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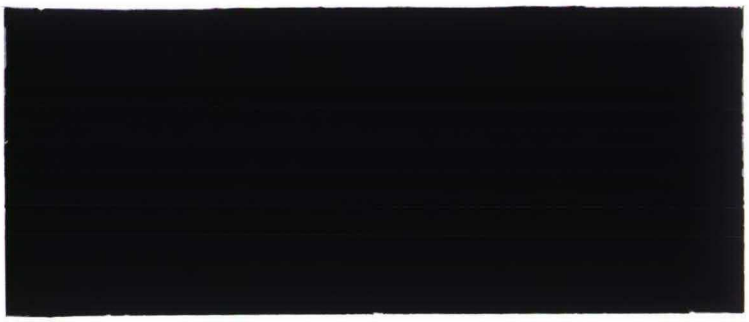

DEPARTMENT OF ECONOMICS

RESEARCH MEMORANDUM

FINANCIAL INTEGRATION AND FISCAL POLICY IN INTERDEPENDENT TWO-SECTOR ECONOMIES WITH REAL AND NOMINAL WAGE RIGIDITY

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FEW 526

FINANCIAL INTEGRATION AND FISCAL POLICY IN INTERDEPENDENT TWO-SECTOR ECONOMIES WITH REAL AND NOMINAL WAGE RIGIDITY

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A two-country-two-sector model with a portfolio choice between money and imperfectly substitutable domestic and foreign assets, floating exchange rates and perfect foresight is presented. Account is taken of capital accumulation, government debt and current account dynamics. Numerical methods, including extensive sensitivity analysis, are used to trace the consequences of financial integration for the effects and spill-over effects of fiscal policy. Another purpose is to establish the relevance of desaggregation for the outcomes of fiscal policy.

1 INTRODUCTION

Economic integration is one of the central issues of contemporary and, most probably, future economics. On the occasion of the Centenary of THE ECONOMIC JOURNAL, a number of distinguished economists expressed their views on the prospects for economics in the next hundred years. Several authors (Bhagwati, Malinvaud, Schmalensee, Turnovsky) point at integration as a key topic in economic theorizing.

Van der Ploeg (1991a), in describing the various phases in the process of European integration, suggests that the financial, goods and labour markets are integrating at different speeds. Low factor mobility is expected to be rather persistent, due to impeding factors like language, culture and tradition. On the contrary, there seems to be a strong tendency towards a high degree of international financial capital mobility, thanks to, amongst others, virtual absence of transportation

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costs. Integration of goods markets is considered to take a position somewhere in between. If this sequence applies to the European integration proces, there is no obvious reason, why it would not apply to the process of global integration. This would be an argument to give priority to financial integration. Therefore, it is hardly surprising, that precisely this phenomenon receives most attention.

There is a reasonable amount of *prima facie* evidence in favour of the hypothesis of increased integration of financial markets (e.g. Frankel, 1989, Keuzenkamp and Van der Ploeg, 1990). The process of financial integration can be observed from enhanced substitutability of assets and a growing interdependence of yields.

This paper examines the consequences of financial integration for the effects and spill-over effects of fiscal policy. For that purpose, a two-country-two-sector perfect foresight model, allowing for intertemporal government budget constraints, current account dynamics, wealth effects, capital accumulation, imperfect substitutability between home and foreign bonds, floating exchange rates, imperfect substitution between home and foreign tradables, international labour and intersectoral capital immobility, real wage rigidity at home and nominal wage rigidity abroad is formulated.

There is a considerable amount of literature on international interdependent macroeconomics using a portfolio balance framework (e.g. Tobin and de Macedo, 1980, Branson and Henderson, 1985, Ribe and Beeman, 1986, Van de Klundert, 1991). On the other hand, some work has been done on international interdependent two-sector economies, without or with at best an elementary financial sector (Corden and Turnovsky, 1983, Obstfeld, 1988, De Groof and Schaling, 1991).

The dominant feature of the present model is the combination of these two frameworks. The portfolio balance approach enables a careful modelling of stock-flow relationships. The distinction between tradables and nontradables opens the possibility of investigating the influence of the composition of a change in government expenditure. In doing so, we try to meet the apparent need for disaggregation, as expressed by, for instance, Allen (1991).

The main findings, applying within certain boundaries of the crucial parameters, are as follows. Looking at real disposable income as a measure

of the regions' spending power, financial integration appears to have no influence on the qualitative effects and spill-over effects of fiscal policy. This is not the case, if total real output, as a measure of the regions' productive efforts, is used to characterize these (spill-over) effects. Then financial integration turns out to be relevant, especially in the long run. However, this only applies to a fiscal expansion falling on tradables, which implies, that these long-run (spill-over) effects depend on the commodity composition of government purchases.

The paper is organized as follows. In section 2 the model is presented. Its complexity makes an analytical solution intractable. Instead, a comprehensive set of simulations is carried out. Appendix 1 contains the linearized simulations version of the model, along with the numerical assumptions with respect to the initial steady state situation. Analytical models sacrifice reality by ruling out several sources of dynamics, in order to keep the analysis manageable. On the other hand, the results of the simulations approach are coefficient specific. To overcome this dilemma, the system has been submitted to extensive sensitivity analysis. To that end, intervals of robustness for all behavioural parameters have been established (cf.Karakitsos, 1989). Besides, the role of the economies' sector structure and technology has been critically analyzed. As for the latter, we reverse the sectors' factor intensities as compared to the reference situation, in which tradables production is assumed to be capital intensive (Prachowny, 1984, Obstfeld, 1988, Verbruggen, 1988). This sensitivity analysis can be found in Appendix 2. Section 3 presents an overview of the effects and spill-over effects of unilateral fiscal expansions for the reference situation. Section 4 considers the influence of financial integration. For that purpose we compare, in qualitative terms, the policy multipliers for the reference situation, characterized by a low degree of financial integration, with those applying for a situation with a high degree of financial integration. For the short run, the latter case reflects the Mundell-Fleming assumption of uncovered interest parity. In the medium and long run, however, stock-flow effects drive a wedge between home and foreign interest rates. Section 5 concludes the paper.

2 A TWO-COUNTRY-TWO-SECTOR MODEL WITH IMPERFECT SUBSTITUTABILITY WITH RESPECT TO TRADABLES AND FINANCIAL ASSETS

Countries export and import tradable (consumption) goods and assets. Following Van de Klundert (1991), we divide the complex system of interrelations into four subsystems, viz the portfolio, commodity, labour and dynamic subsystem. The description of the model is completed by a set of definitional equations.

At this point it should be stressed that, apart from nominal wage formation, the two countries are identical.

Lower-case letters refer to real variables, variables expressed as rates are denoted with a 'tilde', while exogenous variables are barred. The subscript i (i = h,n) refers to the home tradables sector and the nontradables sector, respectively, while the subscripts j and k (j = 1,2 , k = 1,2, j ≠ k) refer to countries: country 1 stands for Europe and country 2 for the U.S.. The superscript 'e' refers to expectational variables. In order to save space we present nominal and real exchange rates as country-specific variables.

The portfolio subsystem

The portfolio subsystem draws heavily on Van de Klundert (1991). Agents spread their real non-human wealth (we) over real cash balances (m), domestic bonds (b_{jj}) and foreign bonds (b_{jk}).

The shares of these assets in total wealth are assumed to be independent of nominal price levels. Therefore, asset demand functions in nominal and in real terms are perfectly equivalent. However, asset demand decisions depend on *nominal* interest rates.

Following the well-known Fisher relationship, the nominal interest rate ($\tilde{r}_n$) is defined as the sum of the real interest rate ($\tilde{r}$) and expected inflation

$$\tilde{r}_{n_j} = \tilde{r}_j + \tilde{p}^e_{c_j} \qquad (1) - (2)$$

When choosing between domestic and foreign securities, agents take nominal exchange rate expectations into account. For example, the expected yield

on US bonds held by European residents equals the sum of the U.S. nominal interest rate ($\tilde{r}_2 + \tilde{p}^e_{c_2}$) and the expected depreciation of the European currency, say ECU ($\tilde{e}^e_1$). For all practical purposes, the real value of bonds is assumed to be fixed within a period (Haas and Masson, 1986). At the same time, bonds are indexed to the consumers' price index (CPI $\equiv p_c$), thus constituting sure claims on given amounts of future consumption goods (baskets). Expectations are assumed to be rational. Furthermore, stochastic components are absent. Therefore, agents have perfect foresight.

Transactions demand for (domestic) real cash balances is supposed to be related to real disposable income of the private sector (y_d; see, for instance, Goodhart 1990, pp. 269-270). Moreover, we ignore currency substitution. Under these assumptions the asset demand functions read

$$m_j = m_j \left(\overset{+}{y_{d_j}}, \overset{+}{we_j}, \overset{\pm}{r_{n_j}}, \tilde{r}_{n_k}, \overset{0}{+} \tilde{e}^e_j \right) \qquad (3) - (4)$$

$$b_{jj} = b_{jj} \left(\overset{-}{y_{d_j}}, \overset{+}{we_j}, \overset{\pm}{r_{n_j}}, \tilde{r}_{n_k}, \overset{-}{+} \tilde{e}^e_j \right) \qquad (5) - (6)$$

$$q_{c_j} b_{jk} = q_{c_j} b_{jk} \left(\overset{0}{y_{d_j}}, \overset{+}{we_j}, \overset{\pm}{r_{n_j}}, \tilde{r}_{n_k}, \overset{+}{+} \tilde{e}^e_j \right) \qquad (7) - (8)$$

where q_{c_j} is the real exchange rate applying to country j. The bold signs above variables denote the signs of the partial derivatives. From Appendix 1 it can be verified, that the familiar "adding-up" constraints apply (Turnovsky 1977). Furthermore, in our numerical exercises, we assume the demand functions for bonds to be based on CES utility functions.

The supply of real cash balances equals the exogenous money stock ($\underline{M}$) divided by the CPI

$$m_j = \frac{\underline{M}_j}{p_{c_j}} \qquad (9)-(10)$$

Net investment of firms is completely financed by issuance of bonds. It is assumed that all transactions are paid for at the beginning of the period.

