PRICE AND TERMS OF TRADE RESPONSES TO REVALUATION IN WEST-GERMANY*

by

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Summary

In this paper German industries are classified into a competitive and a non-competitive sector. The effects of revaluation of the deutschmark and of changes in world market prices are computed with a pricing model inspired by the Scandinavian approach.

It is then shown that in the short-run the terms of trade and profit shares in the competitive sector are strongly affected by revaluation. The effects are weaker when wages are adjusted for changes in prices, but still important. Hence, a revaluation does produce real effects in West Germany although it is not clear whether the trade account surplus is increased or decreased.

An exogenous deterioration of the terms of trade is accentuated by the existence of a non-competitive sector. Profits in the competitive sector increase attracting resources from sheltered sectors, independent of whether terms-of-trade increase or decrease as long as prices in the competitive sector rise. In general, the trade account response is again ambiguous.

1. Introduction

The purpose of this paper is to anayze the price effects of exchange rate revaluation and of changes in terms of trade in West Germany, and to derive some conclusions for the response of the trade account.

Recent literature on the effectiveness of exchange rate alterations has stressed the importance of the distinction between traded goods and non-traded goods.(1) That is, a small country that is unable to affect the terms of trade can only eliminate a balance-of-trade deficit and maintain full employment if the relative price of traded goods can be increased.(2)

In general equilibrium, a balance-of-trade deficit has as counterpart excess supply of non-traded goods.(3) The mechanism of a devaluation is then as follows. With given international prices, domestic currency prices of imported commodities increase by the full amount of devaluation. So do export prices in domestic currency since the home country is a price taker. Higher prices for traded goods attract resources from non-traded goods. The excess supply on non-traded goods as well as excess demand for traded goods is thereby getting eliminated.

An important empirical question then becomes whether it is possible to affect significantly the relative price structure. Difficulties stem from three considerations. First, virtually all industries have trading relations with the outside world. Prices of all industries would then be directly affected by devaluation, although to varying degrees. Second, all industries are indirectly affected by increased costs of their imported, or import containing, inputs. Finally, wages can be expected to adjust to rising import prices. In the limit, with fully indexed wages, and all other costs properly adjusted, a devaluation may not change at all the relative price of traded and non-traded goods and become therefore ineffective.

When this model is applied to West Germany several particular problems arise. This country has *revalued* its currency several times. Is a revaluation simply the reverse of a devaluation ? There seem to be differences in at least two respects. The success of a devaluation depends to a certain extent on imperfect adjustment of wages to increased import prices. After a revaluation, the question rather becomes to what extend revaluation is passed on to import prices. Rigidities may prevent a corresponding fall

in import prices in domestic currency. Second, even if import prices fall, with nominal wages being rigid downward the risk of a revaluation-offsetting wage adjustment is absent here. Of course, if revaluation is a consequence of higher inflation rates abroad- and non intended to change the real exchange rate - such price rigidities are of less importance.

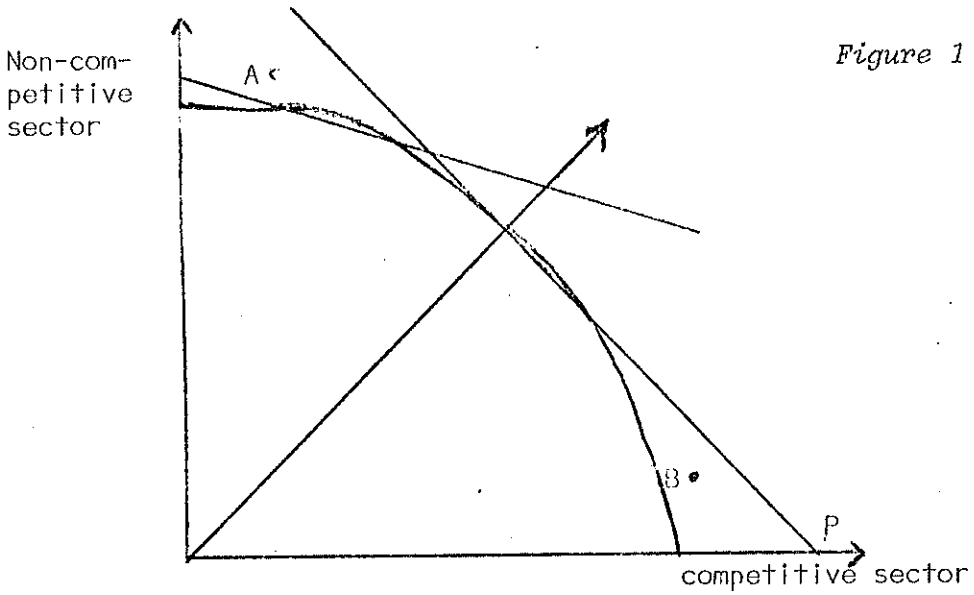
A difficulty of a conceptual nature is the distinction between traded and non-traded commodities. We use industry and not commodity data so that concepts like traded and non-traded are very approximative. Moreover, virtually all industries are engaged in some international trade but several of them cannot be considered as pure price takers in international markets. In another paper (Morel-Steinherr, 1978) we have therefore argued that a distinction should be made between competitive and non-competitive industries, regardless of whether an industry is engaged in international trade or not. In the following analysis we are using the classification derived in that paper from testing a pricing model.

