ETLA ELINKEINOELÄMÄN TUTKIMUSLAITOS
THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
Lönnrotinkatu 4 B 00120 Helsinki Finland Tel. 609 900 Telefax 601753

Keskusteluaiheita - Discussion papers

No. 432

Kari Alho

TERMS-OF-TRADE BOOMS, SECTORAL ADJUSTMENT AND FISCAL POLICY IN A SMALL OPEN ECONOMY*

* An earlier version of the paper was presented under the title "Does a rise in the terms of trade eventually lead to a contraction of the open sector" at the VII Annual Congress of the European Economic Association, in Dublin, August 1992.

ISSN 0781-6847

18.02.1993

ALHO, Kari, **TERMS-OF-TRADE BOOMS, SECTORAL ADJUSTMENT AND FISCAL POLICY IN A SMALL OPEN ECONOMY.** Helsinki: ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 1993. 27 p. (Keskusteluaiheita, Discussion Papers, ISSN 0781-6847; no. 432).

ABSTRACT: The paper analyses the dynamic effects of an improvement in the terms of trade on macroeconomic and sectoral adjustments in a two-sector model with intertemporal optimization and home-built capital. It is shown that in a small open economy under these conditions there is no resource movement effect and that the approximative condition for the open sector to contract is that the instantaneous demand elasticity of substitution between foreign and domestic goods is lower than unity. Fiscal policies, constrained by the intertemporal government budget constraint, are shown to aggravate the expansion or contraction of the open sector.

KEY WORDS: Two-sector model, terms of trade, fiscal policy

Kari Alho

TERMS-OF-TRADE BOOMS, SECTORAL ADJUSTMENT AND FISCAL POLICY IN A SMALL OPEN ECONOMY

1. Introduction

From the literature on the Dutch disease it is well known that a resource boom may lead to deindustrialization, see e.g. Neary (1985) and Corden and Neary (1982). The possibility that the initial deindustrialization reverses itself over time has also been raised by Mansoorian (1991). Normally, there is no capital accumulation in these models. In this paper a two-sector dynamic model is used to show how a small open industrial economy with capital accumulation adjusts to an improvement in the terms of trade and whether the open sector - where the boom originated - contracts in the end.

We build a dynamic perfect foresight model for a small open economy emphasizing the interplay between open sector firms, their capital investment and wages, on the one hand, and the role of consumer expenditure and the dynamics of wealth accumulation of households and government finances, on the other.[1]

---

[1] In many dynamic models of the open economy households are in fact not only owners and workers of firms but also at the same time entrepreneurs; therefore wage formation is a transfer price which can be neglected as having no effect on the combined owner-worker decision units comprising the economy, see e.g. Roldos (1991) and Turnovsky and Sen (1991).

Normally in the Dutch disease literature there is a resource movement effect and a spending effect which determine the sectoral outcome related to the terms-of-trade shock. We show that in a small open economy with endogenous capital accumulation there is no resource movement effect and only the spending effect determines the long-run solution of the economy. Therefore, it is straightforward to derive a condition whether the open sector expands or contracts after an improvement in the terms-of-trade. The sufficient condition for the open sector to contract is that the elasticity of substitution in consumption is less than unity between the domestically produced and foreign goods.

The model also incorporates the intertemporal budget constraint of the government and considers the role of fiscal policies in the adjustment, which is a novel feature in the literature on the Dutch disease. It is shown that fiscal policies do not determine whether the open sector begins to contract or expand, but it will accentuate the reaction of the economy.

The background behind the paper is the fact that many countries have witnessed export led booms to culminate in a recession with serious competitiveness problems in the export sector. This has been witnessed e.g. by Finland in the late 1980's. One reason behind this development, raised in the popular debate, is the fact that, as government revenues rise

in the boom, the government has the temptation to expand its expenditure and thereby tightens the scarcity of resources.

The paper is organized in the following manner. In section 2 we present the model and the behaviour of households, the firms in the two sectors, and the government. Section 3 describes the long-run equilibrium. The dynamic adjustment and the two alternatives of a contraction vs. expansion in the open sector after a positive terms-of-trade shock are considered in section 4. Section 5 analyses fiscal policies and section 6 concludes.

2. The model

In our economy the open sector is defined so that it exports all its production. Thus the country buys from abroad all the tradables it needs. This separation of export and import goods is done in order to increase the realism and due to analytical convenience. The open sector uses production inputs from the domestic sheltered sector only in its investment outlays. The substitution between domestic production and import goods takes place in the consumption expenditure of the households.

The sheltered sector operates under the quantity constraint of effective demand, comprised of the consumption, investment and public demand directed towards these goods. The open sector is a price taker facing no quantity constraint in the world market, but in the short run it is constrained by the fixed capital stock.

Capital is a specific production factor of the open sector. The capital stock of the open sector is produced by the domestic sheltered sector which only uses labour, hence the model resembles the Austrian model. This assumption is not, however, crucial to the results of the paper. We assume that the firms in the sheltered sector operate under perfect competition and constant returns to scale with no pure profits and hence no dividends. The open sector also operates under constant returns to scale and competition. But as the firms in this sector use a specific production factor, in the short run they may earn a rent which is distributed as dividends to the households.

