TARIFFS, INTEREST RATES, AND THE TRADE BALANCE IN THE WORLD ECONOMY

Grant W. GARDNER and Kent P. KIMBROUGH*

*Fuqua School of Business, and Department of Economics, Duke University, Durham,
NC 27706, USA*

Received February 1988, revised version received October 1988

A two-commodity intertemporal framework is used to show that, in contrast to the conventional wisdom, both permanent and temporary tariffs may worsen the trade balance of a large country. For a temporary tariff the key condition for this result is a low intertemporal elasticity of substitution in consumption. When a temporary tariff worsens the trade balance the world real interest rate must fall if the tariff-imposing country is running a deficit and rise if it is running a surplus. Temporary tariffs can only worsen the trade balance of a surplus country when international differences in tastes are important.

1. Introduction

Trade balance concerns have historically aroused protectionist sentiments, and the recent U.S. experience has continued this tradition. As the U.S. trade deficit increased from around 1 percent of GNP in 1982 to 3.5 percent in 1986, the debate over the recently passed trade bill produced several protectionist measures aimed at reducing the deficit. The best known of these was the Gephardt Amendment which required increased tariffs or quotas on imports from countries running large bilateral trade surpluses with the United States.

The underlying intuition behind such proposed legislation is that by raising the price of importables relative to exportables a tariff shifts demand from foreign goods to domestic goods, thereby improving the trade balance. Academic support for this popular view of the effects of tariffs on the trade balance can be found in the writings of Robinson (1947, p. 159) and Meade (1951, p. 309) among others. More recent attempts to model the effects of tariffs on the trade balance have been undertaken by Dixit and Norman (1980, pp. 240–243) and Dornbusch (1980, pp. 65–66). Like earlier work on

*Funding of this research was provided in part by a grant from the Sloan Foundation to the Department of Economics. We would like to thank two anonymous referees for helpful comments.

the trade balance effects of tariffs these treatments also stress the role of changes in the relative price of importables in terms of exportables.

The predicted favorable effects of tariffs on the trade balance which characterize the above models is a result of the within-period substitution in consumption induced by imposing a tariff. An alternative explanation of the link between tariffs and the trade balance is found in Razin and Svensson (1983). Using a two-good, two-period model of a small open economy, they show that starting from free trade, the imposition of a temporary tariff will improve the trade balance. Although this result is similar to those found elsewhere in the literature, the underlying mechanism is entirely different. In the Razin and Svensson setup a tariff improves the trade balance by raising the relative price of current goods in terms of future goods (i.e. by raising the domestic real interest rate) and inducing consumers to substitute away from current consumption and towards future consumption. Rather than within-period substitution effects, it is the intertemporal substitution effects of a tariff that account for its favorable impact on the trade balance. This emphasis on intertemporal substitution in consumption in determining the trade balance effects of tariffs and other commercial policies reflects recent work by economists aimed at highlighting the intertemporal aspects of trade balance determination. Examples include Sachs (1981), Greenwood (1983), and Svensson and Razin (1983).

Although emphasizing the intertemporal nature of the trade balance, Razin and Svensson's (1983) results highlight only one aspect of the problem confronting policymakers in industrialized countries when considering the likely trade balance impact of proposed protectionist measures – the direct intertemporal substitution effects of the tariff. The reason their analysis captures only this one aspect of the problem is that they deal with a small country and thus rule out any potential effects of tariffs on either the within-period or intertemporal terms of trade.¹ This restriction eliminates two important channels through which tariffs enacted by large countries, like the United States, can influence the trade balance. First, the terms-of-trade effects associated with levying a tariff can generate intertemporal substitution effects which may either reinforce or run counter to the direct intertemporal substitution effects of the tariff itself. Second, even starting from free trade, the terms-of-trade effects associated with the imposition of a tariff by a large country will give rise to important wealth effects which will influence the trade balance.

The purpose of this paper is to examine the effects of tariffs on the trade balance when a country is large enough to alter its terms of trade. This is done by extending the work of Razin and Svensson (1983) and Svensson and

¹Edwards (1987) maintains the small country setup but allows for tariffs to alter relative prices by introducing nontraded goods into Razin and Svensson's framework.

Razin (1983) to a two-country setting and tracing out the effects of permanent and temporary tariffs on current and future relative prices of importables in terms of exportables (the traditional within-period terms of trade) and real interest rates (the intertemporal terms of trade). Incorporating these terms-of-trade effects into the analysis of the trade balance effects of tariffs turns out to be qualitatively as well as quantitatively important. For instance, once such effects are allowed for, conditions can be derived under which a temporary tariff worsens the trade balance.

2. The economic environment

The framework adopted here extends to the large country case, the setup used by Svensson and Razin (1983) to study the Harberger–Laursen–Metzler effect. The model is a standard two-period intertemporal model. The world economy consists of two countries, each represented by a single consumer who is endowed with fixed quantities of two distinct and perishable commodities in each of the two periods. The home consumer's endowment is given by $\{\bar{m}^t, \bar{x}^t\}_{t=1}^2$ and the foreign consumer's endowment of the two goods is given by $\{\bar{m}^{*t}, \bar{x}^{*t}\}_{t=1}^2$. It is assumed that conditions are such that good m can be taken to be the home importable and good x the home exportable in both periods.

