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CURRENT ACCOUNT POLICIES

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## ABSTRACT

The effectiveness of tariffs and taxes on foreign borrowing for reducing current account deficits is examined in a two-sector neoclassical optimal growth model of a small open-economy. The outputs of both sectors are tradable, and capital is used in only one sector while labor is employed in both. The dynamics of the current account are modelled over an infinite horizon with an endogenous discount rate. Imposition of a tariff on the capital-using good leads to a current account deficit on impact followed by surpluses as adjustment to the steady-state occurs. A tariff placed on the other good leads to surpluses both initially and over time. A tax levied on foreign borrowing also leads to surpluses.

## 1. Introduction

Tariffs or taxes on foreign borrowing are frequently proposed policies aimed at reducing or eliminating current account deficits. This paper explores the effectiveness of those policies in the context of a two-sector neoclassical optimal growth model. We can make no special claims for the realism of our particular modelling of the economy, but we hope that this analysis can serve as a benchmark that provides some insight into the consequences of these policies in a dynamic setting.

Our small open economy consists of two sectors - one that produces a good that can be used either for current consumption or for investment, and the other being a pure consumption good. The composite good is manufactured with labor and capital, while the pure consumption good uses labor and land in its production. This particular structure was chosen because it represents the simplest possible arrangement that allows a capital good to be produced and traded, and that allows international borrowing.<sup>1</sup> It is well known that the more familiar two sector models in which labor and capital are used to produce both goods yields, in general, an indeterminate total capital stock when foreign borrowing is permitted.<sup>2</sup>

The model is dynamic, since international borrowing is inherently not a static phenomenon. Furthermore, we examine the dynamics of the current account over an infinite horizon. Another approach would have been to look at a two-period horizon for the economy, but there are several drawbacks to such an approach. It is impossible in the two-period model to distinguish between the short-run and long-run effects of policy changes. Also, the two-period view can be limiting when trying to study the dynamics of borrowing. A dollar borrowed today must be paid back with interest tomorrow in that set-up. With

an infinite horizon, the principal on the loan never needs to be paid back - the present-value of the stream of interest payments equals the value of the principal.

There are two familiar classes of infinite period growth models. Eaton (1984a, b) examines some trade issues in the overlapping generations framework of Samuelson (1958) and Diamond (1965). We instead adopt the Srinivasan (1964)-Uzawa (1964) approach in which decision-making agents have an infinite horizon. A well-known problem arises in examining the borrowing of small countries in such a model. In the steady-state of this economy the discount rate of consumers must equal the interest rate. Since the small country takes the interest rate as given, the discount rate must be endogenous and adjust into equality with the interest rate (unless it happens to be constant and equal to the interest rate). We take the approach of Uzawa (1968) (which has been taken in the international context by Obstfeld (1981, 1982) among others) of assuming the discount rate is positively related to the current level of felicity.

The Uzawa formulation turns out to be much like an assumption that individuals have Metzlerian saving functions - that is, consumers have a target level of wealth and save or dissave according to whether their current wealth is less or greater than their target level. Since consumers' discount rate equals the world interest rate in the long run, consumers have a long run level of felicity that is indexed by the interest rate. A shock that lowers the discounted stream of felicity will lead consumers to increase saving now so that they can eventually achieve their long-run felicity level. This characteristic of Uzawa preferences is, for example, what led Obstfeld (1982) to conclude that if a country's terms of trade worsen, their current

consumption would fall and, hence, their current account would move into surplus.

Because this is a small country the optimal tariff or tax on borrowing is zero. Irrespective of the effects of these policy measures on the current account, they cannot improve welfare. The tariff, however, will have no effect on the long-run steady-state felicity level (because of Uzawa preferences) so that the loss in well-being all occurs along the adjustment path between steady-states. We find there are two critical junctures in the path of the current account in reaction to an increase in the tariff - the impact response in which a discrete amount of capital goods may be exported for bonds and the adjustment path toward the steady-state.

If the tariff is placed on the pure consumption good then production of that good expands, drawing labor out of the composite good sector. This lowers the marginal productivity of capital in that sector, thus making capital a less attractive asset than foreign bonds. Thus, capital is immediately traded for bonds until the marginal productivity of capital increases into equality with the world interest rate. If the tariff were levied on the composite good the opposite reaction would occur - there would be an immediate export of foreign bonds for capital. Thus, the impact effect of the tariff on the current account depends on which good the tariff is levied.

After the initial response in both cases the current account will move into surplus. The long-run level of felicity is unaffected by the tariff, and the steady-state level of expenditure expressed at world prices must actually increase. (The tariff leads to long-run distortions, so that the level of expenditure evaluated at world prices must increase in order to maintain the same level of felicity.) Since the tariff lowers overall wealth in the

country that imposes it, national saving must immediately increase if long-run spending goals are to be reached. Hence, the country adjusts to the steady state by running a current account surplus.

In the case of the tariff on the pure consumption good, there is unambiguously an increase in steady-state holdings of foreign bonds. Both the impact effect and adjustment period require acquisition of foreign assets. So the tariff leads to higher steady-state interest payments and a higher steady-state trade deficit. On the other hand, the effect on the steady-state trade deficit of a tariff on the composite good is ambiguous since the effect on holdings of foreign bonds is ambiguous - there is an immediate drop which may or may not be offset by acquisition of bonds along the adjustment path to the new steady state.

