NBER WORKING PAPER SERIES

COMPOSITIONAL EFFECTS OF GOVERNMENT SPENDING IN A TWO-COUNTRY TWO-SECTOR PRODUCTION MODEL

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Working Paper No. 2543

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1988

We thank Robert Lipsey, Ron McKinnon, Lars E.O. Svensson, and John Taylor for helpful comments, Tam Bayoumi for research assistance, and CEPR for financial support. The research reported here is part of the NBER's research program in International Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research. Support from The Lynde and Harry Bradley Foundation is gratefully acknowledged.

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ABSTRACT

This paper explores the impact of changes in the composition of government spending on the level of relative prices, interest rates and the current account in a two country, two period Heckscher-Ohlin model. We show that shifting the composition of government spending affects macroeconomic variables according to the relative factor intensities of tradeable and non-tradeable goods. Adjustments of composition towards non-tradeables will raise (lower) world interest rates if non-tradeables are capital (labor) intensive. The announcement of a future shift towards non-tradeables will induce a current account deficit (surplus) if future interest rates are expected to increase (decrease). The introduction of production thus places restrictions on the co- movements of fiscal policy and macroeconomic variables beyond those generated by preferences.

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I. INTRODUCTION

The sectoral makeup of government spending patterns is by no means constant over time. In the U.S., for example, the percentage of federal expenditures going to services fell from approximately 77% in 1973 to 66% in 1987. If government services are viewed as primarily non-tradeable, this represents roughly a 10 percentage point swing in federal expenditures from the non-tradeable to the tradeable sector. The purpose of this paper is to study the effects of shifts in the composition of government spending in an open economy. We explore this issue within the context of a two country two sector two period Heckscher-Ohlin model, and thus focus on the production-side channels through which the composition of government spending can affect important macroeconomic variables.

With one traded good and one non-traded good, and with capital traded but labor immobile, we show that a compositional shift in home government spending toward the non-traded good will lead to an appreciation of the real exchange rate in both countries, and if production of the non-traded good is relatively capital (labor) intensive, to a rise (fall) in world real interest rates and an accompanying domestic current account deficit (surplus). Accordingly, the composition of government spending is shown to be an important and predictable determinant of the effects of fiscal policy on key macroeconomic variables of the model. Moreover, the sign of the co-movements in real exchange rates and trade balances induced by the compositional shift is a function of factor intensities in production, and will differ across countries. Co-movements in real exchange rates and real interest rates also depend on factor intensities, but are not country-specific. Finally, the sign of the co-movements in the real interest rate and trade balances induced by the compositional shift is country-specific, but predictable independent of factor intensity data.

Several earlier authors have emphasized the importance of the composition of government spending in determining the impact of fiscal policy in an open economy. Helpman (1976) demonstrates a differential employment effect from government spending on traded

versus non-traded goods in a one period two sector small open economy that faces a minimum wage restriction and associated unemployment. Helpman (1977) adds a restriction on intersectoral capital mobility to the minimum wage restriction and examines the real exchange rate consequences of a shift in government spending toward the non-traded good. Barry (1987) extends Helpman's analysis to allow for anticipated and unanticipated short term and permanent fiscal policy changes. While motivated by similar concerns, these minimum wage models have been used to ask somewhat different questions than and provide answers which are quite different from the equilibrium, full employment model considered below. Papers by Greenwood (1984) and Frenkel and Razin (1986), while similarly interested in the compositional effects of government spending, analyze this question within the context of endowment economies in which the production-side issues which are the focus of this paper do not arise. Finally, Razin (1984) explores the compositional effects of government spending in a model with international *financial* but not *physical* capital mobility where again, production-side issues are absent.[1]

We exploit the notion of an integrated economy (Helpman and Krugman, 1985) to derive in a simple way the impact of domestic government spending composition changes on real exchange rates. With the real exchange rate results, the impact on world real interest rates follows directly from the Stolper-Samuelson theorem. Finally, Rybczynski effects determine the way in which the world capital stock must reallocate across countries to reproduce the integrated equilibrium after the government spending compositional shift. The required international capital movements show up as temporary current account

[1] There is also a large literature on the transfer problem and the relative price changes that must accompany an international transfer of purchasing power. See Jones (1985) for a recent review. However, this literature's primary focus on international movements of purchasing power as opposed to productive resources differentiates it from the present paper, since the production-side issues we explore are largely absent.

imbalances. Thus, the structure of the neoclassical production model is exploited fully in our analysis of the compositional effects of government spending.

The remainder of the paper proceeds as follows. Section II describes the integrated equilibrium and derives the effect of a compositional shift on relative prices and real interest rates. Section III considers a two country trading world that replicates the integrated equilibrium of Section II, and examines the impact of the compositional shift on real exchange rates and world real interest rates. Section III also derives the international capital movements that occur in response to the compositional shift. Section IV relates the results to others in the literature. Section V presents a summary and conclusions.