So, investment goods are bought against today's prices. As a result, the amount of bonds supplied by firms is determined by the stock of capital equipment at the beginning of the next period, including net investment of the present period. The supply of government bonds equals outstanding government debt (d), comprising this period's budget deficit as well. For simplicity, it is assumed that bonds issued by firms and the government are perfect substitutes. Therefore, total bonds' supply reads

$$u_j = \frac{k_{h_{j+1}} \, p_{h_j} + k_{n_{j+1}} \, p_{n_j}}{p_{c_j}} + d_j \qquad (11)\text{-}(12)$$

Equilibrium in the international bonds markets is stated by

$$u_j = b_{jj} + b_{kj} \qquad (13)\text{-}(14)$$

Finally, the portfolio subsystem requires a definition of real wealth. The net real foreign asset position (f_j), by definition equals $q_{c_j} \, b_{jk} - b_{kj}$. In conjunction with equations (13)-(14) and the balance sheet identities

$$we_j = m_j + b_{jj} + q_{c_j} \, b_{jk}$$

this results in

$$we_j = m_j + u_j + f_j \qquad (15)\text{-}(16)$$

The commodity subsystem

The micro-underpinnings of the foregoing portfolio subsystem are no more than rudimentary. In this respect, the commodity expenditure equations show close resemblance, as they lack explicit microfoundations in the form of intertemporal choices made by households and firms as well (as, for example, in Van der Ploeg, 1991b). As Van de Klundert (1991) observes, a thorough microeconomic foundation of macroeconomics requires an integration of saving, investment and portfolio decisions. Research in

this field is still in its infancy (e.g. Rankin, 1991). Moreover, we agree with Allen (1991, p 153), who argues, that optimizing models can not avoid ad hoc qualities either, be it of a different nature than non-optimizing models.

Total private consumption (c) is split up between consumption of nontradable (c_n) and tradable (c_t) goods. The latter, in turn, is subdivided into home (c_h) and foreign produced (c_m) goods. The complex decision problem with respect to consumption is supposed to be separable (cf. Deaton and Muellbauer 1980).

First, consumers decide upon total consumption expenditure according to

$$c_j = c_j \left(\overset{+}{y_{d_j}} , \overset{+}{we_j} , \overset{-}{\tilde{r}_{n_j}} - \overset{-}{\tilde{p}^e_{c_j}} \right) \qquad (17)\text{-}(18)$$

Thus, total consumption is positively related to real disposable income (y_d) and real non-human wealth of the private sector (we), whereas it depends negatively on the real interest rate ($\tilde{r}_n - \tilde{p}_c^e$). Assuming consumption to depend on real disposable income implies ascribing naive expectations concerning human wealth to households. Alternatively, one may assume that households are liquidity constrained.

Next, given total consumption demand, consumers choose between tradables and nontradables by maximizing a (CES) utility function. Consumer expenditure on (non-)tradables depends positively on total consumption expenditure, but negatively on the ratio of the price of (non-)tradables to CPI. Hence, sectoral consumption functions read as

$$c_{t_j} = c_t \left(\overset{+}{c_j} , \frac{\overset{-}{p_{t_j}}}{p_{c_j}} \right) \qquad (19)\text{-}(20)$$

$$c_{n_j} = c_n \left(\overset{+}{c_j} , \frac{\overset{-}{p_{n_j}}}{p_{c_j}} \right) \qquad (21)\text{-}(22)$$

Taking the empirical observations of Deardorff and Stern (1986) into account, home and foreign produced tradables are imperfect substitutes.

Having decided upon total demand for tradable consumption goods and services, consumers choose between home and foreign produced tradables by maximizing another (CES) utility function

$$c_{h_j} = c_h \left(c_{t_j} , \frac{\bar{p}_{h_j}}{p_{t_j}} \right) \qquad (23)\text{-}(24)$$

$$c_{m_j} = c_m \left(c_{t_j} , \frac{\bar{p}_{h_k} e_j}{p_{t_j}} \right) \qquad (25)\text{-}(26)$$

where p_h denotes the price of home produced tradables.

Entrepreneurs only gradually adapt the stock of capital equipment (k_i) to its desired level (k_i^d). Consequently, net investment is a fraction of the gap between the desired and actual stock of capital. The depreciation rate of capital is exponential at a rate δ, which is uniform across sectors. Thus, the functions with respect to gross investment are

$$i_{i_j} = i_{i_j} \left(k^d_{i_j} , k_{i_j} \right) \qquad (27)\text{-}(30)$$

The sign of the partial derivative of k_i is ambiguous. For instance, it can be verified from relations (A27) through (A30) in Appendix 1, that this sign is negative (positive), if the accelerator coefficient exceeds (falls short of) the rate of technical obsolescence.

The desired stock of capital equipment in any sector follows from the equality of the nominal interest rate ($\tilde{r}_n$) and the sector's net marginal physical product of capital plus the expected increase in the value of the sector's capital goods ($\frac{\partial y_i}{\partial k_i} - \delta + \tilde{p}^e_i$). The latter equals the expected increase in the sectoral producers' price, since we assume the sector's investment outlays to fall entirely on the goods produced by the sector itself. Allowing for the intersectoral and international trade in new capital goods, would probably not alter the results substantially (Pasinetti 1981, De Groof and Van Tuijl, 1991). Therefore, the relation for the desired stock of capital equipment can be written as

$$k^d_{i_j} = k^d_{i_j} \left(\overset{+}{y_{i_j}}, \overset{\sim}{r_{n_j}}, \overset{-}{\sim p^e_{i_j}} \right) \qquad (31)\text{-}(34)$$

Sectoral outputs (y_i) follow from linear homogeneous (CES) production functions, using inputs of labour (l_i) and sector-specific capital (k_i) Thus,

$$y_{i_j} = y_{i_j} \left(\overset{-}{\underset{+}{l_{i_j}}}, \overset{-}{\underset{+}{k_{i_j}}} \right) \qquad (35)\text{-}(38)$$

where the upper bold signs reflect the signs of the second partial derivatives.

Equilibrium in tradables and nontradables markets is stated by

$$y_{h_j} = c_{h_j} + i_{h_j} + g_{h_j} + c_{m_k} + g_{m_k} \qquad (39)\text{-}(40)$$

$$y_{n_j} = c_{n_j} + i_{n_j} + g_{n_j} \qquad (41)\text{-}(42)$$

Here g_h and g_m denote exogenous exhaustive government spending on home and foreign produced tradables respectively, while g_n indicates exogenous government expenditure on nontradables.

Macroeconomic real output is defined as

$$y_j \equiv \frac{y_{h_j} p_{h_j} + y_{n_j} p_{n_j}}{p_{y_j}} \qquad (43)\text{-}(44)$$

The labour subsystem

Nominal wages are uniform across both sectors, owing to the assumptions of the homogeneity of labour and perfect intersectoral labour mobility.

However, the labour markets are segmented internationally. Furthermore, they do not clear in the short run, due to rigidity of either nominal wages or real consumers' wages. Empirical evidence points, at least for the short and medium term, in the direction of a relatively high degree of nominal wage rigidity in the U.S. and real wage rigidity in Europe (Van

der Ploeg, 1988). For expositional purposes we assume inertia causing (almost) perfect short-run nominal and real wage rigidity in the U.S. and Europe, respectively. According to Attenasio, Manasse and Van der Ploeg (1987), empirical evidence does not reject the existence of an error-correction mechanism in the wage relation, ensuring consumers' wages to return to their long-run equilibrium value. We assume a stylized version of this mechanism to apply, so that nominal wages adapt gradually to the labour market situation (Phillips mechanism), as well as to the development of CPI. So, in the long run unemployment is at its natural rate.

Assuming country-specific labour supply to be exogenous, these conditions imply

$$\Delta w_j = \Delta w_j \left(\overset{+}{\Delta p_{c_j}}, \overset{+}{l_j} \right) \qquad (45)\text{-}(46)$$

in which w and l denote money wage and macroeconomic employment respectively.

Profit maximizing firms equate the marginal product of labour $(\frac{\partial y_i}{\partial l_i})$ and the real producers' wage $(\frac{w}{p_i})$, with the stock of capital equipment given at each point in time. This results in the following relation for labour demand

$$l_{i_j} = l_{i_j} \left(\overset{+}{y_{i_j}}, \frac{\overset{-}{w_j}}{p_{i_j}} \right) \qquad (47)\text{-}(50)$$

Macroeconomic employment is defined as

$$l_j \equiv l_{h_j} + l_{n_j} \qquad (51)\text{-}(52)$$

The dynamic subsystem

Capital accumulation reads as

$$\Delta k_{i_j} \equiv i_{i_{j-1}} - \delta\, k_{i_{j-1}} \qquad (53)\text{-}(56)$$

Governments buy nontradables and home as well as foreign produced tradables. Moreover, they pay interest on outstanding debt. These outlays are financed by lumps-sum taxes (t), the issuance of bonds, or by means of the 'printing press' ($\Delta \underline{M}_j$). The selling of bonds raises government debt (d), which immediately becomes clear from writing the government budget *identity* (Buiter 1986) as

$$\Delta d_j = \tilde{r}_j\, d_{j-1} + g_j - t_j - \frac{\Delta \underline{M}_j}{p_{c_j}} \qquad (57)\text{-}(58)$$

where g indicates total real government expenditure. Equations (57) and (58) reflect the above assumption of government bonds being indexed to the CPI.