The labour market is homogeneous implying that the wage rate is the same in the two sectors. The assumption of a uniform wage rate related to a homogeneous and competitive labour market means that labour flows freely between the two sectors.

The domestic monetary sector is of the following kind. A fixed exchange rate is assumed throughout, the capital movements are perfectly elastic and the fixed exchange rate is taken to be completely credible; therefore the domestic interest rate i is the same as the foreign rate i*.

For simplicity, let us assume that the economy consists of identical household dynasties, each with an infinite planning horizon and the same constant subjective time preference Ω. The households are owners of the firms.

The aggregate budget constraint of the households in nominal

terms is

$$(1) \qquad \dot{A} = iA + (1-\tau)WL + \pi_O - P_N c_N - P_S c_S \ ,$$

where A is the nominal wealth, i the interest rate, W the wage rate and L labour input, τ the tax rate on labour income, π_O the dividends, equal to the profit of the open sector, c_N the consumption of the import good and c_S that of the domestically produced sheltered sector good, and P_i is the price of c_i. Aggregate consumption, to be defined through the instantaneous utility function (see p. 9 below), is denoted by c and the corresponding price index by P_c. A dot above a variable denotes the time derivative.

As households are owners of the firms, their nominal wealth is

$$(2) \qquad A = qK_O + D_g + F,$$

where K_O is the capital stock in the open sector, q its market price in the equity market, D_g the public debt and F holdings of foreign assets by the households.[2] Over time, the nominal wealth accumulates through savings and capital gains, i.e.

$$(3) \qquad \dot{A} = \dot{q}K_O + q\dot{K}_O + \dot{D}_g + \dot{F} = \dot{q}K_O + S,$$

where S is saving, i.e. income less consumption. The nominal income of the households consists of the after-tax wage income, the profits of the open sector firms which are distributed as dividends to households and the interest income

---

[2] In (2), the government debt is assumed to be valued at its face value as the nominal interest is always taken to be the same as abroad.

earned on foreign assets and government debt. In the following all real variables are defined in terms of the imported consumer good, which has the analytical convenience that the real interest rate is constant over time as we keep the nominal foreign interest i* fixed. The import good price P_N is also unchanged over time. The after-tax aggregate wage income and profits in the open sector together make the value of domestic production less the wage taxes. So we have the following expression for household income

$$(4) \qquad P_N y_h = PQ - \tau WL + i^*(F+D_g) \ ,$$

where y_h is the real household income, and P and Q are the price and volume of aggregate production, respectively. The accumulation of the real wealth $a = A/P_N$ over time can thereby be written with the aid of (3) and (4) in the following way

$$(5) \qquad \dot{a} = y_h - c + \frac{\dot{q}}{P_N} K_o \ .$$

Next, we substitute from the government budget constraint, to be introduced more closely below in (9), for the taxes on labour income in (4) and then substitute y_h from (4) into (5). Differentiating the definition of real wealth in (2) with respect to time and substituting this into the left-hand side of (5) gives us with some manipulation the dynamic budget constraint of the households,

$$(6) \qquad \dot{f} = \frac{PQ}{P_N} + rf - \frac{q}{P_N}\dot{K}_o - a_s wg - \frac{P_c}{P_N} c \ .$$

Here f is the real stock of foreign assets, i.e. F/P_N, and r is the real interest rate, i.e. $i^*-(\dot{P}_N/P_N)=i^*$. In effect (6) is

the current account identity of the economy, i.e. income less expenditure.

The government is in many macro models described as purchasing some of the private goods, which then do not yield any welfare for the private sector. Another, more realistic solution is to identify the government services as separate goods, which then have value for the private sector as in Turnovsky and Sen (1991). A third specification would be that the government buys goods (services) produced by the private sector and extends them free of charge to the private sector. However, to simplify the exposition, we have stuck here to the traditional specification. As was mentioned above, the government collects taxes by levying a proportional tax on labour income at the tax rate τ. For simplicity, profits are not taxed.

The government nominal budget deficit, i.e. the increase in the government nominal debt D_g is accordingly,

$$\dot{D}_g = a_s W g - \tau W L + i D_g \quad , \tag{7}$$

where the first term is the nominal government expenditure, with g being the volume of expenditure, see (19) below. The term $a_s g$ describes the labour input needed to produce the amount of the sheltered sector good demanded by the government. The dynamics of the real government debt $d_g = D_g/P_N$ are then

$$\dot{d}_g = w(a_s g - \tau L) + r d_g \quad , \tag{8}$$

where w is the real wage W/P_N. In an equilibrium with a positive government debt, the share of public sector employment in

total employment has to be less than the tax rate.

By integrating (8) forward in time and using the standard transversality condition we get

$$(9) \qquad d_g(0) = \int_0^{\infty} R_t(\tau wL)_t dt - \int_0^{\infty} R_t(a_s wg)_t dt \ ,$$

where R_t is the discount factor between 0 and t, i.e.

$$(10) \qquad R_t = e^{\int_0^t -i^*(s)ds} \ .$$

As the titles to real capital are internationally traded and so the equity of the open sector firms is a perfect substitute for foreign and domestic bonds, we have the arbitrage condition,

$$(11) \qquad \frac{P_o F_K}{q} + \frac{\dot{q}}{q} = i^* \ .$$

Integrating this forward in time gives the price of equity in period 0,

$$(12) \qquad q(0) = \int_0^{\infty} R_t(P_o F_K)_t dt \ .$$

After these preliminaries, let us turn to derive the behaviour of households and firms. We specify the household decision making to comprise of two stages. In the first stage the aggregate consumption - saving and labour supply decisions are made in an intertemporal context and in the second stage the aggregate consumption expenditure is allocated into the two items, import and domestic sheltered sector goods.