Our tests on sectoral prices revealed that some industries are price-takers on all markets, others are price-takers on foreign but not on domestic markets (discriminatory industries), and a third group is constituted of price makers on all markets.

The distinction between competitive and non-competitive (for short "sheltered") industries has some important consequences for the effects of a revaluation.

In Figure 1 the transformation curve between competitive and sheltered sectors is drawn. At any point on the transformation curve we have full employment of existing resources. A tangent at any of these points indicates the relative price between competitive and sheltered sectors, such as P. Along P the trade account is balanced ; the value of *net* exports of one sector is equal to the value of *net* imports of the other.

Figure 1



At any point above the line P the trade account is in deficit - indicating overspending -, and at any point below it is in surplus. But now an important distinction arises. Consider the points A and B, both corresponding to a trade surplus. At A the competitive sector is a net importer ; at B the roles are reversed.

The relative price between competitive and sheltered sectors decreases after a revaluation and resources are shifted into the sheltered sector. Consequently, the trade surplus is being reduced if the competitive sector is a net exporter (such as at point A). However, if the non-competitive sector is net exporter (such as at point B), as is the case in West Germany (and which is necessarily the case when all imports are considered as competitively priced goods), *then a revaluation may increase the trade account surplus*.[4] This could be an explanation of the observed persistence of the West German trade account surplus "in spite of" frequent *real* exchange rate increases.

One can also observe that within this framework the terms-of-trade do not remain constant after exchange rate adjustments. To assess the trade account response to revaluation the induced terms-of rate variation has to be taken into account.

The plan of this paper is then the following. In section 2 the model is described. In section 3 the effects of revaluation on prices, profits, and the terms-of-trade are calculated. Then, in section 4, exogenous changes in world market prices are analyzed. The most noteworthy results are summarized in section 5.

2. The Model

The basic equation of the model is a decomposition of producer prices :

$$\hat{p}_i \equiv \sum_{j=1}^{T} a_{ji}\hat{p}_j + \sum_{j=1}^{T} b_{ji}\hat{p}_j + d_i\hat{w}_i + f_i\hat{r}_i + c_i\hat{tax}_i + s_{ki}\hat{\psi}_i \qquad i\varepsilon T \qquad (1)$$

where "^" represents a percentage change and

i,j are indexes for the T industries of the sample ;

p_i = price of one unit of output (of sector i) in DM ;

w_i = average wage rate ;

r_i = depreciation ;

tax_i = indirect taxes less subsidies ;

ψ_i = gross profits and property income ;

$a_{ji} = \frac{X^D_{ji}}{X_i}$ = share of domestic inputs j in total value of output of sector i ;

$b_{ji} = \frac{M_{ji}}{X_i}$ = share of imported inputs j in total value of output of sector i ;

d_i = share of wages in value of output ;

f_i = share of depreciation in value of output ;

c_i = share of indirect taxes less subsidies in value of output ;

$s_{k,i}$ = share of gross profits and property income in value of output .

The first term on the right-hand side of definition (1) represents the cost of domestic inputs in the production of one DM of good i. The second term represents the costs of imported inputs. The subsequent terms stand for labor costs, depreciation, taxes, and profits, respectively.

