International Transfers, the Relative Price of Non-Traded Goods, and the Current Account
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International transfers, the relative price of non-traded goods, and the current account

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Abstract. This paper considers the role of the relative price of non-traded goods and the current account in the adjustment of a small open economy to the receipt of an international transfer. The paper shows that the economy's macroeconomic adjustment to the transfer depends upon the relative capital intensities of the traded and non-traded sectors of the economy as well as on the duration of the transfer. The paper provides a new interpretation of France's current account surplus in the 1870s that accompanied the payment of reparations to Germany following the Franco-Prussian War, and of Germany's trade deficit in the 1920s that accompanied reparations payments associated with the First World War.

Transferts internationaux, prix relatifs des biens non-transigés internationalement et compte courant. Ce mémoire examine le rôle des prix relatifs des biens non-transigés internationalement et du compte courant dans le processus d'ajustement d'une petite économie ouverte quand elle reçoit un transfert international. On montre que l'ajustement macroéconomique de l'économie au transfert dépend de l'intensité capitalistique relative des secteurs de biens transigés et nontransigés internationalement et de la durée du transfert. Le mémoire présente une interprétation inédite du compte courant de la France dans les années 1870 (qui a accompagné le paiement de réparations à l'Allemagne à la suite de la Guerre franco-prussienne) et du déficit commercial de l'Allemagne dans les années 1920 (qui a accompagné les paiements de réparations associés à la Première Guerre Mondiale).

I. INTRODUCTION

The original debate on the economic consequences of a financial transfer from one country to another centred around the war reparations imposed on Germany under the Versailles Treaty at the end of the First World War. In this debate Keynes, Pigou, and Robertson, among others, maintained that the payment of reparations involved a secondary burden caused by a deterioration in the paying country's

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terms of trade. Ohlin (1929a, b), however, emphasized the central role of non-traded 'home market' goods in effecting a transfer. In the clearest statement of his position, Ohlin (1929b) considered the case of a transfer between two districts (A and B) of a single country, where labour migration is prohibited between the two districts:[1]

> A borrows a large sum from B to build a railway ... The monetary transfer is primary to the real transfer, and tends to bring the latter about in the following way: A buys more and B less of the goods which go easily between them ('international goods'), whereby the 'trade balance' is directly affected. Furthermore, people in the former district use a part of the increased buying power to purchase 'home market goods,' which become more demanded than before, while the same class of goods becomes less demanded than before in B. Their prices may rise in A and fall in B, but whether these price changes are considerable or not, production of such goods is expanded in the former and reduced in the latter district, while the production of 'internatinal' goods moves in the opposite direction, i.e. is reduced in A. In that way A's imports increase and its exports fall off. B, on the other hand, will buy less and is able to sell more *without offering its own export goods on cheaper terms of exchange than before.*

Ohlin's analysis is compatible with the assumption that A and B are small open economies, so that given fixed terms of trade, the transfer problem conceptually is a problem of the adjustment of the relative price of non-tradables in response to a monetary transfer.

As Samuelson (1971) has stressed, the early verbal discussion of the transfer problem lacked analytical clarity because the examples often combined financial considerations (such as Ohlin's use of railroad financing as a proxy for a transfer) with those of pure exchange. Beginning with Pigou's (1932) paper, analysis of the transfer problem was placed clearly within the context of pure exchange. The large advances made by Samuelson (1952, 1954) and others in the analysis of the transfer problem rested on the simplifying assumption that an outward transfer (such as war reparations) would be *exactly* matched by an economy's trade surplus, so that the current account would remain unaffected by the transfer. This simplifying assumption permitted the use of a static framework for the analysis of international transfers.

This simplifying assumption of an unchanged current account was, however, incorrect empirically. As noted by Ohlin (1929a), Machlup (1976), and others, Germany ran a trade deficit during most of the time in which it was making reparations and did not actually generate a trade surplus until 1929. According to Gavin (1992), France ran not only a trade account surplus, but also a current account surplus during 1872–5 when making reparations payments to Germany following the Franco-Prussian War. In addition, Machlup (1976) documented that the large transfers to the Continent made by England during the Napoleonic Wars between 1796 and 1816 (for maintaining armies and granting subsidies to allies) resulted in British trade surpluses in only three of those years.

1 Quotation marks are in the original; italics were added by author.

This paper returns to Ohlin's view of the transfer problem as one centrally concerned with the adjustment of the relative price of non-traded goods in a setting in which the international credit market plays an important role in the adjustment process.[2] In examining the adjustment of the relative price of non-tradables to a transfer, the paper's analytical framework draws on the resource discovery (or 'Dutch Disease') literature, such as Corden and Neary (1982), Neary and Purvis (1982), Bruno and Sachs (1982), and more recently, Bevan, Collier, and Gunning (1990) and Van Wincoop (1992). This literature has generally treated the discovery of a natural resource as a permanent increase in transfer income to an economy facing a fixed terms of trade. Although the resource discovery models frequently employ an intertemporal framework for determining the role of the relative price of non-tradables in the adjustment process, they either assume a closed capital account (such as the first two papers cited above) or fail to characterize the behaviour of the current account when the capital account is assumed to be open (such as the latter three papers cited above). This paper is closest in spirit to work on the relative price of non-tradables by Brock and Turnovsky (1994) and Turnovsky and Sen (1995). In particular, the adjustment process of the relative price of non-tradables depends on relative capital intensities of the traded and non-traded sectors of the economy, as in those two papers. Unlike those papers, this paper focuses on the transfer problem and derives the adjustment of the current account to both permanent and temporary changes in transfer income.