Assume that the consumer maximizes the following intertemporal

objective function,

$$(13) \qquad \int_0^{\infty} e^{-\Omega t}[\log u(c)-z(L)]dt \ , \text{ where } z' > 0, \ z'' > 0 \text{ and}$$

we have assumed that consumption and leisure are separable from each other in the preferences of the households. Assume then that in the second stage the instantaneous utility function $u(c_N,c_S)$ is the aggregate consumption index c, which is a CES quantity index. This structure of consumer behaviour is the same as that used by Grossman and Helpman, see e.g. their (1991) paper. The price index P_c is then the corresponding CES index. We can solve for the consumption expenditure to be

$$(14) \qquad c_S = b_S c[P_S/P_c]^{-\Gamma} \ , \ c_N = b_N c[P_N/P_c]^{-\Gamma} \ ,$$

where the b_i's are the distribution parameters summing to unity and Γ is the substitution elasticity as specified by the CES-utility function.

The current value Hamiltonian of this optimization problem, with α being the shadow price of wealth, is

$$(15a) \quad \log c - z(L) + \alpha[rf+(q/P_N)\dot{K}_O-a_S wg-\frac{P_c}{P_N}c] \ .$$

The solution is provided by the conditions,

$$(15b) \qquad c^{-1} = \frac{P_c}{P_N}\alpha,$$

$$(15c) \qquad z'(L) = \alpha(1-\tau)w,$$

$$(15d) \qquad \dot{\alpha} = (\Omega-i^*)\alpha \ .$$

In order to be able to produce a steady-state equilibrium with

a fixed price level we have to assume in (15d) that $\Omega = i^*$. Now the shadow price of wealth and also the value of aggregate consumption determined by (15b) are constant over time.

This level of constant aggregate consumption can be solved from the intertemporal budget constraint, which is derived from (5) by integrating forward in time,

$$(16) \qquad \frac{P_C}{P_N} c = \Omega[\bar{Q}(0)+f(0)+(q/P_N)K_O(0)-\bar{G}(0)-\bar{I}(0)],$$

where $\bar{Q}$ is the present value of aggregate production

$$(17a) \qquad \bar{Q}(0) = \int_0^\infty R_t(P/P_N)_t Q_t dt,$$

$\bar{G}$ is the present value of government expenditure

$$(17b) \qquad \bar{G}(0) = \int_0^\infty R_t(wa_S g)_t dt ,$$

and $\bar{I}$ is the present value of rents on capital in the open sector, i.e. the dividends,

$$(17c) \qquad \bar{I}(0) = \int_0^\infty R_t\left(\frac{P_O F_K}{P_N}\right)_t dt ,$$

and other terms in (16) are the initial stocks. The portfolio behaviour of the households is very simple as assets are assumed to be perfect substitutes for each other: the growth in equity is determined by the firm investment, see (20) below, the issues of government bonds are determined through the government budget constraint and the rest of household savings flows into foreign assets. The private sector may also hold a money stock which is endogenous through capital move-

ments.

Let us now turn to firm behaviour. As mentioned above, we distinguish the two production sectors in such a way that only the open sector uses capital in its production, while both sectors use labour. So, capital is a specific factor for the open sector. Both sectors are assumed to produce under constant returns to scale. The production functions are the following,

(18) $$Q_o = F(K_o, L_o) \text{ and } Q_s = L_s/a_s \ ,$$

where as a new symbol a_s is the labour input needed per unit of output in the S sector. The equilibrium in the aggregate labour market constrains the production in the economy. Perfect competition in the sheltered sector gives us the price of good S,

(19) $$P_s = a_s W \ .$$

The capital stock in physical terms and the titles to it in the equity market are identical. As we have assumed the open sector firms always to distribute any pure profits as dividends (and get a similar reimbursement if the profit is negative), the value of equity E of the firms cumulates according to the value of investment,

(20) $$\dot{E} = P_s I,$$

where as defined above, P_s is the price of the investment good and I the volume of investment. Of course, this home built capital is only a crude approximation of reality, and we could more generally specify the open sector to use also imported

investment goods. However, the open sector normally also uses domestic intermediate inputs in its production and one way to describe this situation is as we have done here. We could formulate the decision making of a firm in such a way that there are convex adjustment costs related to investment. However, we can rule out infinite rates of investment as the investment goods are produced by the sheltered sector and the structure and dimensions of the model can be kept simple with this specification. The open sector firm maximizes the present value of its pure profits

$$(21) \qquad \int_0^{\infty} R_t(P_{Ot}F(K_t, L_{Ot}) - W_t L_{Ot} - i^* E_t)dt,$$

where the firm has to pay at least the interest rate on its equity. This maximization is done subject to the financing constraint (20) and the accumulation of the capital stock,

