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**CAPITAL MOBILITY, THE REAL
EXCHANGE RATE, AND THE RATE OF
RETURN TO CAPITAL IN THE
PRESENCE OF NON-TRADED GOODS**

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ABSTRACT

Capital Mobility, the Real Exchange Rate, and the Rate of Return to Capital in the Presence of Non-Traded Goods*

This Paper constructs a general equilibrium trade model of a small open economy producing an exported good, an imported good and a non-traded good by using two or more factors of production, one of which, namely capital, is imperfectly internationally mobile. Within this framework, it is shown that an exogenous capital inflow may lead to a depreciation of the real exchange rate, and to an increase in both the nominal and the real rate of return to capital. For these paradoxical results to occur it is necessary that the non-traded good is capital intensive.

JEL Classification: F10, F20

Keywords: capital mobility, nominal and real rate of return to capital, real exchange rate

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NON-TECHNICAL SUMMARY

International capital mobility has become one of the most characteristic features of world economy, especially over the last couple of decades. The bulk of the corresponding voluminous economic literature that has emerged examining the effects that such an international capital mobility has on key economic variables in both capital-exporting and capital-importing countries, has primarily focused its attention on welfare. (In the presence of non-traded goods, in particular, see, for instance, Hazari, 1982; Srinivasan, 1983; Tanigaki, 1988; and Hatzipanayotou and Michael, 1992). The implications of international capital mobility for the real exchange rate and the rate of return to capital, on the other hand, have not been given the attention they deserve both at an analytical and at a policy level. In fact, most of the trade theoretic studies on the real exchange rate have emphasised the effects either of commercial policy and/or changes in the terms of trade (see, for instance, Corden, 1971; Dornbusch, 1980; Diaz-Alejandro, 1983; Edwards and van Wijnbergen, 1987; Neary, 1988; and Connolly and Deveraux, 1992), or of government expenditure (see, among others, Mundell, 1963; Giovannini, 1988; Edwards, 1989; Frenkel, and Razin, 1992; and Hatzipanayotou and Michael, 1997).

The aim of this Paper is to investigate and shed some light on these relations, namely the effects of an exogenous capital inflow (or outflow) on the real exchange rate and the rate of return to capital for a capital-importing (or, capital-exporting) country. For this purpose, I construct a general equilibrium trade model of a small open economy producing one exported, one imported and one non-traded good, by using two or more domestic factors, one of which, capital, is internationally mobile. Commodity trade is free, but there is a tax on capital.

Within this framework, it is shown that the effects of an exogenous capital inflow may lead to a depreciation, rather than an appreciation, of the real exchange rate, as well as to an increase, rather than a decrease, in both the nominal and the real rate of return to capital. In addition, the possibility of a depreciation of the real exchange rate, or the possibility of an increase in the real rate of return to capital, are both shown to be independent of the existence of a capital tax. The existence of such a tax is, however, necessary for an increase in the nominal rate of return to capital to occur.

These paradoxical results depend crucially on the non-traded good being capital intensive, and work through a substitution effect in production and an income effect in consumption that oppose each other. Examine, for instance, the effects of an exogenous capital inflow on the real exchange rate. Observe, first, that changes in the real exchange rate are of the same sign as the corresponding changes in the price of the non-traded good. Notice, then, that a capital inflow affects the relative price of the non-traded good in two ways.

First, there is a direct substitution effect in production, the sign of which depends on whether the non-traded good is capital or non-capital intensive. In the former case, the substitution effect is positive; a capital inflow increases the production of the non-traded good decreasing, thus, its relative price. In the latter case the opposite holds and the non-traded good price increases. Second, there is an indirect income effect in consumption that is always positive; a capital inflow increases capital tax revenue and decreases net payments to foreign capital invested at home because of the induced decrease in the marginal revenue product of capital. As a result, the increased consumption has a positive effect on the relative price of the non-traded good.

So, if the non-traded good is non-capital intensive then an influx of capital leads to an increase in its relative price and to an appreciation of the real exchange rate, as the supply effect reinforces the (positive) income effect. But if the non-traded good is capital intensive, then the real exchange rate may in fact depreciate if the indirect income effect in consumption of the capital inflow is smaller than the direct substitution effect in production.