In order to prevent government debt from escalation, a feedback rule for taxes is specified, since we intend to reserve exhaustive government spending as a policy instrument. A sensible tax rule was introduced by Buiter (1987). Here, it takes the form

$$t_j = t_j^{\bullet}(d_j) \qquad (59)\text{-}(60)$$

The real current account surplus of Europe (Δf_1), by definition equals the sum of its balance of trade surplus and its capital income account surplus. Under flexible exchange rates, this sum equals the capital account deficit, and, consequently, the increase in Europe's net real foreign asset position.

$$\Delta f_j = \frac{c_{m_k} p_{h_j} - c_{m_j} p_{h_k} e_j + g_{m_k} p_{h_j} - g_{m_j} p_{h_k} e_j}{p_{c_j}}$$

$$+ \tilde{r}_k\, q_{c_j}\, b_{jk_{-1}} - \tilde{r}_j\, b_{kj_{-1}} + b_{jk_{-1}}\, \Delta q_{c_j} \qquad (61)\text{-}(62)$$

It can easily be verified that $f_k = \frac{-f_j}{q_{c_j}}$.

Definitional equations

Real disposable income of the private sector in terms of baskets of home produced commodities equals sum of net value added of firms, interest payments by the domestic government, the capital income account surplus including real-exchange-rate-induced gains on foreign bonds holdings, and the (relative) price-induced wealth effects on physical capital, minus lump-sum as well as inflation taxes. So,

$$
\begin{aligned}
y_{d_j} \equiv\ & (y_j - \delta k_j) p_{y_j} / p_{c_j} + \tilde{r}_j d_{j-1} \\
& + \tilde{r}_k q_{c_j} b_{jk_{-1}} - \tilde{r}_j b_{kj_{-1}} + b_{jk_{-1}} \Delta q_{c_j} \\
& + k_{h_j} \Delta \frac{p_{h_j}}{p_{c_j}} + k_{n_j} \Delta \frac{p_{n_j}}{p_{c_j}} - t_j + \frac{M_{j-1}}{P_{c_j}} - \frac{M_{j-1}}{P_{c_{j-1}}}
\end{aligned}
\qquad (63)\text{-}(64)
$$

The PPI is defined as

$$
p_{y_j} \equiv p_h^{\gamma_{h_y}} p_n^{(1-\gamma_{h_y})} \qquad (65)\text{-}(66)
$$

where γ_{h_y} is the share of output of home produced tradables in total output.

The (ideal) price index of tradables consumption can be written as

$$
p_{t_j} = [\, \gamma_{h_t} p_{h_j}^{(1-\varphi_{hm})} + (1-\gamma_{h_t}) (p_{h_k} e_j)^{(1-\varphi_{hm})} \,]^{\frac{1}{1-\varphi_{hm}}} \qquad (67)\text{-}(68)
$$

where γ_{h_t} denotes the optimal (utility maximizing) share of home produced tradables in total consumption of tradables and φ_{hm} indicates the elasticity of substitution between home and foreign produced tradables.

Analogously, the (ideal) CPI reads as

$$p_{c_j} = [\ \gamma_{t_c}\ p_{t_j}^{(1-\varphi_{tn})} + (1-\gamma_{t_c})\ p_{n_j}^{(1-\varphi_{tn})}\ ]^{\frac{1}{1-\varphi_{tn}}} \qquad (69)\text{-}(70)$$

where γ_{t_c} is the optimal share of consumption of tradables in total consumption expenditure and φ_{tn} indicates the elasticity of substitution between tradables and nontradables consumption.

The macroeconomic real exchange rate by definition equals

$$q_{c_j} \equiv \frac{e_j\ p_{c_k}}{p_{c_j}} \qquad (71)\text{-}(72)$$

Following the Armington tradition rather than assuming the Law of One Price to hold, we have to consider a real exchange rate concerning the tradables sector as well

$$q_{h_j} \equiv \frac{e_j\ p_{h_k}}{p_{h_j}} \qquad (73)\text{-}(74)$$

Evidently, the exchange rates are related as follows

$$e_k = e_j^{-1} \qquad (75)$$

$$q_{c_k} = q_{c_j}^{-1} \qquad (76)$$

$$q_{h_k} = q_{h_j}^{-1} \qquad (77)$$

The system is completed by definitional equations for the macroeconomic stock of capital equipment,

$$k_j \equiv \frac{k_{h_j}\ p_{h_j} + k_{n_j}\ p_{n_j}}{p_{y_j}} \qquad (78)\text{-}(79)$$

and real government expenditure, respectively,

$$g_j \equiv \frac{g_{h_j} p_{h_j} + g_{n_j} p_{n_j} + g_{m_j} p_{h_k} e_j}{p_{c_j}} \qquad (80)-(81)$$

There are 81 equations in 80 endogenous variables, viz. $\tilde{r}_n$, $\tilde{r}$, m, b_{jj}, b_{jk}, b_{kj}, u, we, c, c_t, c_n, c_h, c_m, i_h, i_n, k_h^d, k_n^d, y_h,y_n, y, w, l_h, l_n, l, k_h, k_n, d, g, t, f, y_d, p_h, p_n, p_c, p_t, p_y, e, q_c, q_h, k.
Invoking Walras' law, one of the equilibrium equations is redundant. As a result, equation (14), which is the condition for equilibrium in the market for foreign assets, can be eliminated.
The model contains ten backward-looking state variables viz. k_h, k_n, w, d and f, since they are constrained by their history. The five remaining state variables, p_h, p_n and $e_j = e_k^{-1}$ are unconstrained by their past and are forward-looking. For saddlepoint stability to hold, one should therefore have ten stable (negative) roots and five unstable (positive) roots.

3 INTERNATIONAL AND INTERSECTORAL EFFECTS AND SPILL-OVER EFFECTS OF FISCAL SHOCKS.

In this section, the international and intersectoral transmission effects of unanticipated once and for all (sector-specific) fiscal expansions will be studied, by passing in review the qualitative results of numerical exercises. The computations have been carried out with the PSREM package developed by Van der Ploeg and Markink (1991). The simulations version of the model, along with the numerical assumptions is presented in Appendix 1. It should be stressed that, contrary to the previous section, the symbols now denote relative deviations from the steady state.

The qualitative short-and-long-term effects and spill-over effects, of the unilateral policy measures mentioned above, are shown in Table 1. They will be explained concisely. Thereby we will focus on the the variable y_d. This variable, which will henceforth be referred to as disposable income, indicates the private sector's spending power. However, total real output, which measures the region's productive effort, should be taken into consideration as well. To be sure, macroeconomic employment deserves as much attention. However, the short-term qualifications for

total real output also apply to employment, while in the long run the Phillips mechanism invariably restores equilibrium in the labour market. The macroeconomic characterisations of the various policies pursued, will be indicated by: 'LOC', 'BLOC', 'BTN' and 'BTS', referring to a 'locomotive', 'backward locomotive', 'beggar-thy-neighbour' and 'beggar-thyself' policy, respectively. These expressions grasp both the effects for the country taking the initiative, as well as spill-over effects for the passive region. They can be defined by means of the following scheme, in which Europe is supposed to take the initiative. If the U.S. take the initiative, the signs for BTN and BTS are reversed, of course.

	LOC	BLOC	BTN	BTS
y_{d_1}, y_{d_2} (or y_1, y_2)	+,+	-,-	+,-	-,+

In the short run, *a European fiscal expansion on home produced tradables* [2] raises both the nominal and real interest rate in Europe. In the U.S., the real interest rate increases, while the nominal interest rate decreases. Evidently, the rise in real interest rates in Europe is more pronounced than in the U.S., which is the main factor accounting for Europe's capital income account deficit. Europe also runs a trade balance deficit, making its current account deficit substantial. This causes the ECU to depreciate, despite the capital inflow arising from the positive yield differential. Meanwhile, the European macroeconomic real exchange rate rises, since the (CPI) inflation differential is dominated by the depreciation of the ECU.

As for the supply side, in the short run sectoral supply solely depends on the sector's real producers' wage. The rise in government spending on domestic tradables causes an (ex ante) excess demand for European tradables, exerting an upward pressure on its price. This induces European consumers to shift their expenditure towards U.S. tradables and nontradables, leading to an increase in prices in these sectors too.

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2) In this article, we confine ourselves to fiscal expansions falling on home produced goods, as this type of fiscal policy seems to be the most obvious one. The case where government expenditure falls on goods of foreign origin is discussed extensively in De Groof and Van Tuijl (1991).

TABLE 1 reference situation

Effects and spill-over effects of fiscal shocks

Type of shock	$g_{h1}=1$		$g_{h2}=1$		$g_{n1}=1$		$g_{n2}=1$	
Period	1	∞	1	∞	1	∞	1	∞
y_{d1}	-	-	-	+	-	-	+	+
y_{d2}	-	+	+	-	+	+	-	-
y_1	-	-	-	-	+	-	+	-
y_2	+	-	+	-	-	-	+	-
y_{h1}	+	-	+	-	-	-	+	-
y_{n1}	-	-	-	+	+	+	+	+
y_{h2}	+	-	+	+	-	-	+	-
y_{n2}	-	+	+	-	-	+	+	+
r_{n1}	+	+	-	+	-	+	+	+
r_{n2}	-	+	+	+	+	+	+	+
r_1	+	+	+	+	-	+	+	+
r_2	+	+	+	+	+	+	+	+
e_1	+	+	-	-	+	+	-	-
q_h	-	-	+	+	-	-	-	+
q_c	-	-	-	+	-	-	+	+
$p_{t1} - p_{n1}$	+	+	+	+	-	+	-	+
$p_{t2} - p_{n2}$	+	+	+	+	-	+	-	+

The price of U.S.' nontradables slightly falls, which on balance results from U.S. consumers shifting expenditure towards this type of goods, and a reduction in U.S.' total consumption, including nontradables. In the U.S., changes in producers' prices cause opposite changes in the real producers' wages, since in the short run money wages hardly respond to the increase in the CPI. As a result, an increase or decrease in demand is largely met by higher or lower output. This explains the moderate changes in the U.S.' producers' prices. In Europe the nominal wage rate moves in line with CPI. Consequently, the real producers' wage rate in the tradables sector falls only slightly, whereas it increases in the nontradables sector. Therefore, the tradables production shows only a small rise, while nontradables output drops significantly. So, in Europe, the main outlet for (ex ante) excess demand or supply are price mutations. It is worthwhile noting, that the European terms of trade ($-q_h$) increase, while the tradables-nontradables price ratio ($p_t - p_n$) rises in both regions.