In contrast to the tariff, the imposition of a tax on foreign borrowing (which is modelled here as a tax which raises the interest that must be paid on loans from foreigners) will change the steady-state felicity. The discount rate, and hence the long-run level of felicity, will rise to match the increase in the interest rate faced by domestic residents. The immediate effect of the imposition of the borrowing tax is an export of capital for foreign bonds. The higher interest rate makes foreign bonds a more attractive asset, leading to the capital export. Since long run expenditures rise, and there is an overall decrease in welfare, current saving must increase. Hence, there is a current account surplus as the economy moves to steady state. So, a tax on foreign borrowing moves the current account into surplus both in the short-run and along the adjustment path. The steady-state trade balance must be in greater deficit.

Section 2 of this paper sets up the model and examines dynamics under free trade and borrowing. The next section considers the effects of a tariff

on the pure consumption good, while the tariff on the composite good is studied in section 4. In section 5, the tax on borrowing is examined. The final section considers extensions of the current model.

## 2. The Model under Free Trade

There are two goods produced in our model - a pure consumption good and a composite good that can be consumed or used as an investment good. The composite good, which is labelled good 1, uses capital and labor in its production. The production function is assumed to be constant returns to scale, and output is given by

$$y_1 = kf(x/k)$$

where  $k$  is the stock of capital and  $x$  is the amount of labor employed in industry 1. Output in the second industry uses land and labor in its production, and the technology is again constant returns to scale. Labor is mobile between industries and it is assumed that the total labor supply as well as the total land stock are fixed at 1. So, we can write

$$y_2 = g(1 - x) .$$

At any moment in time, current felicity depends on consumption of both goods -  $u(c_1, c_2)$ . It is convenient, however, to express the level of felicity by the indirect utility function

$$v(z, p) = \max\{u(c_1, c_2) | c_1 + pc_2 \leq z\}$$

where  $z$  represents the level of expenditure at any given time, and  $p$  is the price of good 2 in terms of good 1. We assume  $u$  is concave in  $c_1$  and  $c_2$ , which implies  $v$  is concave in  $z$ . We also assume

$$\lim_{c_1 \rightarrow 0} u_1 = \lim_{c_2 \rightarrow 0} u_2 = \infty$$

so as to avoid corner solutions.

A representative consumer maximizes the integral

$$V = \int_0^{\infty} v_t e^{-\Delta_t} dt$$

where

$$\Delta_t = \int_0^t \delta_s ds$$

and  $\delta_s$  is the instantaneous subjective discount rate at time  $s$ . Following Uzawa, we take  $\delta_s$  to be a function of utility at time  $s$ :

$$\delta_s = \delta(v_s) .$$

As in Uzawa, we assume

$$\delta > 0, \quad \delta' > 0, \quad \delta - \delta'u > 0, \quad \delta'' > 0 .$$



Capital depreciates at a rate  $n$ , so

$$\dot{i} = \dot{k} - nk$$

where  $i$  equals the rate of investment, which is a choice variable for private agents.

The current account is equal to the trade surplus added to interest earned on holdings of foreign bonds. We have

$$\dot{b} = (r - n)b - \tau,$$

where  $b$  is domestic holdings of foreign assets,  $\tau$  is the trade deficit and  $r - n$  is the given world real interest rate. This equation says that the current account surplus equals the rate of accumulation of foreign assets.

There is a budget constraint that requires

$$y_1 + py_2 + \tau = z + i.$$

This simply states that the value of expenditure on consumption plus investment must equal the value of output plus the trade deficit.

We also impose the constraint on individuals that

$$b_t - \int_t^{\infty} \tau_s e^{-(r-n)(s-t)} ds \geq 0.$$

This constraint says that the amount of the small country's debt ( $-b_t$ ) must be less than or equal to the sum of the discounted amount the country plans to pay back each period ( $-\tau_s$ ). Without such a constraint, given the infinite

planning horizon, an individual could achieve an arbitrarily high level of utility by borrowing a large sum now and meeting interest payments through further borrowing. Integrating the condition allows us to rewrite it simply as

$$\lim_{t \rightarrow \infty} b_t e^{-(r-n)t} \geq 0 .$$

When we solve the individual's optimum problem, if the transversality condition is satisfied then this constraint is also satisfied.

We can use the fact that

$$d\Delta = \delta dt$$

to write

$$V = \int_0^{\infty} (v/\delta) d\Delta$$

Thus, the necessary conditions for an optimum can be found by choosing  $z$ ,  $x$ ,  $i$  and  $\tau$  to maximize the Hamiltonian

$$H = (1/\delta)[v + q_1(-nk + i) + q_2((r - n)b - \tau)] \\ + \lambda[y_1 + py_2 + \tau - i - z] .$$

It will be useful to introduce the notation

$$\lambda \equiv v/k .$$

The first-order conditions are given by

$$\partial H / \partial v = 0 \Rightarrow pg'(1 - v) = f'(\lambda)$$

$$\partial H / \partial i = 0 \Rightarrow q_1 = \lambda \delta$$

$$\partial H / \partial \tau = 0 \Rightarrow q_2 = \lambda \delta$$

$$\begin{aligned} \partial H / \partial z = 0 \Rightarrow & (-\delta'v'/\delta)[q_1(i - nk) + q_2((r - n)b - \tau)] \\ & + (v'/\delta)(\delta - \delta'v) = \lambda \delta \end{aligned}$$

$$\dot{q}_1 = (\delta + n)q_1 - \lambda \delta (f(\lambda) - \lambda f'(\lambda))$$

$$\dot{q}_2 = (\delta + n - r)q_2$$

These are the conditions when  $i$  and  $\tau$  are finite, although there may initially be a discrete trade of  $k$  for  $b$ . We consider here only the case of incomplete specialization. The notation  $v'$  (and, later,  $v''$ ) refers to the derivative of  $v$  with respect to  $z$ . The concavity of  $v$  ensures that second-order conditions are met.