II. THE INTEGRATED ECONOMY

We consider in this section a two-period, two-good, two-factor integrated world economy. Within the integrated economy, there is no restriction on the movement of goods or factors. Periods are labeled by $i = (1,2)$ and the two goods are labeled n and t. The economy is endowed with stocks of capital K and labor L that remain fixed over time. Technology is also unchanging over the two periods of the model, and is linearly homogeneous. Define $F(K,L)$ as the set of feasible output vectors for this economy. Facing prices P_i^n and P_i^t, competitive producers will maximize the value of GNP in each period. Nominal GNP is then given by the revenue function

$$(1) \qquad R(P_i^n, P_i^t, K, L) \equiv \max_{Q_i^n, Q_i^t} \{P_i^n Q_i^n + P_i^t Q_i^t \mid (Q_i^n, Q_i^t) \epsilon F(K,L)\} \quad i = 1,2$$

where Q_i^n and Q_i^t are national outputs of n and t respectively.

The economy is populated with identical consumers whose utility is defined over the two-period consumption of n and t. We assume that utility is homothetic and time sepa-

rable, and that consumers discount second period utility by the factor β. The aggregate expenditure function for this economy is given by

$$E(P_i^n, P_i^t, U_i) \equiv \min_{C_i^n, C_i^t} \{P_i^n C_i^n + P_i^t C_i^t | U(C_i^n, C_i^t) \geq U_i\} \quad i = 1, 2 \tag{2}$$

where C_i^n and C_i^t represent aggregate private consumption of n and t, respectively, and where $U(\cdot)$ is the aggregate utility function.

Government purchases of n and t in period i are given by G_i^n and G_i^t respectively. These purchases are assumed not to enter private utility. We will focus on the effects of a shift in the *composition* of government spending rather than on its level or on the timing of spending and taxes. Thus, the government is assumed throughout to balance its budget in each period with lump sum taxes. Moreover, we assume initially that

$$\begin{aligned} G_1^n &= G_2^n \\ G_1^t &= G_2^t \end{aligned} \tag{3}$$

so that both the level and composition of government spending is fixed over time. Finally we assume that initially the government consumes n and t in the same proportion as does the private sector. The relevance of this will be made clear in the next section.

Each individual is endowed at the beginning of period 1 with an identical bundle of capital and labor. The owner of a unit of capital receives its marginal physical product. Individuals save (dissave) in period 1 by buying (selling) claims to the marginal physical product of capital in period 2. The price of these claims we normalize to one. However, since goods are not storable and since the aggregate capital stock is fixed over time, there is no possibility of aggregate saving or dissaving.[2] Consequently, in each period the integrated economy must consume exactly what it produces. By giving up $\frac{1}{P_1^t}$ units of good t in period

[2] The absence of aggregate savings will allow us in the next section to focus on the way in which the existing world capital stock reallocates across countries in response to a

1, a consumer can purchase a claim to a unit of capital which, in the second period, will produce $\frac{r_2}{P_2^t}$ units of good t, where $r_2 \equiv R_K(P_2^t, P_2^n, K, L)$ is the second period interest rate. Therefore, in order for the economy to be content consuming what it produces in each period, intertemporal prices of good t must satisfy

$$\frac{P_2^t}{P_1^t} = r_2 \cdot \left[\frac{\beta \partial U_2(Q_2^t - G_2^t, Q_2^n - G_2^n)/\partial C_2^t}{\partial U_1(Q_1^t - G_1^t, Q_1^n - G_1^n)/\partial C_1^t}\right] \tag{4}$$

Finally, since the *government* budget is by assumption balanced in each period, the intertemporal price structure determined in (4) will ensure that the *private sector* budget constraint holds period by period as well, since the intertemporal prices consistent with (4) must lead the economy as a whole neither to save nor to dissave in either period. To see this, note that the intertemporal (public plus private) budget constraint must fulfill

$$\begin{aligned}(1+r_2)\Big(R(P_1^n, P_1^t, K, L) - E(P_1^n, P_1^t, \overline{U}_1) - P_1^n G_1^n - P_1^t G_1^t\Big) \\ = E(P_2^n, P_2^t, \overline{U}_2) + P_2^n G_2^n + P_2^t G_2^t - R(P_2^n, P_2^t, K, L)\end{aligned} \tag{5}$$

where $\overline{U}_i$ is the equilibrium private utility reached in period i. However, if either side of this equation is nonzero, then net savings must necessarily occur in some period, which our assumptions preclude. As a result, the private budget constraint in each period must be fulfilled. Therefore,

$$R\left(\frac{P_i^n}{P_i^t}, K, L\right) - \frac{P_i^n}{P_i^t} G_i^n - G_i^t = E\left(\frac{P_i^n}{P_i^t}, \overline{U}_i\right) \quad i = 1, 2 \tag{6}$$

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compositional shift in government spending without worrying about the additional complications introduced by the possibility of net capital creation. The absence of aggregate savings is a property shared by models of endowment economies with non-storable goods. See, for example, Frenkel and Razin (1986).

where we have used the linear homogeneity of the revenue and expenditure functions to write each period's budget constraint in terms of relative intratemporal prices.

By standard properties of the revenue and expenditure functions, differentiating (6) with respect to $\frac{P_1^n}{P_1^t}$ yields the equilibrium conditions for the n market

$$R_{\frac{P^n}{P^t_i}}(\cdot) - G_i^n = E_{\frac{P^n}{P^t_i}}(\cdot) \quad i = 1, 2 \tag{7}$$

with equilibrium then guaranteed in the t market by Walras' Law. Equilibrium intratemporal relative prices $\frac{P_1^n}{P_1^t}$ and $\frac{P_2^n}{P_2^t}$ are thus determined by (7), while the relative intertemporal price structure $\frac{P_1^t}{P_2^t}$ is determined by (4). Initially, since $G_1^n = G_2^n$ by assumption, equilibrium intratemporal relative prices are identical in the two periods. This characterizes the initial stationary equilibrium.