European disposable income falls for several reasons. Firstly, taxes are raised, as the government wants to prevent 'runaway debt' (Tobin,1986). Secondly, real cash balances are eroded by inflation. Thirdly, as mentioned above, Europe runs a capital income account deficit. These factors dominate a moderate increase in total European production in terms of (baskets of) consumption goods. To be sure, European total real output in terms of (baskets of) home produced goods (y_1) decreases. However, the rise in the European external terms of trade cause the purchasing power of real output ($y_1 + p_{y_1} - p_{c_1}$) to rise. U.S. disposable income also falls, mainly due to the combined effect of lower total output in terms of consumption goods and the erosion of real cash balances. As a consequence, in the short run a European fiscal expansion on home produced tradables is a BLOC policy.

The understanding of the dynamics of the model may be served by the description of the developments in the medium term, for which we arbitrarily take the third period. It should be noted that, when describing effects and spill-over effects of policy measures in later years ($t>1$), it is convenient to distinguish carefully between the *level* and the *movement* of a variable. The *level* is represented by the relative deviation of a variable from its initial steady state value,

while the *movement* is the period-to-period change of the level. At this point it should be stressed, that the signs in Table 1 indicate *levels*.

In the present case, the medium-term picture shows close resemblance to the short-run picture. At least BLOC is still the correct label. European output in terms of of consumption goods has fallen, mainly attributable to a decline in nontradables production, arising from a crowding-out of capital investment in the preceding periods. Thus, besides higher taxes, an erosion of real cash balances and a capital income account deficit, a negative level of total output now contributes to European disposable income being negative as well. The capital income account deficit follows from a sustained current account deficit, which reinforces the U.S.' position as a net creditor. This causes the ECU to depreciate even further. The European macroeconomic real exchange rate now rises as well, despite European inflation still being comparatively high. Disposable income of the U.S. is now higher than in the short run, owing to an increase in the value of the U.S.' capital stock, arising from an increase in the ratio of the price of home tradables to the nontradables price. Here it should be remembered, that the production of tradable goods is assumed to be relatively capital intensive. Yet U.S.' disposable income income remains negative, mainly due to a fall in the purchasing power of real total output.

In the long run European disposable income gradually declines. This must be attributed to higher taxes and a higher capital income account deficit. The erosion of real cash balances has come to a complete stop, inflation being absent in the long run. On the contrary, U.S.' long-run disposable income attains a positive level, which must be ascribed to both a higher capital income account surplus and a rise in the real value of European bonds held by U.S.' residents. The latter is induced by a decrease in the real exchange rate, caused by the depreciation of the ECU being dominated by the positive inflation rate differential between Europe and the U.S. in the past. So, in the long run a European fiscal expansion on domestic tradables is a BTS policy.

It should be noted, that in the long run Europe's terms of trade fall, turning its balance of trade into a surplus, which is necessary to cover Europe's increased debt service requirements. Real wealth in Europe declines, as the increase in domestic bonds, following from a considerable

build-up of government debt, falls short of the combined effect of real cash balances erosion and foreign debt accumulation. On the contrary, U.S.' long-term real wealth exceeds its initial steady state level, owing to an increase in all of its components.

A rise in European government expenditure on nontradables is a BTS policy in the short run. Now lower government interest payments is an additional factor underlying the decline in European disposable income. The decrease in government interest payments results from a drop in the real interest rate. Logically, the present shock exerts on impact pressure on domestic markets. Hence, in the short run inflation in Europe is considerable, causing a severe decline in real cash balances. This, in turn, affects real disposable income. The latter causes an even stronger fall in the transactions demand for real cash balances, which underlies the somewhat counter-intuitive fall in both the nominal and the real interest rate.

In the U.S., production decreases in both sectors, since both capital investment and exports fall. Another striking difference with the case of a European fiscal expansion on domestic tradables, is the decrease in the value of the U.S.' capital stock, since now the ratio of the price of U.S.' tradables to nontradables decreases. Nevertheless U.S.' disposable income rises, mainly due to a considerable capital income account surplus.

In the long run, a European expansion on nontradables is a BTS policy. European disposable income has declined even further. Total real output as well as the demand for tradables have fallen. The latter stems from reduced total consumption, arising from both decreased disposable income and from declined real wealth. An improvement of the capital income account is the main factor underlying the rise in the U.S.' disposable income.

Initially, the real exchange rate undershoots its long-term steady state value. A substantial depreciation of the nominal exchange rate, outweighing the inflation gap between the U.S. and Europe, features the movement towards its equilibrium value.

A rise in U.S.' exhaustive government spending on domestic tradables turns out to be a BTN policy in the short run. Remember that the corresponding European fiscal expansion is a BLOC policy. One should keep in mind, that any discrepancy with the corresponding European demand shock originates from differences in wage formation.

The present shock leads to an (ex ante) excess demand for U.S. tradables, which drives up their price. As a result, consumers in both regions shift their expenditure away from U.S. tradables towards European tradables as well as nontradables. The price of U.S' nontradables rises as well. In the U.S., real producers' wages drop in both sectors. The rise in demand is to a great extent met by higher output, thereby attenuating the increase in prices. In Europe, the real producers' wage slightly drops in the tradables sector, whereas it rises in the nontradables sector. Consequently, tradables output shows a moderate increase, while nontradables production decreases. Total real output declines, whereas the increase in PPI falls short of the increase in CPI. The latter causes a real cash balance erosion, but also contributes to a decrease in the real value of U.S.' bonds held by Europeans. These are the factors underlying the decrease in disposable income in Europe.
As explained above, if the NWR-country raises its government expenditure on domestic tradables, it experiences a relatively large increase in output and a relatively moderate inflation, causing only a small decline in real cash balances. So, disposable income rises, reverse to the former case, in which the active country was characterized by RWR.

Logically, the long term picture is a mirror image of the one discussed before (the RWR-NWR case). In this respect, the type of short-(and medium-)term wage rigidity is of no importance, since, by virtue of the Phillips mechanism, unemployment returns to its natural rate. Hence, BTS policy is the correct label.

In case of a *U.S. fiscal expansion falling on nontradables*, BTS suits as a short-term characterization. American workers are locked into nominal wage contracts. This time prices tend to go up considerably, as the fiscal shock is directed at the sheltered sector. This implies a strong cut in real producers' wages and, hence, a substantial increase in output. However, high inflation affects disposable income in two ways. Firstly, with the nominal money stock given, a decline in real cash balances is inevitable. Secondly, the real exchange rate rises, causing the real value of European bonds in hands of U.S.' residents to drop. Moreover, taxes are raised, as the government has to keep its debt under control. These three factors combined, dominate the increase in total real output. Therefore, U.S.' real disposable income falls.

In Europe, the real producers' wages decrease in both sectors, since the drop in producers' prices falls short of the cut in money wages, which move in line with CPI. A substantial appreciation of the ECU is the main explanatory factor for this. Of course, the level of total real output rises. In the medium run, U.S.' disposable income increases, as U.S.' residents receive more interest payments from their own government. As a result, they enjoy a level of spending power that exceeds its initial steady state level. In the long run, however, this type of policy recaptures its status as a BTS policy. As mentioned above, the Phillips mechanism restores the natural rate of unemployment. This time the U.S. suffer from severe production losses in the tradables sector. On balance, total real output shows a substantial decline. This explains to a great extent the decrease in disposable income. Europe keeps benefitting from this policy, owing to a capital income account surplus.

A closer look at Table 1 reveals, that disaggregation matters, at least in the short run. As argued repeatedly in the foregoing paragraphs, a mesoeconomic context requires a careful distinction between a fiscal expansion on tradables and nontradables. The short-term outcomes prove to hinge on the sector to which the shock is administered. On the contrary, in the long run a fiscal expansion invariably turns out to be a BTS policy. Then the stock-flow interactions, notably the state of the capital income account, arising from the net foreign asset position, dominate the picture.

4. The role of financial integration

This section discusses the consequences of financial integration. Following Feldman (1986), we consider the process of financial integration to have proceeded further, the larger capital flows will be provoked by given changes in yield differentials. Alternatively, certain impulses will trigger larger capital flows, attenuating yield differentials, the higher the degree of financial integration. The international capital movements, resulting from given changes in yield differentials, depend on the partial demand elasticities of interest bearing assets with respect to their (expected) yields. By manipulating the values of these elasticities ($\epsilon_{b_{jj}r_j}$, $\epsilon_{b_{jj}r_k}$, $\epsilon_{b_{jk}r_j}$ and $\epsilon_{b_{jk}r_k}$, see

Appendix 1) in the demand equations for domestic and foreign bonds ([A5] through [A8]), one obtains a situation in which any yield differential is absent, at least in the short run. Thus, then the Mundell-Fleming assumption of uncovered interest parity, appropriate indeed for short term only, applies. However, later on, a wedge between the domestic and the expectations-corrected foreign nominal interest rate emerges, since investors are only willing to absorb an increasing supply of bonds from the initiating country in their portfolios, if the corresponding interest rate is higher.Q

The results, as far as they differ from those in Table 1, are presented in Table 2. The outcomes concerning real disposable income are perfectly identical to those in the above case of a low degree of financial integration. With respect to total output in terms of home produced goods the results do differ. In the short run, a *European fiscal expansion falling on domestic tradables* generates a LOC instead of a BTS policy, and a *U.S.' fiscal expansion on nontradables* is a BTN instead of a BLOC policy. The first difference is caused by a relatively small decrease in European nontradables output.

A high degree of financial integration implies an intensified capital inflow into Europe. Now Europe can afford a larger balance of trade surplus and, therefore, a larger increase in its terms of trade.This leads to a decrease instead of an increase of the tradables-nontradables price ratio. Consequently, the difference between the increase in the CPI and therefore the nominal wage rate on the one hand, and the increase in the price of nontradables on the other hand, is relatively small. Therefore, the real producers' wage in the nontradables sector shows a relatively small increase, which explains the comparatively small decrease in the output of nontradables.

