrowing. To the best of the author's knowledge these aspects of the political economy linkages between trade liberalization and domestic financial sector reform have not been discussed in the existing academic literature.

How do these results compare with those in Kahkonen (1987)? The main policy conclusions that arise from Kahkonen's model are that domestic financial liberalization (raising the deposit rate of interest and removing the "tax" on household savings) may reduce welfare if tariffs are present, whereas tariffs can raise welfare when financial repression discourages savings. Thus, in Kahkonen's model, tariff reductions increase welfare unambiguously only if the domestic financial market is unregulated, while financial liberalization will unambiguously cause welfare gains only under free trade. Kahkonen concludes that, although "recommendations about the optimal order of liberalization based on the relatively simple model presented here should be interpreted cautiously, it appears that a simultaneous liberalization of trade and domestic financial markets would be beneficial in a financially repressed economy, whether capital movements are regulated or not." [Kahkonen (1987), pp. 543]. These policy implications differ from those implied by the results presented in this paper in large part because Kahkonen's model does not incorporate a nontraded sector, and consequently cannot analyze the implications of trade and financial liberalization for the real exchange rate and for the current account balance.

### Solving the model presented in Section II

It can be shown that labor allocation in period t is unaffected either by the uncertainty parameter  $\pi$  or by the tax and tariff rates expected in period (t+1).  $L_{1t}$  is therefore taken to be a constant for the purpose of solving the model. Thus, the first order conditions for the firm's optimization problem presented in Section 2 are:

$$\begin{aligned}
 A(K_{1t+1}, K_{2t+1}) = & \\
 (1+r^*)^{-1} * & \left[ \pi \alpha a(1+T_2)(K_{1t+1}/L_{1t+1}^T)^{\alpha-1} + \right. \\
 & \left. (1-\pi) \alpha a(K_{1t+1}/L_{1t+1}^{NT})^{\alpha-1} \right] - \\
 & \left[ (1+r^*)^{-1}(1+r_{t+1}^L) - 1 \right] *(1+T_1) = 0
 \end{aligned} \tag{35}$$

$$\begin{aligned}
 B(K_{1t+1}, K_{2t+1}) = & \\
 (1+r^*)^{-1} * & \left[ \pi \beta b p^T_{Nt+1} (K_{2t+1}/(1-L_{1t+1}^T))^{\beta-1} + \right. \\
 & \left. (1-\pi) \beta b p^{NT}_{Nt+1} (K_{2t+1}/(1-L_{1t+1}^{NT}))^{\beta-1} \right] - \\
 & \left[ (1+r^*)^{-1}(1+r_{t+1}^L) - 1 \right] *(1+T_1) = 0
 \end{aligned} \tag{36}$$

By the implicit function theorem

$$\begin{aligned}
 & \left| \begin{array}{cc} A'(K_{1t+1}) & A'(K_{2t+1}) \\ B'(K_{1t+1}) & B'(K_{2t+1}) \end{array} \right| \quad \left| \begin{array}{c} \delta K_{1t+1}/\delta \pi \\ \delta K_{2t+1}/\delta \pi \end{array} \right| \\
 = - & \left| \begin{array}{c} A'(\pi) \\ B'(\pi) \end{array} \right|
 \end{aligned}$$

Solving the model we have

$$\begin{aligned}
 \delta K_{1t+1}/\delta \pi &= - [ C_{11} A'(\pi) + C_{21} B'(\pi) ] / \Delta \\
 \delta K_{2t+1}/\delta \pi &= - [ C_{12} A'(\pi) + C_{22} B'(\pi) ] / \Delta
 \end{aligned}$$

where

$C_{ij}$  is the determinant of the cofactor matrix associated with the element in the  $i^{\text{th}}$  row and  $j^{\text{th}}$  column of the Hessian

and  $\Delta$  is the determinant of the Hessian matrix and is positive definite by the second order sufficient conditions for the firm's optimization problem.

Applying the Implicit Function Theorem, and substituting the balance-of-trade conditions and the government budget constraints into the firm's first order conditions, we get the following results:

$$\delta K_{1t+1}/\delta \pi = - (1/\Delta) [ A'(\pi)B'(K_{2t+1}) - B'(\pi)A'(K_{2t+1}) ] \quad (37)$$

> 0 if the capital account is open;  
ambiguous if the capital account is closed

$$\delta K_{2t+1}/\delta \pi = - (1/\Delta) [ B'(\pi)A'(K_{1t+1}) - A'(\pi)B'(K_{1t+1}) ] \quad (38)$$