Definition (1) can be turned into a theory by making specific assumptions about pricing behavior. Classifying our sample of T industries into a competitive and into a non-competitive sector the following assumption are made.

A.1 In the competitive sector prices are determined on world markets :

$$\hat{p}_i = \hat{p}_i^{*} + \hat{e} \qquad \text{for } i \in C \tag{2}$$

where a star denotes a foreign variable, e is the exchange rate, and the sample of T industries is subdivided into C competitive and T-C = N non-competitive industries in domestic markets. A revaluation gets translated into a decrease in domestic prices of the competitive sector by the same percentage, and therefore into a reduction of unit profits.

A.2 A variety of assumptions about price determination in the sheltered sector can be made and some empirical support can be found for each. The most widely confirmed hypothesis is cost-plus pricing.[5] One version of that hypothesis postulates that producers add a constant amount (ψ) to costs. Since output is constant in our computation we set $\hat{\psi}_i = 0$ in equation (1), for $i \in N$. This assumption implies, of course, that the capital share increases (falls) when output prices fall (increase).

In a second version it is assumed that producers add a constant profit margin (π) to costs. Keeping indirect taxes constant, the variation in output prices is then equal to

$$\hat{p}_i = (1 + \pi_i)\left[\sum_{j=1}^{T} a_{ji}\hat{p}_j + \sum_{j=1}^{T} b_{ji}\hat{p}_j + d_i\hat{w}_i + f_i\hat{r}_i\right]. \tag{3}$$

It is easily verified that in this case the share of capital is constant. Its percentage variation is defined as

$$\hat{s}_{k,i} = \hat{\pi}_i + \frac{\pi_i}{s_{k,i}}\left[\sum_{j=1}^{T} a_{ji}\hat{p}_j + \sum_{j=1}^{T} b_{ji}\hat{p}_j + d_i\hat{w}_i + f_i\hat{r}_i - \hat{p}_i\right]. \tag{4a}$$

Setting $\hat{\pi}_i = 0$ and using (3) one can transform (4a) into :

$$\hat{s}_{k,i} = \left(\frac{\pi_i}{1+\pi_i}\cdot\frac{1}{s_k} - 1\right)\hat{p}_i. \tag{4b}$$

The term in parentheses is equal to zero since, by definition, $s_k = \pi/(1 + \pi)$.

Thus, the hypothesis of adding a constant profit margin to costs is also consistent with the long-run view of a constant share of capital.

A.3 From equations (1) to (3) the following equations can be derived :

a) For the competitive sector :

$$s_{k,i}\hat{\psi}_i = \hat{p}_i^{*} + \hat{e} - \sum_{j=1}^{C} a_{ji}\,(\hat{p}_j^{*} + \hat{e}) - \sum_{j=C+1}^{T} a_{ji}\hat{p}_j - \sum_{j=1}^{T} b_{ji}(\hat{p}_j^{*} + \hat{e}) - d_i\hat{w}_i \qquad i \in \quad (5)$$

b) For the non-competitive sector :

Under the assumption $\psi_i = 0$ for $i \in N$, equation (1) implies :

$$\hat{p}_i = \sum_{j=1}^{C} a_{ji}\,(\hat{p}_j^{*} + \hat{e}) + \sum_{j=C+1}^{T} a_{ji}\hat{p}_j + \sum_{j=1}^{T} b_{ji}\,(\hat{p}_j^{*} + \hat{e}) + d_i\hat{w}_i \; ; \qquad i \in N \quad (6a)$$

The alternative assumption, contained in (3) leads to :

$$\hat{p}_i = (1 + \pi_i)\left[\sum_{j=1}^{C} a_{ji}\,(\hat{p}_j^{*} + \hat{e}) + \sum_{j=C+1}^{T} a_{ji}\hat{p}_j + \sum_{j=1}^{T} b_{ji}\,(\hat{p}_j + \hat{e}) + d_i\hat{w}_i + f_i\,\hat{r}_i\right] \qquad (6b)$$

$$i \in N$$

Alternatively, (6b) was computed imposing constancy of the share of capital. The two methods yielded, of course, identical results. The parameter π_i can be computed from the definition $\pi_i = s_{k,i}/(1 - s_{k,i})$.