Consider now the impact on the integrated economy of an anticipated compositional shift in second period government spending. Since we wish to isolate the importance of the composition of government spending as distinct from its level, we define a compositional shift in government spending as one which leaves private utility unaltered. Totally differentiating (6) and setting $d\overline{U}_1 = d\overline{U}_2 = 0$ yields

$$\frac{dG_2^n}{dG_2^t} = -\frac{P_2^t}{P_2^n} \tag{8}$$

Expression (8) describes second period compositional shifts in government spending that preserve (first and) second period utility. Expression (8) states that for small changes, private utility will be maintained under any shift in the second period composition of government spending which, at original prices, would leave aggregate government expenditure levels unchanged.

With this as our definition of a compositional change, suppose that the government announces in period 1 a compositional shift in second period spending toward good n. The effect of this shift on relative prices comes from totally differentiating (7), which yields

$$d\left(\frac{P_i^n}{P_i^t}\right) = -\left[\frac{1}{E_{\frac{P_i^n}{P_i^t}\frac{P_i^n}{P_i^t}}(\cdot) - R_{\frac{P_i^n}{P_i^t}\frac{P_i^n}{P_i^t}}(\cdot)}\right] dG_i^n \tag{9}$$

Thus, from the properties of the revenue and expenditure functions, $\frac{d\left(\frac{P_2^n}{P_2^t}\right)}{dG_2^n} > 0$: the relative price of n rises in period 2 in response to the second period government compositional shift into n. Relative intratemporal prices in period 1 are unaffected by the second period compositional shift.[3] Thus, the relative intratemporal price of n rises from period 1 to period 2 as a result of the shift. Finally, intertemporal prices $\frac{P_1^t}{P_2^t}$ adjust according to (4).

Figure 1 depicts the effect of the second period compositional shift on period 2 relative prices. Initial period 2 government purchases are given by G_2^n and G_2^t. Private utility $\overline{U}_2$ is measured initially with (G_2^n, G_2^t) as the origin, and $\frac{P_2^n}{P_2^t}$ equates goods supplies to total (public plus private) demands. If the government increases its demand for n to $G_2^{n\prime}$ and continues to demand G_2^t, the initial private utility level $\overline{U}_2$ is no longer attainable as measured from the new origin $(G_2^{n\prime}, G_2^t)$. To guarantee $\overline{U}_2$, government demands for t must fall to $G_2^{t\prime}$, at which point $\overline{U}_2$ is just attainable at the new relative price $\frac{P_2^{n\prime}}{P_2^{t\prime}}$. As a result of the second period compositional shift into n, $\frac{P_2^{n\prime}}{P_2^{t\prime}} > \frac{P_2^n}{P_2^t} = \frac{P_1^n}{P_1^t}$.

Finally, consider the impact of this compositional shift on the second period real interest rate. Since $\frac{P_2^{n\prime}}{P_2^{t\prime}} > \frac{P_2^n}{P_2^t} = \frac{P_1^n}{P_1^t}$, we know that, starting from an initial stationary equilibrium, second period real interest rates will rise (fall) as a result of the second period

[3] The absence of feedback effects on period 1 prices is a direct result of our assumptions of time-separable preferences, a balanced government budget, and the absence of aggregate savings.

government compositional shift into n if n is capital (labor) intensive. This follows directly from the Stolper-Samuelson Theorem.

III. THE OPEN ECONOMY

In this section we carve up the factor endowments of the integrated economy of Section II into two economies, home (no star) and foreign (star), each with distinct government activity. In particular, we assume that there are no government purchases in the foreign country, and that the government modeled in the previous section is located in the domestic country. Finally, we assume that capital and the good t are traded freely between countries, but that labor is internationally immobile and that the good n is non-traded.[4]

Under these assumptions, the two trading economies will replicate the initial integrated equilibrium of the previous section. This can be seen by noting that, with capital internationally mobile and good t freely traded, a common interest rate and traded goods price must be shared in each period by the two economies. With technology linearly homogeneous and identical between countries, the zero profit condition in the tradeables sector then implies that the two economies must also share a common wage rate in each period if good t is produced in both countries. Sharing factor prices and the linearly homogeneous technology for the non-traded good n, both economies must then share a common price each period for the non-traded good as well, as long as both produce it. Finally, equilibrium intertemporal prices must also be shared by the two countries as determined by (4). Since preferences are identical and homothetic and intratemporal prices are shared, the term in brackets on the right hand side of (4) is the same in the two countries. Moreover, we have already argued that factor prices are equalized between countries in each period.

[4] The assumptions of perfect capital mobility and an integrated equilibrium can be relaxed in a small country setting without changing the nature of any of our results. See Durlauf and Staiger (1987).

Thus, by (4), both countries will indeed share intertemporal prices. With all goods and factor prices equalized internationally through trade in capital and the traded good, the international immobility of labor and the nontraded good are nonbinding constraints. As such, the two open economies will replicate the integrated economy.