> 0 if the capital account is open;  
ambiguous if the capital account is closed

where

$$A'(\pi) = (1+r^*)^{-1} * [ \alpha(1+T_2) * \{ (aK_{1t+1}^\alpha (L_{1t+1}^T)^{1-\alpha} - (1+r^*)(K_{1t+1} + K_{2t+1})) K_{1t+1}^{-1} + (1+r^*)(1+K_{2t+1}K_{1t+1}^{-1}) \} - \alpha * \{ (aK_{1t+1}^\alpha (L_{1t+1}^{NT})^{1-\alpha} - (1+r^*)(K_{1t+1} + K_{2t+1})) K_{1t+1}^{-1} + (1+r^*)(1+K_{2t+1}K_{1t+1}^{-1}) \} ]$$

> 0

since  $L_{1t+1}^T > L_{1t+1}^{NT}$   
->  $aK_{1t+1}^\alpha (L_{1t+1}^T)^{1-\alpha} > aK_{1t+1}^\alpha (L_{1t+1}^{NT})^{1-\alpha}$

$B'(K_{2t+1}) < 0$  and  $A'(K_{1t+1}) < 0$  by the second-order necessary conditions for the firm's optimization problem.

$$B'(\pi) = (1+r^*)^{-1} * [ \beta b p_{Nt+1}^T (K_{2t+1}, 1-L_{1t+1}^T)^{\beta-1} - \beta b p_{Nt+1}^{NT} (K_{2t+1}, 1-L_{1t+1}^{NT})^{\beta-1} ] > 0$$

$$A'(K_{2t+1}) = \alpha K_{1t+1}^{-1} [ \pi(1+T_2) + (1-\pi) ] - (1+r^*)(1+T_1) \delta(1+r_{t+1}^L)/\delta K_{2t+1}$$

> 0 if the capital account is closed;  
ambiguous if the capital account is open.

$$B'(K_{1t+1}) = - (1+r^*)^{-1}(1+T_1) \delta(1+r_{t+1}^L)/\delta K_{1t+1}$$

= 0 if the capital account is open;  
< 0 if the capital account is closed.

Before looking at the impact on domestic investment of changes in the tax rate on borrowing, note that in general equilibrium a lower  $\gamma$  will mean a higher  $T_2$  for the government's period (t+1) budget constraint to be met. This can be shown as follows.

Substituting (20) into the worker government's period (t+1) budget constraint (22a) we get

$$\gamma(1 + r_{t+1}^L) [(1+T_1)(K_{1t+1}+K_{2t+1}) - b_t^L] = (1+r^*)D_t^* - T_2 [K_{1t+2} + K_{2t+2} + C_{1t+1}^{Y,T} + C_{1t+1}^{O,T} - F(K_{1t+1}, L_{1t+1}^T)] \quad (39)$$

Differentiating (39), and noting that in general equilibrium  $(1 + r_{t+1}^L)$  is a positive function of  $\gamma$ , we get

$$[(1+T_1)(K_{1t+1}+K_{2t+1}) - b_t^L] ((1 + r_{t+1}^L) + \gamma \delta(1 + r_{t+1}^L)/\delta\gamma) \delta\gamma = - [K_{1t+2} + K_{2t+2} + C_{1t+1}^{Y,T} + C_{1t+1}^{O,T} - F(K_{1t+1}, L_{1t+1}^T)] \delta T_2 \quad (40)$$

This in turn gives us that

$$\delta T_2 / \delta\gamma = \frac{- [(1+T_1)(K_{1t+1}+K_{2t+1}) - b_t^L] ((1 + r_{t+1}^L) + \gamma \delta(1 + r_{t+1}^L)/\delta\gamma)}{[K_{1t+2} + K_{2t+2} + C_{1t+1}^{Y,T} + C_{1t+1}^{O,T} - F(K_{1t+1}, L_{1t+1}^T)]} \quad (41)$$

< 0 given our assumptions about no Laffer curve effects.

$$\delta K_{1t+1} / \delta\gamma = - (1/\Delta) [A'(\gamma)B'(K_{2t+1}) - B'(\gamma)A'(K_{2t+1})] < 0 \quad (42)$$

$$\delta K_{2t+1} / \delta\gamma = - (1/\Delta) [B'(\gamma)A'(K_{1t+1}) - A'(\gamma)B'(K_{1t+1})] = 0 \text{ if the capital account is open;} \\ \text{ambiguous if the capital account is closed.} \quad (43)$$

$$A'(\gamma) = \frac{- (1+r^*)^{-1}(1+T_1)\delta(1 + r_{t+1}^L)/\delta\gamma + (1+r^*)^{-1} \pi\alpha [(aK_{1t+1}^\alpha (L_{1t+1}^T)^{1-\alpha} - (1+r^*)(K_{1t+1} + K_{2t+1})) K_{1t+1}^{-1} + (1+r^*)(1+K_{2t+1}K_{1t+1}^{-1})] \delta T_2 / \delta\gamma}{< 0} \quad (44)$$

$$B'(\gamma) = - (1+r^*)^{-1}(1+T_1)\delta(1 + r_{t+1}^L)/\delta\gamma \quad (45)$$

= 0 if the capital account is open;  
< 0 if the capital account is closed.

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