All weights in equations (5), (6a) and (6b) are assumed to remain constant as well as taxes and depreciation. For the long-run the results therefore to be biased. Even if abstraction is made of technological progress, changes in factor prices lead to different factor proportions in the longer run.

Since revaluation is the focus of our analysis, $\hat{p}_j^*$ can be set equal to zero in (5), (6a) and (6b) ; a decrease in all p_j^* would, of course, have the same effect on non-competitive prices as a revaluation of the exchange rate. For wages, different assumptions can be made. We experiment with three. One is to assume that wages do not adjust ($\hat{w}=0$). At the other extreme, wages may be explicitly or implicitly indexed to consumer prices ($\hat{w}=\hat{p}$). Finally, wages may follow the exchange rate, i.e., prices in the competitive sector ($\hat{w}=\hat{e}$). Support for this hypothesis can be found in Morel-Steinherr (1978).

In spite of the limitations noted above, an analysis of the long-run solution does not seem void of interest, since changes in relative prices affect resource allocation only over a longer time horizon. An essential feature of the Scandinavian model is the assumption that wages are determined largely by the competitive sector, in accordance with long run constancy of the labor share in that sector. In this case one has $\hat{w}=\hat{p}_i = \hat{e}$ for $i \in C$, so that the results derived from the third alternative assumption about wage adjustments can also be interpreted as long-run results.

With wage increases equally spread over all industries, the share of labor in non-competitive industries will increase, if prices in that sector fall by less than the percentage of revaluation, and if that difference is not covered by differential productivity growth. In our computation preference wastherefore given to cost-plus pricing over a price determination that would be derived from a constant labor share in the shielded sector.

What happens to the share of capital in the long-run ? In the sheltered sector this share is constant in the short and in the long-run. In the competitive sector the share of capital remains only constant if all costs fall by the percentage of revaluation. As long as some costs (indirect taxes, depreciation) remain constant, the capital share is bound to decrease.

The responses of prices and profit shares are computed with equations(5), (6a), and (6b) using the input-output table of 1972[6]. This table contains 56 sectors of which we have matched 32 with the classification of the *Systematische Warenverzeichnis für die Industriestatistik*. The remaining sectors of the input-output classification are considered as being sheltered. A list of all industries is given in Appendix I.

Some further limitations of our computations should be noted here. The approach yields comparative static results and no information on the time path of revaluation effects. Moreover, activity levels are assumed to remain constant. Pricing behavior different from those assumed in this paper may of course also lead to different results.

3. Revaluation

3.1 The effects on prices and profit shares

For the analysis on the effects of revaluation on domestic prices and profits the distinction between competitive and non-competitive sectors must be made for the domestic market only.

Tables I and II contain the results obtained for an assumed revaluation by 1 % under the various assumptions discussed in the last section. With full pass-through and downward price flexibility in non-competitive industries[7] the average price decreases in the latter sector are substantially less than 1 %. The decrease is least with constant wages, much higher with wages indexed to the general price level[8], and still higher when indexed to the exchange rate-but much lower than the decrease of competitive prices. The relative price of non-competitive goods changes therefore substantially. The different behavioral assumptions do not change the results drastically.

Profits in competitive industries decrease, of course, most when wages remain constant, and less with a downward wage adjustment. Clearly, in the first case the brunt of revaluation falls on profits alone, while it would be shared in the second case.

As argued before, the case $\hat{w}=\hat{e}$ can also be interpreted as the long-run effect. Revaluation is seen to be less effective in the long-run than in the short run but still powerful.

Price reactions vary substantially among non-competitive industries. The decrease is lowest in mining (8, 211) and in domestic services such as wholesale and retail trading (46, 47) and government services. The highest price reactions occur in industries that have a low ratio of value-added to output value such as aerospace ((22)), printing (57), and plastics (58). Once wage adjustments are taken into account those industries with a high labor share decrease their prices most in comparative terms (e.g, machinery (32)).

Profits in competitive industries decrease least when the ratio of value added to the value of output is low, such as in edible oils (39), mineral oil refining (22) and non-ferrous metals (28). With wage adjustments the dispersion of profit decreases is, of course, much reduced. Industries that are labor-intensive now compensate for low raw material intensity.