In order to begin with trade initially balanced in both periods, we make the additional assumption of identical relative factor abundances in the two countries. Specifically, we assume that individuals in each country are endowed with a common bundle of labor and capital in period 1. On the production side, this implies that aggregate capital-labor ratios are identical in the two economies so that, facing the same intratemporal relative prices in each period, both countries *produce* the traded and non-traded goods in identical proportions. On the demand side, factor price equalization implies that per-capita *disposable* income is lower in the home than the foreign country, due to domestic government expenditures, but constant over time. Homothetic tastes and our assumption that the domestic government initially consumes goods in the same proportion as the private sector then ensures that each country *consumes* non-traded and traded goods in the same proportion as well. As such, there is no trade in goods (or capital) in either period in the initial situation.[5]

Figure 2 illustrates the initial equilibrium. Since it is stationary, the graphs characterize equilibrium in each period. The countries share identical production possibilities frontiers and identical and homothetic preferences. Thus, the only difference between the home and foreign country is that private utility is measured in the home country with (G^n, G^t)

[5] The argument actually only requires that trade initially be balanced, not that countries initially do not trade. Thus, the model is easily generalized to one in which the traded good sector is monopolistically competitive. Then two-way trade occurs between countries with identical relative factor endowments even though the sectoral trade balance in the monopolistically competitive sector is zero. See Helpman, 1985.

as the origin, where G^n and G^t represent stationary domestic government consumption and lie initially on the same ray from the origin as private demands by assumption.

Consider now an anticipated second period domestic government compositional shift into the non-traded good n. We assume that capital can move internationally in response to expected period 2 interest differentials, but must move at the end of period 1. Hence, any current account imbalances associated with the reallocation of the world's capital stock will show up in period 1.[6]

Note first that the foreign private budget constraint in the initial stationary equilibrium, which again holds in each period as a result of the equilibrium determination of intertemporal prices, is given by

$$R(P_i^n, P_i^t, K^*, L^*) = E(P_i^n, P_i^t, \overline{U_i^*}) \quad i = 1, 2 \tag{10}$$

where K^* denotes foreign owned capital which, because trade is balanced, initially coincides with the stock of capital located in the foreign country. Totally differentiating (10) yields

$$\frac{d\overline{U_2^*}}{dG_2^n} = 0 \tag{11}$$

Thus, any small second period compositional shift in domestic government spending will leave foreign utility unaltered. If the domestic government composition shift satisfies (8), it will also leave domestic utility unaltered. As such, a compositional shift in domestic government spending which satisfies (8) will be equivalent in the open economy model of this section to the compositional shift considered in the integrated economy of the previous section. Given this, if the domestic government alters according to (8) the second period

[6] The assumption that physical capital moves the period prior to utilization seems technologically reasonable. Authors such as Razin (1984) have employed this assumption. If capital were instantaneously mobile, the basic results still carry through.

composition of its spending toward the non-traded good, the two open economies will replicate before and after the announced change the integrated equilibria characterized in the previous section, and the effects of this compositional shift on real exchange rates in the two countries (the relative price of non-tradeables to tradeables) and on world real interest rates will be given by the results of the previous section. In particular we have

Proposition I: The first period announcement of a domestic government compositional shift toward the non-traded good in period 2 will lead to an appreciation of the real exchange rates in the second period in both countries and, if the non-traded good is capital (labor) intensive, to a rise (fall) in the second period world real interest rate.[7]

Proposition I implies that co-movements in real exchange rates and the real interest rate induced by a compositional shift in domestic government spending will be the same across countries. However, the sign of the co-movements between these variables will depend on the relative capital intensity of the non-traded good. Real exchange rates and the real interest rate will move in the same direction as a result of a compositional shift if the non-traded good is capital intensive, and will move in opposite directions if the non-traded good is labor intensive. The real interest rate effect is the mechanism through which the domestic shift into non-traded goods, which induces a rise in the domestic real exchange rate, also leads to an appreciation of the foreign real exchange rate. If the non-traded good is capital intensive, the domestic shift drives up real interest rates in the world.

[7] We could also consider the effects of an unanticipated second period compositional shift. The only change in Proposition I would be that the effects on the real interest rate and exchange rate would only occur in the domestic country. The foreign country would be completely unaffected by the unanticipated second period domestic compositional shift in this two period model.

This in turn requires an appreciation of the foreign real exchange rate in order for foreign production of the capital intensive non-traded good to continue. If, instead, the non-traded good is labor intensive, the domestic shift drives the real interest rate down. This in turn requires an appreciation of the foreign real exchange rate in order to eliminate the positive profits that would otherwise accrue to foreign producers of the capital intensive traded good.

These results have strong implications for the testing of macroeconomic theories with data generated by open economies. As an example, consider the testing of the Ricardian equivalence proposition expounded by Barro (1975) and others. In general, testing of the theory explores whether the magnitude of deficits affects interest rates once the magnitude of government spending has been accounted for. If any correlation exists between deficit levels and the composition of government purchases, a regression exploring relationships between interest rates, aggregate government purchases and deficits could easily attribute statistical significance to the deficit variable, with no bearing on the theory per se. Proposition I thus suggests that composition as well as the magnitudes of aggregate variables must be accounted for in order to properly specify empirical studies. The comprehensive survey of tests of Ricardian equivalence by Bernheim (1987) reveals that the issue of spending composition has largely been ignored in the empirical arena. The results of our analysis suggest this is dangerous, particularly when one analyzes data where compositional shifts have clearly occurred. An example of this is Evans (1985), who analyzes interactions of deficits and interest rates during wartime.

