DOI: 10.20378/irb-91730

ISSN 0347-8769

Seminar Paper No. 217

INTERNATIONAL ADJUSTMENT TO AN OIL PRICE SHOCK

- THE ROLE OF COMPETITIVENESS -

by

Michael Schmid

An earlier version of this paper has been presented at the Canadian Economic Association Meeting, Halifax, May 25-27, 1981.

Seminar Papers are preliminary material circulated to stimulate discussion and critical comment.

August, 1982

Institute for International Economic Studies
S-106 91 Stockholm
Sweden

INTERNATIONAL ADJUSTMENT TO AN OIL PRICE SHOCK

- The Role of Competitiveness -

ABSTRACT

It is common political practice to blame the presently poor performance of OECD economies on huge raw material price increases during the 70s. This view is apparently backed by recent small-country oil-shock analysis showing within theoretical models how trade deficits and output and employment losses inevitably occur in net oil importing countries. This paper argues that, by its very nature, an oil shock afflicts an OECD country not in isolation. This requires theoretical analysis of an oil-importing economy together with its major trading partners. The paper demonstrates that due to a country-specific superior technological adjustment the oil shock may possibly give a competitive edge to one country or a group of OECD countries. Then a trade diversion among trading OECD economies benefits a few of them at the expense of others and may be strong enough to weaken or even turn around negative output and employment effects which originated from the real income transfer towards oil producers. Additionally, assessment of real and price level effects of an exchange rate change reveals that in general the beggar-my-neighbor property of a devaluation can be destroyed if imported intermediate goods like oil are taken into account. This outcome should also have some bearing on economic modelling of transatlantic relations under flexible exchange rates.

Michael Schmid
Fakultät für Volkswirtschaftslehre und Statistik
Universität Mannheim
Seminargebäude A 5
D-6800 Mannheim 1
West Germany

INTERNATIONAL ADJUSTMENT TO AN OIL PRICE SHOCK
- The Role of Competitiveness -

Consider the "world oil scenario" given in figure 1. In the upper part, two completely specialized OECD countries trade their final products. This is the standard assumption in most monetary trade models in a world with OPEC. Depicted in the lower part, a substantial amount of industrial final products must be devoted to trade with OPEC, which is modelled here simply as a mono-producer of a natural resource like oil. OPEC's oil production is delivered as an intermediate good to individual OECD countries in exchange for those countries' processed final products. To the best of my knowledge there exists no theoretical analysis of this complete world oil scenario; but, bits and pieces of this complex structure have been investigated. A good deal of effort has been devoted to the "small country" analysis, i.e., an analysis of an individual OECD country. This was the focus in the work of Rodriguez (1977), Findlay and Rodriguez (1977), Obstfeld (1980), Djajic (1980), as well as in Bruno and Sachs (1979) who added a national "oil industry" (shown with dashed lines) to the basic framework. The latter is relevant for those industrial economies which appear to have a choice today of either becoming a net exporter or a net importer of intermediate goods. Besides the ambitious large scale analysis and the small country analysis there exist two other possibly interesting types of intermediate analysis which incorporate some of the repercussions inherent to an oil shock but are not modelled in the small country analysis. (1) By aggregating OECD into one consolidated economy producing only one single final good, Schmid (1976), (1980d) has analyzed a simplified system with OECD - OPEC interactions taking into account the repercussion effects stemming from OPEC's spending of oil revenues on OECD goods. (2) Leaving aside the induced change in OPEC's spending from increased oil prices it is possible to investigate the oil price impact within an intra-OECD analysis.

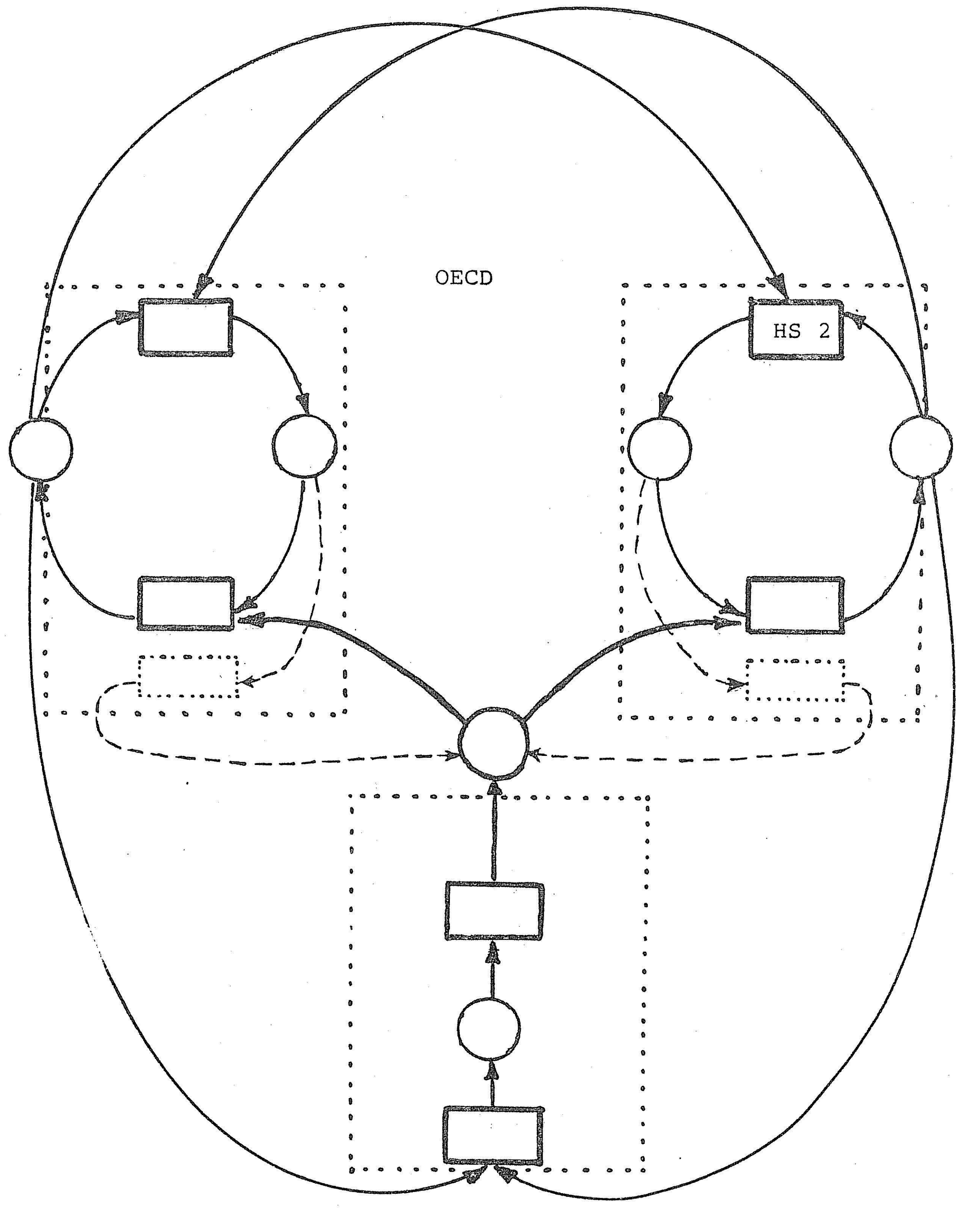


Figure 1

This latter analysis is taken up in this paper starting with the observation that an oil price hike, by its very nature, simultaneously hits each economy within the OECD area. Hence, a small country analysis as in Bruno and Sachs (1979) or Findlay and Rodriguez (1977), assuming export opportunities depend only upon the final goods terms of trade, tends to neglect the adjustment other OECD countries must undergo following an oil price shock. To simplify, we wish to concentrate on OECD consisting of only two industrial economies, the EMS and the US. Using a two-country monetary approach model, first introduced by Dornbusch (1973) and extended to cope with unemployment by Branson and Rotemberg (1980), Schmid (1980a), and Dixit-Norman (1980). we consider an OECD where both member countries produce the same good. This allows us to concentrate upon the adjustment to an oil shock in the form of changes in total absorption, gross production, and income, as opposed to expenditure switching effects from oil price-induced relative price changes which are also of interest, (see Dornbusch (1980)) but are totally neglected in this paper. Taking a European point of view the oil price hike most likely will reduce, in the foreign (US) economy, real gross production and also real income and absorption. Depending upon the US economy's elasticity to substitute imported oil for domestic factors of production and on its marginal propensity to absorb, the result could be either an excess supply or an excess demand for final goods in the US final goods market. In the interesting case where the reduction in US absorption falls short of the recession in gross production there will be (net) imports of final goods to the US, or, put differently, a boost in European exports to the US. The questions we wish to analyze in this paper can now be asked: Under what circumstances is the export boom to the US strong enough to compensate for the oil price-induced loss in European demand for European goods and the induced slump in European production? While all small country analysis so far has unanimously demonstrated a fall in domestic output and real income as the result of an oil price hike, the question is whether it can be shown in a OECD-wide analysis that the fall in output and/or real income can be avoided, at least in one OECD economy, by running a substantial trade surplus with its industrial neighbor economies. It can also be asked in this framework what role is played by different institutional arrangements in the EMS or US leading to nominal or real wage rigidity in the international adjustment process following an oil price shock. Finally, it is well-known that there exists the possibility of real income protection in the presence of oil price shocks by inflation, i.e., by starting an expansionary income policy for domestic factors of production validated by an expanding money supply. Assuming there exists a different preference towards this "inflation" solution for real income protection in the US and the EMS, how is the EMS/US exchange rate affected?

The Model

We start with a specification of production in a typical representative OECD country. Following Bruno and Sachs (1979) we observe that a sufficiently genereal description of production can be obtained using a nested CES function.

$$x = x(v(\ell,k), n) \tag{1}$$

Thus we postulate a linear homogeneous CES technology $v(\cdot)$ producing value added, v, from domestic primary factors of production labor, ℓ, and capital, $\bar{k}$, with elasticity of substitution σ_v. The gross production function $x(\cdot)$ has itself a linear homogeneous CES representation in value added, v, and imported natural resources like oil, n. The elasticity of substitution in gross production will be denoted by σ. We further assume k to be constant which gives us decreasing returns to scale from a uniform increase in the variable factors n and ℓ. Introducing output elasticities of the two variable factors of production

$$\theta_\ell \equiv \frac{\partial x}{\partial \ell}\frac{\ell}{x} \quad \text{and} \quad \theta_n \equiv \frac{\partial x}{\partial n}\frac{n}{x}$$

we use a circumflex to denote a percentage change of a variable and write for gross output

$$\hat{x} = \theta_\ell \hat{\ell} + \theta_n \hat{n}$$

It follows from the Appendix A that $\theta_\ell = (1-\beta_n)\alpha_\ell$ and $\theta_n = \beta_n$ where β_n, α_ℓ represent output elasticities of gross output and value added with respect to the indicated factor. If $0<\alpha_\ell<1$ we always have $\theta_\ell+\theta_n<1$.

If we denote P the (gross) output price level and W, P_n, R the nominal prices for labor, imported intermediates, and the use of the capital stock, respectively, we can express the change in output price as an average of changes in factor prices (see Appendix A for more details).

$$\hat{P} = \theta_{\ell}\,\hat{W} + \theta_n\,\hat{P}_n + (1-\theta_{\ell}-\theta_n)\,\hat{R}$$

We have also shown in Appendix A that it is possible applying standard results of neoclassical production and cost theory to obtain a general output supply function:

$$x = x(W/P,\ P_n/P;\ \overline{k}) \qquad (2')$$

According to the nested CES specification of (1) we have a detailed description of some properties of (2') (see Appendix A for derivations).

$$x = -\varepsilon_n(\hat{P}_n - \hat{P}) - \varepsilon_w(\hat{W} - \hat{P}) \qquad (2)$$

$$\varepsilon_n = \frac{\theta_n[\sigma(1-\theta_n-\theta_{\ell}) + \theta_{\ell}\sigma_v]}{(1-\theta_n)(1-\theta_n-\theta_{\ell})} > 0;\quad \varepsilon_w = \frac{\theta_{\ell}\sigma_v}{1-\theta_n-\theta_{\ell}} > 0$$

$$\varepsilon_p = \varepsilon_n + \varepsilon_w = \frac{\theta_n\sigma(1-\theta_n-\theta_{\ell}) + \theta_{\ell}\sigma_v}{(1-\theta_n)(1-\theta_n-\theta_{\ell})} > 0$$

Using dashed letters to denote US variables we have a similar output supply function for the US. P', P_n', W' are in US currency units.

$$\hat{x}' = -\varepsilon_n'(\hat{P}_n' - \hat{P}') - \varepsilon_w'(\hat{W}' - \hat{P}') \qquad (3)$$

The influence of the constant capital stock accounts for an upward sloping aggregate supply curve in P,x space[1] leaving the possibility of a horizontal supply curve as a special case where $\alpha_k = 0$ and consequently with $\alpha_{\ell} = 1$

---

[1] This appears to be a useful generalization of the linear homogeneous technology in Schmid (1980d) and also in Obstfeld (1979) and Rodriguez (1977).

where $1-\theta_n-\theta_\ell = 0$. Note further that we can simplify elasticities in (2) assuming either the case of no substitution between imported intermediates and value added (σ=0) or the case of a simple straightforward CES representation of (2).