3.2 The effects on the terms of trade

When the economy is dichotomized into sectors producing traded and non-traded goods one can assume that the terms of trade remain constant after a change in the exchange rate. In the present analysis, however, where a distinction is being made between competitive and non-competitive sectors, the terms of trade are affected by revaluation. By definition, a revaluation of 1 % leads to a decrease of import and export prices of the competitive sector by 1 %. To obtain overall export prices the weighted average of the decrease of export prices in competitive and sheltered sectors has to be computed. The change in the terms of trade can then be obtained with the following formula :

$$\hat{T} = \hat{p}_C \frac{X^C}{X} + \hat{p}_N \frac{X^N}{X} - \hat{p}_{imp} \qquad (7)$$

where T = terms of trade, X^C = exports of competitive sector, X^N = exports of non-competitive sector and $X = X^C + X^N$, P_{imp} = import prices.

The variation in export prices of those industries that are price-makers on world markets can be computed analogously to equation (6) with $i \in N'$ where N' denotes the set of industries that are non-competitive on world markets. The results are reproduced in column 5 of Table III. The terms of trade improve in all cases and most when wages are constant.

What do these results imply for the balance-of-payments adjustment ? At least in the short run where quantities adjust little, the trade surplus increases due to improved terms of trade. Will this positive terms-of-trade effect be overcompensated in the long run, i.e., will revaluation produce a durable "perverse" effect or not ? In general, the answer is "it depends". The increase of the relative price of non-competitive goods produces a shift of resources into sheltered industries. The sum of foreign and

domestic demand, however falls. Either there will be some unemployment (except if demand was rationned before) or fiscal demand is increased correspondingly. In the latter case,corresponding to a combination of exchange rate and demand policies, the trade surplus most likely tends to fall.

In the former case, unemployment lowers real national income and therefore also expenditures on imported goods. This effect will be reinforced by lower overall productivity growth due to the resource shift. In another paper (Morel and Steinherr, 1978) it is indeed shown that productivity growth in sheltered industries is significantly lower than in competitive industries. Thus, in general, the trade account response depends on a variety of factors : price determination in non-competitive industries, size of the non-competitive sector, initial conditions (market equilibrium or disequilibrium) and the nature of the constraints on fiscal policy, so that an exchange rate policy often needs to be combined with other policy tools to produce "normal" effects. A rigorous discussion can be found in Steinherr (1978).

3.3 The impact of wages on prices and exchange rate

So far we have considered an exogenous variation in the exchange rate. We now reverse the causality and ask how an exogenous, economy-wide increase in wages gets transmitted to prices and the exchange rate. Table IV shows the results. If industries in the competitive sector could increase their prices, these increases would range from 0.16 % (42 : Tobacco) to 0.66 % (33 : Vehicle construction). If domestic currency were revalued by a rate that corresponds to a weighted average of necessary price increase in the competitive sector (0.52 %), any domestic competitive price could only be raised by that. All those industries with required price increases above 0.52 % either lose markets or must accept lower profits. Industries with lower required price increases have the option between expanding production and foreign sales or letting profits swell.

In the non-competitive sector prices increase in proportions that reflect the share of wages in the value of production and the structure of purchased inputs.

TABLE I

Price decreases in sheltered sectors following a one percent revaluation (in percentage points)