It follows immediately from the first-order conditions that we can write

$$q = q_1 = q_2$$

This, in turn, implies

$$r = f(\lambda) - \lambda f'(\lambda) .$$

For a given world rate of interest and depreciation rate this implies  $\lambda$  is fixed over time. We can also write

$$p = f'(\lambda)/q'(1 - \lambda k) .$$

Since this country takes the world price ratio  $p$  as given, and  $\lambda$  is constant, this implies  $k$  does not change over time. So,

$$\dot{k} = 0 .$$

Therefore,

$$i = nk$$

and the rate of investment does not vary over time. Now, the first-order condition  $\partial H/\partial z = 0$  implies

$$q = -(\delta'v'/\delta)q((r - n)b - \tau) + (v'/\delta)(\delta - \delta'v) ,$$

or

$$q = (v'/\delta)(\delta - \delta'v)/[1 + (\delta'v'/\delta)((r - n)b - \tau)] .$$

This expression gives  $q$  as a function of  $z$ ,  $b$  and  $\tau$ . Taking rates of change we can find  $\dot{q}/q$  (which equals  $\delta + n - r$ ) as a function of  $\dot{z}$ ,

$\dot{b}$  and  $\dot{\tau}$ . Using the fact that  $y_1 + py_2 - i$  is constant, we have

$$\dot{z} = \dot{\tau} .$$

Hence, we can solve for  $\dot{z}$  as a function of  $\dot{b}$ :

$$\dot{z} = v'(\delta - \delta'v)[\delta + n - r + \delta'v'b]/[v''(\delta - \delta'v) - \delta''(v')^2(v + v'b)] . \quad (1)$$

Since we can write

$$\dot{b} = (r - n)b - z - i + py_2 + y_1 \quad (2)$$

we have reduced the dynamic system to one of two differential equations in two variables,  $b$  and  $z$ .

Notice that the line  $\dot{b} = 0$  is linear in  $b, z$  space. The  $\dot{z} = 0$  line is a very non-linear equation. If we write

$$\dot{z} = J(z, b)$$

we see that

$$\partial J / \partial z = 0 .$$

Therefore, in the neighborhood of the steady-state, the  $\dot{z} = 0$  line is horizontal, as in Figure 1. This drawing shows the phase plane for the dynamic system.

The transversality conditions give sufficient conditions for a path of  $k$  and  $b$  that satisfies the first-order conditions to be optimal. In this case, they are<sup>3</sup>:

$$\lim_{\Delta \rightarrow \infty} e^{-\Delta} q_1 k_{\Delta} = 0, \quad \lim_{\Delta \rightarrow \infty} e^{-\Delta} q_2 b_{\Delta} = 0.$$

The path that leads to the steady state is an optimal path, so we will concentrate on the dynamics along the saddle path. Notice that the intertemporal budget constraint is satisfied along the saddle path. If initial conditions are given which are not on the path, then there will be a jump in the state variables  $b$  and  $k$ , such that wealth remains constant.<sup>4</sup>

From the phase diagram, it can be seen that when expenditure is above the steady-state level,  $z^*$ , expenditure is falling, and it is rising when it is below its long-run level. As consumption expenditures fall, this country's holdings of foreign assets decline - that is, it runs a current account deficit. This represents the fact that when consumption exceeds its long-run level, residents have negative levels of saving (as in the Metzlerian consumption function). They dissave by divesting their foreign bonds or borrowing from abroad. The steady-state may allow positive or negative holdings of foreign assets.

The next two sections consider the effects of tariffs on the current account, and section 5 looks at how a tax on foreign borrowing might change the current account. In this model either good may be imported (or both, or neither), so we need to consider the possibility of a tariff on each good.