II. THE ANALYTICAL FRAMEWORK

The framework for the analysis of transfers is the two-sector dependent economy model originally developed by Salter (1959), Swan (1960), and Pearce (1961) to emphasize the complementary roles of the relative price of non-tradables and the trade balance in bringing about macroeconomic equilibrium to a small economy that faces a fixed terms of trade. The framework follows recent literature – especially Van Wincoop (1992), Brock and Turnovsky (1994), and Turnovsky and Sen (1995) – in incorporating optimizing consumption and investment expenditure into the dependent economy model.

1. The production structure

The economy under consideration is inhabited by a single, infinitely lived representative agent who accumulates capital (K) for rental at its competitively-determined rental rate and supplies a fixed amount of labour (normalized to be one unit) at the competitive wage. The agent produces a tradable good using capital (K_t) and labour (L_t) by means of a linearly homogeneous production function, which can be written in intensive notation as follows: $F(K_t, L_t) = f(k_t)L_t$, where $k_t \equiv K_t/L_t$. The

2 McDougall (1965), Samuelson (1971), and Jones (1975) have analysed the response of the relative price of non-tradables to a transfer in a static setting where the change in net exports of the transferring country equals the size of the financial transfer. See also Greenwood (1984) for an analysis of the transmission of government expenditure to the relative price of non-tradables.

agent also produces a non-traded good using capital (K_n) and labour (L_n) by means of a second linearly homogeneous production function, $H(K_n, L_n) = h(k_n)L_n$, where $k_n \equiv K_n/L_n$. The relative price of non-traded goods (p) is taken as exogenous by the agent and is determined by market-clearing conditions in the economy. On the demand side of the economy, the agent consumes both the traded good (C_t) and the non-traded good (C_n).

Following Fischer and Frenkel (1972), Dornbusch (1980), and Obstfeld and Stockman (1985), capital formation requires non-traded investment expenditure (I). Existing alternative specifications for investment expenditure include the use of traded capital or traded capital subject to installation costs. With either of these alternative specifications the economy's intertemporal budget constraint is the only one relevant for expenditure decisions, so that, in particular, the rate of capital accumulation does not depend on the time path of consumption.[3] The specification employed in this paper retains a direct trade-off between investment and consumption, since for any given relative price of non-tradables, the opportunity cost of investment expenditure is forgone non-traded consumption.

In addition to the stock of capital, the agent also holds a stock of net foreign assets ($b \lesseqgtr 0$) that pays an exogenously-given world interest rate (r). Finally, the agent is either a net recipient of transfer income ($\tau > 0$) from the rest of the world or a net payer of transfer income ($\tau < 0$). Equation (1) gives the agent's instantaneous budget constraint, where foreign assets are measured in terms of the numeraire:

$$\dot{b} = \tau + f(k_t)L_t + ph(k_n)L_n + rb - C_t - pC_n - pI. \tag{1}$$

The agent also faces the following standard capital accumulation constraint, where capital depreciates at the rate δ:

$$\dot{K} = I - \delta K. \tag{2}$$

Labour and capital are mobile across the traded and non-traded sectors, with their allocation subject to the following constraints:

$$L_t + L_n = 1 \tag{3}$$

$$K_t + K_n = K. \tag{4}$$

2. *The agent's optimization problem*

The agent chooses consumption levels (C_t, C_n), factor allocations (K_t, K_n, L_t, L_n), and the level of investment to maximize the discounted value of instantaneous utility, where the discount rate ρ is the agent's rate of time preference:

$$\int_0^{\infty} U(C_t, C_n)e^{-\rho s}ds, \tag{5}$$

3 Turnovsky and Sen (1995) fully characterize the dependent economy model with traded capital. When the tradable capital stock can adjust instantaneously, there is no dynamic adjustment process involving the relative price of non-tradables or the current account.

subject to the constraints (1)–(4), the initial stocks of assets K_0 and b_0, and the fixed stocks of labour and land. The instantaneous utility function is assumed to be concave and the consumption goods are assumed to be normal.

The following optimality conditions hold for the agent's optimization problem:

$$\frac{\partial U}{\partial C_t} = \frac{1}{p}\frac{\partial U}{\partial C_n} = \lambda \tag{6a}$$

$$f_k(k_t) = ph_k(k_n) \equiv r^K \tag{6b}$$

$$f(k_t) - k_t f_k(k_t) = p[h(k_n) - k_n h_k(k_n)] \equiv w, \tag{6c}$$

where λ is the shadow value of wealth held in the form of internationally traded bonds, r^K is the rental rate on capital, and w is the real wage, all measured in terms of the numeraire. The appendix uses the optimality conditions in (6a)–(6c) to solve for the agent's consumption as a function of the shadow value of wealth and the relative price of non-tradables, and for the agent's factor allocations as functions of the relative price of nontradables and the stock of capital.