<u>Findlay-Rodriguez (σ=0):</u>

$$\varepsilon_p = \frac{1}{1-\theta_n} \frac{\theta_\ell \sigma_v}{(1-\theta_n-\theta_\ell)}$$

$$\varepsilon_n = \frac{\theta_n}{1-\theta_n} \frac{\theta_\ell \sigma_v}{(1-\theta_n-\theta_\ell)}$$

$$\varepsilon_w = \frac{1-\theta_n}{1-\theta_n} \frac{\theta_\ell \sigma_v}{(1-\theta_n-\theta_\ell)}$$

<u>CES ($\sigma=\sigma_v$):</u>

$$\varepsilon_p = \frac{(\theta_n+\theta_\ell)\sigma}{1-\theta_n-\theta_\ell}$$

$$\varepsilon_n = \frac{\theta_n \sigma}{1-\theta_n-\theta_\ell}$$

$$\varepsilon_w = \frac{\theta_\ell \sigma}{1-\theta_n-\theta_\ell}$$

We turn to a discussion of the demand side. We consider two industrialized economies, the EMS and the US, representing OECD. There is only one final good in the world economy which is produced by two industrialized countries in different amounts, x, x'. This good is consumed by households in both countries as well as by OPEC consumers. Let c_e^*, c_u^* be the quantities of the final goods sold to OPEC by EMS and US, respectively, and let c, c' be final goods consumption in EMS and the US. Then, the world goods market equilibrium is:

$$[c + c_e^* - x] + [c' + c_u^* - x'] = 0 \tag{4}$$

For later reference it is useful to present the goods market equilibrium condition in an alternate manner which highlights income spending and the trade balance. Define the trade accounts of EMS and US with respect to their OPEC trading:

$$B_n = Pc_e^* - P_n n \; ; \quad B_n' = P'c_u^* - P_n'n'$$

Final goods trade between the US and EMS can be captured by a definition of the EMS/US trade balance, B_x, or vice versa, from the US viewpoint by a definition of US/EMS trade balance, B_x':

$$B_x = P(x - c_e^* - c) \; ; \quad B_x' = P'(x' - c_u^* - c') \tag{5}$$

A surplus in the EMS/US trade relation is in favor of EMS if $B_x > 0$. A typical OECD country trades with OPEC final goods against intermediate goods; however, it also trades with other OECD countries in final goods. Therefore, the overall trade balance for the EMS and the US is defined:

$$B = B_x + B_n \; ; \quad B' = B_x' + B_n' \tag{6}$$

Finally, OPEC's overall trade balance, B*, captures its trade relation with the EMS as well as the US, i.e., with OECD as a whole:

$$B^* = P_n'(n + n') - P'(c_e^* + c_u^*) = -[(1/E)B_n + B_n'] \tag{7}$$

Note that we express OPEC's trade balance in US currency units in accordance with the fact that US currency is the most widely used vehicle currency in the underlying transactions. In (7) we used the US/EMS exchange rate, E, (price of US currency in EMS currency units) to relate EMS prices to US prices.

$$P = EP' \quad \text{and} \quad P_n = EP_n' \tag{8}$$

Using (8) and (5) in (4) yields the well-known statement that EMS and US final goods trade balances are not independent in the goods market equilibrium.

$$B_x = - EB_x' \tag{9}$$

Adding and subtracting B_n and B'_n to (9) and making use of (6) and (7) yields an important relation between the overall trade balances of the three trading areas:

$$B = - E[B' + B^*] \qquad (10)$$

We use figure 2 to explain the message of (10). It shows OECD as a 'square' world economy which produces equal amounts x, x' of final goods in the EMS and the US, respectively. Therefore the falling 45° line passing through points 0' and Q' is the OECD gross output line.[2] With factors of production imported in both OECD countries the real value of national gross production x, x' deviates from the real value of national income y, y' by an amount which sometimes is called the national "oil bill." We assume that both the US and the EMS have no national production of natural resources and therefore are importers of oil:

$$y = x = \frac{P_n}{P} n \; ; \qquad y' = x' - \frac{P'_n}{P} n'$$

Assume that both OECD countries absorb goods which, in real value, exactly are equal to the value added (= value of national income) that they have contributed to the manufacturing of their value of gross production. In this case they do retain exactly that amount of their final goods production to compensate OPEC for its delivery of intermediates. In this special case, national income equals national absorption. Absorption (consumption) in each country must be on the income line YY and Y'Y', respectively. Hence, bilateral trade with OPEC is in equilibrium in both countries. Consequently, distance Y'Y' portrays OECD's total "oil needs" in terms of OECD's total final goods

[2]The model has only one good. Therefore, only distances on the abscissa really matter. 45° lines are used to 'make up' the diagram and to suggest possible extension to a world with two traded final goods.

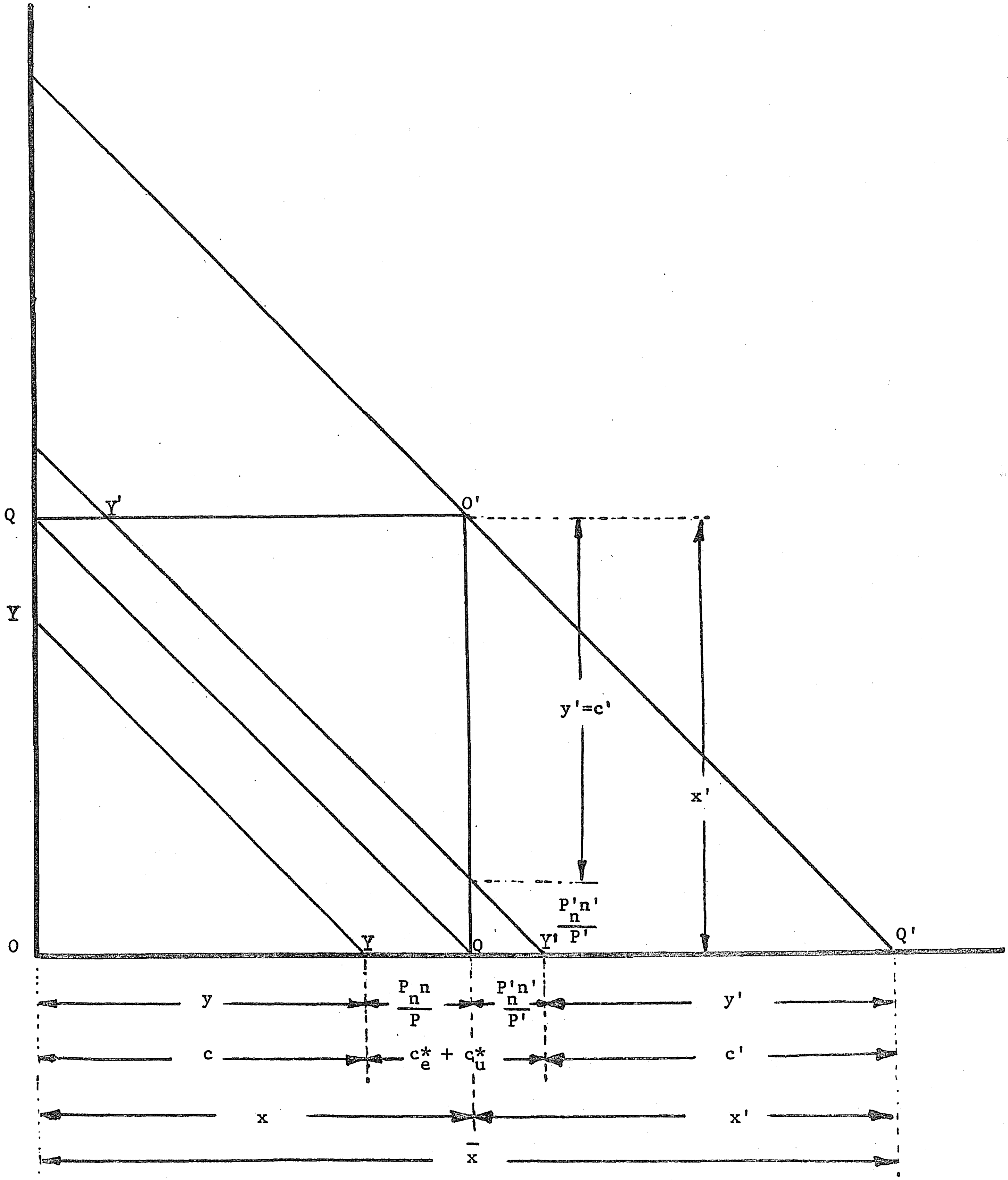


Figure 2

production, i.e., OPEC's consumption of final goods. From figure 2, as well as from (10), we obtain the following statement: If bilateral trade between each OECD country and OPEC is in balanced equilibrium, then the total OECD - OPEC trade balance is in equilibrium ($B^* = 0$). If, in addition, bilateral trade <u>between</u> OECD countries is in balance ($B_x = 0$), then the overall trade balance of both individual OECD countries is in equilibrium ($B = B' = 0$). Figure 2 represents exactly this situation if, and only if, national absorption takes place at points on the YY and Y'Y' lines respectively. We refer to this situation as an initial long run equilibrium position. Note that the notion of a long run equilibrium captures the idea of a two-tier world productive system where OPEC, as an intermediate goods producer, and OECD, as a processing manufacturer, absorb goods exactly in an extent they can afford, in terms of their contributed value added. Note further that there exists a second possibility for the EMS overall trade balance to be in equilibrium, namely from (10):

$$B = 0 \quad \text{and} \quad B' = - B^* \quad \text{with } B^* \neq 0$$

Assuming, realistically, $B^* > 0$ the EMS may run a deficit in its trade relations with OPEC, i.e., $B_n < 0$, but its overall trade balance may be in equilibrium because it manages a matching trade surplus in its trade relations with the US. Assuming further the US has a bilateral trade deficit with OPEC, i.e., $B_n' < 0$, the total US trade deficit equals the total OECD deficit. In terms of figure 2, as above, the EMS absorbs along its YY line; however, the US lives beyond its means because the absorption now is also on the YY line. Note the difference in the distribution of world absorption compared with the above defined long run equilibrium situation. EMS absorbs exactly its real value added in both cases. The US, however, in the latter case, additionally absorbs OPEC's share in world output at the expense of running a considerable total trade deficit which must be compensated by an outflow of US funds to OPEC. Financing international trade poses no problems in this case because the EMS, in its trade relations with the US, earns exactly the amount of US currency it needs to cover its deficit with OPEC.

As a third possibility consider the case of an OECD absorption somewhere on line QQ. Now OECD runs the same overall deficit against OPEC as before because OPEC is again crowded out in terms of final goods consumption. However, with $B_x = 0$ both the EMS and the US suffer from an outflow of money which compensates for their excess spending which equals their respective deficits with OPEC ($B = B_n < 0$ and $B' = B'_n < 0$).

To bring forward the connection between income, spending, and the trade balance, the reader should convince himself that the goods market equilibrium condition (4) can be rewritten also as a modification of the well-known open economy equation

$$Y = C + B_x + B_n \quad \text{or} \quad Y' = C' + B'_x + B'_n \tag{11}$$

$$\text{with} \quad Y = Px - P_n n \qquad \text{with} \quad Y' = P'x'' - P'_n n'$$

$$C = Pc \qquad C' = P'c'$$

Using the expressions for income and spending in both OECD countries we also have from the goods market equilibrium condition (4)

$$[Y - C] + E[Y' - C'] = - EB^*$$

Making use of budget constraints which relate national incomes to expenditures for purchases of goods, C, and cash accumulation (hoarding, H) yields the following statement

$$H + EH' = - EB^* \tag{12}$$

Equation (12) adopts a well-known dictum of the monetary approach to our present model saying that total OECD (dis)hoarding must be equal to OECD's trade (deficit) surplus, i.e., OPEC's trade (surplus) deficit.