A similarly paradoxical result may arise in examining the effects of an exogenous capital inflow on the nominal rate of return to capital. That is, in the absence of capital taxes a capital inflow always reduces the nominal rate of return to capital regardless of the factor intensity of the non-traded good. But, in the presence of capital taxes, there is also an income effect of a capital inflow that works through the change in capital tax revenue induced by the change in the relative price of the non-traded good. This income effect may exert a positive or a negative effect on the nominal rate of return to capital depending on the factor intensity of the non-traded good. In particular, a capital inflow raises capital tax revenue, increases consumption and consequently has a positive effect on the relative price of the non-traded good. As a result, the value of the marginal product of capital increases or decreases depending on whether the non-traded good is respectively capital or non-capital intensive. It is, therefore, concluded that this income effect, as in Neary's (1989) model of international migration, exerts a positive (or negative) effect on the nominal rate of return to capital only if the non-traded good is capital (or non-capital) intensive in this factor.

To sum up, an exogenous capital inflow may increase the nominal rate of return to capital if the non-traded good is capital intensive and if there is a capital tax imposed by the capital-importing country.

Finally, in the case of the non-traded good being capital intensive a capital inflow may cause an increase in the real rate of return to capital. Such a possibility cannot be excluded if either the nominal rate of return to capital is elastic with respect to changes in the stock of capital and the income effect in consumption dominates the substitution effect in production, or the other way around.

The analysis above can easily be extended to cover the opposite case, i.e. that of a net capital-exporting country. Again, the effects of an exogenous capital outflow on the real exchange rate and the rate of return to capital in the capital-exporting country work through a substitution effect in production and an income effect in consumption, and hinge critically on the capital intensity of the non-traded good. If the non-traded good is capital intensive, then an exogenous capital outflow will give rise to the paradoxical result of an appreciation of the real exchange rate. This is because, in this case, both the substitution and income effects are positive. Similarly, an exogenous capital outflow may decrease the domestic nominal rate of return to capital if the income effect thus generated overtakes the positive general equilibrium effect of a capital outflow on the marginal revenue product of capital. A necessary condition for this to happen is that the non-traded good is non-capital intensive. Finally, a capital outflow may decrease the domestic real rate of return to capital if the non-traded good is non-capital intensive and the substitution effect dominates the income effect.

To conclude, at a theoretic level one cannot rule out the possibility that for a capital-importing (or capital-exporting) country an exogenous capital inflow (or outflow) will bring about the paradoxical results of a real exchange rate depreciation (or appreciation), and/or an increase (or decrease) in the nominal and real rate of return to capital. This can only be done by empirical analysis.

1. Introduction

With capital becoming more mobile internationally, a voluminous trade literature has examined the effects of international capital mobility on key economic variables in both capital-importing and capital-exporting countries. Attention has been primarily focused on welfare (in the presence of non-traded goods, in particular, see, for instance, Hazari 1982; Srinivasan 1983; Tanigaki 1988; and Hatzipanayotou and Michael 1992).

Besides welfare, other key economic variables for which international capital mobility bears important analytical as well as policy implications are the real exchange rate and the rate of return to capital. The purpose of this paper is to shed light on these relations. The need arises from the fact that most trade theoretic studies on the real exchange rate have emphasised the effects of commercial policy or the effects of changes in the terms of trade, while completely ignoring capital mobility.

For example, the conventional view has been that, in the context of a small open economy, a higher tariff or an improvement in the terms of trade lead to a real exchange rate appreciation (see, for instance, Corden 1971; Dornbusch 1980; and Diaz-Alejandro 1983). Recent studies have contested these two traditional propositions and have shown that in more general trade models they may not hold. In particular, Edwards and van Wijnbergen (1987) demonstrate that in a three-goods (i.e., exported, imported and non-traded) two-factor Heckscher-Ohlin model the two propositions cannot hold simultaneously. Moreover, they show that within the class of three-goods specific-factor models the two propositions hold simultaneously only under very special conditions regarding the income and substitution effects generated by the tariff increase or by the improvement in the terms of trade.

Similarly, Neary (1988) shows that in a model of many traded and non-traded goods the effects of an improvement in the terms of trade on the real exchange rate depend crucially on the extent of substitutability in consumption between the traded and the non-traded goods. An appreciation of the real exchange rate will occur only if the substitution relationships dominate the complementary ones.