The relative price of non-tradables in the economy evolves as follows:

$$\dot{p} = -r^K(p) + (r + \delta)p, \tag{7}$$

where the appendix demonstrates that capital's rental rate is a function only of the relative price of non-tradables:

$$\frac{\partial r^K}{\partial p} = \frac{h(k_n)}{k_n - k_t}. \tag{7a}$$

The evolution of the capital stock is derived by making use of the non-traded market-clearing condition, $h(k_n)L_n = C_n + I$, in conjunction with equation (2). The appendix demonstrates that non-traded output can be written as a function Y_n of the capital stock and the relative price of non-tradables, so that the non-traded market-clearing condition can be expressed as follows:

$$\dot{K} = Y_n(K, p) - C_n(\lambda, p) - \delta K \tag{8}$$

where

$$\frac{\partial Y_n}{\partial K} = \frac{h(k_n)}{k_n - k_t} \text{ and } \frac{\partial Y_n}{\partial p} > 0.$$

Equation (8) taken in conjunction with the agent's budget constraint (1) implies that the economy's current account, which determines the evolution of the economy's net foreign assets, may be written as follows:

$$\dot{b} = \tau + Y_t(K, p) + rb - C_t(\lambda, p), \tag{9}$$

where $Y_t(K,p) \equiv f(k_t)L_t$ is the production of tradable goods. The following transversality conditions rule out non-optimal solutions to the agent's optimization problem in the neighbourhood of a steady-state equilibrium:

$$\lim_{s \to \infty} \lambda b e^{-rs} = \lim_{s \to \infty} \lambda pKe^{-rs} = 0. \tag{10}$$

3. Evolution of the shadow value of wealth

I assume that the agent's discount factor (ρ) is a constant, which implies that the evolution of the shadow value of wealth is as follows:

$$\frac{\dot{\lambda}}{\lambda} = \rho - r. \tag{11}$$

The rate of time preference and the interest rate must be assumed equal in order to have a steady-state solution to the model.[4] Given this assumption, the shadow value of wealth must be expected to remain constant, and will jump discretely in response to unanticipated disturbances.

Several noteworthy papers in international economics – Findlay (1978), Obstfeld (1981), and Devereux and Shi (1991) – have assumed that the rate of time preference is endogenous along the lines of Uzawa (1968). If one were to assume in this paper's model that the agent's discount factor took the form assumed by Uzawa (1968), the shadow value of wealth would evolve as follows:

$$\frac{\dot{\lambda}}{\lambda} = \rho\{U[C_t(\lambda, p), C_n(\lambda, p)]\} - r, \tag{11a}$$

where the rate of time preference must be an increasing function of instantaneous utility ($\rho' > 0$) in order to ensure stability. In this model, the no-arbitrage condition (7) in the capital market determines the long-run relative price of non-tradables ($\tilde{p}$). Given this value of the relative price of non-tradables, equation (11a) of the modified version of the model would then determine the long-run shadow value of wealth ($\tilde{\lambda}$) and long-run levels of consumption of both goods. Given the long-run values $\tilde{p}$ and $\tilde{\lambda}$, equation (8) would determine the long-run value of the capital stock ($\tilde{K}$). Given these long-run values, equation (9) would then determine the long-run value of net foreign assets ($\tilde{b}$). With Uzawa preferences, therefore, changes in international transfers would not change long-run levels of consumption, labour allocation, or the size of the capital stock. From (9) a permanent increase in transfer income would result in a long-run decrease in net foreign asset holding:

$$d\tilde{b} = -\frac{d\tau}{r}. \tag{12}$$

With Uzawa preferences the propensity to consume out of a permanent increase in income exceeds one.

4 This sort of adjustment dynamics characterizes many economic models with zero roots. See Giavazzi and Wyplosz (1985) for a general analysis of such models.

Although the long-run results that emerge from the specification of Uzawa preferences are of some theoretical interest, the assumption made in this paper of a constant discount rate is close in spirit to the life-cycle/permanent-income approach to modelling consumption. This latter approach has shown empirical relevance at both the aggregate and micro level (see Hall 1978; Deaton 1992). Since empirical discrepancies with the permant income model point towards the existence of liquidity constraints among a fraction of the population (e.g., Flavin 1981), the leveraging of transfer income implied by (12) suggests that a variable rate of time preference may not be the preferred specification of the agent's discount factor for the study of the macroeconomic effects of transfers in a small open economy.[5] The specification of a constant rate of time preference, by contrast, permits the development of a plausible benchmark model in which both permanent and temporary changes in transfer income do permanently affect consumption levels, factor allocation, and the level of the capital stock.