Turning to the behavior of the consumer sector we make use of the distinction between the value of gross production and domestic value added by defining the value of national income Y (= nominal value added)[3] as the difference between value of production and its oil bill.

$$Y = Px - P_n n \tag{13}$$

We know already that the value of production must be exhausted by the sum of payments to domestic primary factors of production. Therefore, the share of GNP in the value of total production equals the sum of all cost shares of domestic factors of production.

$$Y/Px = \theta_\ell + \theta_k = 1 - \theta_n \qquad \text{with } \theta_n = \frac{P_n n}{Px}$$

Concentrating on the oil share θ_n we can derive from (13) a useful relation between the change in GNP in value terms and changes in all other variables.

$$\hat{Y} = \frac{1}{1-\theta_n} (\hat{P} + \hat{x}) - \frac{\theta_n}{1-\theta_n} (\hat{P}_n + \hat{n})$$

If we measure real GNP in terms of gross output (final goods) units, we must use the gross output deflator P to obtain[4]

$$\hat{y} = \frac{1}{1-\theta_n} \hat{x} - \frac{\theta_n}{1-\theta_n} (\hat{P}_n - \hat{P} + \hat{n}) \tag{14}$$

[3]The following discussion of income and spending is given for the EMS only, it applies in an analogous way to the US; we add the US functions later without further comment.

[4]Note that we do not use the value added deflator P_y to determine real GNP. This deflator, so it seems, was used by Bruno and Sachs (1979).

From the CES production side of the model it is well-known that per unit oil requirements can be expressed as a function of the real oil price measured in terms of output units (P_n/P).

$$\hat{n} - \hat{x} = - \sigma(\hat{P}_n - \hat{P}) \tag{15}$$

Using the factor demand function (15) in (14) yields a useful relation between gross production and real income we write down for later use:

$$(1-\theta_n)\ \hat{y} = (1-\theta_n)\ \hat{x} - \theta_n(1-\sigma)(\hat{P}_n - \hat{P}) \tag{16}$$

We postulate real expenditures (= real absorption) expressed in terms of final goods as a function of real income and real cash balances

$$c = c(y,m) \qquad\qquad c_1,\ c_2 > 0 \tag{17}$$

and we make use of a differentiated form of (17).

$$\hat{c} = \alpha\hat{y} + \rho[\hat{M} - \hat{P}] \qquad\qquad \text{with } \alpha + \rho = 1,\ 0<\alpha,\ \rho<1 \tag{18}$$

In (18) we have imposed on c(•) the property of linear homogeneity in y and m.[5] The function is sufficiently general to allow for expenditure effects from real income changes as well as real cash balances. The following statements may explain the expenditure behavior in more detail:

(1) A uniform increase of the final goods price level and nominal cash balances, holding real income constant, raises nominal expenditures by the same percentage rate. Real absorption, however, does not change.

---

[5]In Schmid (1980c) it is shown that the assumption of linear homogeneity is in accordance with a hoarding story where actual cash balances are adjusted to desired cash balances which itself are assumed to be a function of domestic income.

(2) A uniform increase of the price level and nominal income does not affect real income but decreases real balances. Therefore real expenditures fall due to a real balance effect expressed by ρ.

(3) A uniform increase of real income and nominal cash balances, holding the price level constant, raises nominal expenditures by the same percentage because real expenditures have risen.

Similarly for the US we have a real expenditure function[6]

$$\hat{c}' = \alpha' \hat{y}' + \rho' [\hat{M}' + \hat{E} - \hat{P}] \quad (19)$$

$$\alpha' + \rho' = 1, \quad 0<\alpha', \rho'<1$$

and a relation connecting US gross production to GNP

$$(1-\theta_n') \hat{y}' = (1-\theta_n') \hat{x}' - \theta_n'(1-\sigma')[\hat{P}_n' - \hat{P}'] \quad (20)$$

Finally we specify OPEC's demand for OECD exports assuming that OPEC demand for final goods is indifferent against goods from different national origins as long as there is only one price for exportables in a homogeneous world market. Therefore, EMS and US exports are negatively related to the final goods price in US currency units via the same functional form.

$$c_e^* = c^*(P/E) \; ; \qquad c_u^* = c^*(P/E)$$

It is useful to characterize OPEC demand by introducing an elasticity of export demand, η.

---

[6] Note that we use the exchange rate and the final goods price in domestic currency units to express the purchasing power of US cash balances in terms of final goods.

$$\hat{c}^*_e = \eta(\hat{P} - \hat{E}) \;; \qquad \hat{c}^*_u = \eta(\hat{P} - \hat{E}) \qquad -1 \leq \eta \leq 0 \tag{21}$$

Next we shall feed in the behavioral function in a "hat" version of the goods market equilibrium condition. We rewrite and differentiate (4) in an initial state of long run equilibrium.

$$(x - c) + (x' - c') = c^* \qquad \text{with } c^* = c^*_e + c^*_u$$

$$\zeta\,[\hat{x} - (1-\theta_n)\,\hat{c}] + \zeta'[\hat{x}' - (1-\theta'_n)\,\hat{c}'] = \bar{\theta}_n\,\hat{c}^* \tag{22}$$

$$\zeta \equiv x/\bar{x} \;;\; \zeta' \equiv x'/\bar{x} \;;\; \bar{x} \equiv x + x' \;;\; \zeta + \zeta' = 1$$

$$\bar{\theta}_n = \frac{P_n(n+n')}{P\bar{x}} = \zeta\theta_n + \zeta'\theta'_n$$

In (22) $\bar{\theta}_n$ is the total OECD oil share given as an average of national oil shares where the shares of national outputs in total OECD output, ζ, ζ', are used as weights. Using these shares it also follows

$$\hat{c}^* = \frac{\zeta\theta_n}{\bar{\theta}_n}\,\hat{c}^*_e + \frac{\zeta'\theta'_n}{\bar{\theta}_n}\,\hat{c}^*_u \tag{23}$$

Inserting in (22) (23), (21) together with (16), (18), and (19), (20) yields

$$\zeta\delta_o\,\hat{x} + [\zeta\delta_p + \zeta'\delta'_p]\,\hat{P} + \zeta'\delta'_o\,\hat{x}' = \tag{24}$$

$$- [\zeta\delta_n + \zeta'\delta'_n]\,\hat{P}'_n + \zeta(1-\theta_n)\rho\,\hat{M} + \zeta'(1-\theta'_n)\rho'\,\hat{M}' + [\zeta\delta_p + \zeta'\delta'_p - \zeta(1-\theta_n)\rho]\,\hat{E}$$

In the world market equilibrium condition (24) the following parameters appear and are given only for the EMS although a similar set of parameters exists for the US.

$$\delta_o = 1 - (1-\theta_n)\alpha = (1-\theta_n)\rho + \theta_n > 0$$

$$\delta_n = \theta_n\alpha(1-\sigma) \geq 0$$

$$\delta_p = (1-\theta_n)\rho - \theta_n\eta - \theta_n\alpha(1-\sigma) \gtrless 0$$

and $$\delta_p + \delta_n = \delta_o - \theta_n(1+\eta) > 0$$

To explain the coefficients in the world aggregate demand curve note first the inverse of δ_o, δ_o' are gross output multipliers for the EMS and the US, respectively. They demonstrate clearly that the higher a country's oil share, the weaker its multiplier; because the oil share determines the effective marginal propensity to spend from an increase in domestic production. Second, in what follows we assume δ_p, $\delta_p' > 0$. Hence, we postulate the net effect of an increase in the final goods price to result in world excess supply because real balance effects in both OECD areas and a drop in OPEC demand for OECD final goods together outweigh the positive demand effect from rising incomes. The latter follows from a reduced <u>real</u> oil bill if the final goods price level rises. Third, coefficients δ_n, δ_n' capture the tax like effect of an oil price increase at a given level of national production and a fixed final goods price. An increase in P_n' reduces demand for imported oil the less the more technology related rigidities hinder a process of substitution between domestic factors of production and oil. This substitution process is accounted for by σ and σ'. Price and quantity components of the oil bill therefore move in opposite directions and with $\sigma = \sigma' = 1$ there is a possibility that the oil bill might not change. However, rather low substitution, i.e., $0 \leq \sigma, \sigma' < 1$ leads to the more typical result where the negative GNP effect of rising oil prices outweighs the positive substitution effects. Hence, GNP will fall after an oil price increase in all OECD economies in an extent dominated by national oil shares and national technological possibilities to substitute for oil. The loss in real income clearly has an adverse influence on OECD's final goods demand and, in consequence, on its production depending on the size and variability of national propensities to spend. Fourth, holding the final goods price in domestic currency units constant, the goods market impact of a change in the EMS/US exchange rate, specifically of a devaluation of the exchange rate ($\hat{E}>0$), can be shown to be ambiguous. This is because of conflicting forces we recognize by rewriting the exchange rate coefficient in (24)

$$[\zeta'(1-\theta_n')\rho' - \overline{\theta}_n \eta - \zeta\theta_n\alpha(1-\sigma) - \zeta'\theta_n'\alpha'(1-\sigma')]$$

As usual we have a positive real balance effect of holders of US currency. With a final goods price fixed in EMS currency units the exchange rate change lowers final goods price in US currency units and therefore increases OPEC's demand for final goods.[7] On the other hand we have contractionary GNP effects assuming a low degree of substitutability because a devaluation increases the real price of oil measured in terms of final goods, $\frac{P_n'E}{P}$, in both countries. This is because in the EMS, oil price in domestic currency units must rise from a devaluation, while the final goods price in US currency must fall.

Next we give a more compact matrix representation of our model using the national output supply functions (2), (3), and the goods market equilibrium condition (4).

[7] We have assumed the OPEC holds its wealth in US currency. In the present one good model the shift in OPEC's demand for goods could be attributed to OPEC's wealth effect. This interpretation would readily follow from a model of OECD - OPEC interactions.

$$\begin{bmatrix} 1 & -\varepsilon_p & 0 \\ \zeta\delta_o & \zeta\delta_p+\zeta'\delta'_p & \zeta'\delta'_o \\ 0 & -\varepsilon'_p & 1 \end{bmatrix} \begin{bmatrix} \hat{x} \\ \hat{P} \\ \hat{x}' \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ \zeta(1-\theta_n)\rho & \zeta'(1-\theta'_n)\rho' \\ 0 & 0 \end{bmatrix} \begin{bmatrix} \hat{M} \\ \hat{M}' \end{bmatrix}$$

$$+ \begin{bmatrix} -\varepsilon_n & -\varepsilon_n \\ -[\zeta\delta_n+\zeta'\delta'_n] & -\zeta[\delta_n+\theta_n\eta]+\zeta'\delta'_p \\ -\varepsilon'_n & -\varepsilon'_p \end{bmatrix} \begin{bmatrix} \hat{P}'_n \\ \hat{E} \end{bmatrix} + \begin{bmatrix} -\varepsilon_w & 0 \\ 0 & 0 \\ 0 & -\varepsilon'_w \end{bmatrix} \begin{bmatrix} \hat{W} \\ \hat{W}' \end{bmatrix} \tag{25}$$

The determinant of the matrix of endogeneous variables in (25) is

$$\Delta_p = \zeta[\delta_p + \varepsilon_p\delta_o] + \zeta'[\delta'_p + \varepsilon'_p\delta'_o] > 0 \tag{26}$$

Although δ_p, δ'_p can be negative we assume it to be positive. However, even if they would be negative we require $\delta_p + \varepsilon_p\delta_o > 0$ and $\delta'_p + \varepsilon'_p\delta'_o > 0$. This helps to avoid dynamic instability and it simply says that the aggregate absorption curve of a country, when it has a positive slope, that slope must be greater than the slope of the aggregate supply curve (see figure 3 below). Δ_p is the OECD-wide expression weighted by the productive shares individual countries have in total OECD production. In order to determine final goods price and output responses specific to each country, we solve (25) for $\hat{P}$ and $\hat{x}$, $\hat{x}'$.[8]

$$\hat{P}/\hat{P}'_n = -\frac{\Delta_n}{\Delta_p} \gtrless 0 \tag{27}$$

$$\hat{x}/\hat{P}'_n = -\frac{\varepsilon_n\Delta_p + \varepsilon_p\Delta_n}{\Delta_p} \gtrless 0 \; ; \quad \hat{x}'/\hat{P}'_n = -\frac{\varepsilon'_n\Delta_p + \varepsilon'_p\Delta_n}{\Delta_p} \gtrless 0 \tag{28}$$

[8] See Appendix B for computational details of the derivation of the following results.

The change in total OECD production of final goods, $\bar{x}$, can easily be evaluated using (28).

$$\hat{\bar{x}}/\hat{P}'_n = -\frac{\bar{\varepsilon}_n\Delta_p + \bar{\varepsilon}_p\Delta_n}{\Delta_p} < 0 \tag{29}$$

$$\bar{\varepsilon}_n = \zeta\varepsilon_n + \zeta'\varepsilon'_n \ ; \quad \bar{\varepsilon}_p = \zeta\varepsilon_p + \zeta'\varepsilon'_p$$

In (27) - (29) a useful shorthand expression

$$\Delta_n = \zeta[\delta_n - \varepsilon_n\delta_o] + \zeta'[\delta'_n - \varepsilon'_n\delta'_o] \gtrless 0 \tag{30}$$

has been introduced. This term, too, is defined as an average of individual country terms. The economic meaning of these terms bears some importance for the understanding of the model.