Finally, we consider the implications of the compositional shift for international capital movements. Recall that we have assumed that in order to employ capital for production in any period, it must be moved to the production location at the end of the previous period. Since the compositional shift we have considered has no effect on private utility levels anywhere in the world in either period, there will be no change in ownership of capital in response to the announcement of the compositional shift. However, second

period interest rates must be equalized at home and abroad in equilibrium, so that capital will flow between countries until

$$R_{\tilde{K}}(\frac{P_2^n}{P_2^t}, \tilde{K}_2, L) - R_{\tilde{K}^*}(\frac{P_2^n}{P_2^t}, \tilde{K}_2^*, L^*) = 0 \tag{12}$$

where $\tilde{K}_2$ and $\tilde{K}_2^*$ are the stocks of capital located in the domestic and the foreign country, respectively, in period two, and are defined by

$$\tilde{K}_2 \equiv K + I, \ \tilde{K}_2^* \equiv K^* - I \tag{13}$$

with I representing the net international capital flow which takes place at the end of period one. Capital will flow into (out of) the home country if $I > 0$ ($I < 0$).

Totally differentiating (12) yields

$$\frac{dI}{dG_2^n} = \frac{-[dr/d(\frac{P_2^n}{P_2^t})][d(\frac{P_2^n}{P_2^t})/dG_2^n]}{\frac{dr}{d\tilde{K}_2} + \frac{dr^*}{d\tilde{K}_2^*}} \tag{14}$$

From standard properties of the revenue function, the denominator of the right hand side of (14) is negative. From Proposition I we know that $d(\frac{P_2^n}{P_2^t})/dG_2^n > 0$, so that the sign of $\frac{dI}{dG_2^n}$ is the same as the sign of $dr/d(\frac{P_2^n}{P_2^t})$. However, from Proposition I, we also know that the sign of $dr/d(\frac{P_2^n}{P_2^t})$ depends on whether the non-traded good is capital or labor intensive. Combining all this with the knowledge that aggregate savings in each country is zero and that government budgets balance in each period, we have

Proposition II: The first period impact of an announcement of a domestic government compositional shift toward the non-traded good in period 2 will, if the non-traded good is capital (labor) intensive, lead to a first period current account deficit (surplus) in the

home country as the world capital stock reallocates across countries to facilitate greater domestic production of the non-traded good.

Proposition II implies that the co-movements between the real exchange rate and lagged current account balance induced by compositional shifts in government spending depends not only on factor intensities but on the country under consideration as well. In particular, while the real exchange rate appreciates in period 2 in both countries with a domestic government shift toward the non-traded good, the first period domestic current account will worsen (improve) and the foreign current account will improve (worsen) if the non-traded good is capital (labor) intensive. Hence, even given factor intensities, the sign of the co-movements between real exchange rates and current account balances induced by compositional shifts in government spending will be country specific.

In contrast, co-movements between the real interest rate and lagged current account balances are country specific, but independent of factor intensities. In particular the compositional shift toward the non-traded good induces negative co-movements between these variables in the country within which the shift takes place, and positive co-movements between these variables in the rest of the world.

Figure 3 illustrates the results of propositions I and II for the case where the non-traded good is capital intensive. Starting from an initial second period equilibrium with second period relative price $\frac{P_2^*}{P_2^T}$, the announcement in period 1 of a domestic government compositional shift toward the non-traded good in period 2 will lead in the first period to a flow of capital into the home country ($I > 0$) that eliminates the incipient second period international interest rate differential.

This international reallocation of the world capital stock shows up as a home country current account deficit in the first period, and results in the second period home country production possibilities frontier shifting out to the dashed frontier in Figure 3, while the

second period foreign production possibilities frontier shifts into the dotted frontier. The shapes of these shifts reflect the assumption that the non-traded good is capital intensive.

The real exchange rate appreciates in both countries in period 2 ($\frac{P_2^{n\prime}}{P_2^{t\prime}} > \frac{P_2^n}{P_2^t} = \frac{P_1^n}{P_1^t}$), leading the home and foreign countries to the second period production points labeled Q_2' and $Q_2^{*\prime}$, respectively. The home country consumes all of the non-traded good it produces, but exports a portion of its tradable good production to the foreign country as a payment to foreign owners of domestically located capital.[6] For the small changes considered here, the private portion of total domestic second period consumption (labeled C_2') is just sufficient to maintain domestic utility at $\overline{U}_2$. Likewise, the foreign country consumes all of the non-traded good it produces and, in addition to consuming the tradeable goods it produces, receives factor payments from the home country in the form of imported tradeables. Foreign consumption is at $C_2^{*\prime}$, just sufficient to maintain foreign utility at $\overline{U}_2^*$. Finally, with $\frac{P_2^{n\prime}}{P_2^{t\prime}} > \frac{P_2^n}{P_2^t} = \frac{P_1^n}{P_1^t}$ and with the non-traded good capital intensive by assumption, the world real interest rate rises in the second period by the Stolper-Samuelson result.