$$(22) \qquad \dot{K}_t = I_t - \delta K_t \ ,$$

where δ is the rate of depreciation. The optimum conditions are the following

$$(23a) \qquad F_L(K_O, L_O) = W/P_O \ ,$$

$$(23b) \qquad \alpha P_S + \mu = 0 \ ,$$

$$(23c) \qquad \dot{\alpha} = i^* + i^*\alpha \quad \text{and}$$

$$(23d) \qquad \dot{\mu} = -P_O F_K + \mu(\delta + i^*),$$

where α and μ are the costate variables of constraints (20) and (22), respectively. As the open sector is in the short-run constrained by its capital stock, we solve from condition (23a) the labour demand as a static profit maximization condi-

tion given the capital stock,

$$(24) \qquad L_{ot}^{d} = K_{ot}g(W_t/P_{ot}), \; g' < 0.$$

The optimal capital stock is then determined identically as in the seminal result in investment theory pioneered by Jorgenson (1963),

$$(25) \qquad P_o F_K = P_s(i^*+\delta-\dot{P}_s/P_s) \; .$$

3. The long-run solution of the model

In the model of a small open economy, there is a dichotomy between prices and quantities so that prices are basically determined by the supply side from abroad, and they are not dependent on the domestic economy, while quantities are determined jointly by prices and demand in the home economy. This is also valid in the model above. The equilibrium pricing relations are

$$(26) \qquad P_o = r_o\frac{K_o}{Q_o} + W\frac{L_o}{Q_o} = [a_s(i^*+\delta)\frac{K_o}{Q_o} + \frac{L_o}{Q_o}]W,$$

where we have used the pricing relation for the sheltered sector in (19) above and the fact that in equilibrium the rental r_o is equal to the value of the marginal product in (25). From (26) we can solve for the wage rate to be proportional to the price level of the open sector. Furthermore, from (19), the ratio of the factor prices is a constant which implies that the capital-labour ratio is a constant. This in turn implies that the marginal product of capital in (25) is a

constant irrespective of capital.[3] This fits in with the small open economy model, where it is assumed that the small economy is not constrained by demand in foreign markets, but only by supply. In effect, this means that the investment equation does not have an independent role in the sense of determining the capital allocation in the economy, but rather it is a relationship which determines the wage rate: (26a) and (25) are the same function. When the capital stock is not determined by investment demand, it is determined by supply, i.e. by the amount of resources available for capital investment, see (26) below. It should be added that this result does not depend on the specification of the production technology specified in (18), as the result is the same even if also the sheltered sector uses capital.

4. The dynamic solution of the model

Let us first state the momentary equilibrium of the labour market. This is given by

$$(26) \qquad L_o^d + a_s[c_s+g+\dot{K}_o+\delta K_o] = L^s(w) \ .$$

Here on the left-hand side we have the labour demand by the open and sheltered sectors. The latter term depends on the consumption demand for good S, the government demand, and the investment demand by the open sector. On the right-hand side

---

[3] The marginal product of capital can be written as follows, $F_K = F_K(K_o/L_o) = F_K(g)$ where we have used (24). As the product wage in the adjustment is constant, see below, F_K does not depend on the capital stock.

labour supply L^s is given by (15c). We solve (26) for the growth in the capital stock,

$$(27) \qquad \dot{K}_o = -c_s - g + (1/a_s)(L^s - L_o^d) - \delta K_o \ .$$

As the value of aggregate consumption is in a perfect foresight situation constant over time, see (15b) above, it is easy to see that the demand c_s for the domestic sheltered sector goods changes as a function of the wage rate in the perfect foresight equilibrium path in the following way,

$$(28) \qquad d\log(c_s) = -[s_s + \Gamma(1-s_s)]d\log(W),$$

where s_s is the budget share of sheltered sector goods in consumer expenditure. This means that as wages rise, the consumer expenditure for the domestic good diminishes. After inserting this into (27), we can now write

$$(29) \qquad \dot{K}_o = K(K_o, W, g), \text{ where } K_1 < 0,\ K_2 > 0,\ K_3 < 0.$$

The impact of government expenditure is discussed later on in section 5.

The desired capital stock was derived in (25) by equating the marginal product of capital with the user cost of capital. On the basis of what has been said above in section 3, the value of the marginal product can be written as follows

$$(30) \qquad P_o F_K = P_o F_K(K_o, W/P_o),\ F_1 = 0,\ F_2 < 0.$$

Now we can solve the investment equation (25) for the wage dynamics,

$$(31) \qquad \dot{W} = G(W, K_o, P_o),\ G_1 > 0,\ G_2 = 0 \text{ and } G_3 < 0.$$

The whole dynamic model consists of the dynamics for the wage rate and the capital stock in the open sector, the wealth accumulation of the households and the dynamics of government debt. However, the two last items are incorporated in the consumption expenditure, which is constanrt over time, and have therefore been taken into account above and they are in a way a residual in the application of the model we consider here. Therefore in effect the model consists of the equations (29) and (31), which form a recursive dynamic system for K_o and W, given the value of aggregate consumption and the government expenditure.