World goods and credit markets are competitive and there are no impediments to free trade except for current and future period tariffs, τ^1 and τ^2 , that may be levied by the home country. Prices are measured in an arbitrary unit of account, and the nominal prices of importables and exportables on world markets in period t are p^{*t} and q^{*t} . Trade in the presence of tariffs guarantees that prices in the domestic market in period t are given by $p^t = (1 + \tau^t)p^{*t}$ and $q^t = q^{*t}$. The nominal discount factor (equal to one over one plus the nominal interest rate) is denoted by D .²

2.1. The consumer's problem

With this as background, the home country consumer's lifetime budget constraint can be written as

$$\begin{aligned} p^1 m^1 + q^1 x^1 + D(p^2 m^2 + q^2 x^2) \\ = p^1 \bar{m}^1 + q^1 \bar{x}^1 + T^1 + D(p^2 \bar{m}^2 + q^2 \bar{x}^2 + T^2), \end{aligned} \quad (1)$$

²Since this is a real model, only relative prices will be determined. Nominal magnitudes could be pinned down by introducing money into the model using a cash-in-advance constraint along the lines of Helpman (1981). Extending the model in this manner would not alter any of the results that follow.

where m^t and x^t are period t consumption of importables and exportables and T^t is a lump-sum nominal transfer payment made by the government to the consumer at time t . The government's budget constraint requires that

$$T^1 + DT^2 = \tau^1 p^{*1}(m^1 - \bar{m}^1) + D\tau^2 p^{*2}(m^2 - \bar{m}^2).$$

That is, all tariff revenues collected by the government are rebated to consumers in a lump-sum fashion.

The representative home consumer is interested in maximizing his lifetime utility which is given by the weakly separable utility function:

$$U[c^1(m^1, x^1), c^2(m^2, x^2)].$$

The within-period utility functions $c^1(\cdot)$ and $c^2(\cdot)$ are assumed to be homothetic and without any loss of generality can be taken to be linearly homogeneous. As discussed by Svensson and Razin (1983), one of the advantages of this specification of preferences is that it allows the construction of price indices which can be used to convert nominal magnitudes such as income, consumption, and the trade balance into real magnitudes.

The following two-step procedure can be used to characterize the solution to the consumer's problem. First, the consumer can be thought of as minimizing his nominal spending in each period subject to a given level of utility. The solution to this first stage problem is the period t expenditure function:

$$\Pi^t(p^t, q^t)c^t \equiv \min \{p^t m^t + q^t x^t : c^t(m^t, x^t) \geq c^t\}, \quad t=1, 2. \quad (2)$$

The linearity of the expenditure function in terms of c^t reflects the fact that the within-period utility functions are linearly homogeneous. The price index $\Pi^t(p^t, q^t)$, $t=1, 2$, is thus the unit expenditure function associated with the within-period utility level, or consumption bundle, c^t . From the properties of expenditure functions it follows that the price indices $\Pi^t(\cdot)$, $t=1, 2$, are homogeneous of degree one in nominal prices.³ It is also useful to note at this point that the elasticities of the price indices with respect to nominal prices are simply the shares of expenditure falling on importables and exportables, α^t and $1 - \alpha^t$.

The second stage of the problem is to minimize lifetime expenditure for a given level of lifetime utility, u . This yields the home country consumer's lifetime expenditure function:

³Dixit and Norman (1980) provide a thorough discussion of expenditure functions and their application to international trade theory.

$$e(1, \delta, u) \equiv \min \{c^1 + \delta c^2: U(c^1, c^2) \geq u\}, \quad (3)$$

where $\delta \equiv \Pi^2(\cdot)D/\Pi^1(\cdot)$ is the real discount factor in terms of the home country's consumption bundles (i.e. δ is one over one plus the domestic real interest rate).

The foreign consumer's problem parallels that of the home consumer with the exception that no tariff revenues are collected or rebated abroad.

2.2. World equilibrium

The attainable levels of utility at home and abroad are constrained by the budget constraints facing home and foreign consumers. In equilibrium these constraints will be satisfied and it can be seen from (1)–(3) and their foreign counterparts that this requires:

$$e(1, \delta, u) = \frac{\theta^1 \bar{m}^1 + \bar{x}^1 + \tau^1 \theta^{*1} (m^1 - \bar{m}^1)}{\Pi^1(\theta^1, 1)} + \delta \frac{\theta^2 \bar{m}^2 + \bar{x}^2 + \tau^2 \theta^{*2} (m^2 - \bar{m}^2)}{\Pi^2(\theta^2, 1)}, \quad (4)$$

$$e^*(1, \delta^*, u^*) = \frac{\theta^{*1} \bar{m}^{*1} + \bar{x}^{*1}}{\Pi^{*1}(\theta^{*1}, 1)} + \delta^* \frac{\theta^{*2} \bar{m}^{*2} + \bar{x}^{*2}}{\Pi^{*2}(\theta^{*2}, 1)}, \quad (5)$$

where use has been made of the fact that the price indices are homogeneous of degree one in nominal prices and asterisks denote foreign variables. $\theta^t \equiv (1 + \tau^t)\theta^{*t}$ is the within-period domestic relative price of importables in terms of exportables in period t , where $\theta^{*t} \equiv p^{*t}/q^{*t}$ is the world terms of trade. The θ^* s thus represent the terms of trade encountered in static trade models.