Connolly and Deveraux (1992) demonstrate that a higher import tariff or an improvement in the terms of trade will both lead to an appreciation of the real exchange rate only if the latter is defined in the "purchasing power parity" manner (i.e., as the ratio of the foreign to the domestic price level). If, however, it is defined

as the country's relative price of a composite traded good to a non-traded good, then the effects of import tariffs or of changes in the terms of trade on the real exchange rate are ambiguous.

Finally, Hatzipanayotou and Michael (1997) is representative of a line of research investigating the effects of government expenditure on the real exchange rate (see, among others, Mundell 1963; Giovannini 1988; Edwards 1989; and Frenkel and Razin 1992). They examine the effects of fiscal expansion on the real exchange rate under different trade policy regimes (i.e., trade, tariff, VER and import quotas). Fiscal expansion takes the form of the production of a public good financed through income or lump-sum taxation and provided to consumers free of charge. The effects of fiscal expansion on the real exchange rate are ambiguous and depend, among other things, on the interplay between the complementary and substitution effects in production and consumption.

The present paper, following Hatzipanayotou and Michael (1992), constructs a general equilibrium trade model of a small open economy that produces one exported, one imported, and one non-traded good, using two or more domestic factors of which one, capital, is internationally mobile. Commodity trade is free, but there is a tax on capital.

Within this framework, it is shown that the effects of an exogenous capital inflow may lead to a depreciation, rather than an appreciation, of the real exchange rate, as well as to an increase, rather than a decrease, in both the nominal and the real rate of return to capital. These paradoxical results depend crucially on the non-traded good being capital intensive. In addition, the possibility of a depreciation of the real exchange rate, or the possibility of an increase in the real rate of return to capital, are both shown to be independent of the existence of a capital tax. The existence of such a tax is, however, necessary for an increase in the nominal rate of return to capital to occur.

These results have a similar flavour with those of Edwards and van Wijnbergen (1987), Neary (1988) and Hatzipanayotou and Michael (1997), in the sense that they work through a supply effect and an income effect that oppose each other. The difference is that, unlike those papers (and most of the existing literature), the present paper places the emphasis on the effects of international capital mobility on the real exchange rate and on the nominal and real rate of return to capital. Furthermore, it

reveals, in this context, the importance of the capital intensity of the non-traded good sector as the propagation mechanism of these effects.

The rest of the paper is organised as follows. Section 2 describes the model. The effects of an exogenous capital inflow on the real exchange rate are examined in Section 3, while those on the nominal and real rate of return are explored in Section 4. Section 5 summarises the main results and offers some concluding comments.

2. The Model

Consider a small open economy producing three goods, an exported good, an imported good, and a non-traded good, using two or more intersectorally mobile factors¹. In addition, one of these factors, namely capital, is internationally mobile. Endowments of all other production factors are fixed. Commodity trade is free. Thus, the domestic prices of the traded goods, given by the vector p , equal their world prices. The price of the non-traded good q is determined endogenously by the clearing condition of the domestic non-traded good market. All goods are assumed normal. The country is small in world markets; commodity trade or international capital movements do not affect the world prices of the traded goods as well as the world rate of return to capital.

Throughout the paper I assume for concreteness that the home country is a net importer of capital. The analysis for the opposite case (i.e., net capital exporter) is analogous and I will discuss it briefly in the final section of the paper. Being a net capital importer, the country's supply of the internationally mobile capital is given by $K = \bar{K} + K^*$, where \bar{K} the fixed endowment of capital and $K^* > 0$ denotes the net stock of foreign capital invested at home. Clearly, $dK = dK^*$.

The gross domestic product (GDP) function, $R(p, q, K)$, denotes the country's maximum revenue from production of all three goods, given the prices p and q , the

¹ This assumption is facilitating, in the sense that it sharpens our results. The analysis would go through if we assumed many traded and non-traded goods.

supply of capital K , and the factors in fixed supply^{2, 3}. The derivatives of the GDP function with respect to p (i.e., $R_p = \partial R / \partial p$) and q (i.e., $R_q = \partial R / \partial q$) give the supply functions of the traded goods and the non-traded good respectively. The derivative with respect to K (i.e., $R_K = \partial R / \partial K$) is the value of the marginal product of capital. The GDP function is assumed to be strictly convex in prices and strictly concave in K , hence $R_{KK} < 0$ ⁴.