To bring this out more clearly the following discussion is centered around figure 3 where the outer diagrams exhibit EMS and US absorption functions aa, a'a' and aggregate supply functions xx and x'x'. Note that the absorption functions are constructed such that at each price level real income produced at this price level is fed back to determine absorption. Besides real income a real balance effect influences absorption. In showing the absorption functions with negative slopes we tacitly have assumed that a positive real income effect from a rising price level is dominated by a negative real balance effect.[9] We assume an initial long run equilibrium where the final goods price level is P_o. At this price level each country must provide the indicated amounts c^*_u, c^*_e in final goods to pay for the national oil bill. According to the definition of a long run equilibrium we assume that OPEC trade relations are balanced in each OECD country.

[9] For more details concerning slope and shifting parameters of these curves cf. Schmid (1980c).

$\Delta_n < 0$:

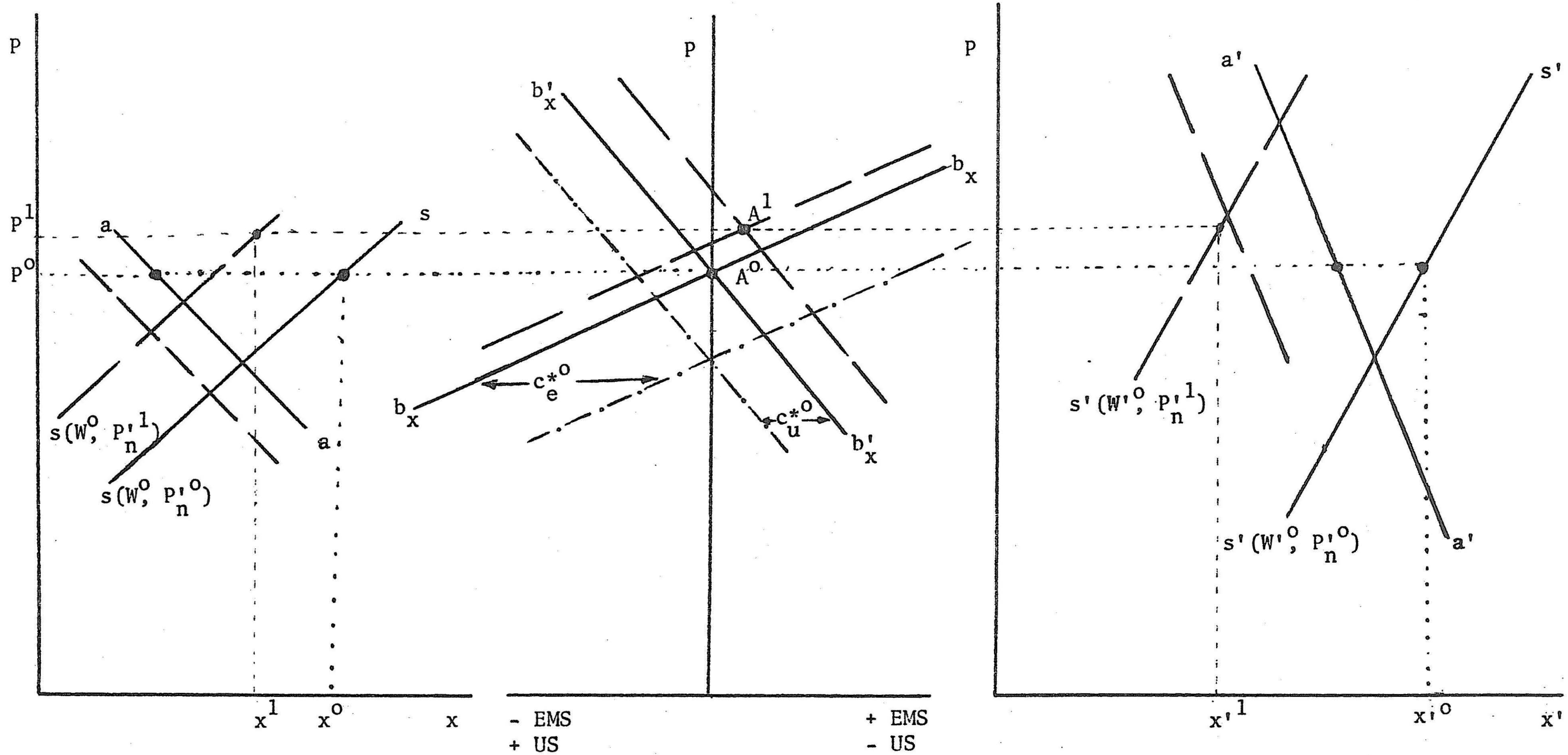


Figure 3

Obviously there exists no trade between the EMS and the US because in the middle diagram (net) excess demand (net of OPEC consumption) is zero. Note that we have to distinguish gross and net excess demand functions.[10] The former are shown as dashed lines but only the latter determines EMS - US trade relations.

Concentrating on EMS we argue that at the given final goods price level an oil price shock moves the EMS supply curve to the left by a percentage change ε_n. At the lower output (gross production) EMS absorption is reduced by $\alpha(1-\theta_n)\varepsilon_n$. Both the oil share and the marginal propensity to spend account for an excess demand situation in the EMS final goods market.

$$- [\varepsilon_n - \alpha(1-\theta_n)\varepsilon_n] = - \varepsilon_n\delta_o < 0$$

However, this analysis suppresses the fact that domestic income after an oil price shock must fall by a larger percentage change than gross production if we realistically assume low technological possibilities to substitute for oil in the short run, i.e., $0 < \sigma < 1$. This additional reduction in absorption due to the tax-like real income squeeze is

$$\alpha\theta_n(1-\sigma) = \delta_n \geq 0$$

and this effect may be strong enough to create an excess supply situation in the EMS final goods market if $\delta_n - \varepsilon_n\delta_o > 0$. Technically speaking we have the EMS absorption curve shifting to the left by a larger percentage than the EMS supply curve whenever $\delta_n - \varepsilon_n\delta_o > 0$. This is

[10] To simplify, we show both excess demand functions as parallel lines. This implicitly assumes that OPEC demand is perfect price inelastic. This assumption also removes the unrealistic property of falling OPEC demand if oil prices rise. In Schmid (1976) a real income effect in OPEC demand for final goods takes care of this unwanted property.

the case of an EMS contributing excess supply to the world market for final goods. Correspondingly in figure 3 the excess supply curve would shift to the right.[11] From this argument it is then obvious that if, not only the EMS, but also the US contributes an excess demand in the world market for final goods, i.e., $\delta_n - \varepsilon_n\delta_o < 0$ and $\delta'_n - \varepsilon'_n\delta'_o < 0$, we have $\Delta_n < 0$ and from (27) world market price for final goods must rise. It is also clear now that for a rising world market price at least one country must adjust by creating excess demand. If both countries adjust by opposing excess demand patterns positive excess demand of one country must be larger than the negative excess demand of the other country, if the final goods price is to rise because of a world excess demand situation.

Knowing now that the final goods price rise is determined by Δ_n/Δ_p this price rise can be taken to determine EMS and US output effects. We find from (28)

$$\hat{x}/\hat{P}'_n \gtrless 0 \quad \text{if} \quad \frac{\varepsilon_n}{\varepsilon_p} \lessgtr -\frac{\Delta_n}{\Delta_p} \quad \text{and} \quad \hat{x}'/\hat{P}'_n \gtrless 0 \quad \text{if} \quad \frac{\varepsilon'_n}{\varepsilon'_p} \lessgtr -\frac{\Delta_n}{\Delta_p} \tag{31}$$

These conditions compare the upward shift of the aggregate supply curve of each individual OECD country with the increase in world market price for final goods. Gross production of an individual OECD country increases if its aggregate supply curve shifts vertically by a lower percentage than the percentage increase in world market price.

[11]Here the impact of an oil shock differs from other supply shocks, for instance a wage push. While from the latter we usually derive an excess demand situation, from an oil shock we get an ambiguous effect on excess demand.

Perhaps even more interesting is an observation from (31) that after an oil price shock there seems to exist the possibility of a positive output effect in each country. Note first that only in an initial <u>world</u> excess demand case, i.e., $\Delta_n < 0$, we may obtain the positive output result. Hence, we can exclude a falling world market price from further investigation. Secondly, notice that the positive output result contradicts virtually all small country theory of oil price shocks where normally the only definite outcome is a fall in gross production and real income.[12]

We turn next to a closer investigation of the positive output effect in our disaggregated OECD framework. First, what determines this atypical outcome? Second, is it possible that both countries simultaneously adjust with positive output expansion; or, is it rather that a positive output effect in one country corresponds to a negative output effect in the other? There also exists a presumption that for a country to experience a positive output effect it seems necessary that it runs a trade surplus in trade with its industrial neighbor economy. To prove this conjecture it is necessary to determine also the oil impact upon B_x, the EMS-US trade balance. From (5) we can derive an expression for the change in B_x taken in a point of long run equilibrium.

$$dB_x = \overline{Y}\zeta[\delta_o \hat{x} + \delta_p \hat{P} + \delta_n \hat{P}'_n + (\delta_n+\theta_n \eta) \hat{E} - (1-\theta_n) \rho \hat{M}]$$

Using (27) and (28) in this expression yields an ambiguous oil price impact upon the EMS-US trade balance.

---

[12] A notable exception is Dornbusch (1980), chapter 5, who discusses in a small country two sector economy the case of an oil shock related terms of trade effect.

$$dB_x/\hat{P}'_n = \bar{Y}\zeta \frac{(\delta_n - \varepsilon_n \delta_o)\Delta_p - (\delta_p + \varepsilon_p \delta_o)\Delta_n}{\Delta_p} \gtrless 0 \quad (32)$$

The following condition relates the upward shift of the EMS (net) excess demand curve in figure 3 to the percentage increase in world market price in order to determine the sign of the EMS trade balance with respect to the US.

$$dB_x/\hat{P}'_n \gtrless 0 \quad \text{if} \quad \frac{\delta_n - \varepsilon_n \delta_o}{\delta_p + \varepsilon_p \delta_o} \gtrless \frac{\Delta_n}{\Delta_p} \quad (33)$$

An expression similar to (33) can be given for the US trade balance with respect to the EMS.

$$dB'_x/\hat{P}'_n \gtrless 0 \quad \text{if} \quad \frac{\delta'_n - \varepsilon'_n \delta'_o}{\delta'_p + \varepsilon'_p \delta'_o} \gtrless \frac{\Delta_n}{\Delta_p} \quad (34)$$

We next give conditions which characterize an atypical adjustment of an OECD country after an oil price shock. Using (31) in connection with (33) or (34) yields.

$$-\frac{\varepsilon_n}{\varepsilon_p} > \frac{\Delta_n}{\Delta_p} < \frac{\delta_n - \varepsilon_n \delta_o}{\delta_p + \varepsilon_p \delta_o} \quad \text{if } \hat{x} > 0 \text{ and } dB_x > 0 \quad (35)$$

$$-\frac{\varepsilon'_n}{\varepsilon'_p} > \frac{\Delta_n}{\Delta_p} < \frac{\delta'_n - \varepsilon'_n \delta'_o}{\delta'_p + \varepsilon'_p \delta'_o} \quad \text{if } \hat{x}' > 0 \text{ and } dB_x < 0 \quad (36)$$

In Appendix C a detailed investigation of possible adjustment patterns contained in (31) and (32) comes to the following conclusions:

(1) The "normal" result from an oil price shock is a simultaneous fall in individual country outputs. The EMS trade balance may react positively or negatively. A favorable EMS trade balance effect is more likely, (i) the smaller the excess demand on the part of EMS and (ii) the larger the excess demand on the part

of US contributed at a given world market price to the world market for final goods.

(2) The atypical result of a positive output effect is possible but never appears simultaneously in both countries. If an OECD country experiences a positive output effect it must also have a positive trade balance with its neighbor economy.

(3) A necessary condition for a positive output effect is a sufficient superiority (low θ_n, high σ) in the technological accommodation to the materials price shock, i.e., the aggregate supply curve of a country with a positive output effect must shift less than the supply curve of the other OECD country. Demand side effects as described in (1) which turn the final goods trade balance in favor of a country with technological superiority enhance the possibility of a positive output effect.

(4) A high technological similarity and/or highly similar spending pattern in both countries eliminate the appearance of positive output effects.