In addition, equilibrium also requires that the markets for current and future importables and exportables clear. Given that the budget constraints (4) and (5) are satisfied, goods market equilibrium can be summarized by the conditions:

$$m^1(\cdot) + m^{*1}(\cdot) = \bar{m}^1 + \bar{m}^{*1}, \quad (6)$$

$$m^2(\cdot) + m^{*2}(\cdot) = \bar{m}^2 + \bar{m}^{*2}, \quad (7)$$

$$x^2(\cdot) + x^{*2}(\cdot) = \bar{x}^2 + \bar{x}^{*2}. \quad (8)$$

By the properties of expenditure functions, the domestic compensated demand functions are given by:

$$m^1(\cdot) = \Pi_p^1(\theta^1, 1)c_1(1, \delta, u),$$

$$m^2(\cdot) = \Pi_p^2(\theta^2, 1)e_\delta(1, \delta, u),$$

$$x^1(\cdot) = \Pi_q^2(\theta^2, 1)e_\delta(1, \delta, u),$$

where subscripts denote derivatives and use has been made of the fact that, by the properties of expenditure functions, $\Pi_i^t(\cdot)$, $i=p, q$, $t=1, 2$, is homogeneous of degree zero in nominal prices. The foreign compensated demand functions are similarly defined.

The equilibrium conditions (4)–(8), along with the relationships

$$\theta^t = (1 + \tau^t)\theta^{*t}, \quad t = 1, 2 \quad (9)$$

and

$$\delta = \left[\frac{\Pi^2(\theta^2, 1)}{\Pi^{*2}(\theta^{*2}, 1)} \cdot \frac{\Pi^{*1}(\theta^{*1}, 1)}{\Pi^1(\theta^1, 1)} \right] \delta^*, \quad (10)$$

can be used to determine equilibrium levels of home and foreign utility, u and u^* , and equilibrium relative prices in world markets, θ^{*1} , θ^{*2} , and δ^* . Given world relative prices, (9) and (10) can be used to uncover domestic relative prices, θ^1 , θ^2 , and δ .

Finally, the home country's trade balance in real terms, evaluated at world prices, is given by:

$$b^1 = \frac{\theta^{*1}\bar{m}^1 + \bar{x}^1 - (\theta^{*1}m^1 + x^1)}{\Pi^1(\theta^{*1}, 1)} \quad (11)$$

3. Tariffs and world equilibrium: Identical tastes

Starting from any initial equilibrium, eqs. (4)–(11) can be used to assess the impact of permanent and temporary tariff changes on utility levels at home and abroad, domestic and world relative prices (including both within-period relative prices and real interest rates), and the trade balance. Here it is assumed that in the initial equilibrium free trade prevails. Temporary tariffs are thus characterized by $d\tau^1 > 0$ and $d\tau^2 = 0$ and permanent tariffs by $d\tau^1 = d\tau^2 > 0$.

In order to obtain concrete results regarding the impact of tariffs on relative prices, welfare, and the trade balance, this section adopts the

assumption that the home and foreign countries have identical and homothetic tastes. The home utility function, for example, is given by:

$$U = \frac{(c^1)^{1-(1/\sigma)}}{1-\frac{1}{\sigma}} + \rho \frac{(c^2)^{1-(1/\sigma)}}{1-\frac{1}{\sigma}}, \quad c^t = (m^t)^\alpha (x^t)^{1-\alpha},$$

where $0 < \rho < 1$ is the subjective discount factor. When the initial equilibrium is one of free trade, this assumption of identical and homothetic tastes, which is commonly encountered in international trade theory, rules out transfer effects and gives formal economic content to the concepts of a world real interest rate and world price level.⁴

These assumptions imply that each country's consumption of each good in each period is equal to its share of world wealth. That is, $m^t/(\bar{m}^t + \bar{m}^{*t}) = x^t/(\bar{x}^t + \bar{x}^{*t}) = W/(W + W^*)$, $t = 1, 2$, where

$$W = \frac{\theta^{*1}\bar{m}^1 + \bar{x}^1}{\Pi^1(\theta^{*1}, 1)} + \delta^* \frac{\theta^{*2}\bar{m}^2 + \bar{x}^2}{\Pi^2(\theta^{*2}, 1)}$$

is domestic wealth, and foreign wealth, W^* , is similarly defined. These facts can be used to solve (6)–(10) for the relative price effects of any given tariff policy. These results can then be used along with (4), (5), and (11) to uncover the welfare and trade balance effects of various tariff policies. The remainder of this section discusses the effects of permanent and temporary tariff changes starting from an initial free-trade equilibrium when tastes are identical and homothetic.

3.1. *Permanent tariffs*

In the case of a permanent tariff, $d\tau^1 = d\tau^2 = d\tau > 0$, world relative price changes are given by:

$$\hat{\theta}^{*1} = \hat{\theta}^{*2} = \frac{-W}{W + W^*} d\tau \quad \text{and} \quad \hat{\delta}^* = 0,$$

while domestic relative price changes are given by:

$$\hat{\theta}^1 = \hat{\theta}^2 = \frac{W^*}{W + W^*} d\tau \quad \text{and} \quad \hat{\delta} = 0,$$

⁴The specification adopted in the text has the additional advantage of ruling out changes in expenditure shares on importables and exportables across periods.

where a 'hat' over a variable denotes its percentage change. As can be seen, a permanent tariff improves the home country's within-period terms of trade by the same proportion in both periods and raises the domestic relative price of importables by the same proportion in both periods without affecting domestic and world discount factors (real interest rates). Notice that the larger the home country, the more the burden of the tariff is shifted to world relative prices and the less is borne by domestic relative prices. Intuitively, the tariff shifts demand in each period away from importables, resulting in a drop in their relative price on world markets. Intertemporal relative prices remain unchanged because any shift in the intertemporal pattern of spending at home is mirrored by an equal and opposite shift abroad (since $b^1 + b^{*1} = 0$) and the marginal propensities to spend on current and future goods, β and $1 - \beta$, are the same at home and abroad.