The aggregate expenditure function, $E(p, q, u)$, denotes the country's minimum expenditure required to achieve a level of utility u at prices p and q . The derivatives of the expenditure function with respect to p (i.e., $E_p = \partial E / \partial p$) and q (i.e., $E_q = \partial E / \partial q$) give the compensated demand functions of the traded goods and the non-traded good respectively. The expenditure function is assumed to be strictly concave in prices.

Although capital is internationally mobile, we assume that it is imperfectly so. It is a common observation that in many countries various economic and non-economic considerations may hinder the free inflows (and outflows) of capital. Imperfect international capital mobility implies that the country's nominal rate of return r does not equal the exogenous world nominal rate of return, but it is, instead, determined by the clearing condition of the domestic capital market.

Finally, we assume that the home country imposes a capital tax ρ . Capital tax revenue (i.e., $\rho r K^*$) is distributed through lump-sum transfers to domestic households, whereas the net earnings of foreign capital invested at home (i.e., $(1 - \rho)r K^*$) are remitted to the source country and are considered part of that country's income.

²Throughout the paper, the factors in fixed supply are omitted since they do not affect the analysis and the results.

³Constant returns to scale in production and arbitrarily given commodity prices imply that, in order to avoid indeterminacy in production, we need the number of factors in fixed supply to exceed the number of goods (see, for instance, Chang, 1979).

⁴Strict concavity of the GDP function with respect to the internationally mobile capital is required to avoid complete specialization in production and trade.

Equilibrium in the domestic capital market implies that the nominal rate of return to capital equals the value of its marginal product at every domestic use. That is,

$$r = R_K(p, q, K) \quad (1)$$

Differentiating equation (1), holding world prices constant (*i.e.*, $dp = 0$), shows that the nominal rate of return to capital responds to changes in the price of the non-traded good and to the exogenous capital flows. That is,

$$dr = R_{Kq}dq + R_{KK}dK^* \quad (2)$$

In equilibrium, the income-expenditure identity requires that expenditure equals revenue from production minus net payments to foreign capital invested at home. That is,

$$E(p, q, u) = R(p, q, K) - (1 - \rho)rK^* \quad (3)$$

Finally, equilibrium in the non-traded good market requires that its excess demand equals to zero, *i.e.*,

$$Z_q(p, q, K, u) \equiv E_q(p, q, u) - R_q(p, q, K) = 0 \quad (4)$$

where Z_q denotes the excess demand of the non-traded good. Clearly, the Z_q function is strictly concave in the non-traded good price, *i.e.*, $Z_{qq} < 0$.

Differentiating equation (4) we get

$$dZ_q = Z_{qu}du + Z_{qq}dq - R_{qK}dK^* = 0 \quad (4')$$

where we have made use of the fact that $Z_{qK} = -R_{qK}$. Finally differentiating equation (3), and using equations (1) and (4'), we derive the changes in the country's level of

utility caused by changes in the nominal rate of return to capital, in the capital tax rate, and in the exogenous capital flows

$$du = -(1 - \rho)K^* dr + rK^* d\rho + r\rho dK^* \quad (5)$$

where by choice of units $E_u = 1$. As one would expect, an increase in r affects domestic welfare negatively, since it increases the net earnings of foreign capital invested at home. Similarly, an increase in the capital tax rate as well as in the inflow of capital has a positive effect on welfare due to the increase in the capital tax revenue thus generated.

The system of equations (2), (4') and (5) provides the general equilibrium effects of changes in the exogenous capital flows and the capital tax rate, on the level of utility, the non-traded good price, and the nominal rate of return to capital. That is,

$$\begin{bmatrix} 1 & 0 & (1 - \rho)K^* \\ Z_{qu} & Z_{qq} & 0 \\ 0 & -R_{Kq} & 1 \end{bmatrix} \begin{bmatrix} du \\ dq \\ dr \end{bmatrix} = \begin{bmatrix} r\rho \\ R_{qK} \\ R_{KK} \end{bmatrix} dK^* + \begin{bmatrix} rK^* \\ 0 \\ 0 \end{bmatrix} d\rho \quad (6)$$

where $Z_{qu} (= E_{qu})$ denotes changes in the compensated demand for the non-traded good due to changes in income; it is clearly positive since goods are assumed normal in consumption. Walrasian stability in the non-traded good market implies that the determinant of the left-hand side coefficient matrix $\Delta = Z_{qq} [1 - (1 - \rho)K^* R_{Kq} Z_{qq}^{-1} Z_{qu}]$ must be negative⁵.