The last statement suggests the idea of treating the EMS and US economies as replicas. Analytically this idea can be made effective in (27) - (29) by setting

$$\alpha = \alpha' = \overline{\alpha} \; ; \quad \theta_n = \theta'_n = \overline{\theta}_n \; ; \quad \sigma = \sigma' = \overline{\sigma} \; ;$$

$$\varepsilon_i = \varepsilon'_i = \overline{\varepsilon}_i \qquad (i = p,w,n)$$

OECD price output response is

$$\hat{P}/\hat{P}'_n = -\frac{\bar{\delta}_n - \bar{\varepsilon}_n\bar{\delta}_o}{\bar{\delta}_p + \bar{\varepsilon}_p\bar{\delta}_o} \gtrless 0 \quad (37)$$

$$\hat{\bar{x}}/\hat{P}'_n = -\frac{\bar{\varepsilon}_n\bar{\delta}_p + \bar{\varepsilon}_p\bar{\delta}_n}{\bar{\delta}_p + \bar{\varepsilon}_p\bar{\delta}_o} < 0 \quad (38)$$

(37) and (38) are identical with the Bruno-Sachs (1979b p. 15) results.[13] Bruno-Sachs in generalizing the Findlay-Rodriguez (1977) work and all of the recent literature have treated an increase in oil prices as an increase in a single country's oil bill. Invoking the small country assumption they interpret formulas (37), (38) for an individual OECD economy. Therefore, they neglect effects of the oil price increase on other OECD countries or OPEC spending of higher oil revenues. Since an oil price shock, by its very nature, hits simultaneously the "rest of the OECD world" and the (small) country , only a fully fledged two OECD country analysis is appropriate; and as our analysis reveals, the case of positive output effects becomes a possible outcome which contradicts the Bruno-Sachs result. To make the Bruno-Sachs formulas valid our procedure of deriving them explains why it is preferable to interpret these formulas for OECD as a whole. Since OECD consists of equivalent countries, by definition we can neglect intra-OECD repercussions.[14] As the reader may have expected from (29), we derive from (38) an unambiguously negative output effect.

---

[13]Note that our model in contrast to Bruno-Sachs excludes imports of final goods but avoids Bruno-Sachs' dichotomy of real and monetary sectors by including a real balance effect. Hence the identity is only in terms of the reduced form parameters of the aggregate demand and supply framework, not in terms of the underlying structural equations.

[14]OPEC spending for OECD goods would give another repercussion effect from an oil price shock. We here do not wish to deal with this problem because it was analyzed in Schmid (1976) and Schmid (1980d).

If $\Delta_n > 0$ the final goods price level falls because the oil price shock produces a world-wide excess supply situation in the final goods market. At first this may appear counterintuitive since doubtless rising raw material prices tend to raise output prices from the cost side. However, as we have set up the model price determination is from the cost side as well as from the demand side. Hence, if excess supply is prevailing in the world market for final goods producers of both countries cannot pass through oil cost related price increases. Therefore, falling output prices indicate a clear case of profit squeeze.

Devaluation

Oil price shocks are inflicted to the OECD from the outside by OPEC. It is interesting to notice that exchange rate changes act, at least upon those EMS economies which are net importers of oil, in much the same way as an oil price shock. This holds as long as oil prices are posted in US currency. The traditional theory of devaluation derives positive output and price effects for the devaluing country. If exports of manufactured goods have an 'import content' in terms of imported intermediates like oil it appears dubious whether supply side related effects of a devaluation are matched by the usual demand side effects. In a previous small country analysis Schmid (1980b) argues that a devaluation tends to be price increasing and output reducing if factor substitution between oil and domestic factors of production is assumed realistically low. This section follows up this previous investigation by looking at devaluation in an OECD-wide framework. We also have a special interest in reconciling conflicting views about devaluation. Is it, as stated recently by economic analysts, that a devaluation is "like an oil price shock?"[15] Or is a devaluation of the domestic currency like a windfall wealth gain accruing to holders of foreign currency and therefore like an exogeneous increase in foreign currency?[16] Or, finally, in a competitive world economy with output variability due to sticky wages, is a devaluation equivalent to a foreign money shock plus a foreign supply shock, like a wage push?[17] Knowledge of the basic working of exchange rate changes seems to be an important precondition before one sets out to answer the ultimate question: How is the price of oil related to the price of the dollar? We shall address this question briefly in our conclusions but it is beyond the scope of the present paper.

The impact effect upon price level and country specific output levels of an exchange rate change can be calculated from (25). This is done in Appendix D where the following results are derived:

$$\hat{P}/\hat{E} = -[\Delta_n + \bar{\theta}_n \eta] + \zeta'[\delta_o'(\varepsilon_p' - \varepsilon_n') + (1-\theta_n')\rho'] \gtrless 0 \tag{39}$$

$$\hat{x}/\hat{E} = -[\varepsilon_n \Delta_p + \varepsilon_p(\Delta_n + \theta_n \eta)] + \varepsilon_p \zeta'[\delta_o' \varepsilon_w' + (1-\theta_n')\rho'] \gtrless 0 \tag{40}$$

$$\hat{x}'/\hat{E} = -\varepsilon_p' \zeta[\delta_o \varepsilon_w + (1-\theta_n)\rho] < 0 \tag{41}$$

It is helpful for an interpretation of (39) - (41) to exclude first any demand-side effects accruing to OECD from the non-OECD world due to the

---

[15] Cf. Kouri-Macedo (1979).

[16] This position is implicit in the full-employment models by Dornbusch (1973), Henderson-Rogoff (1980) who extend the original Dornbusch model to a world of currency substitution.

[17] This position has been taken by Schmid (1980c) who has extended the original Dornbusch model to cope with sticky wages and unemployment.

EMS devaluation. This can be accomplished by assuming a totally inelastic OPEC demand for OECD goods, i.e., $\eta = 0$. Recalling our oil shock results (27) - (28) and similar results for wage and money policies derived from (25) we obtain as an important outcome from (39) - (41).

$$\hat{P}/\hat{E} = \hat{P}/\hat{P}_n' + \hat{P}/\hat{W}' + \hat{P}/\hat{M}' \gtrless 0$$

$$\hat{x}/\hat{E} = \hat{x}/\hat{P}_n' + \hat{x}/\hat{W}' + \hat{x}/\hat{M}' \gtrless 0 \qquad (42)$$

$$\hat{x}'/\hat{E} = - [\hat{x}'/\hat{W} + \hat{x}'/\hat{M}] < 0$$

According to (42) EMS price and output effects resulting from an EMS devaluation are completely equivalent to a US policy of wage and money supply increase and a simultaneous oil price shock. The US output effect is equivalent to an EMS policy of wage and money supply restraint.

To understand this outcome assume a given equilibrium price P_o in EMS currency, then the EMS devaluation lowers prices of EMS goods in US currency units. To stay competitive, prices of US produced final goods must be reduced. Given the oil price and US money wages, the necessary US price concessions lead to a reduction in US output[18] and real income. Note that in a (net) oil importing US economy there is an additional tendency for a reduction in US real income stemming from the implicit higher real US oil price P_n'/P' if $0 \leq \sigma' < 1$. Simultaneously, US residents as holders of US currency, enjoy a windfall gain in their wealth which boasts US absorption. The income and wealth effects have a contradicting influence upon US absorption. Whatever the combined net outcome for US absorption may be, the more crucial point is that the

[18]The devaluation related US output reduction is as if the US production costs would have been increased ($\hat{P}_n' = \hat{W}' > 0$) at a given US output price.

US can contribute excess demand or excess supply to the world market for final goods.[19] Simultaneously, at the given price P_o, the higher price of the Dollar has also increased the real price of oil in the EMS, EP'_n/P_o. Hence, the exchange rate change acts like an oil price shock in the EMS. As discussed in the previous section this may lead to an excess supply or excess demand in the EMS. It should be clear by now that again we need $\Delta_n < 0$, the condition for the appearance of world excess demand, to make sure that a devaluation increases the final goods price level in (39).

The equivalence statements in (42) can be understood best by transferring them into neutrality statements. According to (42) an appreciation of the US currency plus a simultaneous US policy of wage and money supply restraint $(\hat{W}' = \hat{M}' = -\hat{E})$ together with a reduction in oil price $(\hat{P}'_n = -\hat{E})$ must be neutral with respect to EMS price level and output. This is easy to understand because the loss in competitiveness the US suffered from the Dollar appreciation could be avoided by cutting US production cost via a reduction of US factor prices, i.e., oil price and US wage. This way the US can escape the output reduction. The US price level would fall exactly in an amount necessary to overcome the appreciation; hence, the EMS price level and EMS output remain constant. To get the full neutrality result the wealth gain for US residents from the falling US price level must be liquidated by a contractionary US money supply policy. We obtain a similar neutrality result if in (42) a EMS devaluation is accomplished by a EMS policy of wage push validated by an increase in EMS money supply. This is a well understood phenomenon in models without oil. Obviously it

---

[19] Note that in a world without imported intermediates the US must have an excess demand. This is shown in Schmid (1980c).

also holds in the present framework because the EMS depreciation plus the EMS wage push increase EMS production costs and price level by the same percentage. Hence, final goods price in US currency units remains constant. To compensate EMS residents for their real wealth loss an expansion in EMS money supply is needed.

It was observed in Schmid (1980c) that real effects of an EMS devaluation can be annihilated by other ill conceived policies originating in EMS such as, a money validated EMS wage push, or by a US policy of wage and money restraint which is beyond EMS control. The presence of oil in OECD production leaves the first half of the sentence valid, but destroys the second part because the US would also rely upon cooperation of OPEC to restrain oil prices.

So far we have abstracted from outside demand effects due to a EMS devaluation. If $0 < \eta \leq 1$ this adds an OPEC demand pull to the world market for final goods and improves the likelihood of a positive result for EMS price and output. Now, even if intra-OECD interaction might result in an excess supply, the outside demand component, if strong enough, can turn the final outcome in a positive direction.

It is possible to focus directly on conflicting impulses of an exchange rate change by comparing demand side effects of the exchange rate change with restrictive cost push effects. This is done most efficiently by neglecting all intra-OECD interaction in an OECD where both economies are replicas.

Assume the EMS depreciation is accompanied by restrictive US wage and money policies ($\hat{M}' = \hat{W}' = -\hat{E}$ with $\hat{E} > 0$) and expansive EMS wage and money policies ($\hat{M} = \hat{W} = \hat{E}$ with $\hat{E} > 0$). Because these policies are in opposite directions they leave the OECD money supply and wage rate unchanged. However, by adding these concomitant policy measures with the EMS devaluation in formulas (39) - (41) we obtain the following reduced impact effects of an EMS devaluation:

$$\hat{P}/\hat{E} = -\frac{(\bar{\delta}_n - \bar{\varepsilon}_n\bar{\delta}_o) + \bar{\theta}_n\eta}{\delta_p + \bar{\varepsilon}_p\delta_o} \gtrless 0 \qquad (43)$$