Since the home country's within-period terms of trade improve in each period while the intertemporal terms of trade are unchanged, it is clear that a permanent tariff raises home welfare and lowers foreign welfare. These results reflect the fact that the initial equilibrium is one of free trade and indicate that a permanent tariff unambiguously moves the home country tariff vector towards its optimum level.

The trade balance effects of a permanent tariff are given by:

$$\begin{aligned} \frac{db^1}{W} = & \left\{ (1 - \beta) \left[\frac{\theta^{*1}(m^1 - \bar{m}^1)}{\Pi^1 W} + \alpha \frac{b^1}{W} \right] \right. \\ & \left. - \beta \delta^* \left[\frac{\theta^{*2}(m^2 - \bar{m}^2)}{\Pi^2 W} + \alpha \frac{b^2}{W} \right] \right\} \frac{W}{W + W^*} d\tau, \end{aligned} \quad (12)$$

where $c^1/W = c_W^1 = \beta$ (i.e. the average and marginal propensities to spend on current goods are equal). As (12) highlights, a permanent tariff may either improve or worsen the trade balance. This is because the wealth effects associated with movements in the within-period terms of trade work in different directions. On the one hand a permanent tariff improves the current terms of trade and this works, via income smoothing, to improve the trade balance. On the other hand, however, a permanent tariff also improves the future terms of trade and this works to worsen the trade balance as home consumers borrow against their now higher future income. If the wealth effects associated with the future terms-of-trade improvement dominate, levying a permanent tariff may result in a worsening of the trade balance rather than an improvement, as is popularly thought to occur.

3.2. *Temporary tariffs*

Much of the commercial policy focus recently, at least in the United

States, has been on levying tariffs to combat large and growing trade balance deficits. Since the economy's intertemporal resource constraint implies that trade must balance intertemporally, there is some sense in which current trade balance deficits can be viewed as temporary. As a consequence, consumers are likely to perceive that tariffs enacted with an eye toward reducing trade balance deficits will be temporary in nature. In light of this, it may be more pertinent to today's policy debate to consider the effects of a temporary tariff ($d\tau^1 > 0$, $d\tau^2 = 0$) on the equilibrium of the world economy.

The response of world relative prices to a temporary tariff is given by:

$$\hat{\theta}^{*1} = \frac{-W}{W + W^*} d\tau^1, \quad \hat{\theta}^{*2} = 0,$$

and

$$\hat{\delta}^* = \frac{\alpha W}{W + W^*} d\tau^1,$$

while the response of domestic relative prices is given by:

$$\hat{\theta}^1 = \frac{W^*}{W + W^*} d\tau^1, \quad \hat{\theta}^2 = 0,$$

and

$$\hat{\delta} = \frac{-\alpha W^*}{W + W^*} d\tau^1.$$

As was the case with a permanent tariff, it is shares of world wealth at home and abroad, $W/(W + W^*)$ and $W^*/(W + W^*)$, that determine how the burden of relative price adjustment is distributed. The larger the home country the greater the adjustment of world relative prices. Also, like a permanent tariff, a temporary tariff improves the home country's within-period terms of trade. However, the improvement occurs only in the period when the tariff is levied; the future terms of trade are unaffected. In addition, a temporary tariff also alters intertemporal relative prices. The world discount factor rises and the domestic discount factor falls, which means that world real interest rates fall while domestic real interest rates rise.

The intuition behind this pattern of world relative price adjustment is clear. All else equal, a temporary tariff raises the relative price of current goods in general and current importables in particular in the home country. This reduces the world demand for current goods and current importables. For equilibrium to be restored following a temporary tariff, the relative price of current goods, the world real interest rate, and the current world relative price of importables θ^{*1} , must fall. Future relative prices on world markets,

θ^{*2} , are unchanged since any changes in future spending at home and abroad are of opposite sign but equal in magnitude, and expenditure shares on importables and exportables, $\alpha(1-\beta)$ and $(1-\alpha)(1-\beta)$, are the same in both countries.

The home country's current terms of trade are thus unambiguously improved by a temporary tariff, while its intertemporal terms of trade improve or worsen as they are running a trade balance deficit or surplus. Despite this it can be shown that:

$$e_u du = -e_u^* du^* = \frac{\theta^{*1}(m^1 - \bar{m}^1)}{\Pi^1} \frac{W}{W + W^*} d\tau^1,$$

which implies that home (foreign) welfare unambiguously improves (worsens) when a temporary tariff is enacted.