Figure 4 summarizes the co-movements in the real interest rate, real exchange rates, and trade balances induced by a government compositional shift. We summarize these relationships in

Proposition III: Shifts in the composition of government spending from the traded to the non-traded good will result in

[6] Since the world ends after the second period, paying for the second period services of capital is equivalent to paying back the entire loan: the value of the principle after the second period is zero. Thus, as a result of the two period assumption, the domestic current account surplus in the second period offsets exactly the domestic current account deficit in period 1. With more periods of course, future current accounts can balance indefinitely after the initial international capital movements.

1. co-movements between the real exchange rate and the real interest rate, the sign of which is the same across countries but depends on the relative factor intensity of the non-traded good;
2. co-movements between the real interest rate and the lagged current account balance, the sign of which is opposite across countries but independent of factor intensities; and
3. co-movements between the real exchange rate and the lagged current account balance, the sign of which is opposite across countries and depends on the relative factor intensity of the non-traded good.

IV. RELATIONSHIP TO PREVIOUS RESULTS

In this section we compare the results from Section III to previous results in the literature. Helpman (1976) explores the importance of the composition of government spending for the employment level in a one period small open two sector production economy with a minimum wage restriction and no international physical capital mobility. The (binding) minimum wage restriction $w = f(P_n, P_t)$, along with zero profit (price equal unit cost) conditions $C_t(r,w) = P_t$ and $C_n(r,w) = P_n$ determine all relative goods and factor prices in the model, independent of shifts in the composition of government spending that leave both goods produced domestically. Thus, changes in the composition of government spending have no affect on real exchange rates or real interest rates in this model. Moreover, aggregate investment and private savings are assumed to be zero, so that the current account balance is determined by the government budget balance. As such, the current account is also unaffected by a (balanced budget) compositional shift in government spending.

Helpman (1977) considers a one period small open two sector production economy with a minimum wage, but adds the assumption of sector specific capital so that the wage restriction no longer ties down P_n. As in Proposition I above, a compositional shift

toward the non-traded good leads to an appreciation of the real exchange rate in his model. However, the sector-specific nature of capital in the model implies that sectoral rents to capital will move in opposite directions in response to changes in the composition of government spending. Hence, predictions about the behavior of a single real interest rate do not emerge from the model. Finally, as in Helpman (1976), the current account balance is determined by the government budget balance, and is thus unaffected by compositional changes.

Razin (1984) explores the importance of the composition of government spending in a two-period two-sector small open production economy with internationally mobile financial capital. The real exchange rate effect of a compositional shift in government spending in his model is qualitatively identical to that studied above. However, interest rates (on financial capital) are fixed by the small country assumption, and thus unresponsive to government composition shifts. And because only financial capital is mobile internationally, the current account is also left unaltered by a compositional shift as defined above.

Frenkel and Razin (1986) have examined the importance of the composition of government spending in a two-period two country endowment model. Since there is no production in the model, the impact of the composition of government spending on real exchange rates, real interest rates, and trade balances depends upon a comparison of temporal and intertemporal rates of substitution in consumption in the public and private sectors. The restrictions on preferences in Frenkel and Razin are weaker than ours, as they require that the social welfare function factor such that $U(C_{1t}, C_{1n}, C_{2t}, C_{2n}) = U\big(f_1(C_1^n, C_1^t), f_2(C_2^n, C_2^t)\big)$. Our assumption of time separability falls in this class. Thus for at least a subset of the preferences considered in Frenkel and Razin, the introduction of production will place restrictions on co-movements of government spending and prices beyond those imposed by demand. It is an empirical question as to what extent the demand

side considerations identified by Frenkel and Razin are dominated by the production side effects considered here for more general preferences.[9]

Finally, in a recent article Drazen and Helpman (1987) explore through a pure endowment economy the role of cuts in government spending on tradeables versus non- tradeables in assisting with the stabilization of the home country's currency. These authors develop a model where the expectation of future cuts in non-tradeables spending has a different anticipatory effect on the current account than a cut in future tradeables spending. In particular if the marginal utility of tradeables is increasing in non-tradeables, the expectation of a non-tradeables cut will generate a large current account surplus (relative to a tradeables cut) in order to create greater tradeables consumption in the future. The structure of the Drazen-Helpman model is not directly comparable to ours in that their model refers to a small economy with an infinite horizon. Nevertheless, our two-period results suggest that the introduction of production into the Drazen-Helpman model could generate quite different results.

V. SUMMARY AND CONCLUSIONS

This paper has explored the impact of shifts in the composition of government spending on equilibrium prices and quantities in a two-country, two-period, two-sector Heckscher-Ohlin model. The presence of production in such an economy places strong restrictions on co-movements of the composition of government spending with relative prices and hence factor returns. Within a given period, a shift in the composition of a government spending towards the non-tradeable good will raise the relative price of non-tradeables, and thus

[9] To be precise, Frenkel and Razin consider shifts in the levels of government spending in the two sectors rather than compositional shifts as we have defined them here. It is straightforward to show that in their model, compositional shifts will lead to relative price movements whose signs are dependent upon the characteristics of demand.

raise (lower) the real interest rate if the non-tradeable good is capital (labor) intensive. The real exchange rate, tautologically equal to the non-tradeable/tradeable price ratio, appreciates as well. Second, we consider the intertemporal effects of a compositional shift when international capital movements must occur the period prior to utilization. In a two-period model, the anticipation of a period 2 shift in government spending toward the non-traded good generates a period 1 current account deficit (surplus) when non-tradeables are capital (labor) intensive. The co-movement of real exchange rates and the lagged current account is thus opposite for the two countries, but determined by the factor intensity of non-tradeables. Conversely, the correlation between the lagged current account and real interest rates will not depend upon the factor intensity of the sector which experiences increased government purchases.