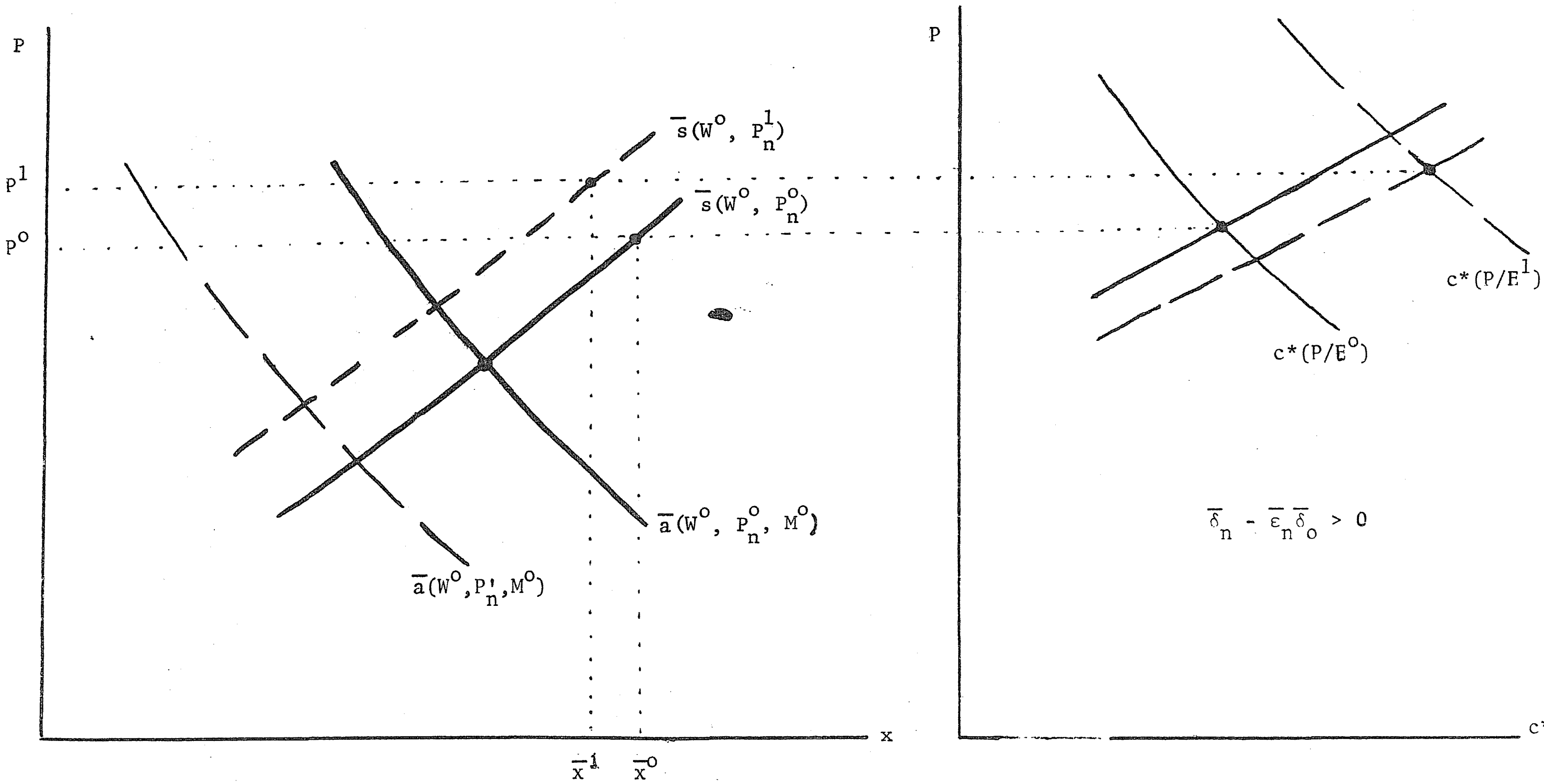
$$\hat{\bar{x}}/\hat{E} = -\frac{\bar{\varepsilon}_n(\bar{\delta}_p + \bar{\varepsilon}_p\bar{\delta}_o) + \bar{\varepsilon}_p(\bar{\delta}_n - \bar{\varepsilon}_n\bar{\delta}_o + \bar{\theta}_n\eta)}{\bar{\delta}_p + \bar{\varepsilon}_p\bar{\delta}_o} \gtrless 0 \qquad (44)$$

If OPEC demand is inelastic the price and output effects of an EMS exchange rate depreciation are indeed equivalent to an oil price shock. If $0 < \eta < 1$ OPEC exhibits a positive demand effect (see figure 4). Hence, even if OECD initially adjusts with an excess supply we may finally find a positive price effect if the devaluation related stimulation of OPEC demand is large enough. A positive price effect is a necessary condition for a positive output effect in (44) but there exists nothing that makes this result, a priori, more likely. The criterion for the output reaction is

$$\hat{\bar{x}}/\hat{E} \gtrless 0 \quad \text{if} \quad -\frac{\bar{\varepsilon}_n}{\bar{\varepsilon}_p} \gtrless \frac{\bar{\delta}_n - \bar{\varepsilon}_n\bar{\delta}_o + \bar{\theta}_n\eta}{\bar{\delta}_p + \bar{\varepsilon}_p\bar{\delta}_o} \qquad (45)$$

An initial excess supply, i.e., relatively low σ and a low η, makes it rather likely that we obtain a negative output effect from a devaluation.[20]

[20] This has been argued in Schmid (1980b). The formulas for price and output effects from a devaluation derived there follow from (43) and (44) if $\varepsilon_p \Rightarrow \infty$ as $1-\theta_n - \theta_\ell \Rightarrow 0$.



P
P^1
P^o
$\bar{s}(W^o, P_n^1)$
$\bar{s}(W^o, P_n^o)$
$\bar{a}(W^o, P_n^o, M^o)$
$\bar{a}(W^o, P_n', M^o)$
x
$\bar{x}^1$
$\bar{x}^o$
P
$c^*(P/E^1)$
$c^*(P/E^o)$
$\bar{\delta}_n - \bar{\varepsilon}_n\bar{\delta}_o > 0$
c*

Figure 4

Conclusions

This paper has emphasized the importance of a two-country framework in the analysis of an oil price shock. First, it was shown that blaming oil price increases for a stagnation or reduction in output, although in accordance with present academic analysis, really is no excuse in a world of interacting OECD economies. There always exist strategic parameter constellations such that an economy can escape output recessions. However, in a group of n economies at most (n-1) countries can avoid a falling output. Second, it has been shown that incorporation of oil as an intermediate factor of production possibly destroys the well-known beggar-my-neighbor property of an exchange rate change, because a depreciating EMS exchange rate can result in a negative output effect in the devaluing EMS country. Third, the paper demonstrates exchange rate changes are similar in many respects to oil price shocks. However, in a world of sticky nominal wages the equivalence of a devaluation with an oil price shock can be proved only in the case of an inelastic OPEC demand and compensating income and monetary policies which must be enacted in opposite directions in both countries. As a general result, an exchange rate policy has been shown to be equal to a blend of supply and demand management measures which in particular include the price of oil. This leads to a last question: How is the US/EMS exchange rate related to the price of oil? While this problem could best be addressed by adding a currency substitution portfolio sector[21] to our present model, we conclude with some remarks which are along a current account view of exchange rate

[21] This could be done along lines shown in a non-oil world by Henderson and Rogoff (1980).

determination rather than a possibly more useful portfolio balance approach. Assuming OPEC shocks the OECD world with an oil price hike, in which way could OECD react to protect output and real incomes? The present model, namely equation (42), suggests a simple solution: Both OECD countries must start simultaneously expansionary wage policies validated by simultaneous expansionary money supply policies.[22] This has been called the "inflation solution" because it would increase the final goods price by the same percentage as the oil price has risen and OPEC would not gain anything. If we now assume EMS resists the inflation solution and thus refuses to enact a policy of expansionary money supply and wage increases, real incomes in both OECD countries could be protected as before if the US currency would be depreciated by the percentage increase in oil price. More generally, we obtain real income protection if the degree of the dollar depreciation exactly matches the EMS reluctance to conduct the same inflationary US money-cum-wage policies. This same adjustment in the exchange rate would be produced automatically had we assumed an exchange rate mechanism designed to clear the overall EMS trade balance.

[22] This assumes an inelastic OPEC final goods demand and does leave out the possibility that OPEC indexes oil prices.

Appendix A

Define the following variables:

P	gross output price level
P_v	value added price level
W	(nominal) wage rate
R	(nominal) rental rate
P_n	oil price in domestic currency units
σ	elasticity of substitution between oil and domestic value added
σ_v	elasticity of substitution between domestic factors of production
β_i, α_i	shares of factors or output elasticities of production functions $x=x(v,n)$ and $v=v(\ell,k)$

We represent technology as a nested CES function

$$x = x(v(\ell,k), n) \qquad \text{(A1)}$$

which is to say the underlying functions are CES. We refer to these functions as the gross production function and the value added function. Differentiation of these functions yields

$$\hat{x} = \beta_v \hat{v} + \beta_n \hat{n} \qquad\qquad \hat{v} = \alpha_\ell \hat{\ell} + \alpha_k \hat{k}$$

$$\beta_v + \beta_n = 1 \qquad\qquad \alpha_\ell + \alpha_k = 1$$

We can define the elasticities of factor substitution

$$\hat{n} - \hat{v} = -\sigma(\hat{P}_n - \hat{P}_v) \qquad\qquad \hat{k} - \hat{\ell} = -\sigma_v(\hat{R} - \hat{W}) \qquad \text{(A2)}$$

Using these definitions it is possible to represent the change in gross output and value added as follows

$$\hat{x} = -\beta_n \sigma(\hat{P}_n - \hat{P}_v) + \hat{v} \qquad \hat{v} = \alpha_\ell \sigma_v (\hat{R} - \hat{W}) + \hat{k} \tag{A3}$$

The change in gross output price level as well as the change in value added price level are weighted averages of the changes in their respective factor price components.

$$\hat{P} = \beta_v \hat{P}_v + \beta_n \hat{P}_n \qquad \hat{P}_v = \alpha_\ell \hat{W} + \alpha_k \hat{R} \tag{A4}$$

Using the right hand equation of (A4) in the equation on the left hand side we can determine the change in gross output level as a function of the changes in all its components.

$$\hat{P} = (1-\beta_n)(\alpha_\ell \hat{W} + \alpha_k \hat{R}) + \alpha_n \hat{P}_n \tag{A5}$$

It is useful to define the following shares of factor costs in total value of gross output

$$\theta_n = \alpha_n \; ; \quad \theta_\ell = (1-\beta_n)\alpha_\ell \; ; \quad \theta_k = (1-\beta_n)\alpha_k = 1-\theta_n-\theta_\ell$$

This yields

$$\hat{P} = \theta_\ell \hat{W} + \theta_k \hat{R} + \theta_n \hat{P}_n \tag{A6}$$

The domestic capital stock is constant in the short run, therefore concentrating on the value added function in (A3) we can express the change in value added as a function of the domestic real wage in terms of value added, W/P_v.

$$\hat{v} = -(\alpha_\ell \sigma_v / \alpha_k)(\hat{W} - \hat{P}_v) \tag{A7}$$

Note that the rental rate is determined as a residual if in (A5) value added varies together with its price level assuming $\hat{W} = 0$. Using (A7) in the gross output function (A3) yields gross output as a function of real wage and real oil price in terms of value added, W/P_v, P_n/P_v.

$$\hat{x} = - \beta_n \sigma (\hat{P}_n - \hat{P}_v) - (\alpha_\ell \sigma_v / \alpha_k)(\hat{W} - \hat{P}_v) \qquad \text{(A8)}$$

We can rewrite (A8) using the definitions of gross shares.

$$\hat{x} = - \theta_n \sigma (\hat{P}_n - \hat{P}_v) - (\theta_\ell \sigma_v / \theta_k)(\hat{W} - \hat{P}_v) \qquad \text{(A9)}$$

From the left hand equation in (A4) we get

$$\hat{P}_v = \frac{1}{1-\theta_n} [\hat{P} - \theta_n \hat{P}_n]$$

Therefore, we can express changes in gross output as a function of real wage and real oil price in terms of gross output, W/P, P_n/P.

$$\hat{x} = - \varepsilon_n (\hat{P}_n - \hat{P}) - \varepsilon_w (\hat{W} - \hat{P}) \qquad \text{(A10)}$$

$$\varepsilon_n = \frac{\theta_n [\sigma(1-\theta_n-\theta_\ell) + \theta_\ell \sigma_v)]}{(1-\theta_n)(1-\theta_n-\theta_\ell)} > 0$$

$$\varepsilon_w = \frac{\theta_\ell \sigma_v}{1-\theta_n-\theta_\ell} > 0$$

$$\varepsilon_p = \varepsilon_n + \varepsilon_w = \frac{\theta_n \sigma (1-\theta_n-\theta_\ell) + \theta_\ell \sigma_v}{(1-\theta_n)(1-\theta_n-\theta_\ell)} > 0$$

Appendix B

The matrix of the endogeneous variables in (25) is

$$\begin{bmatrix} 1 & -\varepsilon_p & 0 \\ \zeta\delta_o & \zeta\delta_p + \zeta'\delta'_p & \zeta'\delta'_o \\ 0 & -\varepsilon'_p & 1 \end{bmatrix} \tag{B1}$$

Multiplying the first and the third row by $-\zeta\delta_o$ and $-\zeta'\delta'_o$, respectively, and adding to the second row gives

$$\begin{bmatrix} 1 & -\varepsilon_p & 0 \\ 0 & \Delta_p & 0 \\ 0 & -\varepsilon'_p & 1 \end{bmatrix} \tag{B2}$$

The determinant of (32) is Δ_p.