The second difference can be explained in a similar way. The main factor underlying this outcome, is a decrease (instead of an increase) in European nontradables output. A high degree of financial integration implies an influx of capital from Europe into the U.S.. Now a European trade balance surplus is required, since the higher capital account deficit outweighs the improvement of Europe's capital income account. Therefore, Europe's external terms of trade fall, since competitiveness must be strengthened. As a result the tradables-nontradables price ratio

TABLE 2 The role of financial integration

Deviations from Table 1, due to a high degree of financial integration

Type of shock	$g_{h1}=1$		$g_{h2}=1$		$g_{n1}=1$		$g_{n2}=1$	
Period	1	∞	1	∞	1	∞	1	∞
y_{d1}								
y_{d2}								
y_1	+	+					-	
y_2				+				
y_{h1}		+						
y_{n1}							-	
y_{h2}								
y_{n2}					+			
r_{n1}								
r_{n2}								
r_1								
r_2								
e_1								
q_h		+		-		+	+	-
q_c	-	+		-		+		-
$p_{t1} - p_{n1}$					-		+	
$p_{t2} - p_{n2}$					+			

increases, despite the rise in the price of nontradables arising from a shift of consumer expenditure towards this category. Consequently, the rise in the price of nontradables falls short of the increase in the CPI and, therefore, money wages. Thus, the real producers' wage rises, implying a decline of nontradables output.

As stated before, in the long run stock-flow interactions dominate the scene. Therefore, divergent long-term outcomes deserve great attention. A *fiscal expansion on tradables* turns out to be a BTN-policy instead of a BLOC-policy, if macroeconomic output is taken into account. A high degree of financial integration implies intensified capital outflows from the passive country. Hence, in the long run the initiating country is confronted with a relatively large net foreign debt. As a result, its capital income account shows a relatively large deficit. In the long run, the current account is in equilibrium, making a (relatively) large balance of trade surplus necessary. Hence, the active country's tradables-output rises, causing total output in terms of home produced goods to increase.

Meanwhile, the passive country's tradables-output sharply declines, due to a mitigation of the rise in private consumption of home produced tradables (as compared to the reference situation). Yet, consumption of tradables increases considerably, higher imports filling the gap. In short, the driving force behind the observed departures is the fact, that a high degree of financial integration leads to a comparatively pronounced ultimate net debtor (rentier) position of the active (passive) country.

However, it should be stressed, that the above observations only apply to the *tradables impulses*. The long-run outcome concerning total real output of *a fiscal expansion on nontradables* is still a BLOC policy. Under a high degree of capital mobility, the gap between real interest rates is narrowed. Consequently, (crowding out of) capital investment and, therefore, especially the capital intensive production of tradables converge. So, as compared to a fiscal expansion on tradables, the present shock causes the initiating country to produce less tradables in the long run, which explains it to remain a BLOC policy. Nevertheless, in the initiating country, the rise of exports and the decline of imports is relatively steep, which is caused by a relatively large increase of the real exchange rate with respect to traded goods. Thus, in the present case

the balance of trade surplus, necessary to finance its debt service requirements, can be brought about with a relative small divergence in tradables output.

5 CONCLUDING REMARKS

The central question in this paper is, to what extent financial integration influences the (spill-over) effects of fiscal policy. This question is dealt with, by focusing on the qualitative effects and spill-over effects of the various policy measures. These (spill-over) effects are measured in terms of real disposable income as well as total real output, serving as indicators of the regions' spending power and productive effort, respectively.

Using the first measure, it is shown that, within certain boundaries of the behavioural parameters of the model, *financial integration does not influence the qualitative (spill-over) effects of fiscal policy*. If total real output is used to characterize the configuration of these (spill-over) effects, financial integration turns out to be relevant for the outcomes of fiscal policy. Especially in the long run, it causes fiscal expansion spent on tradables to generate divergent configurations. Financial integration proves to enlarge the long run net foreign debt of the active country and, therefore, to reinforce the rentier position of the passive country.

Such a divergence is absent, if the fiscal expansion falls on nontradables, which is only one out of many indications emerging from this analysis, that disaggregation matters. Sectors are a fact of life and so are governments, buying tradables as well as nontradables. Therefore, if disaggregation causes fiscal policy to generate different (spill-over) effects depending on the sector on which it falls, pure macroeconomic policy recommendations are not unconditionally reliable. This raises the intriguing problem of the degree of disaggregation, which would indeed permit robust policy statements.

Sensitivity analysis shows, that the above results depend on the relative factor intensity. Obstfeld (1988), reaches the same conclusion, although in our analysis its role is not as crucial as in his study.

Moreover, the relative size of the industries involved, also influences the results to some extent.

Financial markets, goods markets and labour markets integration are considered to be sucessive phases in the process towards full economic integration. The analysis of the latter two phases can be accomplished within the framework of the model used in this study.

In a substantial number of cases, the results with respect to total output are compounds of opposite results for the sectors involved. A crucial condition here is, that the assumed excess supply of labour in one sector can be transferred costlessly to the other. This raises the question of what happens, if labour, qualified for work in the expanding sector, may become a bottle-neck. This would be due to labour being sector-specific, at least temporary. Such an assumption could prevent unemployed workers to move from the contracting sector towards the work available in the prosperous sector. The existence of imperfect intersectoral labour mobility may force a country to undergo a costly reallocation proces with employment and output losses. Allowing for temporary sector specificity of labour, therefore, is another possible extension of the present analysis.

REFERENCES

Allen, P.R. (1991), 'Open Economy Macroeconomics, A Review Essay', *Journal of Monetary Economics*, Vol. 27, pp 151-156.

Branson, W. (1983), 'Macroeconomic Determinants of Real Exchange Rate Risk', in R.J. Herring (ed.), *Managing foreign exchange risk*, Cambridge University Press, Cambridge, pp. 33-74.

Branson and D.W. Henderson (1985), 'The Specification and Influence of Asset Markets', in R.W. Jones and P.B. Kenen (eds.), *Handbook of International Economics, Vol. II*, Elsevier Science Publishers B.V., pp. 749-805.

Buiter, W. (1986), 'Fiscal Prerequisites for a Viable Managed Exchange Rate Regime: A non-technical eclectic introduction', *Praeadviezen voor de Vereniging voor de Staathuishoudkunde*, Stenfert Kroese, Leiden, pp. 99 - 117.

Buiter,W. (1987), 'Fiscal Policy in Open Interdependent Economies', in: A. Razin and E. Sadka (eds.), *Economic Policy in Theory and Practice*, London.

Corden, W and S. Turnovsky (1983), 'Negative International Transmission of Economic Expansion', *European Economic Review* , 16, pp 291-310.

Deardorff, A.V. and R.M. Stern (1986), *'The Michigan Model of World Production and Trade: Theory and Applications'*, MIT Press, Cambridge, Ma.

ECONOMIC JOURNAL, THE (1991), vol. 101, no 404.

Feldman, R. (1986), *Japanese financial markets: deficits, dilemma, and deregulation*, MIT Press, Cambridge, Ma

Frankel, J.A.(1989), 'Quantifying capital mobility in the 1980s', *NBER Working Paper*, no.2856.

Frenkel, J.A. and A. Razin (1987), *Fiscal Policies and the World Economy*, MIT Press Cambridge, Ma.

Goodhart, C. (1989), *Money, Information and uncertainty,,MacMillan*, London, New York.

Groof, R.J. de and E. Schaling, (1991), 'Monetary and Fiscal Policy in Interdependent Two-Sector Economies', *De Economist*, forthcoming.

Groof, R.J. de and M.A. van Tuijl (1991), 'Budgettaire Politiek, Interdependentie en Sectoranalyse' (Fiscal Policy, Interdependence and Mesoeconomics), *Maandschrift Economie*, forthcoming.

Haas, R.D. and P.R. Masson, 'MINIMOD: specification, simulation and results', *IMF Staff papers, Vol 33, No 4, 1986,pp 722-767.*

Karakitsos, E. (1989), 'Monetary Policy, Exchange Rate Dynamics and the Labour Market', *Oxford Economic Papers*, vol. 41, no. ,pp. 410-433.

Keuzenkamp, H.A. and F. van der Ploeg (1990), Saving, Investment, Government Finance and the Current Account: the Dutch Experience, *Discussion Paper,No.9049, CentER for Economic Research*, Tilburg University .

Klundert, Th. van der (1990), 'Crowding Out of Private and Public Capital Accumulation in an International Context', mimeographed paper, Tilburg University.

Klundert, Th. van der (1991), 'Reducing External Debt in a World with Imperfect Asset and Commodity Substitution', *European Journal of Political Economy*, no.7, pp 17-40.

McKinnon, R.I. (1990), 'Why Floating Exchange Rates Fail: A Reconsideration of the Liquidity Trap', *Open Economies Review*, 1, no. 3, pp. 229-250.

Obstfeld, M. (1988), 'Fiscal Deficits and Relative Prices in a Growing World Economy', *NBER Working Paper*, no. 2725,

Prachowny, M.F. (1984), *'Macroeconomic Analysis for Small Open Economies'*, Clarendon Press, Oxford.

Pasinetti, L. (1981), *'Structural Change and Economic Growth: a Theoretical Essay on the Dynamics of the Wealth of Nations'*, Cambridge University Press.

Ploeg, F. van der (1988), 'International Interdependence and Policy Coordination in the OECD Economies', *Greek Economic Review*, 10, no. 1, pp. 1-48.

Ploeg, F. van der (1991 a), 'Macroeconomic policy coordination during the various phases of economic and monetary integration in Europe', in: Emerson M. (ed), *The Economics of EMU* , vol II, pp. 82-113, Brussel.

Ploeg, F. van der (1991b), *'Money and Capital in Interdependent Economies with Overlapping Generations*, *Economica*, 58, pp. 233-256.

Ploeg, F. van der and A.J. Markink (1991), 'Dynamic Policy in Linear Models with Rational Expectations of Future Events, A Computer package', *Computer Science in Economics and Management*, Vol. 4, no 3, pp 175-199.