The trade balance effects of a temporary tariff are given by:

$$\begin{aligned} \frac{db^1}{W} = & \left\{ \beta(1-\beta)\sigma\alpha \frac{W^*}{W + W^*} + (1-\beta) \left[\frac{\theta^{*1}(m^1 - \bar{m}^1)}{\Pi^1 W} + \alpha \frac{b^1}{W} \right] \right. \\ & \left. \times \frac{W}{W + W^*} + \beta \frac{b^1}{W} \frac{\alpha W}{W + W^*} \right\} d\tau^1. \end{aligned} \quad (13)$$

The impact of a temporary tariff on the trade balance is not clear-cut. The rise in the domestic real interest rate generates intertemporal substitution effects which work along with the wealth effects of the improved current terms of trade to improve the trade balance.⁵ However, as the last term in (13) indicates, the wealth effect associated with the decline in the world real interest rate can go in either direction. If the home country is running a surplus, this channel also points towards an improved trade balance, but if the home country is running a deficit, it tends to worsen the trade balance. One result that (13) thus clearly establishes is that if the home country is initially running a surplus, a temporary tariff must improve the trade balance. If, however, the home country is running a deficit, it appears that the trade balance may actually deteriorate. This possibility deserves serious consideration since the current policy debate suggests it is precisely in times

⁵To see that the second term in (13) is positive, recall $b^1 = [\theta^{*1}(\bar{m}^1 - m^1) + \bar{x}^1 - x^1]/\Pi^1$. This implies:

$$\frac{\theta^{*1}(m^1 - \bar{m}^1)}{\Pi^1} + \alpha^1 b^1 = \frac{1}{\Pi^1} [(1-\alpha^1)\theta^{*1}(m^1 - \bar{m}^1) - \alpha^1(x^1 - \bar{x}^1)] > 0,$$

since the trade pattern implies $m^1 > \bar{m}^1$ and $\bar{x}^1 > x^1$ in both periods.

of trade balance deficits that tariffs may be seen as a useful means for improving the trade balance.

In order to examine the conditions that might lead a temporary tariff to worsen the trade balance, first note that when $\sigma > 1$,

$$(1-\beta)\sigma \frac{W^*}{W+W^*} + \frac{b^1}{W} \frac{W}{W+W^*} > 0.^6$$

Therefore, as can be seen from (13), when the home country is running a deficit and the intertemporal elasticity of substitution is greater than one, the intertemporal substitution effects dominate the intertemporal relative-price-associated wealth effects of a temporary tariff, and such a policy unambiguously improves the trade balance. That is to say, either an initial trade balance surplus or a high intertemporal elasticity of substitution is sufficient to guarantee that a temporary tariff improves the trade balance. Necessary conditions for a temporary tariff to worsen the trade balance are a trade balance deficit and a low intertemporal elasticity of substitution ($\sigma < 1$).

To gain further insight into the economic factors underlying these results the change in the trade balance can be expressed in terms of relative prices. For the home country:

$$\begin{aligned} \frac{db^1}{W} = & -\beta \left[(1-\beta)\sigma - \frac{b^1}{W} \right] \hat{\delta}^* - (1-\beta) \left[\frac{\theta^{*1}(m^1 - \bar{m}^1)}{\Pi^1 W} + \alpha \frac{b^1}{W} \right] \hat{\theta}^{*1} \\ & + \beta \delta^* \left[\frac{\theta^{*2}(m^2 - \bar{m}^2)}{\Pi^2 W} + \alpha \frac{b^2}{W} \right] \hat{\theta}^{*2} + \beta(1-\beta)\sigma\alpha(d\tau^1 - d\tau^2), \end{aligned} \quad (14)$$

where use has been made of the fact that from (10) $\hat{\delta} = \hat{\delta}^* + \alpha(d\tau^2 - d\tau^1)$ when preferences are identical across countries and periods. Similarly, it can be shown that:

⁶To see this, note that equilibrium with identical and homothetic tastes requires that $b^1 + b^{*1} = 0$ or that:

$$\frac{W}{W+W^*} \frac{b^1}{W} + \frac{W^*}{W+W^*} \frac{b^{*1}}{W^*} = 0.$$

Since $b^{*1} = y^{*1} - c^{*1}$, where $y^{*1} = (t^{*1}\bar{m}^{*1} + \bar{x}^{*1})/\Pi^{*1}$ is first-period foreign real income, it follows that:

$$\frac{W}{W+W^*} \frac{b^1}{W} + \frac{W^*}{W+W^*} (1-\beta) > 0,$$

since first-period income as a share of foreign wealth, y^{*1}/W^* , is typically less than one. Therefore, when $\sigma > 1$:

$$\frac{W}{W+W^*} \frac{b^1}{W} + \frac{W^*}{W+W^*} (1-\beta)\sigma > 0.$$

$$\begin{aligned} \frac{db^{*1}}{W^*} = & -\beta \left[(1-\beta)\sigma - \frac{b^{*1}}{W^*} \right] \hat{\delta}^* - (1-\beta) \left[\frac{\theta^{*1}(m^{*1} - \bar{m}^{*1})}{\Pi^{*1}W^*} + \alpha \frac{b^{*1}}{W^*} \right] \hat{\theta}^{*1} \\ & + \beta \delta^* \left[\frac{\theta^{*2}(m^{*2} - \bar{m}^{*2})}{\Pi^{*2}W^2} + \alpha \frac{b^{*2}}{W^*} \right] \hat{\theta}^{*2}. \end{aligned} \quad (15)$$