To solve for $\hat{P}/\hat{P}'_n$ the matrix in the denominator of the solution can be manipulated by multiplying the first and third column by ε_n and ε'_n, respectively, and adding to the second column. We then obtain

$$\begin{bmatrix} 1 & 0 & 0 \\ \zeta\delta_o & -\Delta_n & \zeta'\delta'_o \\ 0 & 0 & 1 \end{bmatrix} \tag{B3}$$

Using (B3) we obtain the complete solution.

$$\hat{P}/\hat{P}'_n = -\Delta_n/\Delta_p \gtrless 0$$

To solve for $\hat{x}/\hat{P}'_n$ and $\hat{x}'/\hat{P}'_n$ the matrices in the denominator of the solutions can be manipulated by multiplying the first and third row by $-\zeta\delta_o$ and $-\zeta'\delta'_o$, respectively, and adding to the second row. We then obtain

$$\begin{bmatrix} -\varepsilon_n & -\varepsilon_p & 0 \\ -\Delta_n & \Delta_p & 0 \\ -\varepsilon'_n & -\varepsilon'_p & 1 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} 1 & -\varepsilon_p & -\varepsilon_n \\ 0 & \Delta_p & -\Delta_n \\ 0 & -\varepsilon'_p & -\varepsilon_n \end{bmatrix} \qquad \text{(B4)}$$

Using (B4) we find the complete solutions.

$$\hat{x}/\hat{P}'_n = -\frac{\varepsilon_n\Delta_p + \varepsilon_p\Delta_n}{\Delta_p} \gtrless 0$$

$$\hat{x}'/\hat{P}'_n = -\frac{\varepsilon'_n\Delta_p + \varepsilon'_p\Delta_n}{\Delta_p} \gtrless 0$$

The change in OECD production of final goods, $\bar{x}$, is composed of changes in individual country production.

$$\hat{\bar{x}} = \zeta\hat{x} + \zeta'\hat{x}'$$

From the above solutions we obtain (29) in the text.

Appendix C

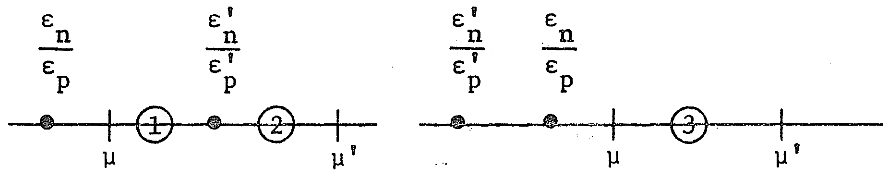
Denote $\mu \equiv \frac{\delta_n - \varepsilon_n \delta_o}{\delta_p + \varepsilon_p \delta_o}$ and $\mu' \equiv \frac{\delta'_n - \varepsilon'_n \delta'_o}{\delta'_p + \varepsilon'_p \delta'_o}$ then it is possible to show that Δ_n / Δ_p must be an average of μ and μ.

$$\frac{\Delta_n}{\Delta_p} = \frac{1}{1+\phi}\,\mu + \frac{\phi}{1+\phi}\,\mu' \qquad \text{where} \qquad \phi \equiv \frac{\zeta'(\delta'_p + \varepsilon'_p \delta'_o)}{\zeta(\delta_p + \varepsilon_p \delta_o)}$$

We can visualize this by the observation that the algebraic value of Δ_n / Δ_p must always lie in between lower and upper bounds μ and μ'.

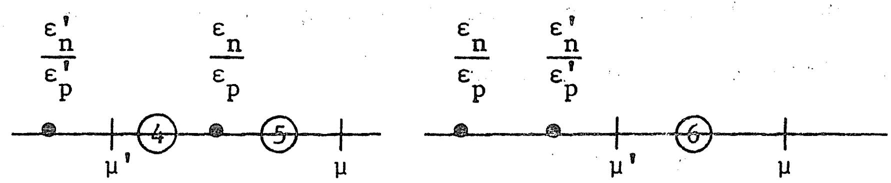
case: $\mu < \mu'$

EMS trade balance deteriorates



case: $\mu > \mu'$

EMS trade balance improves



Note that this property simply reflects the fact that US and EMS trade balances have opposite signs. Note also that we must distinguish two cases: If $\mu < \mu'$ we have a deterioration of the EMS trade balance, $dB_x < 0$, if $\mu > \mu'$ the EMS trade balance improves. It is further possible to show $-\varepsilon_n/\varepsilon_p < \mu$ and $-\varepsilon'_n/\varepsilon'_p < \mu'$. As $\varepsilon_n/\varepsilon_p \gtrless \varepsilon'_n/\varepsilon'_p$ we are concerned with the four interesting cases of possible parameter constellations shown above.

Therefore, we have

the following taxonomy of possible adjustment patterns from (31) and (32):

(1) $\hat{x} < 0$, $dB_x < 0$, $\hat{x}' > 0$	(2) $\hat{x} < 0$, $dB_x < 0$, $\hat{x}' < 0$	(3) $\hat{x} < 0$, $dB_x < 0$, $\hat{x}' < 0$
(4) $\hat{x} > 0$, $dB_x > 0$, $\hat{x}' < 0$	(5) $\hat{x} < 0$, $dB_x > 0$, $\hat{x}' < 0$	(6) $\hat{x} < 0$, $dB_x > 0$, $\hat{x}' < 0$

Cases (1) and (4) exhibit positive output effects. They demonstrate that if a country experiences a positive output effect it must also show an improvement in its bilateral trade relation to the other OECD country. It also follows simply by inspection of our graphical scheme that chances for cases (1) and (4) to appear are reduced and finally disappear totally if we make both economies technologically more equal.

Appendix D

To solve for $\hat{P}/\hat{E}$ the matrix in the denominator of the solution can be manipulated by multiplying the first and third row by $-\zeta\delta_o$ and $-\zeta'\delta'_o$, respectively, and adding to the second row. We then obtain

$$\begin{bmatrix} 1 & -\varepsilon_n & 0 \\ 0 & -\zeta[(\delta_n-\varepsilon_n\delta_o)+\theta_n\eta]+\zeta'[\delta'_p+\varepsilon'_p\delta'_o] & 0 \\ 0 & -\varepsilon'_p & 1 \end{bmatrix} \tag{D1}$$

Using (D1) we find the complete solution

$$\hat{P}/\hat{E} = \frac{-\zeta[(\delta_n-\varepsilon_n\delta_o)+\theta_n\eta]+\zeta'[\delta'_p+\varepsilon'_p\delta'_o]}{\Delta_p}$$

$$= \frac{-[\Delta_n+\bar{\theta}_n\eta]+\zeta'[\delta'_o(\varepsilon'_p-\varepsilon'_n)+(1-\theta'_n)\rho']}{\Delta_p}$$

To solve for $\hat{x}/\hat{E}$ and $\hat{x}'/\hat{E}$ the matrices in the denominator of the solutions can be manipulated by multiplying the first and third row by $-\zeta\delta_o$ and $\zeta'\delta'_o$, respectively, and adding to the second row. This yields

$$\begin{bmatrix} -\varepsilon_n & -\varepsilon_p & 0 \\ -\zeta[(\delta_n-\varepsilon_n\delta_o)+\theta_n\eta]+\zeta'[\delta'_p+\varepsilon'_p\delta'_o] & \Delta_p & 0 \\ -\varepsilon'_p & -\varepsilon'_p & 1 \end{bmatrix} \tag{D2}$$

The EMS output result is from (D2)

$$\hat{x}/\hat{E} = \frac{-\varepsilon_n\Delta_p - \varepsilon_p\{\zeta[(\delta_n-\varepsilon_n\delta_o) + \theta_n\eta] + \zeta'[\delta_p'+\varepsilon_p'\delta_o']\}}{\Delta_p}$$

$$= \frac{-[\varepsilon_n\Delta_p + \varepsilon_p(\Delta_n+\bar{\theta}_n\eta)] + \varepsilon_p\zeta'[\delta_o'(\varepsilon_p'-\varepsilon_n')+(1-\theta_n')\rho']}{\Delta_p} \gtrless 0$$

$$\begin{bmatrix} 1 & -\varepsilon_p & -\varepsilon_n \\ 0 & \Delta_p & -\zeta[(\delta_n-\varepsilon_n\delta_o)+\theta_n\eta] + \zeta'[\delta_p'+\varepsilon_p'\delta_o'] \\ 0 & -\varepsilon_p' & -\varepsilon_p' \end{bmatrix} \qquad \text{(D3)}$$

The US output result is from (D3)

$$\hat{x}'/\hat{E} = \frac{-\varepsilon_p'\{\Delta_p + \zeta[(\delta_n-\varepsilon_n\delta_o) + \theta_n\eta] - \zeta'[\delta_p'+\varepsilon_p'\delta_o']\}}{\Delta_p}$$

$$= \frac{-\varepsilon_p'\{\Delta_p - \Delta_p + \zeta[(\delta_n-\varepsilon_n\delta_o)+ \theta_n\eta + (\delta_p+\varepsilon_p\delta_o)]\}}{\Delta_p}$$

$$= \frac{-\varepsilon_p'\ \zeta[\delta_o(\varepsilon_p-\varepsilon_n) + (1-\theta_n)\rho]}{\Delta_p} < 0$$

References

Branson, W.H. and J.J. Rotemberg, 1980, "International Adjustment with Wage Rigidity," European Economic Review, 13, 309-342.

Bruno, M. and J. Sachs, 1979a, "Supply Versus Demand Approaches to the Problem of Stagflation," National Bureau of Economic Research, Working Paper No. 382, August.

Bruno, M. and J. Sachs, 1979b, "Macroeconomic Adjustment with Import Shocks: Real and Monetary Aspects," Institute for International Economic Studies, Discussion Paper No. 118, Stockholm, February.

Djajic, S., 1980, "Intermediate Inputs and International Trade: An Analysis of Real and Monetary Effects of an Oil Price Shock," Queen's University, September (unpublished).

Dornbusch, R., 1980, "Relative Prices, Employment and the Trade Balance in a Model with Intermediate Goods," unpublished, reprinted as chapter 5 in: Open Economy Macroeconomics, (New York: Basic Books).

Dornbusch, R., 1973, "Devaluation, Money and Nontraded Goods," American Economic Review, 63, 871-880.

Findlay, R. and C.A. Rodriguez, 1977, "Intermediate Imports and Macroeconomic Policy under Flexible Exchange Rates," Canadian Journal of Economics, 10, 208-217.

Henderson, D.W. and K. Rogoff, 1980, "Net Foreign Asset Positions and Stability in a World Portfolio Balance Model," mimeo, International Finance Division, Board of Governors of the Federal Reserve System, September.

Herberg, H., 1976, "On Imported Inflation," Zeitschrift für die gesamte Staatswissenschaft, Bd. 132.

Kouri, P.J.K. and J.B. de Macedo, 1979, "Perspectives on the Stagflation of the 1970's," Paper presented at the Kiel Conference on Macroeconomic Policies for Growth and Price Stability - The European Perspective, June.

Obstfeld, M., 1979, "Intermediate Imports and the Dynamics of the Exchange Rate and Current Account," Columbia University, Discussion Paper No. 37, November.

Rodriguez, C.A., 1977, "Flexible Exchange Rates and Imported Inputs: A Dynamic Analysis of the Interactions between the Monetary and Real Sectors for a Small Open Economy," Discussion Paper No. 76-7708, Columbia University.

Schmid, M., 1980 a, "Lohnpolitik und Beschäftigungin der offenen Wirtschaft" Zeitschrift für Wirtschafts-und Sozialwissenschaften, 100, 297-336.

Schmid, M., 1980 b, "Stagflationary Effects from a Devaluation in a Model with Imported Intermediate Goods," Jahrbücher für Nationalökonomie und Statistik, 197 (1982), 107-129.

Schmid, M., 1980 c, "Devaluation: Keynesian Trade Models and the Monetary Approach," Working Paper No. 8016, Centre for the Study of International Economic Relations, University of Western Ontario, June; European Economic Review, 17 (1982), 27-50.

Schmid, M., 1980 d, "Oil, Employment and the Price Level," Working Paper No. 8005, Centre for the Study of International Economic Relations, University of Western Ontario, March.

Schmid, M., 1976, "A Model of Trade in Money, Goods and Factors," Journal of International Economics, 6, 347-361.

SEMINAR PAPER SERIES

The series was initiated in 1971. For a complete list of Seminar Papers see the Institute's annual brochure.