	a) based on equation (6a)			b) based on equation (6b)		
Industry	$\hat{w} = 0$	$\hat{w} = \hat{p}$	$\hat{w} = \hat{e}$	$\hat{w} = 0$	$\hat{w} = \hat{p}$	$\hat{w} = \hat{e}$
(1)	.25	.32	.43	.42	.60	.75
(2)	.15	.27	.45	.21	.42	.61
(3)	.26	.36	.53	.31	.50	.66
211	.11	.32	.65	.15	.48	.78
213	.13	.35	.68	.15	.47	.74
(8)	.10	.32	.67	.11	.44	.71
25	.28	.44	.68	.35	.61	.85
27	.22	.40	.67	.25	.51	.75
291	.17	.37	.68	.20	.49	.76
301	.23	.40	.66	.27	.53	.76
59	.30	.48	.75	.33	.59	.82
55	.37	.50	.69	.39	.58	.75
31	.19	.38	.69	.22	.53	.81
32	.19	.39	.69	.23	.54	.82
(22)	.42	.58	.83	.43	.66	.86
(23)	.26	.47	.79	.28	.58	.85
36	.26	.44	.72	.29	.58	.83
37	.22	.41	.69	.26	.55	.81
302	.20	.39	.69	.23	.52	.79
38	.24	.42	.69	.28	.55	.79
51	.23	.43	.74	.25	.53	.78
52	.22	.40	.68	.26	.53	.77
54	.25	.40	.63	.31	.57	.80
57	.20	.39	.69	.23	.53	.79
58	.41	.55	.76	.45	.66	.84
63	.35	.49	.71	.40	.61	.80
64	.30	.46	.70	.35	.59	.81
(44)	.25	.38	.57	.35	.58	.78
(45)	.15	.34	.64	.19	.51	.79
(46)	.10	.25	.48	.14	.42	.67
(47)	.06	.23	.48	.10	.40	.67
(48)	.10	.43	.94	.12	.62	.99
(49)	.39	.51	.69	.42	.60	.74
(50)	.19	.35	.60	.23	.50	.73
(51)	.04	.29	.67	.06	.45	.81
(52)	.08	.28	.58	.13	.47	.78
(53)	.06	.13	.24	.12	.29	.38
(54)	.17	.28	.47	.28	.55	.77
(55)	.00	.37	.94	.00	.49	.00
Average	.15	.33	.60	.20	.50	.65

Numbers in parentheses denote input-output sectors, all others industries of the *Systematische Warenverzeichnis für die Industriestatistik*.

TABLE II

Decreases in profits (deflated by output values) in competitive industries following a one percent revaluation (in percentage points)

	a) based on equations (5) and (6a)			b) based on equations (5) and (6a)		
Industry	$\hat{w} = 0$	$\hat{w} = \hat{p}$	$\hat{w} = \hat{e}$	$\hat{w} = 0$	$\hat{w} = \hat{p}$	$\hat{w} = \hat{e}$
215	.74	.60	.55	.73	.52	.51
216	.67	.55	.53	.66	.49	.52
28	.52	.40	.38	.50	.34	.35
40	.58	.45	.43	.56	.38	.39
22	.54	.50	.47	.53	.47	.45
53	.69	.57	.54	.65	.46	.46
33	.69	.52	.48	.68	.43	.43
39	.67	.51	.51	.66	.44	.48
56	.69	.54	.52	.68	.47	.49
61	.60	.46	.46	.59	.38	.42
(38)	.57	.49	.43	.49	.34	.28
(39)	.41	.34	.31	.39	.29	.28
(40)	.74	.64	.57	.66	.47	.41
(41)	.76	.65	.65	.74	.59	.61
(42)	.87	.84	.83	.87	.82	.82
(43)	.61	.51	.45	.56	.39	.35
Average	.64	.53	.50	.62	.46	.45

Table III

Summary of aggregate results of a one percent revaluation

A. Based on equation (6a)

	$\hat{p}_N$	$s\hat{\psi}$	$\hat{p}_c - \hat{p}_N$	$\hat{p}$	$\hat{T}$
$\hat{w} = 0$	-.15	-.64	-.85	-.39	.42
$\hat{w} = \hat{p}$	-.33	-.53	-.67	-.52	.32
$\hat{w} = \hat{e}$	-.60	-.50	-.40	-.71	.17

B. Based on equation (6b)

	$\hat{p}_N$	$s\hat{\psi}$	$\hat{p}_c - \hat{p}_N$	$\hat{p}$	$\hat{T}$
$\hat{w} = 0$	-.20	-.62	-.80	-.42	.39
$\hat{w} = \hat{p}$	-.50	-.46	-.50	-.64	.23
$\hat{w} = \hat{e}$	-.65	-.45	-.35	-.74	.14

P = general price level

TABLE IV

Increase in prices induced by an one-percent increase of wages.