Rankin, N. (1991), *'Exchange Rate Risk and Imperfect Capital Mobility in an Optimising Model'*, Discussion Paper 9116, CentER for Economic Research, Tilburg University.

Ribe, F.C. and W.J. Beeman (1986), 'The Monetary-Fiscal Mix and Long-Run Growth in an Open Economy', *American Economic Review*, Papers and Proceedings,

Tobin, J. and J.B. de Macedo (1980), 'The Short-Run Macroeconomics of Floating Exchange Rates: an Exposition', in: Chipman, J. and C. Kindleberger (eds) , *Flexible Exchange Rates and the Balance*

of Payments, Essays in Memory of Egon Sohmen, pp.5-23, North-Holland Publishing Company.

Turnovsky S. (1977), *'Macroeconomic Analysis and Stabilization Policy'*, Cambridge University Press, chapter 3.

Verbruggen, J.P. (1988), 'Two recent trends combined in an econometric model for the Netherlands: the supply-side and sectoral approach' in: *Economic Modelling in the OECD Countries*, H. Motamen (ed.), Chapman and Hall, London/New York, pp. 353-380.

APPENDIX 1 THE LINEAR MODEL AND THE NUMERICAL ASSUMPTIONS

The model presented in section 2 is linearized around a symmetrical steady state solution. Now, variables are expressed as relative deviations. However, for the rates absolute instead of relative deviations are taken in case no tilde is used. This means that a tilded variable still refers to its initial steady state value. The numbers of equations correspond with the numbers given in section 2. All coefficients are positively defined. Their numerical values are given below.

Portfolio submodel

$$r_{n_j} = r_j + \Delta p^e_{c_j} \qquad \text{(A1)-(A2)}$$

$$m_j = \varepsilon_{m_{y_d}} y_{d_j} + we_j - \varepsilon_{m_j r_j} \left(\frac{r_{n_j}}{\tilde{r}}\right) \qquad \text{(A3)-(A4)}$$

$$b_{jj} = -\varepsilon_{b_{jjy_d}} y_{d_j} + we_j + \varepsilon_{b_{jj}r_j} \left(\frac{r_{n_j}}{\tilde{r}}\right) - \varepsilon_{b_{jj}r_k} \left(\frac{r_{n_k} + \Delta e^e_j}{\tilde{r}}\right) \qquad \text{(A5)-(A6)}$$

$$b_{jk} + q_{c_j} = + we_j - \varepsilon_{b_{jk}r_j} \left(\frac{r_{n_j}}{\tilde{r}}\right) + \varepsilon_{b_{jk}r_k} \left(\frac{r_{n_k} + \Delta e^e_j}{\tilde{r}}\right) \qquad \text{(A7)-(A8)}$$

$$m_j = - p_{c_j} \qquad \text{(A9)-(A10)}$$

$$u_j = \gamma_{k_u} \{\gamma_{h_y} \kappa_h (k_{h+1} + p_h) + (1 - \gamma_{h_y}) \kappa_n (k_{n+1} + p_n) - \kappa p_c\} + (1-\gamma_{k_u}) d_j \qquad \text{(A11)-(A12)}$$

$$u_j = \gamma_{b_{jj_u}} b_{jj} + (1-\gamma_{b_{jj_u}}) b_{kj} \qquad \text{(A13)-(A14)}$$

$$we_j = \Omega m_j + (1-\Omega) u_j + \omega f_j, \quad \Omega = \gamma_{m_y} / \omega, \quad \omega = \kappa + \gamma_{d_y} + \gamma_{m_y} \qquad \text{(A15)-(A16)}$$

In the initial steady state it is assumed that $\hat{f}_j = 0$, in which $\hat{f}_j$ denotes the initial steady state value of the net foreign asset position of country j. The relative deviation is defined as $\hat{f}_j \equiv \frac{d\hat{f}_j}{y}$.

The commodity subsystem

$$c_j = \varepsilon_{cy_d} y_{d_j} + \varepsilon_{cw} we_j - \varepsilon_{cr} \left(\frac{r_{n_j} - \Delta p^e_{c_j}}{\tilde{r}}\right) \qquad \text{(A17)-(A18)}$$

$$c_{t_j} = c_j - \varphi_{tn} (p_{t_j} - p_{c_j}) \qquad \text{(A19)-(A20)}$$

$$c_{n_j} = c_j - \varphi_{tn} (p_{n_j} - p_{c_j}) \qquad \text{(A21)-(A22)}$$

$$c_{h_j} = c_{t_j} - \varphi_{hm} (p_{h_j} - p_{t_j}) \qquad \text{(A23)-(A24)}$$

$$c_{m_j} = c_{t_j} - \varphi_{hm} (p_{h_k} + e_j - p_{t_j}) \qquad \text{(A25)-(A26)}$$

$$i_{i_j} = k_{i_j} + \frac{\alpha}{\delta} (k^d_{i_j} - k_{i_j}) \qquad \text{(A27)-(A30)}$$

$$k^d_{i_j} = y_{i_j} - \frac{\varphi_{kl_i}}{\tilde{r} + \delta} (r_{n_j} - \Delta p^e_{i_j}) \qquad \text{(A31)-(A34)}$$

$$y_{i_j} = \lambda_{i_j} l_{i_j} + (1-\lambda_{i_j}) k_{i_j} \qquad \text{(A35)-(A38)}$$

$$y_{h_j} = \gamma_{c_h} c_{h_j} + \gamma_{i_h} i_{h_j} + \gamma_{g_h} g_{h_j} + \gamma_{b_h} c_{m_k} + \gamma_{b_{g_h}} g_{m_k} \qquad \text{(A39)-(A40)}$$

$$y_{n_j} = \gamma_{c_n} c_{n_j} + \gamma_{i_n} i_{n_j} + \gamma_{g_n} g_{n_j} \qquad \text{(A41)-(A42)}$$

$$y_j \equiv \gamma_{h_y} y_{h_j} + (1-\gamma_{h_y}) y_{n_j} \qquad \text{(A43)-(A44)}$$

The labour subsystem

$$\Delta w_j = (1-\zeta_j) \Delta w_{j_{-1}} + \zeta_j \Delta p_{c_j} + \eta l_j - \eta (1-\zeta_j) l_{j_{-1}} \qquad \text{(A45)-(A46)}$$

$$l_{i_j} = y_{i_j} - \varphi_{kl_i} (w_j - p_{i_j}) \qquad \text{(A47)-(A50)}$$

$$l_j \equiv \frac{\gamma_{h_y} \lambda_h}{\lambda} l_{h_j} + \frac{(1 - \gamma_{h_y}) \lambda_n}{\lambda} l_{n_j} \qquad \text{(A51)-(A52)}$$

The dynamic subsystem

$$\Delta k_{i_j} = \delta (i_{i_{j_{-1}}} - k_{i_{j_{-1}}}) \qquad \text{(A53)-(A56)}$$

$$d_j = (1+\tilde{r}_j) d_{j_{-1}} + \gamma_{d_y}^{-1} (g_j - t_j) \qquad \text{(A57)-(A58)}$$

$$t_j = \gamma_{d_y} \beta d_j \qquad \text{(A59)-(A60)}$$

it should be noted that changes in taxes are expressed as a percentage of output ($t_j \equiv \frac{dT_j}{y_j}$, where T denotes the steady state value of lump sum taxes).

$$f_j = f_{j_{-1}} + \Phi (r_k - r_j + \Delta q_{c_j}) + \tilde{r} \Phi (q_{c_j} + b_{jk_{-1}} - b_{kj_{-1}})$$

$$+ \Upsilon (c_{m_k} - c_{m_j} - q_h) + \Psi (g_{m_k} - g_{m_j} - q_h),$$

$$\Phi \equiv (1 - \gamma_{b_{jj_u}})(\kappa + \gamma_{d_y}), \quad \Upsilon \equiv \gamma_{h_y} \cdot \gamma_{m_h}, \quad \Psi \equiv \gamma_{h_y} \cdot \gamma_{b_{g_h}} \qquad \text{(A61)-(A62)}$$

Definitional equations

$$y_{d_j} \equiv \Theta \{ y_j + p_{y_j} - p_{c_j} + \gamma_{d_y} (r_j + \tilde{r}_j d_{j_{-1}}) + \Phi (r_k - r_j + \Delta q_{c_j})$$

$$+ \tilde{r} \Phi (b_{jk_{-1}} + q_{c_j} - b_{kj_{-1}}) - \delta \kappa (k_j + p_{y_j} - p_{c_j}) - t_j$$

$$+ \gamma_{h_y} \kappa_h \Delta p_{h_j} + (1-\gamma_{h_y}) \kappa_{n_j} \Delta p_{n_j} - (\kappa + \gamma_{m_y}) \Delta p_{c_j} \},$$

$$\Theta \equiv (1 - \delta \kappa - \gamma_{t_y} + \tilde{r} \gamma_{d_y})^{-1} \qquad \text{(A63)-(A64)}$$

$$p_{y_j} \equiv \gamma_{h_y} p_{h_j} + (1-\gamma_{h_y}) p_{n_j} \qquad \text{(A65)-(A66)}$$

$$p_{t_j} \equiv \gamma_{h_t} p_{h_j} + (1-\gamma_{h_t}) (p_{h_k} + e_j) \qquad \text{(A67)-(A68)}$$

$$p_{c_j} \equiv \gamma_{t_c} p_{t_j} + (1-\gamma_{t_c}) p_{n_j} \qquad \text{(A69)-(A70)}$$

$$q_{c_j} \equiv e_j + p_{c_k} - p_{c_j} \qquad \text{(A71)-(A72)}$$

$$q_{h_j} \equiv e_j + p_{h_k} - p_{h_j} \qquad \text{(A73)-(A74)}$$

$$e_k = - e_j \qquad \text{(A75)}$$

$$q_{c_k} = - q_{c_j} \qquad \text{(A76)}$$

$$q_{h_k} = - q_{h_j} \qquad \text{(A77)}$$

$$k_j \equiv \frac{\gamma_{h_y} \kappa_h}{\kappa} (k_{h_j} + p_{h_j}) + \frac{(1-\gamma_{h_y}) \kappa_n}{\kappa} (k_{n_j} + p_{n_j}) - p_{y_j} \qquad \text{(A78)-(A79)}$$

$$g_j \equiv \gamma_{h_y} \gamma_{g_h} (g_{h_j} + p_{h_j}) + (1-\gamma_{h_y}) \gamma_{g_n} (g_{n_j} + p_{n_j})$$

$$+ \gamma_{h_y} \gamma_{mg_h} (g_{m_j} + p_{h_k} + e_j) - \{ \gamma_{h_y} (\gamma_{g_h} + \gamma_{mg_h}) + (1-\gamma_{h_y}) \gamma_{g_n} \} p_{c_j} \qquad \text{(A80)-(A81)}$$