Eqs. (14) and (15) describe trade balance schedules, or net supply curves of current goods, for the home and foreign country. As can be seen from (14), when the home country is running a deficit, $(1-\beta)\sigma - (b^1/W) > 0$ and a drop in the world real interest rate (a rise in δ^*) unambiguously worsens the desired home trade balance. However, the foreign trade balance schedule may be positively sloped, or backward bending in this case, as $(1-\beta)\sigma - (b^{*1}/W^*) \geq 0$.⁷ Using the fact that $b^{*1}/W^* = (y^{*1} - c^{*1})/W^* = v^* - \beta$, where

$$v^* = \frac{(\theta^{*1}\bar{m}^{*1} + \bar{x}^{*1})}{\Pi^{*1}W^*}$$

is the share of first-period income in foreign wealth, it can be seen that

$$(1-\beta)\sigma - \frac{b^{*1}}{W^*} = (1-\beta)(\sigma - 1) + 1 - v^*.$$

Thus, for the foreign trade balance schedule to be backward bending, not only must the foreign country be running a surplus, but $\sigma < 1$ must hold. When the intertemporal substitution effect is weak, the negative wealth effect associated with a drop in the world real interest rate may overwhelm the substitution effect and lead to a desired improvement of the foreign country's trade balance.

This result suggests that the possibility of a temporary tariff worsening the trade balance when the home country is running a deficit and $\sigma < 1$ is intimately related to the fact that it is only under these conditions that the foreign trade balance schedule can be backward bending. In fact, it can be shown that the foreign trade balance schedule must be backward bending in order for a temporary tariff to worsen the trade balance. Figs. 1 and 2 illustrate this. In fig. 1 the home country is running a trade balance deficit but the intertemporal elasticity of substitution is high enough that the foreign trade balance schedule has the usual slope. The initial free trade equilibrium is at point A. Holding the within-period terms of trade, θ^{*1} and θ^{*2} , at their

⁷As is known from static trade theory, a rise in the relative price of a good must lower the buyer's (in this case, deficit country's) net demand but may raise or lower the seller's (surplus country's) net supply.

Fig. 1. The effects of a tariff when $(1 - \beta)\sigma - (b^{*1}/W^*) > 0$.

free trade levels, the imposition of a temporary tariff raises the relative price of current goods in the home country causing home consumers to substitute away from current goods toward future goods. This shifts the home trade balance schedule to the left and serves to improve the trade balance and lower the world real interest rate, as shown by the move to *B*. Recall, however, that a temporary tariff improves the home country's current terms of trade. This serves to generate wealth effects that shift both the home and foreign trade balance schedules to the left. Home consumers experience a rise in current income, part of which they wish to save, while foreigners wish to borrow against their future income to cushion the drop in current consumption arising from the decline in their current income. Since the wealth effects associated with the changed terms of trade are qualitatively similar to a transfer, and since identical and homothetic tastes preclude transfer effects, the terms of trade effects of the tariff shift the home and foreign trade balance schedules to the left by the same amount. The new equilibrium following the imposition of a temporary tariff is thus at a point like *C*. As can be seen, the within-period terms-of-trade effects reinforce the direct trade-balance-improving effects of the tariff. In addition, the world real interest rate falls to stimulate current world consumption in the face of the intertemporal substitution effects away from current consumption that are touched off by the tariff.

Fig. 2. A tariff that worsens the trade balance, $(1 - \beta)\sigma - (b^*/W^*) < 0$.

In fig. 2, the intertemporal elasticity of substitution is low enough so that the foreign country's trade balance schedule is backward bending. As before, the initial free trade equilibrium is at *A*. Once again levying a temporary tariff shifts the home trade balance schedule to the left by raising the domestic relative price of current goods and inducing consumers to substitute away from them. However, in this case, if the within-period terms of trade are held at their free trade level, the trade balance worsens: the drop in the world real interest rate required to eliminate the incipient excess supply of current goods generates an increase in foreign saving because the foreign trade balance schedule is backward bending. The result is shown by the move to *B* in fig. 2. Once again, though, the wealth effects associated with the improvement in the home country's current terms of trade act to improve the trade balance. However, as the new equilibrium at *C* in fig. 2 illustrates, if these effects are weak, the trade balance can in fact worsen in response to a temporary tariff.⁸

The practical implication of these results is that policymakers endeavoring to improve the trade balance via tariff policy must be aware of the possibility

⁸Note that Hicksian stability does not rule out this possibility. With identical and homothetic tastes, the matrix to be examined for stability is simply a matrix of substitution terms which much satisfy the Hicksian stability conditions [Hicks (1946, pp. 315–317)].

A numerical example has been worked out to demonstrate that the trade balance can worsen in response to a temporary tariff. It is available upon request.

that tariffs may actually worsen the trade balance. This can occur for both permanent and temporary tariffs. In the case of a temporary tariff, which is perhaps the most relevant case when tariffs are aimed at correcting trade balance woes, the trade balance may worsen if the tariff-imposing country is large, running a trade balance deficit, and the (foreign) intertemporal elasticity of substitution is low.