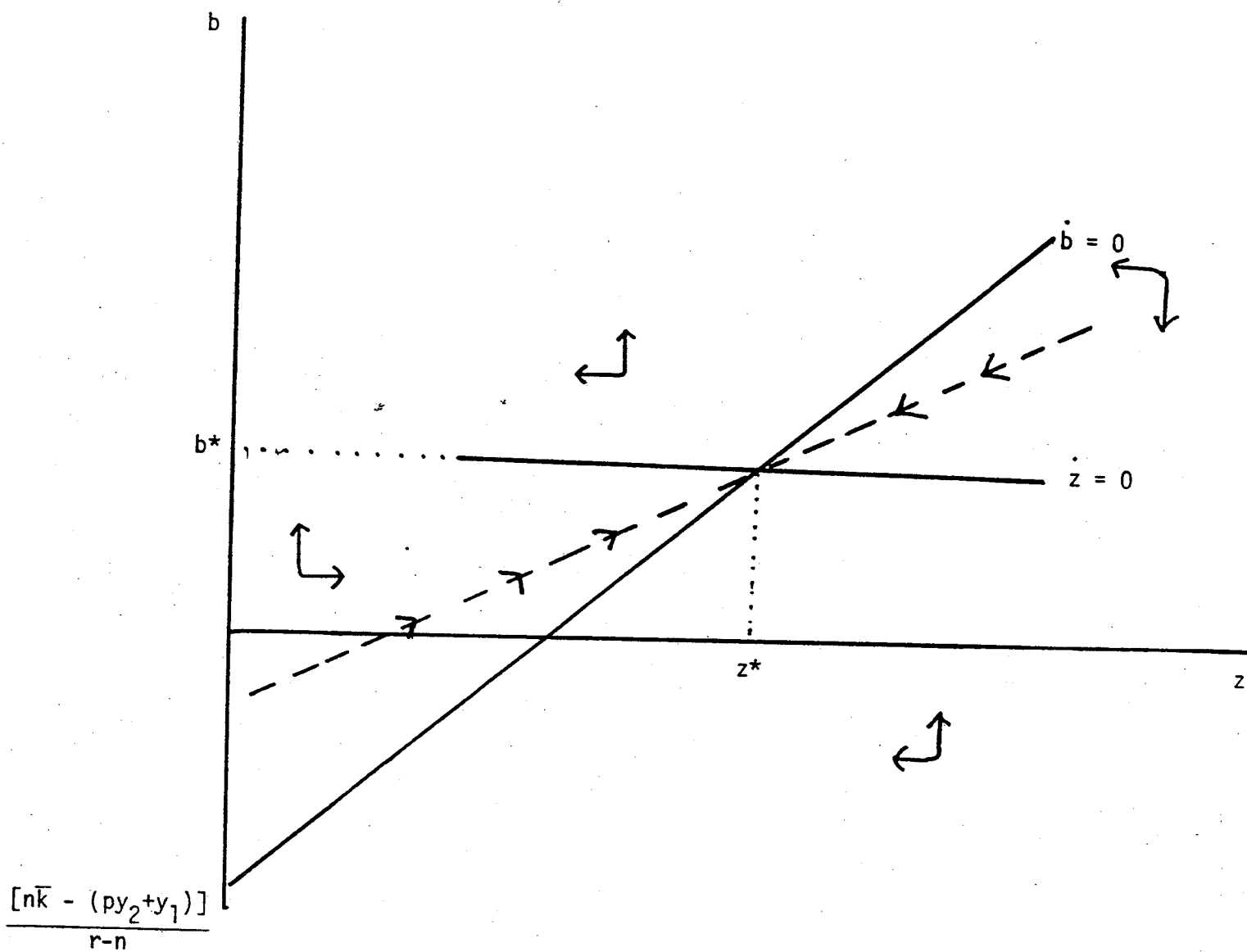


Figure 1

The ratio of this country's land to labor supply would, in general, be a determinant of which good is imported, but we have fixed that ratio at one. So, only tastes are important in determining both the inter-industry and intertemporal patterns of trade.

### 3. A Tariff on the Pure Consumption Good

This section considers a tariff on the pure consumption good. We are interested in the competitive solution, so we assume that individuals face the after-tariff price when making production and consumption decisions. We need, therefore, first to redefine the optimization problem and resolve the model before moving on to examine how the dynamics are altered by the imposition of a tariff.

Let  $\tilde{p}$  ( $> p$ ) be the domestic price of good 2 in terms of good 1. Then, we define

$$v(I, \tilde{p}) = \max\{u(c_1, c_2) \mid c_1 + \tilde{p}c_2 \leq I\} .$$

The symbol  $I$  represents expenditures for individuals in terms of good 1 when good 2 is evaluated at domestic prices. The budget constraint for individuals is

$$I = y_1 + \tilde{p}y_2 + R + \tau - i .$$

Tariff revenue,  $R$ , is assumed to be redistributed to individuals, but each agent does not perceive that his decisions alter  $R$  in any way. To close the



model we impose the requirement

$$R = (\tilde{p} - p)(c_2 - y_2) .$$

The Hamiltonian for the individual's consumption problem is now

$$H = (1/\delta)(v + q_1(i - nk) + q_2((r - n)b - \tau)]$$

$$+ \lambda(y_1 + \tilde{p}y_2 + R + \tau - i - I) .$$

The first-order conditions are essentially unchanged from section 2 -  $p$  is replaced by  $\tilde{p}$  and  $v'$  represents the partial of  $v$  with respect to  $I$ . The  $\dot{b}$  equation (equation (2)) is changed only by the change of  $p$  to  $\tilde{p}$ . The derivation of the  $\dot{z}$  equation, however, is altered. We will consider only a small increase in the tariff starting from a position of free trade, so that equations (1) and (2) remain valid. The results in this case are unaltered if we start from a position in which a tariff is already in place. (For a complete analysis of this situation, see Engel and Kletzer (1985).)

An increase in the tariff rate will raise the steady-state level of expenditure evaluated at world prices. The condition that  $\dot{q} = 0$  in steady-state means

$$\delta(v) = r - n .$$

The steady-state level of felicity is unaffected by the tariff level. Figure 2 demonstrates the increase in expenditure. Before the tariff, steady-state consumption is at point  $a$ , and the expenditure is  $z$ . With the tariff,