Extensions for further research fall into two areas. First, the two period approach needs to be to be expanded to an infinite horizon problem. This extension is important if testable empirical implications are to be developed. The two period model places extremely strong restrictions on the relationship between current trade flows and announced policy shifts. Extension of the model to many periods will generate much richer dynamics.

Secondly, the compositional results may be generalized to the question of taxes. In particular, if income or sales taxes generate price distortions, a separate channel for the composition of fiscal policy to affect prices will exist. Whether shifting distortionary taxes will generate real effects that are as closely linked to factor intensity as the government purchase effects is an important question in addressing the general issue of the role of changing deficits on macroeconomic variables.

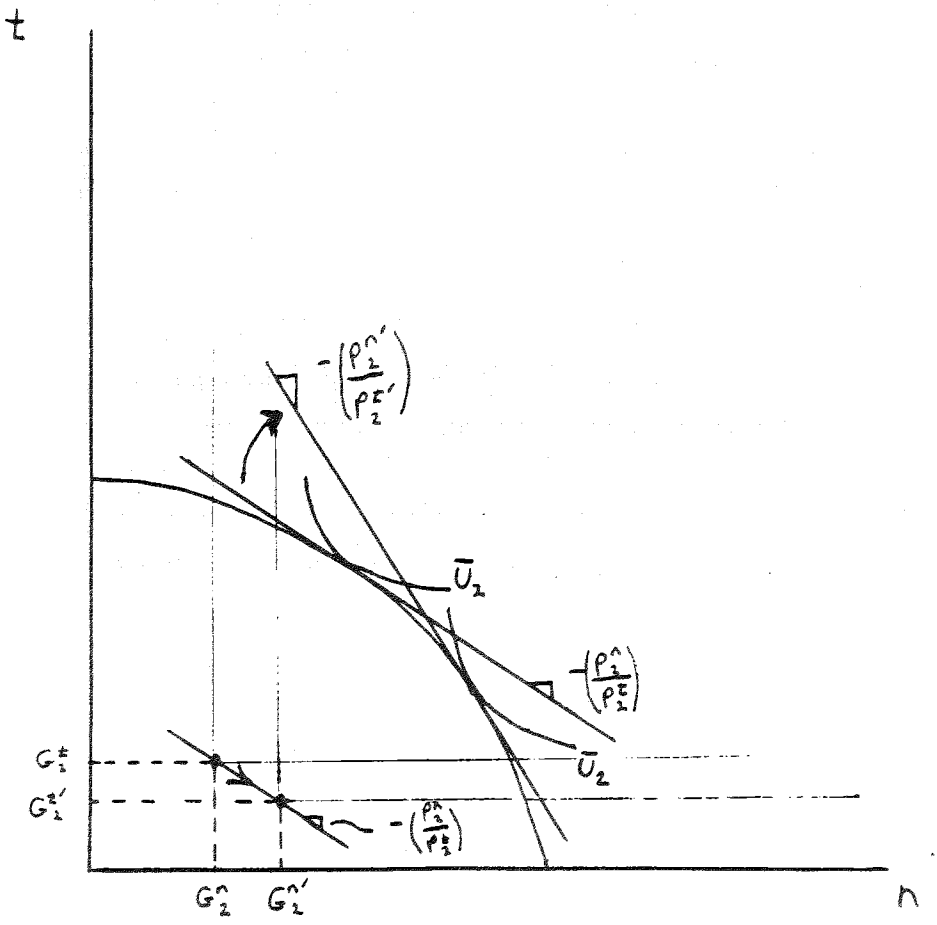
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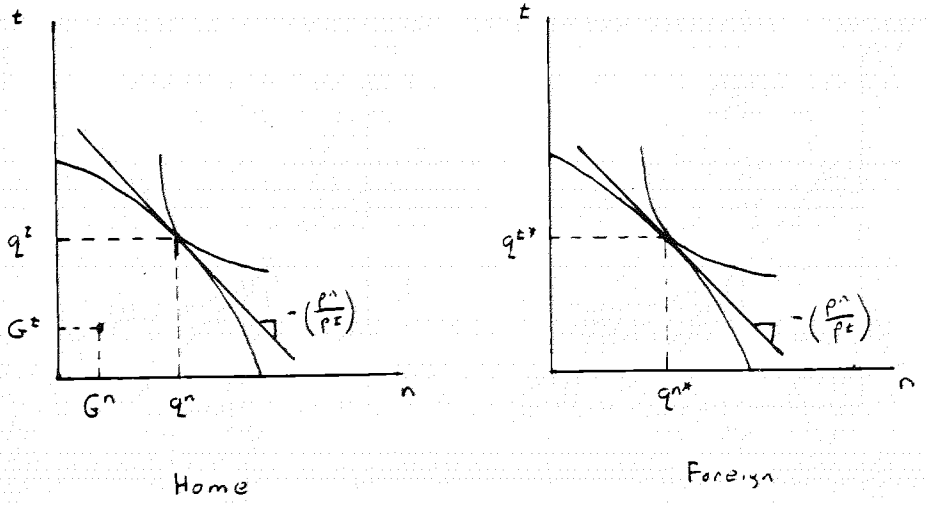
FIGURE 1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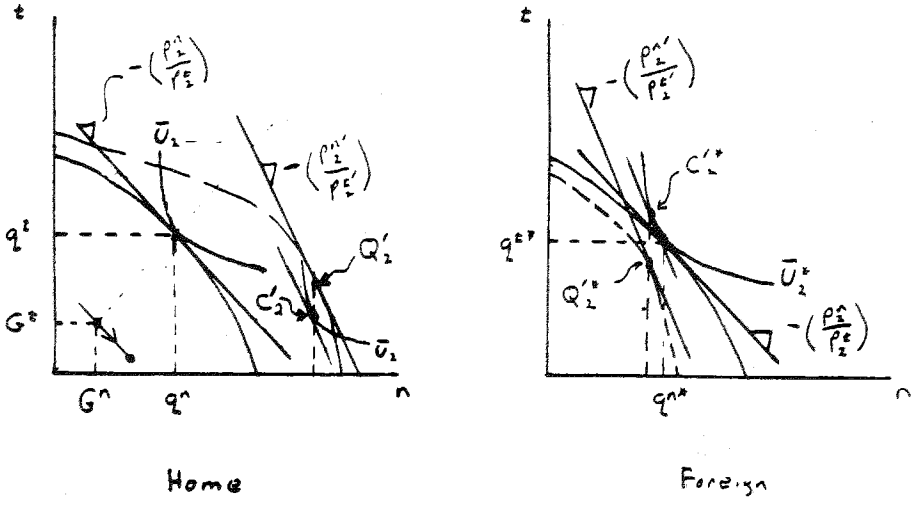
Foreign