Equation (29) determines the equilibrium wage rate, denoted as the curve LL, and (31) the equilibrium capital stock, curve KK, but their dynamic content is the reverse, corresponding to what has been said above. The labour market equilibrium LL denotes how much resources are allocated into the production of investment goods for the open sector, so the LL curve is the supply of capital. The KK curve denotes the wage rate consistent with the required rate of return on capital and the current wage level.[4]

In figure 1 the KK curve is horizontal at the wage rate imposed by the price of the open sector, while the equilibrium wage rate (LL) depends positively on the capital stock. Below the KK curve there is a higher profitability than in the equilibrium in the open sector and above it the profitability

---

[4] This sort of dynamics for the capital stock has some features which are similar to the model presented by Begg (1982), pp. 54-71.

is lower. Above the LL curve there is unemployment and below it excess demand for labour.

The linearized system is the following

$$(32)\qquad \begin{aligned} \text{KK:}\quad & \dot{W} = a_{11}W + a_{12}K_o \\ \text{LL:}\quad & \dot{K}_o = a_{21}W + a_{22}K_o \ , \end{aligned}$$

where by (29) and (31) $a_{11} > 0$, $a_{12} = 0$ and $a_{21} > 0$, and $a_{22} < 0$.[5] The determinant of (32) is negative and we have saddle-point dynamics with one positive and one negative characteristic root. The unstability is due to the KK curve (31) as it implies that a high wage rate and a high wage inflation can coincide with each other.

The stable arm is horizontal and coincides with the KK curve. This can be seen by considering the solution related to the negative characteristic root, denoted by y,

$$(33)\qquad \begin{aligned} K_o &= K_e + d_1\exp(yt) \text{ and} \\ W &= W_e + d_2\exp(yt) \ . \end{aligned}$$

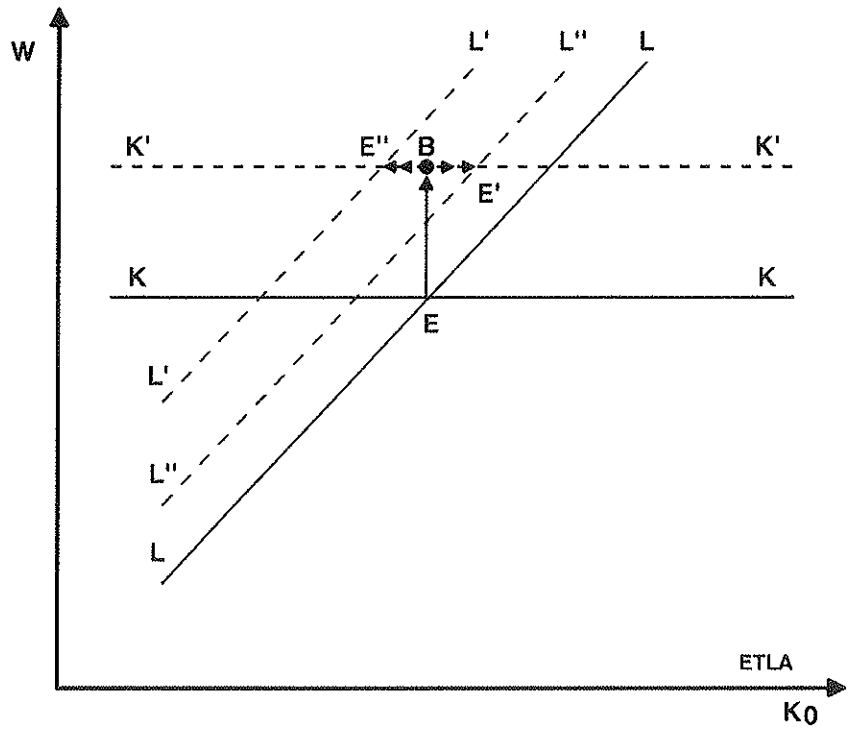
The vector (d_1,d_2) is the characteristic vector corresponding to the root y. The slope of the stable arm is defined by the ratio d_1/d_2, which is $a_{12}/(a_{11}-y)$. This takes a value of zero meaning that the wage rate is always a constant in an adjustment.

---

[5] The elements are the following,
$a_{11} = i^*+\delta-(F_K)_W > 0$, $a_{12} = 0$,
$a_{21} = (c_s/W)[s_s+\Gamma(1-s_s)]+(1/a_s)(dL^s/dW-dL_o^d/dW) > 0$ and
$a_{22} = -(1/a_s)(dL_o^d/dK_o) < 0$.

Accordingly, in an adjustment to the right there is diminishing unemployment and expanding capital in the open sector, hence we call this a booming or expansionary adjustment from the point of view of the export sector. On the contrary, in a contractionary adjustment upward to the left there is diminishing excess demand for labour and diminishing capital stock in the open sector.

Figure 1. The adjustment of the economy to an improvement in the terms of trade



E = initial equilibrium
E' = expansionary adjustment to an improvement in the terms of trade
E'' = contractionary adjustment to an improvement in the terms of trade

4. Adjustment to an improvement in the terms of trade

Consider then an unexpected rise in the export price P_o, which is here an unexpected improvement in the economy's terms of trade. As can be seen from (29) and (31), the KK curve shifts upwards by the rise in the export price and also the LL curve shifts upward. The wage rate, being a jump variable here, adjusts instantaneously to the new stable arm, i.e. to its new equilibrium.