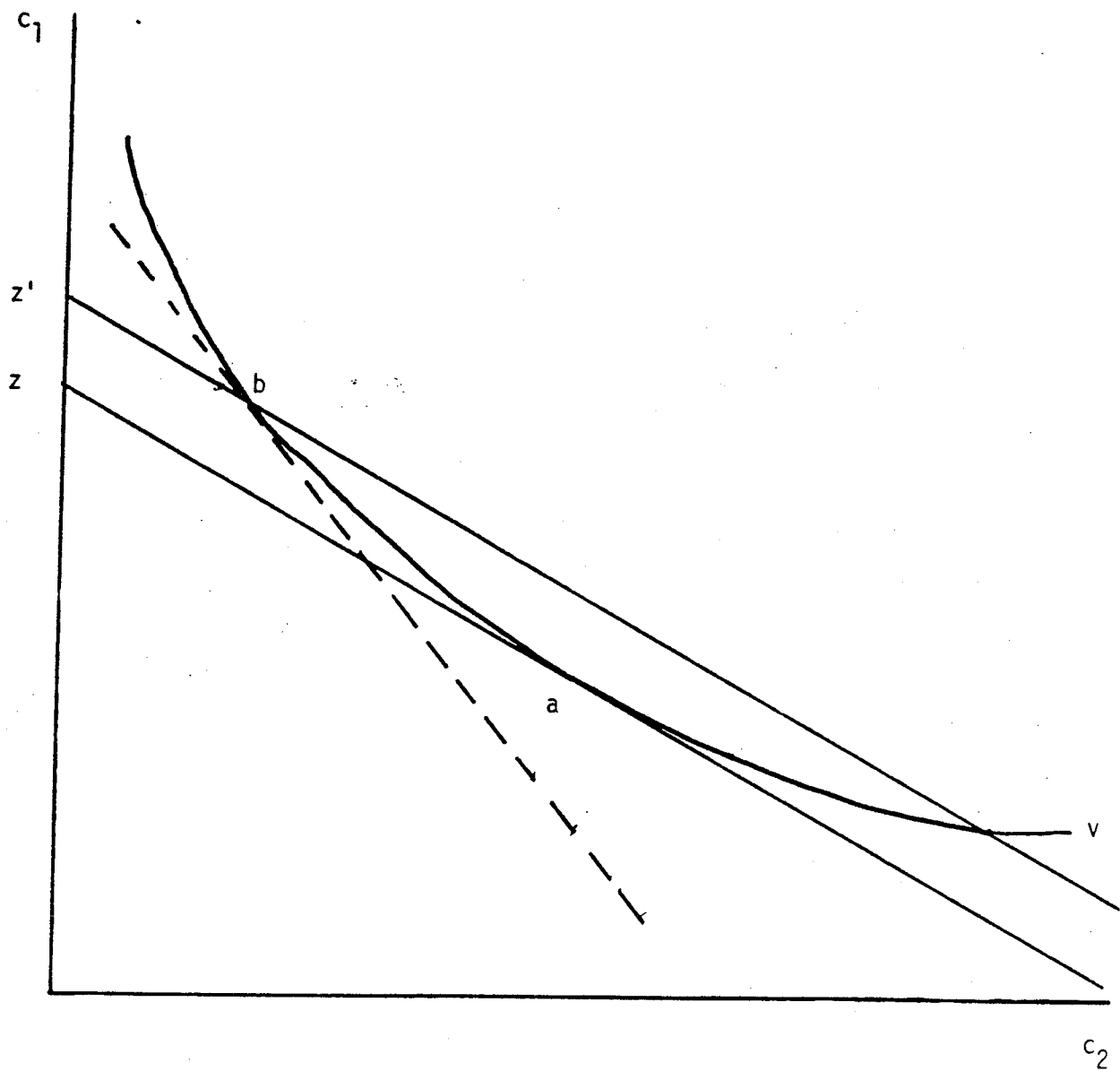


Figure 2

consumers set their marginal rate of substitution equal to the domestic price given by the slope of the dotted line. So, in order to maintain the same long-run felicity, expenditure rises to  $z^*$ .

The  $\dot{b} = 0$  line also shifts up with a tariff. First, note that the tariff leads to a decrease in the domestic capital stock. We have

$$p \approx \tilde{p} = f'(\lambda)/g'(1 - k\lambda) . \quad (3)$$

But, it is still the case that

$$r = f(\lambda) - \lambda f'(\lambda)$$

so  $\lambda$  is unaffected by the tariff. It follows immediately from the concavity of  $f$  and  $g$  that  $k$  must fall. Holding  $\lambda$  constant, we see that the shift in the  $\dot{b} = 0$  intercept for a given change in the capital stock is given by

$$d[-(y_1 + py_2 - i)/(r - n)]/dk = -[f(\lambda) - \lambda p g'(1 - \lambda k) - n]/(r - n) .$$

But given (3), this derivative equals one in absolute value. Hence,  $\dot{b} = 0$  shifts up and the vertical shift up is equal to the initial import of foreign bonds ( $db = -dk$  initially).

Figure 3 shows the dynamics of the current account and consumption expenditures upon imposition of a tariff. The initial free-trade steady-state is at point  $c$ , and after the tariff the economy moves to point  $d$  in the long run. The diagram shows the long-run increase in  $z$  and the shift up in the  $\dot{b} = 0$  line. At the time of the imposition of the tariff there is a jump from point  $c$  onto the new saddle path. In the previous paragraph we argued there