III. LOCAL STABILITY ANALYSIS

The equilibrium dynamics of the economy (including the current account) are governed by equations (7), (8), (9), and (11). The equations can be linearized to determine the local stability properties of any steady state. The system of equations is block recursive so that the behaviour of the capital stock and relative price of non-tradables can be determined before deriving the behaviour of the current account.[6] Equation (13) contains the linearized system of equations (7) and (8):

$$\begin{bmatrix} \dot{p} \\ \dot{K} \end{bmatrix} = \begin{bmatrix} -(A_1 - r) & 0 \\ A_2 & A_1 \end{bmatrix} \begin{bmatrix} p - \tilde{p} \\ K - \tilde{K} \end{bmatrix}, \tag{13}$$

where $A_1 = [h/(k_n - k_t)] - \delta$ and $A_2 = (\partial Y_n/\partial p) - (\partial C_n/\partial p) > 0$. The two eigenvalues associated with (13) are[7]

$$\mu_1 = A_1 < 0, \ \mu_2 = -(A_1 - r) > 0 \text{ for } k_t > k_n \tag{14a}$$

$$\mu_1 = -(A_1 - r) < 0, \ \mu_2 = A_1 > 0 \text{ for } k_n > k_t. \tag{14b}$$

Around stationary points the following solutions hold for the capital stock and the relative price of non-tradables ($\tilde{K}$ and $\tilde{p}$ denote steady-state values):

$$K(s) = \tilde{K} + (K_0 - \tilde{K})e^{\mu_1 s} \tag{15}$$

$$p(s) = \tilde{p} - \frac{A_1 - \mu_1}{A_2}[K(s) - \tilde{K}] \tag{16}$$

5 This, of course, does not rule out the use of a variable rate of time preference in other settings.
6 This is a standard feature of small open economy models in which the agent's discount rate is set equal to the world interest rate.
7 Around a steady state, $h_k = r + \delta$. It is straightforward to show that $h(k_n)/(k_n - k_t) > h_k$ for $k_n > k_t$.

The slope coefficient in (16) will be either zero or negative:

$$-\frac{A_1 - \mu_1}{A_2} \equiv p'(K) = 0 \text{ for } k_t > k_n \tag{17a}$$

$$p'(K) = -\frac{2A_1 - r}{A_2} < 0 \text{ for } k_n > k_t. \tag{17b}$$

By using (15) and (16), the appendix shows that a linearized approximation to the current account can be written as follows:

$$\dot{b} = -\left[p + \frac{p'(K)}{\mu_1 - r}\frac{\partial C}{\partial p}\right]\dot{K}. \tag{18}$$

where $C \equiv C_t + pC_n$ is total consumption and $\partial C/\partial p \equiv \partial C_t/\partial p + p(\partial C_n/\partial p) = \lambda(\partial C_n/\partial \lambda) < 0$. The first term in brackets in (18) is the purchase price of capital, while the second term is the value of savings in response to the high but falling relative price of non-tradables. Unless the savings response is large, the current account will be negatively correlated with capital accumulation. This negative correlation will hold unambiguously when the capital intensity of the manufacturing sector exceeds that of the non-traded sector, since in that case the flat saddlepath results in the following expression for the current account:

$$\dot{b} = -\tilde{p}\dot{K} \tag{18a}$$

IV. PERMANENT AND TEMPORARY TRANSFERS

1. Permanent transfers

In a small economy with a fixed terms of trade, such as the one in this paper, a permanent increase in the flow of international transfers affects an economy by lowering the shadow value of wealth (see appendix equation A13a). The lower shadow value of wealth then leads to an increase in consumption demand for both traded and non-traded goods. If non-tradables are relatively capital intensive compared with tradables, the steady-state capital stock will increase in order to meet the greater non-traded consumption demand. Figure 1 shows the saddlepath adjustment of the relative price of non-tradables and the capital stock in response to the transfer. At time $s = 0$ the relative price of non-tradables jumps from $\tilde{p}$ to p_0 on the saddlepath SS'. During the transition from the initial capital stock $\tilde{K}_0$ to the new long-run capital stock $\tilde{K}_1$ the transitorily high relative price of non-tradables encourages saving. From equation (19) it is readily apparent that, unless there is a large consumption response to the high but declining relative price of non-tradables, the increased investment resulting from a permanent increase in transfer income will cause the current account to deteriorate, thereby leading to a long-run decline in net foreign assets:

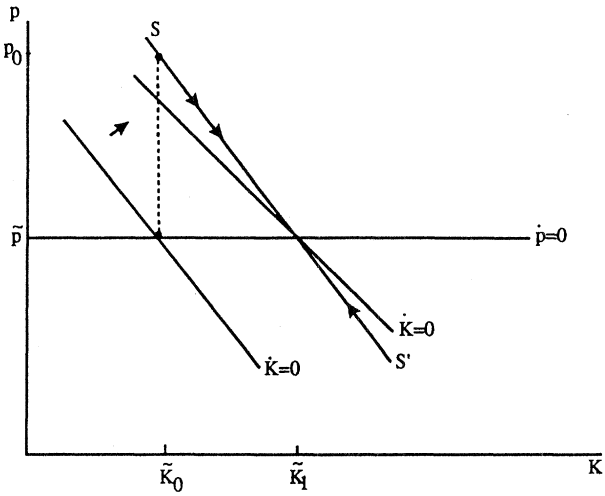

FIGURE 1

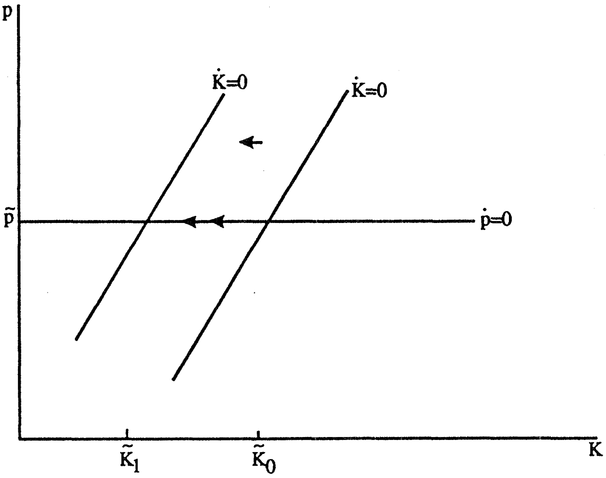

FIGURE 2

$$\frac{\partial \tilde{b}}{\partial \tau} = -\left[p + \frac{p'(K)}{\mu_1 - r}\frac{\partial C}{\partial p}\right]\frac{\partial \tilde{K}}{\partial \tau} \lessgtr 0, \qquad k_n > k_t. \tag{19}$$