It is straightforward to derive a condition for this economy with home-built capital to experience a cycle of expansion or contraction of the open sector. Assume initially that the labour supply is inelastic. The nominal wage rate reacts after the rise in P_o in such a way as to keep the product wage in the open sector constant. So, it is sufficient to examine the balance in the labour market at point B on the new KK curve in figure 1. The demand for labour by the open sector is the same as before the shock and we only have to analyse the change in the labour demand by the sheltered sector. If the consumer demand for the sheltered sector goods increases (decreases), the demand for labour increases (decreases) and there is excess demand for (supply of) labour in the economy. These alternatives are depicted as the two dotted LL curves in figure 1. Let us derive a condition for the two developments.

The price-equals-unit value functions are

$$\hat{P}_o = \Theta_{KO}\hat{r}_o + \Theta_{LO}\hat{W} \tag{34a}$$

$$\hat{P}_s = \hat{W}, \tag{34b}$$

where the Θ's denote the factor shares in output and a hat refers to the relative change. Combining these with (25), which states that $\hat{r}_o = \hat{P}_s$, gives $\hat{W} = \hat{P}_o$ and $\hat{r}_o - \hat{W} = 0$. Furthermore, let a_o be the labour required per unit of production in the open sector. Differentiating the labour market equilibrium condition $a_oQ_o + a_sQ_s = L$ and noting that the input coefficient a_o does not change as the factor price ratio stays unchanged, we get

$$\hat{Q}_o = -\frac{\Phi_s}{\Phi_o}\hat{Q}_s , \tag{35}$$

where Φ_i is the share of sector i in total labour in the economy. So, we see that the expansion or contraction of the open sector can be determined solely by the spending effect and there is no resource movement effect, as identified by Corden and Neary (1982). The resource movement effect is eliminated through the rise in the price of the capital good. Let us now derive the condition under which the open sector will expand or contract after an improvement in the terms of trade.

With a constant marginal productivity of capital and an unchanged product wage the price of capital in the equity market rises by the rise in the export price (see (12)). The (real) value of the domestic aggregate production also rises by this amount. Let us first keep the government expenditure unchanged and postpone its effect on consumer expenditure to section 5. According to (16) the value of consumption would

rise (approximately) by the value of the rise in the export price,[6]

$$(35) \qquad d\log(P_c c) = d\log P_o \ .$$

The price P_s of the sheltered sector goods rises by the rise in the wage rate, i.e. by $d\log P_o$. Therefore, the consumer price index rises by the amount

$$(36) \qquad d\log P_c = s_s d\log P_o,$$

where s_s is the budget share of good S in consumer expenditure. Using the demand function for c_s in (14) and (36) we can now derive from (35) the result,

$$(37) \qquad d\log(c_s) = (1-\Gamma)(1-s_s)d\log P_o.$$

This means that after a rise in the export price, the economy goes into an adjustment where in the new equilibrium the capital in the export sector contracts if the elasticity of substitution Γ in consumption between the foreign and domestic goods is less than unity. If Γ is higher than unity, the economy absorbs the rise in the real incomes through a rise in imports spurring an expansion of the open sector. In practice in Finland the crucial elasticity seems to be below unity, which would point in the direction of a vicious outcome, see Torsti (1992).

This result is, however, valid only approximatively as we have omitted the effect via government expenditure. If they remain

---

[6] The initial level of foreign assets f(0) also has an influence on aggregate consumption. If f(0) is positive (negative), the rise in consumption is less (more) than when there is no initial foreign debt.

unchanged, the initial rise in consumption is higher than $d\log P_o$, and we would run into the contractionary path also with Γ slightly higher than unity. Another factor is that we used in the above reasoning the assumption of an inelastic labour supply. However, according to (15c), at point B labour supply is the same as initially. This is so because in point B α, the marginal utility of consumption, is reduced by $d\log P_o$. As the real wage rises by the same amount, the labour supply does not change.

In the expansionary adjustment after the terms-of-trade shock there is unemployment as the stable arm is located above the new LL curve. This leaves resources for the capital build-up in the open economy. In the contractionary adjustment things are the reverse: there is excess demand for labour caused by the consumer demand and this leads to a capital shrinkage.

5. Fiscal policies

Both in the expansionary and the contractionary new equilibrium the real (consumption) wage is higher than in the initial steady state equilibrium where the government budget was in balance. However, as can be seen from (8), this does not have any impact on the government budget balance as both expenditure and revenues rise by the same amount. However, if employment is also higher (lower) than in the initial equilibrium, (8) implies that there is a surplus (deficit) in the government budget. As was inferred above, in the expansionary adjustment on the stable manifold the labour supply is constant and the same as in the initial equilibrium. So, during

the adjustment employment is lower than in the initial equilibrium. This means that the government is running a budgetary deficit. In the contractionary adjustment the government is definitely runnign a budgetary surplus.

This deficit is not sustainable in the long run, and the government has to cut its expenditure g or raise taxation, or both. From the labour market equilibrium condition (27) we see that a change in g operates through two channels. First, a rise in g increases directly the demand for labour, and secondly, it crowds out private consumption and therefore cuts also the demand for the sheltered sector goods.

It is fairly straightforward to derive the latter reaction to be the following,

$$(39) \qquad \frac{dc_s}{dg} = -s_s \ .$$

So altogether, we see that a unit's expansion in government expenditure increases the demand for the sheltered sector good by $1-s_s$ and tightens the labour market as the conventional wisdom tells. This shifts the LL curve to the left.