3. Capital Flows and the Real Exchange Rate

Following Neary (1988), I define the real exchange rate π as a fixed-weight index number of the relative prices of the non-traded good divided by a price index for the

⁵ To see that, in the system of equations (2), (4') and (5) treat u , Z_q and r as the endogenous variables, and q , K^* , and ρ as the exogenous ones. It is then easy to see that in order to have $dZ_q / dq < 0$, we need $\Delta < 0$.

traded goods, p_T ⁶. That is, $\pi \equiv xq / p_T$, where x represents the base-period excess demand for the non-traded good. Differentiating the above equation, and noting that p_T is constant, gives the changes in the real exchange rate as follows

$$d\pi = xdq / p_T \quad (7)$$

Equation (7) indicates that the effect of a (net) influx of capital on the real exchange rate will be of the same sign with that on the price of the non-traded good. If the latter effect is positive (respectively, negative), then it would imply a real exchange rate appreciation (respectively, depreciation). The system of equations (6) gives the effect of a capital inflow on the non-traded good price as follows

$$\Delta(dq / dK^*) = R_{qK} - [r\rho - (1 - \rho)K^* R_{KK}] Z_{qu} \quad (8)$$

Notice that a capital inflow affects the relative price of the non-traded good in two ways. First, there is a direct substitution effect in production represented by R_{qK} . The sign of this effect depends on whether the non-traded good is respectively capital or non-capital intensive⁷. In the former case, the substitution effect in production is positive, i.e., $R_{qK} > 0$; a capital inflow increases the production of the non-traded good and, thus, has a negative effect on its relative price. In the latter case the opposite holds and the non-traded good price increases.

⁶ As Neary (1988) notes, these price indices can be well justified if the trade expenditure function is homothetically separable in the prices of traded and non-traded goods. Connolly and Devenaux (1992) examine the effects of commercial policy (i.e., higher tariffs) on the real exchange rate by using alternative definitions of the latter.

⁷ Following Dixit and Norman (1980), the cross derivative of the GDP function, R_{qK} , may be interpreted as a general equilibrium measure of factor intensity. R_{qK} is positive if the output of the non-traded good increases with an increase in the supply of capital; in this case I call the non-traded good capital intensive, while in the opposite case (i.e., $R_{qK} < 0$) I call it non-capital intensive. Notice that with many many goods and factors R_{ij} would be a matrix, where i denotes output prices and j denotes endowments or, more generally, input supplies. Observe that all elements of any row can be positive, meaning that if any sector uses a particular factor intensively in the way defined in the text, it does not necessarily follow that it would use any other factor unintensively. An example of this is the specific-factors model.

Second, there is an indirect income effect in consumption represented by the term in square brackets, *i.e.*, $[r\rho - (1 - \rho)K^* R_{KK}]Z_{qu}$. This effect is always positive. Notice that, first, a capital influx increases capital tax revenue, (*i.e.*, $r\rho Z_{qu} > 0$). Second, it decreases net payments to foreign capital invested at home, $(1 - \rho)K^* R_{KK}Z_{qu} < 0$, due to the induced decrease in the value of the marginal product of capital (*i.e.*, $R_{KK} < 0$). As a result, a capital inflow has a positive effect on consumption and, thus, on the relative price of the non-traded good.

So, if the non-traded good is non-capital intensive then an influx of capital leads to an increase in its relative price and to an appreciation of the real exchange rate, as the supply effect reinforces the (positive) income effect. But if the non-traded good is capital intensive, then the real exchange rate may in fact depreciate if the indirect income effect in consumption of the capital inflow is smaller than the direct substitution effect in production, *i.e.* if $[r\rho - (1 - \rho)K^* R_{KK}]Z_{qu} < R_{qK}$. We summarise by stating

Proposition 1. *Assume that (i) the non-traded good market is Walras stable, (ii) capital is internationally mobile and (iii) commodity trade is free. Then, an exogenous capital inflow will always cause a real exchange rate appreciation if the non-traded good is non-capital intensive. If, however, the non-traded good is capital intensive, then an exogenous capital inflow will cause a real exchange rate appreciation (respectively, depreciation) only if the income effect in consumption dominates (respectively, is smaller than) the substitution effect in production.*

Observe that even in the special case where either $\rho = 0$ or $K = 0$ (or both) the effects of an exogenous capital inflow on the price of the non-traded good and, hence, on the real exchange rate, continue to be ambiguous and to depend crucially on the capital intensity of the non-traded good. Comparing the present results to existing ones regarding the effects of commercial policy (e.g., higher tariffs) on the real exchange rate, one notes that in certain ways they resemble but in certain others they differ from them.