If tradables are relatively capital intensive, the steady-state capital stock will decrease in order to increase production of the relatively labour-intensive non-tradables. Figure 2 shows the saddlepath adjustment of the capital stock to the transfer income at a constant relative price of non-tradables $\tilde{p}$. Equation (19a) demonstrates that in such a case the current account will unambiguously improve with a permanent increase in transfer income, thereby leading to a long-run increase in the economy's net foreign assets:

$$\frac{\partial \tilde{b}}{\partial \tau} = -\tilde{p}\frac{\partial \tilde{K}}{\partial \tau} > 0, \qquad k_t > k_n. \tag{19a}$$

In standard small open production economies with installation costs for new capital (e.g., Frenkel and Rodriguez 1975; Sen and Turnovsky 1990) the current account is unaffected by a permanent change in transfer income, since these models are separable in production and consumption decisions. In this model the current account is non-zero, owing to the induced change in the capital stock caused by the increase in non-traded consumption.

2. Temporary transfers

Most episodes of international transfers are temporary rather than permanent. The temporary nature of the transfers does not alter the channel by which the economy reacts to the transfer. The transfer alters the shadow value of wealth, which, in turn, alters consumptions expenditure. In particular, the adjustment of the capital stock and the relative price of non-tradables depends only on the present value of the transfers, not on their timing. The behaviour of the current account, however, does depend on the timing of the transfers. If the transfers are temporary, the appendix shows that the current account during the period $[0, T]$ of the transfer can be written as

$$\dot{b}_s = -\left[p_s + \frac{\partial C}{\partial p} \cdot \frac{p'(K)}{\mu_1 - r}\right]\dot{K}_s + \hat{\tau}e^{-r(T-s)}, \qquad s \in [0, T]. \tag{20}$$

In the period $[T, \infty)$ following the termination of the transfer income, the current accounts dynamics are the same as they are in (18).

A comparison of equations (18) and (20) indicates that during the period of the temporary transfer income the agent saves an amount $\hat{\tau}e^{-rT}$ whose compounded sum

$$\int_0^T \hat{\tau}e^{-r(T-s)}ds = \frac{\hat{\tau}}{r}(1 - e^{-rT}) \tag{21}$$

creates an annuity of the amount $\hat{\tau}(1 - e^{-rT})$ for the time period $[T, \infty)$.

Equation (20) contains a term in $\dot{K}$ that will be opposite in sign to the second term if non-tradables are relatively capital intensive in comparison with tradables. In that case, the term in $\dot{K}$ will get smaller in absolute value with the passage of time, while the second term will get larger. If $\dot{K} > 0$, for example, the current account could initially be negative before becoming positive prior to the termination of the transfer income. In the period following time $s = T$ when the transfer ceases, the current account would once again become negative, reflecting the ongoing upward adjustment of the capital stock along the transition path to the new steady state.

When the traded sector is relatively capital intensive, equation (20) becomes

$$\dot{b}_s = -\tilde{p}\dot{K}_s + \hat{\tau}e^{-r(T-s)}. \tag{20a}$$

In this case both right-hand-side terms are positive if $\hat{\tau} > 0$, so the current account will not change sign. The first term decreases in size with time while the second term increases in size, however, so that the current account may not monotonically decrease in size. The current account surplus may initially decline before growing as time T approaches. Following the termination of the transfer income, the current account will remain in surplus at a lower level than at time T, reflecting the continuing downward adjustment of the capital stock.

V. THE FRENCH AND GERMAN REPARATIONS PAYMENTS

As Gavin (1992) has noted, despite the long-standing analytical interest of economists in the transfer problem, there has been relatively little empirical work on the macroeconomic impact of large transfers. The emprical evidence that does exist suggests a puzzle. During the four years of reparations payments (1872–5) following France's defeat in the Franco-Prussian War, for example, Gavin (1992) finds that France's net exports were large enough to create a current account surplus rather than a deficit. Standard theory based on consumption-smoothing arguments would suggest that the French should have borrowed to finance a portion of the reparations payments. Gavin (1992) correctly refers to the evidence of an improvement in the current account as 'a striking empirical departure from the theoretical baseline which informs most of the literature on the transfer problem.' Gavin suggests that the behaviour of the current account might be explained by an alternative assumption that intertemporal preferences give rise to a target level of consumption.