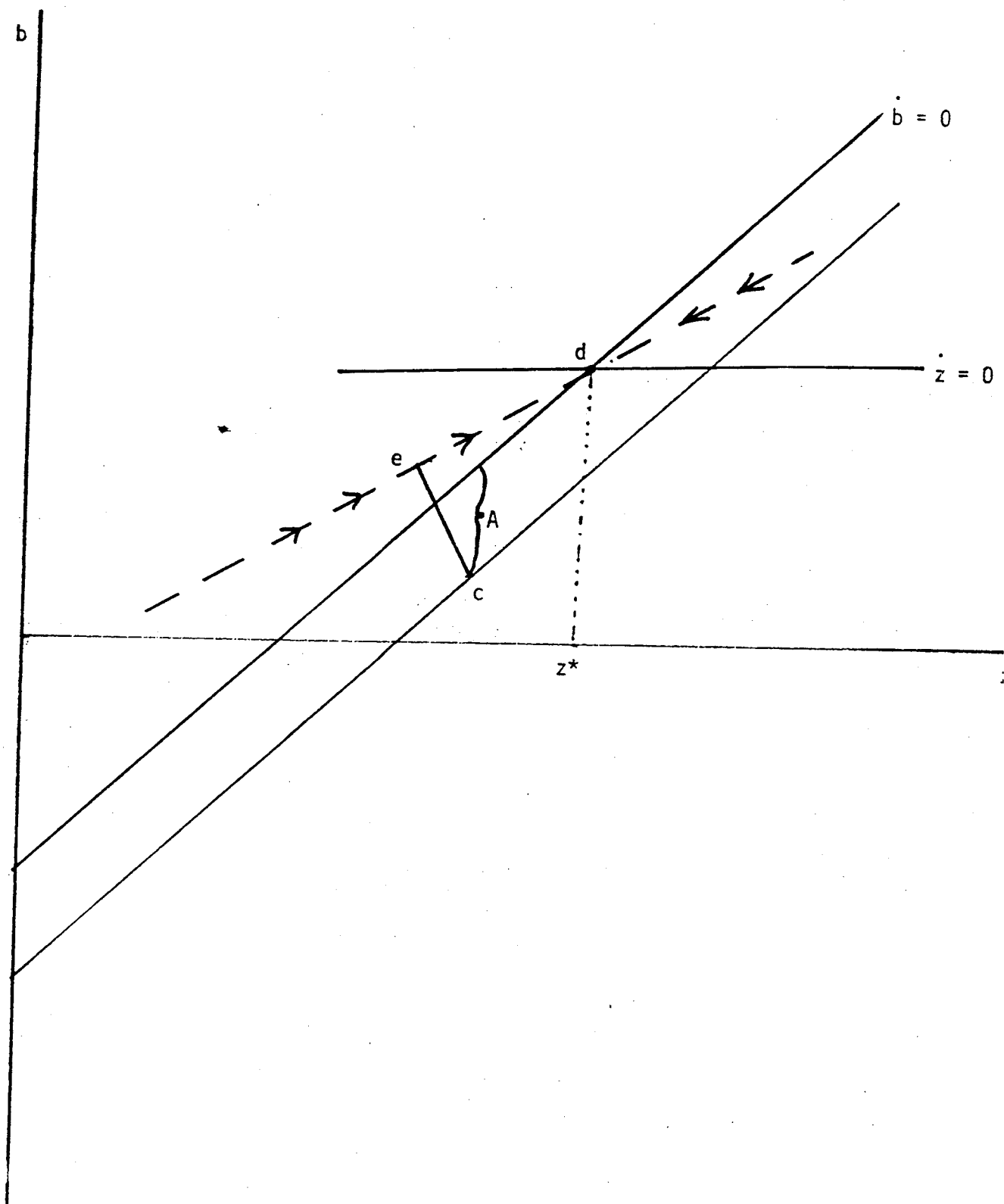


Figure 3

is initially an export of capital for bonds - so we know there is an upward jump from point c. We also showed that the vertical rise in the  $\dot{b} = 0$  line (given in Figure 3 by the distance A) equals the initial acquisition of foreign bonds. Hence, to land on the saddle path, the economy must jump northwestwardly from c to a point such as e. Thus, initially the level of consumption expenditure falls.

The current account moves into surplus both on impact and along the adjustment path to steady state. The initial surplus is caused by a drop in "investment" as capital is traded for bonds. The further acquisition of bonds occurs because consumption falls and saving increases. The long-run amount of expenditure rises, and the long-run felicity level is unchanged. However, the tariff does cause a welfare loss to this country along the transition path. In order to reach the steady-state consumption target, saving must initially increase.

Figure 3 shows that steady-state holdings of foreign bonds unambiguously increases (or foreign debt falls). This implies that interest payments to domestic residents is higher in steady-state. Since the current account is balanced in the long-run, the trade balance must be in greater deficit.

This section has examined the effects of a tariff on the current account of a small country when the pure consumption good is imported. A surplus arises both on impact as capital is exported for bonds, and as the economy proceeds to the new steady-state. The next section studies the policy of protecting the capital-using sector.

#### 4. A Tariff on the Composite Good

We will again take up the competitive solution when a tariff is imposed on the good that can be used either for consumption or investment. It is useful to change numeraires so that the symbol  $p$  refers to the price of good 1 in terms of good 2 on world markets, and  $\tilde{p}$  the domestic price of good 1. (This change in numeraires applies only to this section of the paper.)

The indirect utility function  $v(I, \tilde{p})$  is defined by

$$v(I, \tilde{p}) = \max\{u(c_1, c_2) \mid \tilde{p}c_1 + c_2 \leq z\} .$$

The budget constraint for individuals is given by

$$I = \tilde{p}y_1 + y_2 + R + \tau - \tilde{p}i .$$

Tariff revenues are determined by

$$R = (\tilde{p} - p)(c_1 - y_1) .$$

The Hamiltonian for the individual is

$$H = (1/\delta)(v + q_1(i - nk) + q_2((r - n)b - \tau)] \\ + \lambda[\tilde{p}y_1 + y_2 + R + \tau - \tilde{p}i - I] .$$

The first-order conditions are not altered from section 4, except that

$$p \cong \tilde{p} = g'(1 - k\lambda)/\theta'(\lambda) . \quad (4)$$

We again employ the tactic of considering small increases in the tariff starting from a position of free trade. Hence, equation (1) describes  $z$  dynamics, and equation (2) is replaced by

$$\dot{b} = (r - n)b - z - i + py_1 + y_2 .$$

Since the net marginal productivity of capital equals the world real interest rate, the labor to capital ratio,  $\lambda$ , in sector 1 is unchanged by the tariff. Concavity of  $q$  and  $f$  tells us by equation (4) that there must be an immediate increase in the capital stock upon imposition of the tariff that is accomplished by selling off foreign bonds.