For example, Edwards and van Wijnbergen (1987) use a three-good (one exported, one imported, and one non-traded) two-factor (capital and labour) model, where

capital is a specific factor, to investigate the effects of a tariff change on the real exchange rate. They demonstrate that a higher tariff gives rise to two opposing effects, a substitution effect and an income effect. The substitution effect, by both reducing production and increasing consumption of the non-traded good, has a positive effect on its relative price and, hence, on the real exchange rate. The income effect, assuming a non-zero initial tariff, reduces expenditure and welfare and has, thus, a negative effect on the relative price of the non-traded good and on the real exchange rate. Overall, the relative price of the non-traded good increases (respectively, decreases), and the real exchange rate appreciates (respectively, depreciates) if the substitution effect dominates (respectively, is less than) the income effect.

In the present model, there is also a substitution effect and an income effect of a capital inflow on the real exchange rate. But, contrary to Edwards and van Wijnbergen (1987), the substitution effect works through production only, and the income effect through consumption. Furthermore, in our model we can relate these two effects to the capital intensity of the non-traded good. If the non-traded good is non-capital intensive then both these effects work in the same direction, increasing its relative price, and leading to a real exchange rate appreciation. If, however, the non-traded good is capital intensive, then these two effects work in opposite directions, so that its price increases, and the real exchange rate appreciates, only if the induced income effect in consumption dominates the substitution effect in production. Moreover, contrary to Edwards and van Wijnbergen (1987) who required a positive initial tariff, here, even if initially there is no foreign capital (*i.e.*, $K^* = 0$) and capital taxes are zero (*i.e.*, $\rho = 0$), a small capital inflow still has an ambiguous effect on the real exchange rate. The latter appreciates (respectively, depreciates) if the non-traded good is non-capital (respectively, capital) intensive, since the capital inflow induces in this case only a substitution effect in production, namely R_{Kq} .

4. Capital Flows and the Rate of Return to Capital

Competitive general equilibrium trade models have the property that, assuming constant prices and technologies, an increase in the supply of a factor cannot raise its rate of return (see, for instance, Komiya 1967). Neary (1989), however, using a model with non-traded goods, international labour mobility, and no factor taxes,

demonstrates that if the non-traded goods are labour intensive, then immigration may in fact raise the nominal wage rate in the host country. This result is prompted through an income effect induced by changes in the non-traded goods prices. In addition, Neary shows that the possibility that even the real wage is increased due to immigration cannot be ruled out, unless workers have homothetic preferences that are the same as those for the rest of the economy, or unless labour is “neutral” with respect to the non-traded goods⁸.

In this section we show that, assuming that commodity trade is free, a similar possibility exists with respect to an exogenous capital flow. Namely, it can raise both the nominal and the real rate of return to capital in the capital-importing country.

Observe that from the system of equations (6) the effect of a capital inflow on the nominal rate of return to capital is given as follows

$$Z^{-1}\Delta(dr/dK^*) = \tilde{R}_{KK} - r\rho R_{Kq}Z^{-1}Z_{qu} \quad (9)$$

where $\tilde{R}_{KK} = R_{KK} + R_{Kq}Z^{-1}R_{qK} < 0$ represents the general equilibrium effect of a capital inflow on the marginal revenue product of capital, R_K . Now, if there are no capital taxes, *i.e.* $\rho=0$ then it follows immediately that $dr/dK^* = \tilde{R}_{KK} < 0$. That is, in the absence of capital taxes a capital inflow always reduces the nominal rate of return to capital regardless of the factor intensity of the non-traded good. This is because the direct effect of such an inflow of capital (*i.e.*, R_{KK}), as well as the indirect effect (*i.e.*, $R_{Kq}Z^{-1}R_{qK}$) generated by the induced changes in the price of the non-traded good, are both negative. Since earnings by foreign capital invested in the capital-importing country are part of the foreign country’s welfare, then the induced changes in the relative price of the non-traded good do not generate the income effect *a la* Neary (1989) that may raise the nominal rate of return to capital.