Equation (19) suggests an approach to the interpretation of the French reparations payments that does not rely on the assumption of a long-run target level of consumption to drive the current account. If the non-traded sector is relatively more capital intensive than the manufacturing sector, then payment of a permanent flow of reparations would cause the current account to go into surplus as a result of a decline in investment expenditure, which, in turn, results from a decline in non-traded consumption. Gavin (1992), in fact, estimates that at least half of France's current account improvement relative to a baseline projection during 1872–7 was the result of a depressed level of investment expenditure. France's current account experience with a temporary outward transfer is also consistent with equation (20), assuming that the non-tradables sector is relatively capital intensive and that the capital adjustment term is larger in absolute value than the term representing dissaving in response to the temporary outward transfer.

A second puzzle is the behaviour of Germany's trade balance following the start of its reparations payments. Partly as a result of reconstruction loans to Germany,

Germany's net exports were negative between 1925 and 1928 before becoming positive between 1929 and 1932 (Machlup 1976). This behaviour of the trade account is puzzling from the standpoint of *either* the standard theory of consumption *or* the alternative theory based on a variable rate of time preference. Both theories predict an improvement in the trade account, with a greater improvement corresponding to the variable-rate-of-time-preference theory.

By making use of the following relationship between net exports (NX) and the current account,

$$Y_t(s) - C_t(s) \equiv NX(s) = \dot{b}_s - rb_s - \tau_s, \tag{22}$$

equation (20) can be expressed, with the help of equations (15), (A17), and (A18), as

$$NX(s) = -r\tilde{b} - \left[(\mu_1 - r)p_s + \frac{\partial C}{\partial p}p'(K)\right](K_0 - \tilde{K})e^{\mu_1 s}. \tag{23}$$

Equation (23) shows that the behaviour of net exports is the sum of two components. The first is the steady-state level of the trade balance consistent with the long-run stock of net foreign assets [$NX(\infty) = -r\tilde{b}$]. If $\tilde{b} < 0$, net exports must be positive in the long run. The second term is the effect of the adjustment in the capital stock in response to the transfer. If the traded sector is relatively capital intensive, the payment of reparations will require an upward adjustment in the capital stock so that the second term will be opposite in sign to the first and may cause the economy initially to run a trade deficit before running a trade surplus. Germany's move from trade deficit during 1925–8 to trade surplus during 1929–32 is consistent with equation (23) if the traded sector was relatively capital intensive and the projected long-run net foreign asset position of the economy was negative.

VI. CONCLUSION

This paper's analysis of the macroeconomic role of the current account as part of an economy's adjustment to increased transfer income has made use of the dependent economy model as most recently developed by Van Wincoop (1992), Turnovsky and Sen (1995), and Brock and Turnvosky (1994). Several results of the analysis are worth highlighting. First, the receipt of a transfer changes the shadow value of wealth, thereby changing the desired level of non-traded consumption. In order to accommodate the changed level of non-traded consumption, the steady-state capital stock must change. Unlike static models of adjustment to a transfer, the trade balance will not exactly offset the transfer, so that the economy's current account plays an important part in the adjustment process to a transfer.

Second, this paper's analytical results are sensitive to the assumed capital intensity of the traded sector relative to the non-traded sector. If the non-traded sector is relatively capital intensive, the saddlepath adjustment of the economy will involve a high but falling relative price of non-tradables. If the traded sector is relatively capital intensive, the saddlepath will involve adjustment with the relative price of non-tradables at its long-run level. Although non-tradables are often assumed to be labour-intensive services such as haircuts, the services provided by an economy's infrastructure and stock of housing are generally quite capital intensive. Krueger (1977) has suggested that the non-traded sector may be relatively more capital intensive in labour-abundant countries and less capital intensive in capital-abundant countries.

Third, the model exhibits *hysteresis*, since the wealth effect associated with a temporary transfer results in a permanent change in the steady-state levels of the capital stock, the stock of net foreign assets, and consumption of both goods. With a temporary transfer the capital stock and the relative price of non-tradables exhibit a monotonic adjustment to their new long-run levels consistent with the new shadow value of wealth. The current account, on the other hand, will generally exhibit non-monotonic behaviour. If the non-traded sector is relatively capital intensive, in particular, the initiation of a temporary transfer may cause the current account to go from deficit to surplus prior to the termination of the transfer, followed by a return to deficit after the termination of the transfer.

As a concluding note, there is relatively little empirical work on the macroeconomic effects of transfers. Two large and ongoing international transfer programs suggest themselves as possible sources of new evidence. First, the reconstruction of eastern Europe and the Soviet Union involves a large flow of concessional aid that may create a macroeconomic adjustment of the sort explored by this paper. Second, following the signing of the Single European Act in 1986, the European Community embarked on a large-scale – and still continuing – transfer of funds from the richer nations of the community towards Spain, Portugal, Greece, and Ireland. Empirical evidence from the latter experiment will have the advantage of being generated by a set of stable, well-functioning market economies.