FIGURE 2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Q'_2
C'_2
G^e
$\bar{U}_2$
G^n
q^n
n
Home
t
$-\left(\frac{p_2^{n\prime}}{p_2^{e\prime}}\right)$
C'^*_2
$q^{e\prime}$
Q'^*_2
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$-\left(\frac{p_2^n}{p_2^e}\right)$
q^{n*}
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Foreign

FIGURE 3

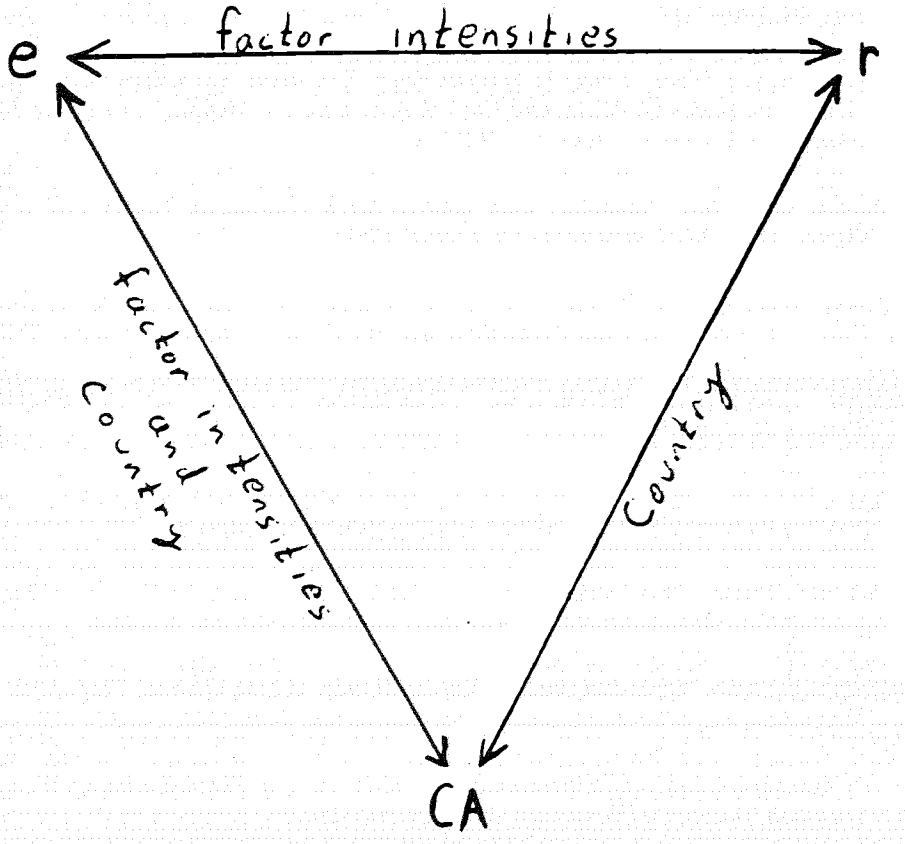
e
factor intensities
r
factor intensities and Country
Country
CA

FIGURE 4

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