⁸ Neary’s (1989) conclusion is drawn assuming immigration of many types of labour. Neutrality of labour with respect to the non-traded goods ensures that the marginal propensity to consume non-traded goods equals their share in national expenditure, and that the factor-intensity elasticity of non-traded goods equals their share in national output (see, for instance, Ruffin and Jones 1977).

But, in the presence of capital taxes, *i.e.*, $\rho > 0$, such an income effect of a capital inflow does appear. In equation (9) it is captured by the term $-r\rho R_{Kq} Z_{qq}^{-1} Z_{qu}$ and it works through the change in capital tax revenue induced by the change in the relative price of the non-traded good. This income effect may exert a positive or a negative effect on the nominal rate of return to capital depending on the factor intensity of the non-traded good. In particular, a capital inflow raises capital tax revenue, increases consumption (*i.e.*, $r\rho Z_{qu} > 0$), and consequently has a positive effect on the relative price of the non-traded good. As a result, the value of the marginal product of capital increases or decreases (*i.e.*, $R_{Kq} > 0$ or $R_{Kq} < 0$) depending on whether the non-traded good is respectively capital or non-capital intensive. It is, therefore, concluded that this income effect, as in Neary's model of international migration, exerts a positive (respectively, negative) effect on the nominal rate of return to capital only if the non-traded good is capital (respectively, non-capital) intensive in this factor. We can sum up our discussion as

Proposition 2. *Assume that (i) the non-traded good market is Walras stable, (ii) capital is internationally mobile and (iii) commodity trade is free. Then, an exogenous capital inflow may increase the nominal rate of return to capital if the non-traded good is capital intensive, and if there is a capital tax imposed by the capital-importing country. In all other cases a capital inflow will cause a decrease in the nominal rate of return to capital.*

Let us now turn to the effects of a capital inflow on the real rate of return to capital in the capital-importing country. It is more convenient to work in proportional terms. In what follows a “hat” (^) over a variable denotes a proportional change of that variable, (*i.e.*, $\hat{j} = dj/j$). It is easy to confirm that $sign[d(r/q)/dK^*] = sign(\hat{r} - \hat{q})$. We rewrite equation (2) in proportional terms, and subtract from both sides of the modified equation the proportional change in the non-traded good price to obtain the proportional change in the real rate of return to capital given by

$$\hat{r} - \hat{q} = e_K \hat{K}^* + (e_q - 1)\hat{q} = [e_K + (e_q - 1)(dq/dK^*)(K^*/q)]\hat{K}^* \quad (10)$$

where $e_j [= (\partial r / \partial j)(j/r)]$, $j = K, q$ denotes the elasticity of the nominal rate of return to capital with respect to the stock of foreign capital invested at home, and with respect to the non-traded good price.

Equation (10) illustrates that the proportional change in the real rate of return to capital due to an exogenous (proportional change of the) capital inflow. The first term in the squared brackets, $e_K (= R_{KK} K^*/r)$, captures the direct effect of such a capital inflow. This effect is always negative, since $R_{KK} < 0$; an increase in the capital inflow will *ceteris paribus* decrease the real rate of return to capital.

There is, however, a second, indirect effect, given by the second term in the squared brackets, that works through the changes in the non-traded good price caused by a capital inflow. The sign of this effect is clearly ambiguous, since both $e_q = R_{Kq} q/r$ and dq/dK^* can be either positive or negative, depending on the non-traded good being capital or non-capital intensive. If it is non-capital intensive, then $e_q < 0$ by the fact that $R_{Kq} < 0$, and $dq/dK^* > 0$ by Proposition 1. In this case, therefore, the indirect effect of a capital inflow is negative and reinforces the (negative) direct effect. Consequently, the real rate of return to capital will certainly decrease.

If, however, the non-traded good is capital intensive, *i.e.* $R_{Kq} > 0$, so that $e_q > 0$, and if $dq/dK^* < 0$, then the possibility of an increase in the real rate of return to capital resulting from a capital inflow cannot be excluded. In particular, it requires that the indirect effect is positive and greater (in absolute terms) than the (negative) direct effect. Hence, the necessary condition for an increase in the real rate of return to capital is that either the nominal rate of return to capital is elastic with respect to changes in the stock of capital (*i.e.*, $e_q > 1$) and the capital inflow causes an appreciation of the real exchange rate (*i.e.*, $dq/dK^* > 0$), or the other way around. More succinctly,

$$\text{either } \{e_q > 1 \text{ and } dq/dK^* > 0\} \text{ or } \{0 < e_q < 1 \text{ and } dq/dK^* < 0\}.$$