4. Tariffs and the world economy: The role of transfer effects

In the previous section the assumption of identical and homothetic tastes ruled out any possible role for transfer effects in determining the impact of tariffs on the world economy. Here the role of transfer effects is explored by relaxing the assumption that tastes are identical across countries. Specifically, the home utility function continues to be specified as in the previous section, while the foreign utility function is respecified as:

$$U^* = \frac{(c^{*1})^{1-(1/\sigma^*)}}{1-\frac{1}{\sigma^*}} + \rho^* \frac{(c^{*2})^{1-(1/\sigma^*)}}{1-\frac{1}{\sigma^*}}, \quad c^{*t} = (m^{*t})^\alpha (x^{*t})^{1-\alpha}.$$

Under this specification the home country's trade balance schedule is still given by (14). The foreign trade balance schedule is now given by

$$\begin{aligned} \frac{db^{*1}}{W^*} = & -\beta^* \left[(1-\beta^*)\sigma^* - \frac{b^{*1}}{W^*} \right] \hat{\delta}^* - (1-\beta^*) \left[\frac{\theta^{*1}(m^{*1} - \bar{m}^{*1})}{\Pi^{*1}W^*} + \alpha \frac{b^{*1}}{W^*} \right] \hat{\theta}^{*1} \\ & + \beta^* \delta^* \left[\frac{\theta^{*2}(m^{*2} - \bar{m}^{*2})}{\Pi^{*2}W^*} + \alpha \frac{b^{*2}}{W^*} \right] \hat{\theta}^{*2}. \end{aligned} \quad (16)$$

where $\beta^* = c_w^* = c^{*1}/W^*$.

The specification of preferences adopted here allows for international differences in the parameters characterizing the intertemporal aspects of preferences (the intertemporal elasticity of substitution and the subjective discount factor) while retaining the assumption that within-period preferences (i.e. expenditure shares) are identical across countries. The virtue of this is that it allows the concepts of a world real interest rate and world price level to have formal economic content and eliminates within-period transfer effects. This focuses attention on the intertemporal aspects of the problem, especially the role played by intertemporal transfer effects.

Not surprisingly, allowing for these transfer effects considerably broadens the range of possible results concerning the co-movement of real interest

rates and the trade balance. This section highlights those results that differ from those of the previous section as well as the general results that continue to hold once transfer costs are allowed to come into play.

4.1. *Permanent tariffs*

A permanent tariff improves the home country's within-period terms of trade in both periods but by only a fraction of the tariff hike. Hence the domestic relative price of importables increases in both periods. The response of the world (and domestic) discount factor to a permanent tariff is such that

$$\text{sign}(d\delta^*/d\tau) = \text{sign}(\beta^* - \beta).$$

That is, transfer effects determine the response of the world real interest rate to a permanent tariff: it increases or decreases as the domestic marginal propensity to spend on current goods is greater than or less than the foreign marginal propensity to spend on current goods.

To see the intuition behind this result, note that since the home country's within-period terms of trade improve in both periods, home welfare rises and foreign welfare falls when a permanent tariff is levied. However, it is easy to show that $e_u du = -e_u^* du^*$ so that the impact of the change in welfare is analogous to that of a transfer from foreign to domestic residents. If, for example, the home marginal propensity to spend on current goods exceeds that abroad ($\beta > \beta^*$), an incipient excess demand for current goods arises when a permanent tariff is levied and the world real interest rate must rise to maintain equilibrium.

The possible rise or fall of the world real interest rate is the major new result that arises when transfer effects are explicitly incorporated into the analysis of permanent tariffs. As was the case without transfer effects, a permanent tariff may improve or worsen the trade balance when transfer effects are present.

4.2. *Temporary tariffs*

Like a permanent tariff, a temporary tariff improves the home country's terms of trade but only in the current period; the future terms of trade are unaffected. The world real interest rate may rise or fall in response to a temporary tariff. The direct effect of the tariff works to reduce the world real interest rate by raising the domestic real interest rate and inducing home consumers to intertemporally substitute away from current goods. However, if $\beta > \beta^*$ transfer effects like those just discussed for the case of a permanent tariff can overcome this tendency, and enacting a temporary tariff can lead to an increase in the world real interest rate. If $\beta < \beta^*$ a temporary tariff unambiguously lowers the world real interest rate.

Fig. 3. A tariff that raises the world real interest rate when $(1 - \beta)\sigma - (b^1/W) > 0$ and $\beta > \beta^*$.

Fig. 3 illustrates the possibility of a temporary tariff raising the world real interest rate for the case where the home country's trade balance is initially in surplus and both trade balance schedules have the usual slope.⁹ The direct effect of the tariff is to shift the world economy from *A* to *B*, improving the trade balance and lowering the world real interest rate. However, the improvement in the home country's terms of trade essentially transfers current income from foreign consumers to home consumers. As can be seen from (14) and (16), this shifts both trade balance schedules to the right as a result of income smoothing on the part of consumers at home and abroad. If $1 - \beta < 1 - \beta^*$ (i.e. $\beta > \beta^*$), as is assumed in fig. 3, the desire of home consumers to save some of their increased income for the future is not as strong as the desire by foreigners to borrow to cushion the drop in their current consumption, and the world real interest rate must rise to eliminate this tendency toward an excess demand for current goods. If this transfer effect is strong enough, the world real interest rate may rise as shown by the new equilibrium at *C* in fig. 3.

The fact that the world real interest rate may rise when a temporary tariff is levied raises a new possibility: a temporary tariff may worsen the trade balance even when the home country is running a surplus. Fig. 4 demon-

⁹The notation and logic underlying the shifts of the home and foreign trade balance schedules is the same and in the earlier diagrams but the shifts are in the opposite direction because the horizontal axis has been reversed.