Parameter values for the reference situation/situation of a high degree of finacial integration

Partial demand elasticities:

$\varepsilon_{m_{yd}} = 1.0$ (disposable) income-elasticity of real cash balances

$\varepsilon_{m_j r_j} = 0.3$ interest-elasticity of real cash balances

$\varepsilon_{b_{jj} yd} = 0.083$ (disposable) income elasticity of home bonds

$\varepsilon_{b_{jj} r_j} = 0.22/2.687$ elasticity of home bonds held by residents with respect to the domestic nominal interest rate

$\varepsilon_{b_{jj} r_k} = 0.2/2.667$ elasticity of home bonds held by residents with respect to the expected yield on foreign bonds

$\varepsilon_{b_{jk} r_j} = 0.78/10.647$ elasticity of foreign bonds held by residents with respect to the domestic nominal interest rate

$\varepsilon_{b_{jk} r_k} = 0.8/10.667$ elasticity of foreign bonds held by residents with respect to the expected yield on foreign bonds

$\varepsilon_{cyd} = 0.8$ (disposable) income-elasticity of private consumption

$\varepsilon_{cr} = 0.225$ interest-elasticity of private consumption

$\varepsilon_{cw} = 0.1$ (real) wealth-elasticity of private consumption

Elasticity of substitution:

φ_{tn}	= 1.5	between tradable and nontradable consumption goods
φ_{hm}	= 5.0	between 'home produced' and 'foreign produced' tradable consumption goods
φ_{kl_h}	= 0.55	between capital and labour in the tradables-sector
φ_{kl_n}	= 0.55	between capital and labour in the nontradables-sector

Other behavioural parameters:

α	= 0.08	acceleration coefficient
β	= 0.5	tax rule feedback coefficient
ξ_1	= 0.999	nominal wage inertia coefficient for Europe
ξ_2	= 0.001	nominal wage inertia coefficient for the U.S.
η	= 0.1	Phillips coefficient

Initial steady state ratio of:

γ_{k_u}	= 0.8	bonds issued by firms to total supply of bonds
γ_{m_y}	= 0.25	real cash balances to output
$\gamma_{b_{jj_u}}$	= 0.8	holdings of domestic bonds to total bonds holdings of residents
γ_{m_h}	= 0.2667	private sector's imports (exports) to tradables-output
γ_{mg_h}	= 0.0533	government imports to tradables output
γ_{c_h}	= 0.4	private consumption of 'home produced' tradables by residents to tradables output

γ_{c_n} = 0.6667 private consumption of nontradables to nontradables output

γ_{g_h} = 0.08 government expenditure on 'home produced' tradables by the domestic government to tradables output

γ_{g_n} = 0.2 government expenditure on nontradables to nontradables output

γ_{i_h} = 0.2 gross capital investment to tradables output

γ_{i_n} = 0.1333 gross capital investment to nontradables output

γ_{h_y} = 0.5 tradables output to total output

γ_{t_c} = 0.5 consumption of tradables to total private consumption

γ_{h_t} = 0.6 consumption of 'home produced' tradables to total tradables consumption

γ_{t_y} = 0.2 lump sum taxes to total output

γ_{d_y} = 0.75 government debt to total output

Other non-behavioural parameters

δ = 0.0556 rate of technical obsolescence

κ_h = 3.6 capital-output ratio in the tradables sector

κ_n = 2.4 capital-output ratio in the nontradable sector

λ_h = 0.6, wage share in the tradables sector

λ_n = 0.7333 wage share in the nontradables sector

$\tilde{r}$ = 0.0444 real interest rate

APPENDIX 2 SENSITIVITY ANALYSIS

Tables A2 1 through A2 3 summarize the results of the sensitivity analysis. Table A2 1 presents the intervals of robustness of the behavioural parameters with respect to short-and long-run disposable income. They are given for both the reference situation and the situation of a high degree of financial integration.

Tables A2 2a and 2b reveal, only for the variables y_{d_j} and y_j, the deviations from the reference situation (Table 1) and the situation of a high degree of financial integration (Table 2), due to a reversal of the sectors' factor intensities ($\kappa_h < \kappa_n$ instead of $\kappa_h > \kappa_n$). Tables A2 3a and 3b depict, again for the variables y_{d_j} and y_j, the deviations from the reference situation (Table 1) and the situation of a high degree of financial integration (Table 2), due to a variation in the sector structure ($\gamma_{h_y} = 0.9$ instead of $\gamma_{h_y} = 0.5$).[3)]

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3) Experiments with a comparatively small tradables sector ($\gamma_{h_y} = 0.4$ instead of $\gamma_{h_y} = 0.5$) in the reference situation and in the situation of a high degree of financial integration, proved to influence the results only in one case. Namely, under a high degree of financial integration, a European fiscal expansion on tradables is a BTS instead of a LOC policy, as far as real output is concerned.

Table A2 1 Intervals of robustness; reference situation (RS) and the situation of a high degree of financial integration (HDFI)

parameter	reference value	RS t=1	RS $t\to\infty$	HDFI t=1	HDFI $t\to\infty$
φ_{kl_h}	0.55	0.3 - 0.7	0.2 - 1	0.3 - 0.7	0.2 - 1
φ_{kl_n}	0.55	0.3 - 0.7	0.2 - 1	0.3 - 0.7	0.2 - 1
φ_{tn}	1.5	0.25 - 3	0.25 - 3	0.25 - 3	0.25 - 3
φ_{hm}	5	3 - 8	3 - 300	3 - 8	3 - 300
ϵ_{cy_d}	0.8	0.6 - 0.9	0.6 - 0.9	0.7 - 0.9	0.6 - 0.9
ϵ_{cw}	0.1	0 - 0.25	0 - 0.25	0.05 - 0.25	0.05 - 0.25
ϵ_{cr}	0.225	0.1 - 0.45	0.01 - 0.5	0.1 - 0.45	0 - 0.45
$\epsilon_{m_j r_j}$	0.3	0.15 - 0.45	0.1 - 0.6	0.15 - 0.45	0.1 - 0.6
$\epsilon_{m_j y_d}$	1	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2
α	0.08	0.01 - 0.15	0.01 - 0.15	0.01 - 0.15	0.01 - 0.15
β	0.5	0.3 - 1	0.2 - 1	0.3 - 1	0.1 - 1
η	0.1	0.01 - 0.5	0.01 - ∞	0.01 - 05	0 .01 -
ζ_1	0.999	0.95 - 1	0.8 - 1	0.95 - 1	0.8 - 1
ζ_2	0.001	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.2

The role of technology

Table A2 2a
Deviations from the reference situation (Table 1), due to a reversal of the sectoral factor intensities ($\kappa_h < \kappa_n$)

Type of shock	$g_{h1}=1$		$g_{h2}=1$		$g_{n1}=1$		$g_{n2}=1$	
Period	1	∞	1	∞	1	∞	1	∞
y_{d1}								
y_{d2}							+	
y_1	+				-			
y_2		+		+		+		+

Table A2 2b
Deviations from the situation of a high degree of financial integration (Table 2), due to a reversal of the sectoral factor intensities ($\kappa_h < \kappa_n$)

Type of shock	$g_{h1}=1$		$g_{h2}=1$		$g_{n1}=1$		$g_{n2}=1$	
Period	1	∞	1	∞	1	∞	1	∞
y_{d1}		-						
y_{d2}							+	
y_1					-		+	
y_2				-				-

The role of the sector structure

Table A 3a

Deviations from the reference situation (Table 1),
due to a comparatively large tradables sector (γ_{hy} = 0.9)

Type of shock	g_{h1}=1		g_{h2}=1		g_{n1}=1		g_{n2}=1	
Period	1	∞	1	∞	1	∞	1	∞
y_{d1}								
y_{d2}								
y_1	+							
y_2								

Table A2 3b

Deviations from the situation of
a high degree of financial integration (Table 2),
due to a comparatively large tradables sector (γ_{hy} = 0.9)

Type of shock	g_{h1}=1		g_{h2}=1		g_{n1}=1		g_{n2}=1	
Period	1	∞	1	∞	1	∞	1	∞
y_{d1}								
y_{d2}							+	
y_1		-			-			
y_2				-			+	

APPENDIX 3 FIGURES

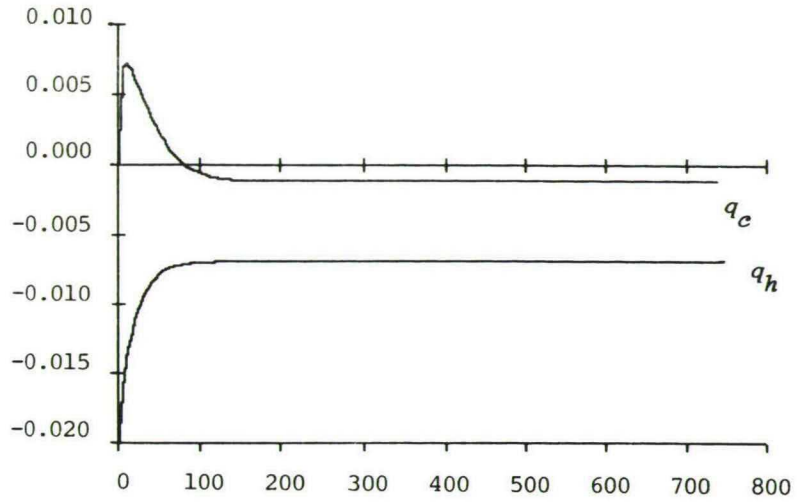

Figure A 1a Effects of g_{h_1} = 1 in case of a low degree of financial integration