As in the previous section, starting from a position of free trade, the vertical shift in the  $\dot{b} = 0$  line equals in absolute value the change in the capital stock:

$$d[-(py_1 + y_2 - i)/(r - n)]/dk = -[p(f(\lambda) - n)$$

$$- \lambda g'(1 - \lambda k)]/(r - n) = 1 .$$

To complete our understanding of the dynamics, we note that steady-state expenditures  $z$  rise as a result of the tariff on the composite good for the same reason that they rose when the tariff was imposed on the pure consumption good.

Figure 4 represents the phase diagram and the change in expenditure and foreign bond holdings over time as a consequence of the tariff. The initial

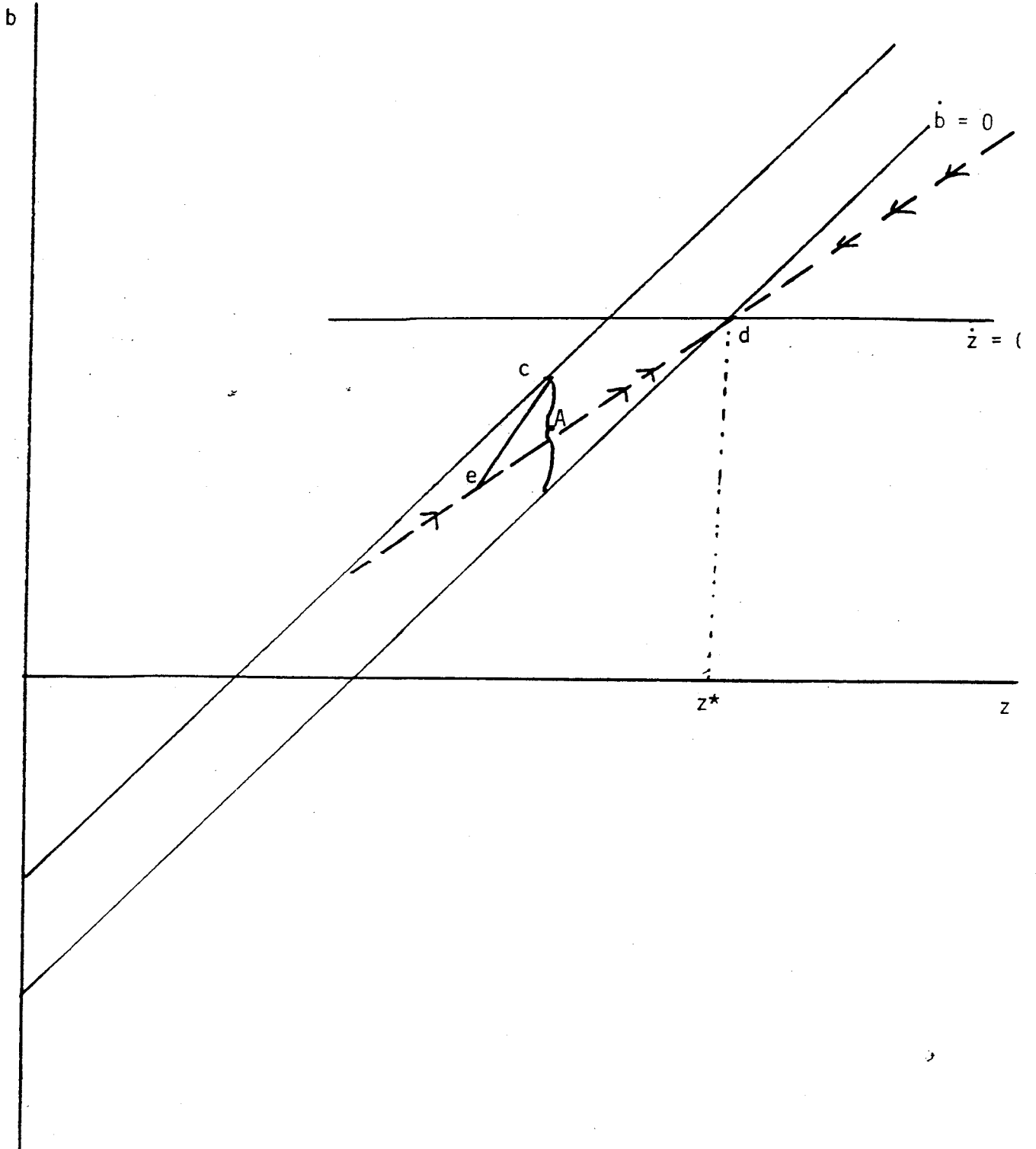


Figure 4



steady state is at point c and after the tariff steady-state expenditure and foreign bonds are given by point d. The decline in bond holdings initially is given by the distance A. Hence, on implementation of the tariff the economy jumps to point e and adjusts along the saddle path to d. Expenditure initially falls and then later exceeds the original steady-state spending level.

With a tariff on the good that uses capital in its production, there is a difference between the immediate response of the current account and its later adjustment path. At first, the increase in the marginal productivity of capital leads to an import of capital goods and a deficit on current account. But saving also increases, which means that over time the country runs a current surplus ( $b > 0$ ). The steady-state bond-holdings of the economy may rise or fall (Figure 4 shows a rise), so the steady-state trade deficit may increase or decrease.

## 5. A Tax on Foreign Borrowing

In this section we study the consequences of a tax on foreign borrowing (or, equivalently, a subsidy to foreign lending). Once again we shall consider the competitive solution in which individuals take the tax rate as given.