APPENDIX

1. Properties of short-run solutions

a. Consumption: Taking the differentials of the equations in (6a) gives

$$\begin{bmatrix} U_{tt} & U_{tn} \\ U_{nt} & U_{nn} \end{bmatrix} \begin{bmatrix} dC_t \\ dC_n \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ p & \lambda \end{bmatrix} \begin{bmatrix} d\lambda \\ dp \end{bmatrix}, \tag{A1}$$

leading to the following partial derivatives:

$$\frac{\partial C_t}{\partial \lambda} = \frac{1}{D}[U_{nn} - pU_{tn}] < 0 \qquad \frac{\partial C_t}{\partial p} = -\frac{\lambda}{D} U_{tn} \lesseqgtr 0$$

$$\frac{\partial C_n}{\partial \lambda} = \frac{1}{D}[pU_{tt} - U_{nt}] < 0 \qquad \frac{\partial C_n}{\partial p} = -\frac{\lambda}{D} U_{tt} < 0,$$

where $D \equiv U_{tt}U_{nn} - U_{tn}^2 > 0$.

b. Production: Differentiating the resource allocation conditions in (6b) and (6c) gives

$$\begin{bmatrix} f_{kk} & -ph_{kk} \\ -k_t f_{kk} & pk_n h_{kk} \end{bmatrix} \begin{bmatrix} dk_t \\ dk_n \end{bmatrix} = \begin{bmatrix} h_k \\ h - k_n h_k \end{bmatrix} [dp]. \tag{A2}$$

From the production block the following derivatives can be obtained:

$$\frac{\partial k_t}{\partial p} = \frac{h}{f_{kk}(k_n - k_t)} \tag{A3a}$$

$$\frac{\partial k_n}{\partial p} = -\frac{h + h_k(k_n - k_t)}{ph_{kk}(k_n - k_t)} \tag{A3b}$$

$$\frac{\partial r_k}{\partial p} = h_k + ph_{kk}\frac{\partial k_n}{\partial p} = \frac{h}{k_n - k_t}. \tag{A3c}$$

By noting that $L_t k_t + L_n k_n = K$ and $L_t + L_n = 1$, non-traded output can be written as follows:

$$Y_n = h(k_n)L_n = \frac{h(k_n)(K - k_t)}{k_n - k_t} \tag{A4}$$

$$\frac{\partial Y_n}{\partial K} = \frac{h}{k_n - k_t} \tag{A5}$$

$$\frac{\partial Y_n}{\partial p} > 0. \tag{A6}$$

2. Derivation of the current account

Linearizing equation (9) around the steady state gives

$$\dot{b}_s = \left[\frac{\partial Y_t}{\partial K} + \left(\frac{\partial Y_t}{\partial p} - \frac{\partial C_t}{\partial p}\right) p'(K)\right](K_s - \tilde{K}) + r(b_s - \tilde{b}), \tag{A7}$$

where $p'(K) \leqq 0$ is the slope of the saddlepath.

Noting that $\partial Y_n/\partial K = \partial I/\partial K$ and that $\partial Y_n/\partial p = (\partial C_n/\partial p)+(\partial I/\partial p)$, the current account can be rewritten as

$$\dot{b}_s = \left[\frac{\partial Y_t}{\partial K} + p\frac{\partial Y_n}{\partial K} - p\frac{\partial I}{\partial K} + \left(\frac{\partial Y_t}{\partial p} + p\frac{\partial Y_n}{\partial p} - \frac{\partial C_t}{\partial p} - p\frac{\partial C_n}{\partial p} - p\frac{\partial I}{\partial p}\right)p'(K)\right] \cdot (K_s - \tilde{K}) + r(b_s - \tilde{b}) \tag{A8}$$

Using equation (15) and the relationships, $(\partial Y_t/\partial K)+p(\partial Y_n/\partial K) = r^K = (r+\delta)p-\dot{p}$, $(\partial Y_t/\partial p)+p(\partial Y_n/\partial p) = 0$, and $(\partial I/\partial K)+(\partial I/\partial p)\cdot p'(K) = \mu_1+\delta$, the current account can be expressed as

$$\dot{b}_s = -\left[(\mu_1 - r)p_s + \dot{p}_s + \frac{\partial C}{\partial p}\cdot p'(K)\right](K_0 - \tilde{K})e^{\mu_1 s} + r(b_s - \tilde{b}), \tag{A9}$$

where $\partial C/\partial p \equiv (\partial C_t/\partial p) + p(\partial C_n/\partial p) = \lambda(\partial C_n/\partial \lambda) < 0$ and $\dot{p}_s(K_0 - \tilde{K})e^{\mu_1 s} = p'(K)(K_s - \tilde{K})^2$ is of second-order importance. Starting from an initial stock of bonds b_0 and dropping the term in $\dot{p}_s$, the solution to (A9) is

$$b_s = \tilde{b} - \left[p_s + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_0 - \tilde{K})e^{\mu_1 s}$$
$$+ \left[b_0 - \tilde{b} + \left(p_0 + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right)(K_0 - \tilde{K})\right]e^{rs}. \tag{A10}$$

In order for the economy's intertemporal solvency condition ($\lim_{s\to\infty} \lambda b e^{-rs} = 0$) to hold, the second term in brackets of (A10) must equal zero, implying that

$$\tilde{b} = b_0 + \left(p_0 + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right)(K_0 - \tilde{K}), \tag{A11}$$

that the stock of net foreign assets at any time s is given by

$$b_s = \tilde{b} - \left[p_s + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_0 - \tilde{K})e^{\mu_1 s}, \tag{A12}$$

and that the current account can be expressed as in equation (18) of the text.