1979

116.	*Carl Hamilton:*	Import Penetration and Import Price Elasticities with Special Reference to Dynamic LDC Export Commodities: The Case of Sweden 1960-75. 36 pp.
117.	*Thorvaldur Gylfason:*	Interest, Inflation and the Aggregate Consumption Function. 44 pp.
118.	*Michael Bruno and Jeffrey Sachs:*	Macro-Economic Adjustment with Import Price Shocks: Real and Monetary Aspects. 51 pp.*
119.	*Harvey Lapan and Roy Gardner:*	The von Neumann Turnpike under Uncertainty: 2-Sector Case. 24 pp.
120.	*Gary P. Sampson and Richard H. Snape:*	Effects of Variable Import Levies and Options for Retaliation. 26 pp.
121.	*Lance Taylor:*	Denationalization vs. National Growth: Who Gains from the "Advantage" of the MNC's? 19 pp.*
122.	*Torsten Persson:*	Alternative Transactions Variables in Money Demand Equations: A Note on the Baumol-Tobin Theory. 15 pp.
123.	*John F. Helliwell:*	Policy Modelling of Foreign Exchange Rates. 33 pp. (Also as Reprint No. 131)
124.	*Mordechai E. Kreinin:*	United States Foreign Economic Policy - An Overview. 34 pp. (Also as Reprint No. 137)
125.	*Mordechai E. Kreinin:*	Effect of European Integration on Trade Flows in Manufactures. 28 pp.
126.	*Ronald W. Jones*	Demand Behavior and the Theory of International Trade. 34 pp. (Also as Reprint No. 151)
127.	*Lars Calmfors and Staffan Viotti:*	Wage Indexation and Macroeconomic Stability in the Open Economy 32 pp.*
128.	*Kalyan K. Sanyal and Ronald W. Jones:*	The Theory of Trade in Middle Products. 65 pp.
129.	*Elhanan Helpman:*	Inflation and Balance of Payments Adjustments with Maximizing Consumers. 34 pp.
130.	*Clas G. Wihlborg and Per M. Wijkman:*	Outer Space Resources in Efficient and Equitable Use - New Frontiers for Old Principles. 30 pp. (Also as Reprint No. 165)

131. *Laurence Weiss:* Information Aggregation and Policy. 26 pp.

132. *J.A. Frenkel, T. Gylfason and J.F. Helliwell:* A Synthesis of Monetary and Keynesian Approaches to Short-Run Balance-of-Payments Theory. 20 pp. (Also as Reprint No. 141)

133. *Thorvaldur Gylfason and Assar Lindbeck:* Cost Inflation and Macroeconomic Theory. 66 pp.

134. *P.K.M. Tharakan:* Political Economy of Protection - An Empirical Investigation of the Belgian Case. 30 pp.

135. *Pavel Pelikan:* Towards a Rational Method of Choosing Economic Institutions. 60 pp.

1980

136. *Stanley W. Black:* Central Bank Intervention and the Stability of Exchange Rates. 26 pp.

137. *Gordon C. Winston:* The Timing of Work and Consumption, I: A Time-Specific Household Production Model. 50 pp.

138. *Per M. Wijkman:* Effects of Cargo Reservation: A Review of UNCTAD's Code of Conduct for Liner Conferences. 63 pp.

139. *Pekka Ahtiala and Jean M. Blin:* Inflation Risk, Resource Allocation and the Social Cost of Inflation. 18 pp.

140. *Carl Van Duyne:* Food Prices, Expectations, and Inflation. 39 pp.

141. *Torsten Persson:* Currency Areas and Alternative Exchange Rate Regimes in a Simple Three-Country General Equilibrium Model. 36 pp.

142. *Clas Wihlborg:* Commodity and Labor Market Rigidities in a Monetarist Model of Exchange Rate Determination. 37 pp.

143. *J. Peter Neary:* Intersectoral Capital Mobility, Wage Stickiness and the Case for Adjustment Assistance. 36 pp.

144. *Peter J. Lloyd:* 3 x 3 Theory of Customs Unions. 41 pp.

145. *Peter J. Lloyd:* Economies of Scale Due to the Length of Production Runs. 34 pp.

146. *Peter J. Lloyd:* The Effects of Trade Interventions on International Price Instability and National Welfare. 34 pp.

147. *Åke G. Blomqvist:* International Migration of Educated Manpower and Social Rates of Return to Education in LDCs. 41 pp.

148. *Assar Lindbeck:* Tax Effects versus Budget Effects on Labor Supply. 41 pp.

149. *Richard T. Selden:* The Inflationary Seventies: Comparisons among Selected High-Income Countries. 27 pp.

150. *Lars E.O. Svensson:* National Welfare in the Presence of Foreign-Owned Factors of Production: A Note on the Dual Approach. 19 pp.

151. *Ronald W. Jones:* Comparative and Absolute Advantage. 45 pp. (Also as Reprint No. 153)

152. *Carl Hamilton and Lars E.O. Svensson:* On Welfare Effects of a "Duty-Free Zone". 39 pp.

153. *James R. Markusen:* Trade and the Gains from Trade with Imperfect Competition. 28 pp.

154. *James R. Markusen and James R. Melvin:* Trade, Factor Prices, and the Gains from Trade with Increasing Returns to Scale. 35 pp.

155. *Elhanan Helpman and Assaf Razin:* Monopolistic Competition and Factor Movements. 23 pp.

156. *Elhanan Helpman and Assaf Razin:* A Comparison of Exchange Rate Regimes in the Presence of Imperfect Capital Markets. 42 pp.

157. *Elhanan Helpman:* International Trade in the Presence of Product Differentiation, Economies of Scale, and Monopolistic Competition: A Chamberlin-Heckscher-Ohlin Approach. 58 pp. (Also as Reprint No. 168)

158. *J. Peter Neary:* International Factor Mobility, Minimum Wage Rates and Factor-Price Equalization: A Synthesis. 32 pp.

159. *Assaf Razin:* Capital Movements, Intersectoral Resource Shifts, and the Trade Balance. 33 pp.

160. *James R. Markusen:* Multinationals and the Gains from Trade: A Theoretical Analysis Based on Economies of Multi-Plant Operation. 40 pp.

161. *Dennis Warner and Mordechai E. Kreinin:* Determinants of International Trade Flows. 31 pp.

162. *Michael Michaely:* The Terms of Trade between Poor and Rich Nations. 36 pp.

163. *Michael Michaely:* Capital Imports, Economic Structure, and Dependence. 32 pp.

164. *Assar Lindbeck:* Work Disincentives in the Welfare State. 60 pp. (Also as Reprint No. 176)

165. *Roy J. Ruffin:* Taxing International Capital Movements in a Growing World. 38 pp.

1981

166. *Torsten Persson:* The Neutrality of Money and the Analysis of Alternative Exchange Rate Regimes. 28 pp.

167. *Roy J. Ruffin:* Trade and Factor Movements with Three Factors and Two Goods. 19 pp. (Also as Reprint No. 170)

168. *Carl Hamilton:* A New Approach to Estimation of the Effects of Non-Tariff Barriers to Trade on Prices, Employment and Imports: An Application to the Swedish Textile and Clothing Industry. 65 pp. (Also as Reprint No. 160)

169. *Marian Radetzki:* Has Political Risk Scared Minerals Investments away from the Deposits in Developing Countries? 24 pp. (Also as Reprint No. 174)

170. *Lars E.O. Svensson and Assaf Razin:* The Terms of Trade, Spending, and the Current Account: The Harberger-Laursen-Metzler Effect. 43 pp.

171. *Assar Lindbeck:* The Distribution of Factor Income versus Disposable Income in a Welfare State: The Case of Sweden. 84 pp.

172. *Åke G. Blomqvist:* Education, Unemployment and Government Job Creation for Graduates in LDCs. 35 pp.

173. *Per Magnus Wijkman:* Seigniorage, Financial Intermediation, and the International Role of the Dollar, 1960-1971. 48 pp.

174. *Carl Hamilton:* Public Subsidies to Industry: The Case of Sweden and Its Shipbuilding Industry. 31 pp.

175. *Lars Calmfors:* Output, Inflation and the Terms of Trade in a Small Open Economy. 25 pp.

176. *Carl Van Duyne:* Price Determination in Markets for Storable Commodities. 30 pp.

177. *Peter Svedberg:* Colonialism and Foreign Direct Investment Profitability. 35 pp.

178. *Carl Hamilton and Lars E.O. Svensson:* On the Choice Between Capital Import and Labor Export. 47 pp.

179. *Henrik Horn:* Some Implications of Non-homotheticity in Production in a Two-sector General Equilibrium Model with Monopolistic Competition. 39 pp.

180. *Thorvaldur Gylfason and John F. Helliwell:* A Synthesis of Keynesian, Monetary, and Portfolio Approaches to Flexible Exchange Rates. 37 pp.

181. *Elhanan Helpman and Assaf Razin:* The Role of Saving and Investment in Exchange Rate Determination under Alternative Monetary Mechanisms. 33 pp.

182. *Mario I. Blejer and Hans Genberg:* Permanent and Transitory Shocks to Exchange Rates: Measurement and Implications for Purchasing Power Parity. 36 pp.

183. *Torsten Persson:* Global Effects of National Stabilization Policies under Fixed and Floating Exchange Rates. 45 pp.

184. *Lars E.O. Svensson:* Oil Prices and a Small Oil-Importing Economy's Welfare and Trade Balance: An intertemporal approach. 55 pp.

185. *Michael Hoel:* Short Run and Long Run Effects of a Tax Cut in an Open Economy with a Sticky Real Wage. 60 pp.

186. *Martin Feldstein:* Inflation, Tax Rules and the Accumulation of Residential and Nonresidential Capital. 32 pp.

187. *Jeffrey Sachs:* The Current Account in the Macroeconomic Adjustment Process. 20 pp.

188. *J. Peter Neary and Douglas D. Purvis:* Sectoral Shocks in a Dependent Economy: Long-Run Adjustment and Short-Run Accommodation. 58 pp.

189. *Tomas Björk, Johan Myhrman, and Mats Persson:* Consumption and Savings under Price Uncertainty. 40 pp.

190. *John F. Helliwell, Paul M. Boothe, and Robert N. McRae:* Stabilization, Allocation and the 1970s Oil Price Shocks. 53 pp.

191. *Nancy P. Marion and Lars E.O. Svensson:* World Equilibrium with Oil Price Increases: An Intertemporal Analysis. 38 pp.

192. *Lars Calmfors:* Employment Policies, Wage Formation and Trade Union Behavior in a Small Open Economy. 39 pp.

1982

193. *Michael Bruno:* Adjustment and Structural Change Under Supply Shocks. 39 pp.

194. *Assaf Razin and Lars E.O. Svensson:* The Current Account and the Optimal Government Debt. 21 pp.

195. *W.M. Corden and J.P. Neary:* Booming Sector and De-Industrialisation in a Small Open Economy. 45 pp.

196. *Torsten Persson and Lars E.O. Svensson:* Is Optimism Good in a Keynesian Economy? 19 pp.

197. *Lars E.O. Svensson:* On Variable Capital Utilization and International Trade Theory. 14 pp.

198. *Wilfred J. Ethier:* International Trade and Labor Migration. 30 pp.

199. *Harry Flam, Torsten Persson, and Lars E.O. Svensson:* Optimal Subsidies to Declining Industries: Efficiency and Equity Considerations. 28 pp.

200. *Lars E.O. Svensson:* Factor Trade and Goods Trade. 37 pp.

201. *Thorvaldur Gylfason and Michael Schmid:* Do Devaluations Cause Stagflation? 27 pp.

202. *Lars Hörngren, Johan Myhrman, Per-Åke Nilsson, Staffan Viotti and Anders Vredin:* The SSEM Model - A Brief Description. 24 pp.

203. *Hans Tson Söderström and Eva Uddén-Jondal:* Does Egalitarian Wage Policy Cause Wage Drift? An Empirical Study of Sweden 1960-1979. 49 pp.

204. *Jonathan Eaton and Henryk Kierzkowski:* Oligopolistic Competition, Product Variety and International Trade. 36 pp.

205. *Pehr Wissén:* Growth Models for Open Economies with Non-Shiftable, Malleable Capital and Nontraded Goods. 63 pp.

206. *Carl Hamilton and Lars E.O. Svensson:* Should Direct or Total Factor Intensities be Used in Tests of the Factor Proportions Hypothesis in International Trade Theory? 22 pp.

207. *John T. Cuddington:* Portfolio Balance and IS-LM: A Marriage under Fixed Exchange Rates. 40 pp.

208. *Carl Hamilton and Lars E.O. Svensson:* Revealed Comparative Advantage: The Case of Sweden. 20 pp.

209. *Carl Hamilton and Lars E.O. Svensson:* Testing Theories of Trade among Many Countries. 62 pp.

210. *Avinash Dixit:* Growth and Terms of Trade under Imperfect Competition. 25 pp.

211. *M June Flanders:* The Balance-of-Payments Adjustment Mechanism: The Doctrine According to Ohlin. 31 pp.

212. *Ronald W. Jones and Douglas D. Purvis:* International Differences in Response to Common External Shocks: The Role of Purchasing Power Parity. 38 pp.

213. *Åke Blomqvist and Henrik Horn:* Public Health Insurance and Optimal Income Taxation. 32 pp.

214. *Carl Hamilton:* Agricultural Protection in Sweden 1970-1980. 25 pp.

215. *Thorvaldur Gylfason:* Why Rational Expectations do not Neutralize Monetary Policy. 8 pp.

216. *John T. Cuddington:* Currency Substitution, Capital Mobility and Money Demand. 25 pp.

217. *Michael Schmid* International Adjustment to an Oil Price Shock - The Role of Competitiveness. 49 pp.