Fig. 4. A tariff that worsens the trade balance, $(1 - \beta)\sigma - (b^1/W) < 0$ and $\beta > \beta^*$.

strates this possibility. The diagram assumes that $(1 - \beta)\sigma - (b^1/W) < 0$ so that the home trade balance schedule is backward bending. When the initial free trade equilibrium at *A* is disturbed by the imposition of a temporary tariff, the direct effect of the policy is to move the economy to point *B*, lowering the world real interest rate and improving the trade balance just as in fig. 3. But if the home country marginal propensity to spend on current goods is significantly greater than the foreign marginal propensity to spend, the improvement in the home country's current terms of trade can lead to a sharp rise in the world real interest rate. This rise in the world real interest rate serves to worsen the trade balance as the positive wealth effect on home consumption dominates the negative intertemporal substitution effect. As the new equilibrium at *C* demonstrates, when the home country is running a surplus the within-period terms-of-trade-induced deterioration of the trade balance can dominate the direct trade-balance-improving effects of the tariff, and a temporary tariff can actually worsen the trade balance. For this to happen it is necessary that the real interest rate rise (which requires $\beta > \beta^*$) and that the home trade balance schedule be backward bending [which requires $\sigma < 1$ by enough so that $(1 - \beta)\sigma - (b^1/W) < 0$].

5. Conclusion

This paper has used an intertemporal framework to study the interest rate and trade balance effects of permanent and temporary tariffs. At a general level it has been shown that for a large country tariffs may generate any possible pattern of co-movement between real interest rates and the trade balance. More specifically, it has been shown that in contrast to the conventional wisdom, both permanent and temporary tariffs may worsen the trade balance. For instance, in an example characterized by identical and homothetic tastes, it was demonstrated that a temporary tariff may worsen the trade balance if the intertemporal elasticity of substitution in consumption is low enough ($\sigma < 1$) and the tariff-imposing country is running a deficit.

It has been noted at several points throughout the paper that policymakers, persuaded by the conventional wisdom, are inclined to use tariffs in times of trade balance difficulties in an attempt to improve matters. The results of the paper highlight several important issues relating to this strategy which are generally not recognized. One message is that it matters for the trade balance effects of a tariff whether it is perceived as permanent or temporary. A temporary tariff is more likely to improve the trade balance than a permanent tariff. However, both permanent and temporary tariffs may worsen the trade balance and policymakers should be aware of this possibility. The key in the case of a temporary tariff is whether or not the intertemporal elasticity of substitution in consumption is high enough to rule out this possibility. Even if it is, policymakers need to realize that while once enacted a tariff may improve the trade balance, lengthy debates that lead consumers to anticipate the tariff will cause the trade balance to deteriorate prior to its enactment.¹⁰ Finally, even if conditions are such that tariffs are a useful tool for improving the trade balance it is not clear that using tariffs to achieve such noneconomic objectives is desirable from a welfare perspective. To see this, consider the case of a country that is interested in maximizing private sector utility subject to the trade balance exceeding some target level. In this case, the optimal policy consists of two components.¹¹ First, tariffs and other taxes should be set at their optimum (i.e. welfare-maximizing) levels. Second, the tax structure should be adjusted so as to hit the trade balance target. Since the trade balance is fundamentally related to the country's intertemporal pattern of income and spending, policies striking directly at intertemporal relative prices, such as taxes on international borrowing and lending, will typically achieve the trade balance objective at a

¹⁰This is readily verified by considering the case where $d\tau^1 = 0$ and $d\tau^2 > 0$. Qualitatively the results are the same as those for a temporary tariff except the effects on current and future periods are reversed.

¹¹This follows from Sandmo (1975). See Greenwood and Kimbrough (1987) for discussions of optimal policies for achieving trade balance and other balance of payments related objectives in the small country case.

lower cost in terms of potential welfare than will policies striking at within-period relative prices. From the welfare perspective, then, tariffs are not a desirable tool for attaining trade balance objectives.

References

- Dixit, A.K. and V. Norman, 1980, *Theory of international trade* (Cambridge University Press, Cambridge).
- Dornbusch, Rudiger, 1980, *Open economy macroeconomics* (Basic Books, New York).
- Edwards, Sebastian, 1987, Tariffs, terms of trade, and the real exchange rate in an intertemporal optimizing model of the current account, NBER Working Paper no. 2175.
- Greenwood, Jeremy, 1983, Expectations, the exchange rate, and the current account, *Journal of Monetary Economics* 12, 543–569.
- Greenwood, Jeremy and Kent P. Kimbrough, 1987, An investigation in the theory of foreign exchange controls, *Canadian Journal of Economics* 20, 271–288.
- Helpman, Elhanan, 1981, An exploration in the theory of exchange-rate regimes, *Journal of Political Economy* 89, 865–890.
- Hicks, J.R., 1946, *Value and capital* (Oxford University Press, London).
- Mcade, J.E., 1951, *The balance of payments* (Oxford University Press, London).
- Razin, Assaf and Lars E.O. Svensson, 1983, Trade taxes and the current account, *Economics Letters* 13, 55–57.
- Robinson, Joan, 1947, Beggar-my-neighbor remedies for unemployment, in her *Essays in the theory of employment* (Basil Blackwell, Oxford).
- Sachs, Jeffrey D., 1981, The current account and macroeconomic adjustment in the 1970s, *Brookings Papers on Economic Activity* 1, 201–268.
- Sandmo, Agnar, 1975, Optimal taxation in the presence of externalities, *Swedish Journal of Economics* 77, 86–98.
- Svensson, Lars E.O. and Assaf Razin, 1983, The terms of trade and the current account: The Harberger–Laursen–Metzler effect, *Journal of Political Economy* 91, 97–125.