3. Long-run effects of a permanent increase in transfers

The long-run comparative statics of the economy can be found by differentiating (7), (8), (9), and (A11) around the steady state:

$$\begin{bmatrix} \frac{\partial r^K}{\partial p} - \delta & \frac{\partial Y_n}{\partial p} - \frac{\partial C_n}{\partial p} & 0 & -\frac{\partial C_n}{\partial \lambda} \\ 0 & \frac{\partial r^K}{\partial p} - r - \delta & 0 & 0 \\ \frac{\partial Y_t}{\partial K} & \frac{\partial Y_t}{\partial p} - \frac{\partial C_t}{\partial p} & r & -\frac{\partial C_t}{\partial \lambda} \\ p_0 + \frac{\partial C}{\partial p}\cdot\frac{p'(K)}{\mu_1 - r} & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} d\tilde{K} \\ d\tilde{p} \\ d\tilde{b} \\ d\tilde{\lambda} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -d\tau \\ 0 \end{bmatrix} \tag{A13}$$

from which the following results can be obtained:

$$\frac{d\tilde{\lambda}}{d\tau} = -\frac{\left(\frac{\partial r_K}{\partial p} - \delta\right)\left(\frac{\partial r_K}{\partial p} - r - \delta\right)}{\Delta} < 0 \tag{A13a}$$

$$\frac{\partial \tilde{K}}{\partial \tau} = \frac{\partial \tilde{K}}{\partial \tilde{\lambda}}\frac{\partial \tilde{\lambda}}{\partial \tau} \tag{A13b}$$

$$\frac{\partial \tilde{b}}{\partial \tau} = -\left(p + \frac{\partial C}{\partial p}\cdot\frac{p'(K)}{\mu_1 - r}\right)\frac{\partial \tilde{K}}{\partial \tau} \tag{A13c}$$

$$\frac{\partial \tilde{p}}{\partial \tau} = 0 \tag{A13d}$$

where the determinant of (A12), Δ, must be greater than zero for stability and equation (10) implies that

$$\frac{\partial \tilde{K}}{\partial \tilde{\lambda}} = \left(\frac{\partial C_n}{\partial \tilde{\lambda}}\right) \Big/ \left(\frac{\partial r_K}{\partial p} - \delta\right) \lessgtr 0.$$

4. Temporary transfers

Suppose that the economy receives a temporary flow of transfer income $\hat{\tau}$ between time $t = 0$ and $t = T$. At time T the transfer income ceases. The current account can be derived by consideration of the dynamics in the intervals $[0, T]$ and $[T, \infty)$. Between time $t = 0$ and $t = T$ the current account will be the following:

$$\dot{b}_s = -\left[p_s(\mu_1 - r) + \frac{\partial C}{\partial p} \cdot p'(K)\right](K_s - \tilde{K}) + \hat{\tau} + r(b_s - \tilde{b}). \tag{A14}$$

Integrating equation (A14) solves for the path of net foreign assets between time $s = 0$ and $s = T$:

$$b_s e^{-rs} = -\tilde{b}(1 - e^{-rs}) + \left[p_s + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_0 - \tilde{K})(1 - e^{(\mu_1 - r)s}) + \frac{\hat{\tau}}{r}(1 - e^{-rs}) + b_0. \tag{A15}$$

Evaluating equation (A15) at time $s = T$ gives the following solution for b_T:

$$b_T e^{-rT} = -\tilde{b}(1 - e^{-rT}) + \left[p_T + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_0 - \tilde{K})(1 - e^{(\mu_1 - r)T}) + \frac{\hat{\tau}}{r}(1 - e^{-rT}) + b_0. \tag{A15a}$$

Now consider the economy at time $s = T$ with an initial stock of assets equal to b_T^* and with transfer income set permanently equal to zero. From (A12) the evolution of the stock of net foreign assets at time $s = T$ must satisfy the following condition:

$$b_T^* = \tilde{b}^* - \left[p_T^* + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_T^* - \tilde{K}^*). \tag{A16}$$

Imposing the boundary conditions $b_T = b_T^*$, $\tilde{b} = \tilde{b}^*$, $p_T = p_T^*$, and $K_T^* - \tilde{K}^* = (K_0 - \tilde{K})e^{\mu_1 T}$, and equating (A15a) with (A16) gives the following intertemporal solvency condition:

$$\tilde{b} = b_0 + \left[p_0 + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_0 - \tilde{K}) + \frac{\hat{\tau}}{r}(1 - e^{-rT}). \tag{A17}$$

If we substitute the solution for $\tilde{b}$ in equation (A17) in equation (A15), the evolution of net foreign assets in the interval $[0, T]$ can be written as follows:

$$b_t = b_0 + \left[p_0 + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right](K_0 - \tilde{K})(1 - e^{\mu_1 s}) + \frac{\hat{\tau}}{r}(e^{-r(T-s)} - e^{-rT}). \qquad \text{(A18)}$$

Noting from (15) that $\dot{K}_s = \mu_1(K_0 - \tilde{K})e^{\mu_1 s}$, time differentiation of (A18) gives the current account in the interval $[0, T]$ as a function of capital accumulation and the compounded sum of saving out of the transitory transfer income:

$$\dot{b}_s = -\left[p_s + \frac{\partial C}{\partial p}\frac{p'(K)}{\mu_1 - r}\right]\dot{K}_s + \hat{\tau}e^{-r(T-s)}. \qquad \text{(A19)}$$

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