But from Proposition 1, we know that in the case of the non-traded good being capital intensive an exogenous capital inflow will cause an appreciation (respectively, depreciation) of the real exchange rate if the income effect in consumption dominates

(respectively, is dominated by) the substitution effect in production. Hence, we can summarise the discussion above as

Proposition 3. *Assume that (i) the non-traded good market is Walras stable, (ii) capital is internationally mobile and (iii) commodity trade is free. Then, an exogenous capital inflow will decrease the real rate of return to capital if the non-traded good is non-capital intensive. If, however, the non-traded good is capital intensive, then a capital inflow may increase the real rate of return to capital. This will happen if either (a) the nominal rate of return to capital is elastic with respect to changes in the stock of capital, and the income effect in consumption dominates the substitution effect in production, or (b) the other way around.*

5. Concluding Comments

This paper develops a general equilibrium model of a small open economy producing three goods -an exported good, an imported good and a non-traded good-, by using two or more factors of production, one of which, capital, is imperfectly internationally mobile. The aim of the paper is to investigate within this framework the effects of an exogenous capital inflow on important economic variables, such as the real exchange rate and the rate of return to capital.

Assuming that the non-traded good market is Walras stable and that the commodity trade is free, we can summarise our results as follows. A capital inflow will bring about the “standard” traditional results, namely a real exchange rate appreciation and a decrease in the nominal rate of return to capital, only if the non-traded good is non-capital intensive. In the opposite case, however, *i.e.*, if the non-traded good is capital intensive, it is possible that an exogenous capital inflow gives rise to the paradoxical results of (a) a real exchange rate depreciation, and (b) an increase in the nominal rate of return to capital. A sufficient condition for (a) to happen is that the substitution effect in production caused by the capital inflow dominates the income effect in consumption, while a necessary condition for (b) to occur is that there is a capital tax imposed by the capital-importing country.

Moreover, in the case of the non-traded good being capital intensive a capital inflow may even cause an increase in the real rate of return to capital. Such a possibility cannot be excluded if either the nominal rate of return to capital is elastic

with respect to changes in the stock of capital and the income effect in consumption dominates the substitution effect in production, or the other way around.

Throughout the paper I have confined the discussion to the case of a country that is a net capital importer. The analysis can easily be extended to cover the opposite case, i.e., that of a net capital exporter, and can be conducted along similar lines to those followed above. Here, I will briefly discuss the results of this case. Throughout this discussion I make the reasonable assumption that the net nominal rate of return to capital abroad is no less than that at home. Again, the effects of an exogenous capital outflow on the real exchange rate and the rate of return to capital in the capital-exporting country work through a substitution effect in production and an income effect in consumption, and hinge critically on the capital intensity of the non-traded good. (Clearly, the income effect will be zero if the domestic and foreign net rates of return to capital are the same). If the non-traded good is capital intensive, then an exogenous capital outflow will give rise to the paradoxical result of an appreciation of the real exchange rate. This is because both the substitution and income effects are positive. An exogenous capital outflow will decrease the production of the non-traded good thus raising its price (substitution effect), while the induced increase in capital revenue prompted by the increase in the value of the marginal product of capital will also raise the non-traded good's price by increasing its consumption. If, on the other hand, the non-traded good is non-capital intensive then the substitution effect will tend to lower its price and, hence, an appreciation of the real exchange rate will only occur if the (positive) income effect dominates the (negative) substitution effect. Similarly, an exogenous capital outflow may decrease the domestic nominal rate of return to capital if the income effect thus generated overtakes the positive general equilibrium effect of a capital outflow on the marginal revenue product of capital, \tilde{R}_{KK} . A necessary condition for this to happen is that the non-traded good is non-capital intensive. Finally, a capital outflow may decrease the domestic real rate of return to capital if the non-traded good is non-capital intensive and the substitution effect dominates the income effect.

To conclude, at a theoretic level one cannot rule out the possibility that for a capital-importing (respectively, capital-exporting) country an exogenous capital inflow (respectively, outflow) will bring about the paradoxical results of a real exchange rate depreciation (respectively, appreciation), and/or an increase

(respectively, decrease) in the nominal and real rate of return to capital. This can only be done by empirical analysis.

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