So, in the expansionary adjustment the government finances are going to lead to a larger expansion of the open sector than would be realized in a pure private economy through a cut in g. If the government raises taxes, the labour supply is reduced through the substitution effect (see 15c). At the same time, the labour supply increases through the income effect as aggregate production is reduced. So, the net effect is ambigu-

ous. With an inelastic labour supply tax policy does not have any effect on the outcome of the private sector decisions, so let us consider only this situation.

In the contractionary adjustment there is a budgetary surplus. If the government expands its expenditure, the new long-run equilibrium is bound to lie to the left of that reached above (point E" in figure 1).

To prevent a contractionary adjustment, the government could also try to tighten its fiscal policy by a cut in its expenditure, to keep the labour market equilibrium curve LL in its former position and thereby to force the economy onto an expansionary adjustment path. This can only work temporarily and it cannot be realized as a permanent situation. The cut in government expenditure, if its intertemporal budget constraint is taken seriously by the private sector, postpones the moment when the private sector thinks that the expansion in government expenditure takes place. However, this does not have any effect on the adjustment of the wage rate as the fiscal policy does not change the locus of the stable arm. In the end the government is going to expand more than with an immediate reaction, and the open sector contracts more.

6. Concluding remarks

In this paper we have presented an analysis of the adjustment in an open economy with fixed exchange rates over time to a terms-of-trade shock, using an intertemporal optimizing model.

We found that the adjustment to a terms-of-trade shock only involves the spending effect, as the cost push in the sheltered sector is reflected into the capital input cost of the open sector. The spending effect may well in reality turn the economy to a path where the open sector contracts.[7] The conclusions may seem quite pessimistic from the point of view of the resource allocation in a homogeneous economy facing international shocks. However, from a stabilization point of view the situation may look better. In a booming economy we found that the sector starting the boom may eventually contract. If, however, things are free to change symmetrically, an adverse terms-of-trade shock should then lead, at least eventually, to a rise in the export sector capital and to a rise in the volume of exports.

The adjustment of the economy turned out to be quite simple, as the wage rate reacts immediately to its new long-run equilibrium. In practice such a strict obedience of the competitiveness norm of the open sector is rarely observed and the wage rate easily overshoots this equilibrium causing unstability in the economy.

Traditionally in Finland when capital flows, credit markets and interest rates were regulated, macroeconomic policy making could be characterized as having more instruments than goals.

---

[7] The two-sector open economy model with specific capital where the demand effects are discarded produces the result that a rise in the price of a sector inevitably leads to an expansion in that sector and to a contraction in the other sector, see Meckl (1990) on this.

Aside from the goals of internal (growth and employment) and external (current account) equilibrium, inflation was often clearly subordinated to these two goals in macroeconomic preferences. The open sector, its profitability and investment were the key transmission mechanisms recognized in policy making, which thereby had more classical emphasis than the standard demand management policies pursued in the big countries; see on this Alho (1991). Thus fiscal policy could be left to a secondary, passive role in policy making. Here our analysis has in a way lent credence to this aspect of fiscal policy, but the intertemporal budget constraint was shown to widen the fluctuations in the economy.

ACKNOWLEDGEMENT

The author thanks Professors James Tobin and J. Peter Neary for helpful comments on initial ideas of the paper.

REFERENCES

Alho K. (1991): Financial Markets and Macroeconomic Policy in the Flow-of-Funds Framework, Gower.

Begg D.K.H. (1982): The Rational Expectations Revolution in Macroeconomics, Macmillan.

Corden W.M. and Neary J.P. (1982): "Booming Sector and De-industrialisation in a Small Open Economy", The Economic Journal, Vol. 92, No. 368, December, 825-848.

Grossman H.M. and Helpman E. (1991): "Endogenous Product Cycles", The Economic Journal, Vol. 101, No. 408, September, 1214-1229.

Jorgenson D.W. (1963): "Capital Theory and Investment Behaviour", American Economic Review, Vol. 53, 247-259.

Mansoorian A. (1991): " Resource Discoveries and Excessive External Borrowing", The Economic Journal, September, 1497-1509.

Meckl J.(1990): "Dynamic Adjustment in Open Economies", University of Konstanz, Discussion paper, Serie II, No. 121, 1990.

Neary J.P. (1985): Real and Monetary Aspects of the 'Dutch Disease', In Structural Adjustment in Developed Open Economies, ed. by K. Jungenfelt and D. Hague, Macmillan.

Roldos J.E. (1991): "Tariffs, Investment and the Current Account", International Economic Review, Vol. 32, No.1, February, 175-194.

Turnovsky S.J. and Sen P. (1991): "Fiscal Policy, Capital Accumulation and Debt in an Open Economy", Oxford Economic Papers, Vol. 43, March, 1-24.

Torsti E. (1992): Tuotantopanosten kysyntä ja hyödykemarkkinoiden lyhyen ajan tasapaino avoimella ja suljetulla sektorilla, (The demand for factors of production and short-term equilibrium in the open and sheltered sector, in Finnish), ETLA series C 63.