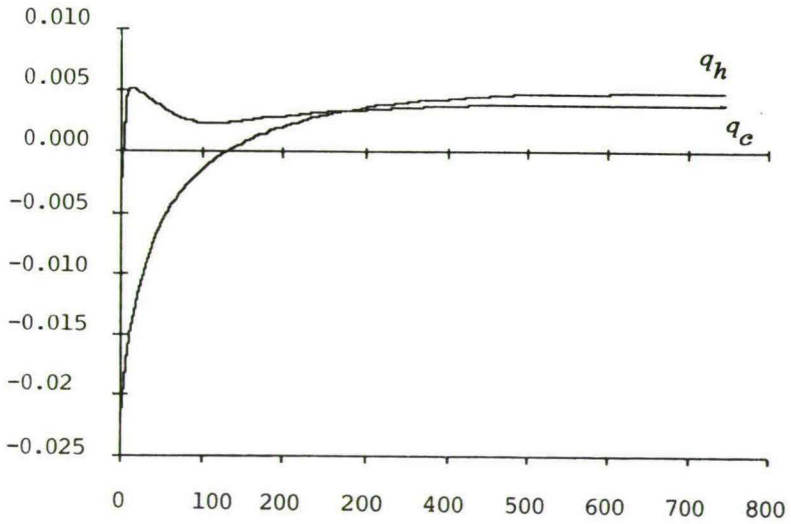

Figure A 1b Effects of g_{h_1} = 1 in case of a high degee of financial integration

$\hat{r}$

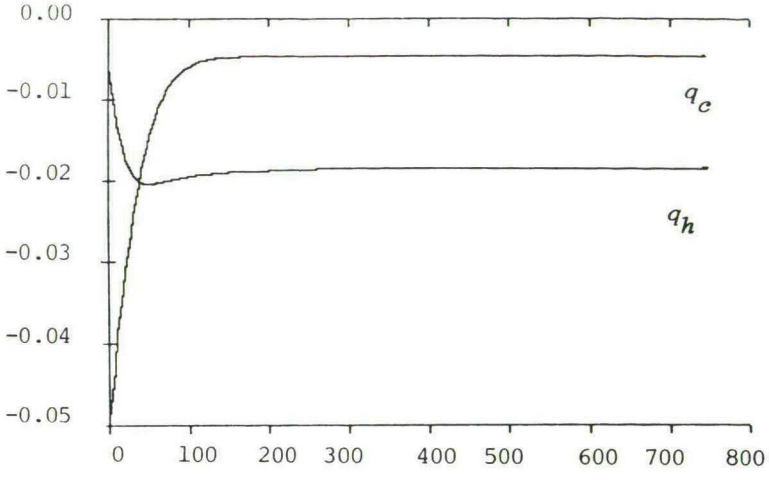

Figure A 2a Effects of g_{n_1} = 1 in case of a low degree of financial integration

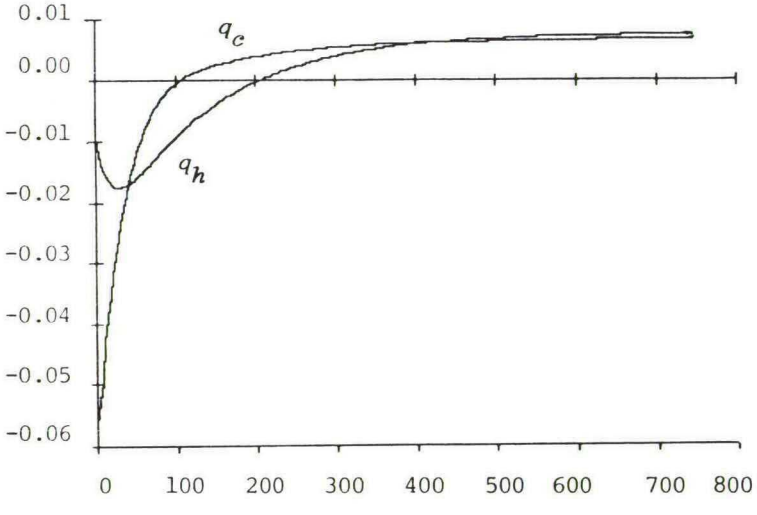

Figure A 2b Effects of g_{n_1} = 1 in case of a high degee of financial integration

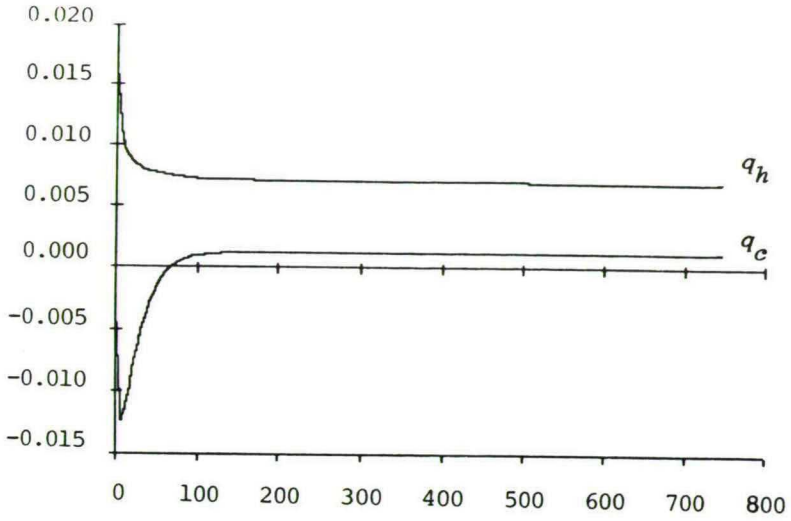

Figure A 3a Effects of g_{h_2} = 1 in case of a low degree of financial integration

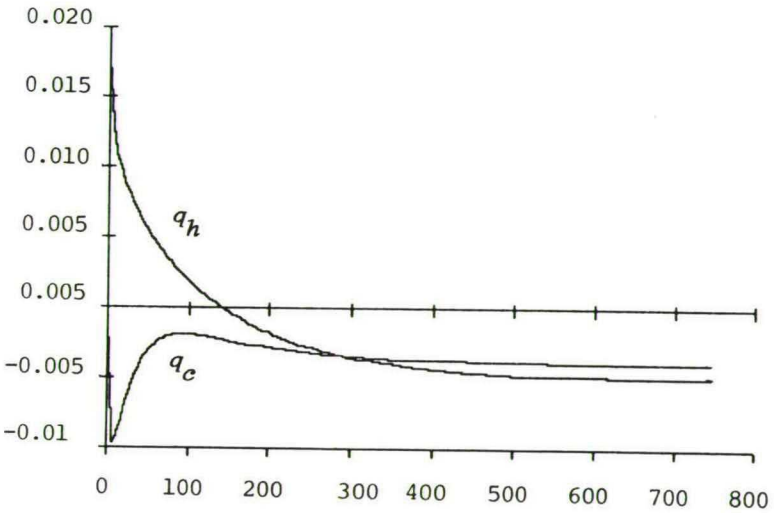

Figure A 3b Effects of g_{h_2} = 1 in case of a high degee of financial integration

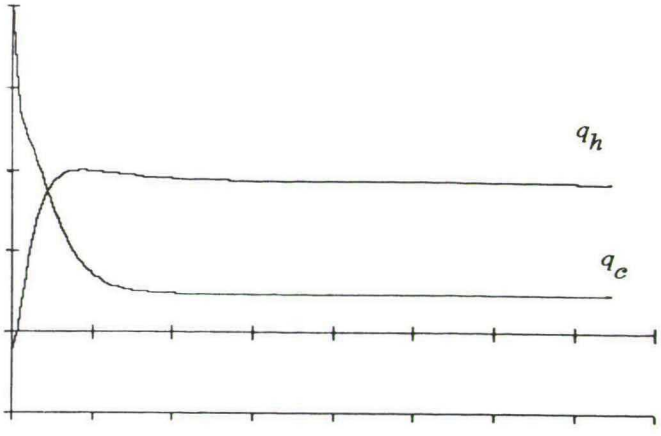

Figure A 4a Effects of g_{n_2} = 1 in case of a low degree of financial integration

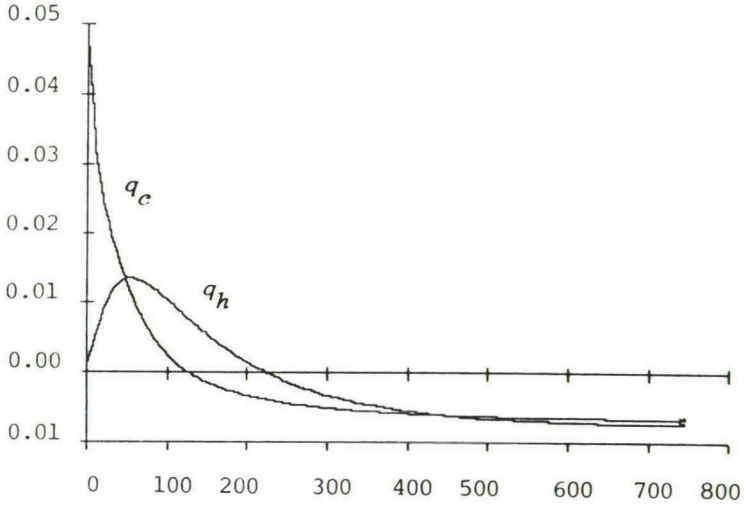

Figure A 4b Effects of g_{n_2} = 1 in case of a high degee of financial integration

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Basics of inventory management: Part 5
The (R,b,Q)-model

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Basics of inventory management: Part 6
The (R,s,S)-model