Competitive industries		Sheltered industries	
Industry	$\hat{p}_C$	Industry	$\hat{p}_N$
215	.54	(1)	.40
216	.49	(2)	.40
28	.62	(3)	.39
40	.61	211	.58
22	.32	213	.52
53	.55	(8)	.58
33	.66	25	.52
39	.63	27	.50
56	.59	291	.55
61	.64	301	.50
(38)	.58	59	.52
(39)	.55	55	.45
(40)	.54	31	.57
(41)	.42	32	.56
(42)	.16	(22)	.61
(43)	.57	(23)	.56
Average	.52	36	.15
		37	.14
		302	.21
		38	.21
		51	.15
		52	.16
		54	.18
		57	.14
		58	.25
		63	.17
		64	.13
		(44)	.23
		(45)	.17
		(46)	.06
		(47)	.05
		(48)	.11
		(49)	.18
		(50)	.14
		(51)	.03
		(52)	.08
		(53)	.10
		(54)	.16
		(55)	.00
		Average	.18

4. Changes in world market prices

An exogenous deterioration of the terms of trade implies that if the balance of payments surplus be unchanged, the country has to increase exports or decrease imports. Hence, either the country reduces its absorption or the trade account surplus is being reduced.

Consider now the case where world market prices of all imported goods increase more than world market prices of those goods that are exported by the competitive and discriminatory sectors in Germany (e.g., the increase in oil prices).[9] Suppose for instance that $\hat{p}_{imp} = 2\ \%$, $\hat{p}_{c} = 1\ \%$. The change in the terms of trade can then again be computed from (7). The results are summarized in Table V.

The existence of a sheltered sector accentuates the exogenous worsening in the terms of trade, since only the increased costs of imported inputs and of inputs produced by discriminatory and competitive industries are on to prices of sheltered industries. If wages adjust to higher prices then prices in sheltered industries increase more than otherwise, so that the terms of trade deterioration is somewhat less but still remains substantial.

With and without wage adjustments the increase in profits of competitive industries is substantial, as is the change in relative prices.

The implications of the deterioration of the terms of trade for the balance of payments are again not clear. The cost of a given import quantity is increased. However, since the relative price of competitive goods increases, domestic supply rises and demand fails : the quantity of imports falls. The change in exports is also ambiguous : the relative price change tends to raise foreign demand but to reduce domestic excess supply. If fiscal expenditures are reduced exports increase. If not, foreign demand is rationned and exports fall.

The origin of the deterioration of the terms of trade is of great importance in this analysis. If competitive export prices had decreased while import prices had remained constant, then the relative price of non-competitive goods would have increase. Resources would then shift into the non-competitive sector and the above analysis would have to be changed accordingly.

TABLE V

Effects of changes in relative world market prices :

$\hat{p}_c = 1\ \%$; $\hat{p}_{imp} = 2\ \%$

A. Based on equation (6a)

	$\hat{p}_N$	$s\hat{\psi}$	$\hat{p}_c - \hat{p}_N$	$\hat{p}$	$\hat{T}$
$\hat{w} = 0$	.21	.50	.79	.53	-1.39
$\hat{w} = \hat{p}$	.41	.38	.59	.67	-1.27
$\hat{w} = \hat{e}$	.66	.36	.34	.85	-1.13

B. Based on equation (6b)

	$\hat{p}_N$	$s\hat{\psi}$	$\hat{p}_c - \hat{p}_N$	$\hat{p}$	$\hat{T}$
$\hat{w} = 0$	.28	.48	.72	.58	-1.35
$\hat{w} = \hat{p}$	.63	.28	.37	.83	-1.16
$\hat{w} = \hat{e}$	.73	.31	.27	.90	-1.10

5. Conclusions

In this paper it is shown that revaluations produce substantial adjustments in relative prices between competitive and sheltered sectors in German industry. The profit shares of competitive industries (accounting for about 13% of production of the 56 sectors) decrease sharply. The key assumptions for obtaining these results are, one, that mark-up pricing prevails in the non-competitive sector and, two, that some costs (depreciation and indirect taxes in our case) do not adjust by the rate of revaluation.

Two factors may, however, mitigate these revaluation effects. One is an adjustment of wages to lower price inflation, brought about by revaluation, another, long run wage adjustment to keep labor's share constant. The brunt of revaluation would then be shared by capital and labor. The remaining decrease in profit-shares of competitive industries would nevertheless remain important. Thus, revaluation of the (real) exchange rate does produce important structural effects. Due to diminished profits, investment and growth will be discouraged in competitive industries. Since average productivity growth is higher in those industries than elsewhere, overall productivity growth will also be reduced. On the other hand, investment in non-competitive sectors is stimulated by the relative price adjustment following revaluation.