ELINKEINOELÄMÄN TUTKIMUSLAITOS (ETLA)
THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
LÖNNROTINKATU 4 B, SF-00120 HELSINKI

Puh./Tel. (90) 609 900 Telefax (90) 601 753
Int. 358-0-609 900 Int. 358-0-601 753

KESKUSTELUAIHEITA - DISCUSSION PAPERS ISSN 0781-6847

No 405 RITA ASPLUND, Human Capital Earnings Functions: A Theoretical Introduction. 05.05.1992. 33 p.

No 406 MIKA WIDGRÉN, A Game Theoretic Analysis of the Nordic Coalition's Role in the Decision Making of the EC Council of Ministers. 07.05.1992. 21 p.

No 407 OLAVI RANTALA, Luottotappioriskin hinnoittelu. 01.06.1992. 30 s.

No 408 MARKKU KOTILAINEN, Euroopan raha- ja talousunioni ja Suomi. (The European Economic and Monetary Union and Finland). 25.06.1992. 31 s.

No 409 RISTO MURTO - TEEMU VÄÄNÄNEN, Linear and Nonlinear Dependence in the Finnish Forward Rate Agreement Markets. 03.08.1992. 29 p.

No 410 MARKKU LAMMI, An Imperfect Competition Model in an Industry with Differentiated Domestic and Foreign Products. 24.08.1992. 11 p.

No 411 RISTO MURTO, Korkorakennemallien käyttö korkoriskin arvioinnissa ja hallinnassa. 28.08.1992. 41 s.

No 412 MIKA MALIRANTA, Paperiteollisuuden palkat ja tehdasteollisuuden palkkarakenne. 28.08.1992. 37 s.

No 413 SYNNÖVE VUORI - PEKKA YLÄ-ANTTILA, Industrial Transformation in Finland - From Factor Driven to Technology-Based Growth. 15.09.1992. 37 p.

No 414 RITA ASPLUND, Occupational Earnings Differentials in Finland - Empirical Evidence from a Cross Section of Individuals. 16.09.1992. 51 p.

No 415 JUHA KETTUNEN, Increasing Incentives for Reemployment. 16.09.1992. 30 p.

No 416 TIMO MYLLYNTAUS, Technology Transfer and the Contextual Filter in the Finnish Setting. Transfer Channels and Mechanisms in an Historical Perspective. 18.09.1992. 52 p.

No 417 RITA ASPLUND (Ed.), Human Capital Creation in an Economic Perspective. 12.10.1992.

No 418 V. BUSHENKOV - V. KAITALA - A. LOTOV - M. POHJOLA, Decision and Negotiation Support for Transboundary Air Pollution Control between Finland, Russia and Estonia. 15.10.1992. 25 p.

No 419 HARRI LUUKKANEN, Helsingin palvelualan yritykset: Suljettu sektori murroksessa; esitutkimus. 07.10.1992. 93 s.

No 420 JUHA JUNTTILA, Kotitalouksien pankkitalletusten kysyntä Suomen vapautuneilla rahoitusmarkkinoilla. 10.11.1992. 93 s.

No 421 PETER SJÖBLOM, ETLAs databastjänst och dess marknad. 01.12.1992. 97 s.

No 422 PASI AHDE - TEET RAJASALU (eds.), On the Economic Structure of Estonia and Finland before the 1990's. 01.12.1992. 101 s.

No 423 PER HEUM - PEKKA YLÄ-ANTTILA, Firm Dynamics in a Nordic Perspective - Large Corporations and Industrial Transformation. 15.12.1992. 81 p.

No 424 MARKKU RAHIALA - TAPANI KOVALAINEN, Wage Formation in Finland in the 1980's; An Econometric Study. 17.12.1992. 41 p.

No 425 JUHA KETTUNEN - REIJO MARJANEN, Suomen työnantajain keskusliiton palkkatilastot: Syntyhistoria, sisältö ja käyttötarkoitus. 17.12.1992. 42 s.

No 426 PETRI ROUVINEN, Data-guide to OECD Exports. 15.01.1993. 75 p.

No 427 RITA ASPLUND, Private- and Public-Sector Earnings Structures in Finland. 25.01.1993. 72 p.

No 428 RITA ASPLUND, Human Capital and Industry Wage Differentials in Finland. 25.01.1993. 94 p.

No 429 KARI ALHO, Growth, the Environment and Environmental Aid in the International Economy. 26.01.1993. 36 p.

No 430 OLAVI LEHTORANTA, Technology Diffusion and Lifetimes of Paper Machines, Posing the Question and Description of the Data. 10.02.1993. 30 p.

No 431 JUHA KETTUNEN - JUHANA VARTIAINEN, Suomen teollisuuden työntekijöiden palkkarakenne. 15.02.1993. 35 s.

No 432 KARI ALHO, Terms-of-Trade Booms, Sectoral Adjustment and Fiscal Policy in a Small Open Economy. 18.02.1993. 27 p.

Elinkeinoelämän Tutkimuslaitoksen julkaisemat "Keskusteluaiheet" ovat raportteja alustavista tutkimustuloksista ja väliraportteja tekeillä olevista tutkimuksista. Tässä sarjassa julkaistuja monisteita on rajoitetusti saatavissa ETLAn kirjastosta tai ao. tutkijalta.
Papers in this series are reports on preliminary research results and on studies in progress; they can be obtained, on request, by the author's permission.

E:\sekal\DPjulk.chp/18.02.1993