The production structure of the model is not modified in this section, but there are some alterations on the consumption side. The individual finds that the tax raises the interest rate he faces to  $r - n + s$  where  $s$  is the tax rate. The individual's expenditure level  $z$  is given by

$$z = y_1 + py_2 + R + \tau' - i .$$

In this relationship,  $R$  is the lump-sum revenue redistribution that comes from the borrowing tax (or the lump-sum tax used to finance the lending subsidy). The symbol  $\tau'$  represents the amount by which the individual's consumption expenditures and investment exceed his income from all sources. For this person, asset accumulation is given by

$$\dot{b} = (r - n + s)b - \tau' .$$

The model is closed by imposing the equilibrium condition

$$R = sb .$$

The trade deficit for the country as a whole is

$$\tau = \tau' - sb .$$

Thus, we have that

$$\dot{b} = (r - n)b - \tau$$

and

$$z = y_1 + py_2 + \tau - i .$$

So, we can see that the model is consistent, and that expenditures on consumption by individuals equal national expenditure. We can write the indirect utility function

$$v(z, p) = \max\{u(c_1, c_2) | c_1 + pc_2 \leq z\} .$$

The Hamiltonian for the individual's problem is now

$$H = (1/\delta)[y + q_1(i - nk) + q_2((r - n + s)b - \tau')] \\ + \lambda[R + \tau' - i + y_1 + py_2 - z] .$$

The only change in first-order conditions from section 2 is that

$$\dot{q}_2 = (\delta - (r - n + s))q_2 .$$

This in turn implies that

$$r + s = f(\lambda) - \lambda f'(\lambda) \tag{5}$$

and, that, in steady-state,

$$\delta = r - n + s . \tag{6}$$

As in the previous sections, we will consider the effects of a small increase in the tax starting from a position of zero taxes. Hence, equations (1) and (2) describe the dynamics near the free-trade steady-state.

From equation (6) we note that an increase in the tax rate will lead to a higher steady-state discount rate for individuals. This, in turn, implies that long-run consumption expenditures will be greater, given  $\delta' > 0$ .

Equation (5) tells us that the tax must lead to a greater marginal productivity of capital, and, thus a higher labor to capital ratio,  $\lambda$ , in sector 1. Given that (3) must hold, the tax will lead to an immediate decline in the capital stock (and a discrete acquisition of bonds).

Qualitatively, the dynamics are identical to those when the pure consumption good is protected. In both cases the steady-state spending level increases, and there is export of capital at the instant of the policy change. Thus, Figure 3 accurately depicts the movements over time of  $z$  and  $b$  when a tax on borrowing is imposed, starting from a position of laissez-faire.

It is worth noting that there are, in effect, two factors that work to increase saving and lead to a current account surplus along the path to steady-state. First, even if steady-state expenditures were to remain unchanged, this economy would need to save more now in order to reach its long-run spending levels. That is because the optimal borrowing tax is zero, and any non-zero tax would lower "permanent income". In addition to this effect, we have that steady-state spending does in fact increase. The implication of this is that if the economy were to start at a point other than free trade, the consequences of raising the borrowing tax might be quite different. For example, if a subsidy to foreign borrowing were already in place, lowering that subsidy is not equivalent to the tax increase we consider here. Although the effects on steady-state expenditures are the same, the lowering of the subsidy would work to reduce a distortion. Hence, the net effect might be to increase current consumption (Engel and Kletzer (1985)).

## 6. Conclusions

The response of the current account to tariffs or a tax on foreign borrowing depends on how saving and investment are affected by these policies. The investment effect comes through an instantaneous discrete import or export of capital required to equate the net marginal productivity of capital to the real interest rate paid to domestic residents on foreign bonds. These policies all have the effect of increasing saving because they both lower "permanent income" (the integral of discounted felicity of expenditure) and they raise the target steady-state consumption expenditure rate.

There are several natural extensions to this model. If this country were large enough to affect world prices there may be an optimal tariff that increases welfare. In this case, from a position of free trade a tariff might lead to an increase in consumption and a current account deficit. There might also be an optimal tax or subsidy to borrowing from abroad if the country were large enough to change the world rate of interest. A country that is in debt to the rest of the world may wish to lower the equilibrium interest rate. A tax on borrowing might accomplish this, therefore such a tax might be welfare enhancing. Consumption might rise and the equilibrium level of foreign borrowing for this country might actually increase.

Another set of issues revolves around the reversibility of investment. In this model all changes in the capital stock occur through discrete increases or decreases of the stock. In fact, once capital is in place it may be impossible to dismantle and trade it for bonds. If investment is

irreversible, the current account dynamics of the model are likely to be substantially altered.

In the type of model presented here, as long as the country is small, the individual's optimization problem corresponds to the planner's problem. Any tariff or tax must be sub-optimal. However, in other types of models this is not generally true. In the overlapping generations model, or the uncertain lifetime model (see Yaari (1965) and Blanchard (1985)) the competitive equilibrium may not be Pareto optimal, so there may be a role for policy that is Pareto improving. There may also be policies that redistribute from one generation to another that improve welfare according to some social welfare function.

Thus, this model should be considered only a first try at an understanding of how tariffs and other trade policies influence the current account. It is clear from our results that the effects of such policies depend on the characteristics of consumption and investment behavior over time.

## Footnotes

1. This model of the production side was used, for example, by Eaton (1984a, b) to study various dynamic trade issues.
2. See, for example, Mundell (1957).
3. See Arrow and Kurz (1970) and Obstfeld (1982) for a discussion of these transversality conditions.
4. Arrow and Kurz (1970) show that if a jump in the state variable is ever optimal, it will only occur initially.

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