Due to some non-competitive behavior on foreign markets revaluation also affects the terms of trade ; they improve substantially, although somewhat less with wage adjustments. It was then argued that while there are relative price and terms of trade adjustments it is not certain that a revaluation will, in fact, lead to a reduction of the trade account surplus. The contrary may be true in several particular instances.

As a second exercise the case of an exogenous deterioration of the terms of trade was analyzed. Here, the existence of a non-competitive sector accentuates the initial, exogenous change in their terms of trade. Profits in competitive industries either increase or decrease depending on the initial disturbance in the terms of trade, so that exports either increase or decrease. Wage adjustments, particularly in the long-run, again reduce the incentives for such resource transfers. The impact on the trade account is ambiguous since the effects of changes in the terms of trade with constant resource allocation and resource shifts can have opposite effects.

In spite of some limitations of the model underlying computations it seems safe to argue that exchange rate policy does produce real effects. Whether it is an efficient instrument is however another question since simultaneous demand policies are required to maintain employment and the direction of effects on the trade balance cannot be known a priori with a high degree of confidence.

Footnotes

[1]Some barriers to factor flows must exist to maintain such a dichotomy in the long-run.

[2]Alternatively, expenditure reducing policies could also lead to improvement of the trade account but at the cost of creating unemployment.

[3]A further discussion of this framework is contained in Corden and Jones (1976).

[4]We say "may" since demand reaction is not considered in Figure 1. For a detailled analysis see Steinherr (1978). The adjustment is distinct from the J-curve effect that concerns the time path of exchange rate effects.

[5]A thorough discussion and careful empirical tests of cost-plus pricing based on "normal" costs is contained in Nordhaus and Godley (1972). For our computation the distinction between normal and actual costs in only relevant in so far as producers consider an exchange-rate adjustment as *temporary* or *permanent*. The implicit assumption of our analysis is that they are considered to be permanent.

[6]Pischner, Stäglin and Wessels (1975). The import-matrix of 1972, as yet unpublished, was kindly made available by the DIW, Berlin.

[7]Since foreign prices are assumed constant the real exchange rate is revalued in this exercise. It may therefore be argued that the assumption $\hat{w} = 0$ is the most realistic one for a revaluation. Downward price rigidity would further strengthen our results.

[8]Our model determines producer prices. The weights of the consumer price index are applied to these prices and the derived index can be considered as an approximation of the consumer price index if wholesale and retail mark-ups are fairly constant.

[9]This implies, of course, that for each industry exports and imports are non-substitutable.

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APPENDIX I

List of competitive, discriminatory and sheltered industries

A	B	a) Competitive industries	A	B	b) Discriminatory industries	A	B	c) Sheltered industries
6	215	Potash and rock salt mining	9	25	In. of building materials	1		Agriculture
7	216	Mineral oil extraction	11	291	Iron and steel foundries	2		Electricity
13	28	Ind. of non-ferrous metals	16	59	Rubber and asbestos man.	3		Gas, water
14	40	Chemicals	18	55	Cell. and paper proces.	4	211	Coal mining
15	22	Mineral oil refining	19	31	Constructional steel	5	213	Iron ore mining
17	53	Saw-Mills and Timber	27	38	Ind. of hardware and metal	8		Mining m.e.s
21	33	Vehicle const.	29	52	Glass	10	27	Iron and steel ind.
31	39	Musical inst.,toys...	30	54	Timber manuf.	12	301	Steel drawing, cold rolling mills
32	56	Paper and board manuf.	33	57	Printing and duplic.	20	32	Machinery construct.
35	61	Leather manuf.	34	58	Plastics	22		Aerospace
38		Grain milling	37	64	Clothing	23		Shipbuilding
39		Edible oils and marga.				24	36	Electrical equip.
40		Sugar				25	37	Precision and optical ind.
41		Brewing and malting				26	302	Steel forging
42		Tobacco				28	51	Fine ceramic ind.
43		Other foods and beverages				36	63	Textile
						44		Handicrafts, trades
						45		Construction
						46		Whole-saling
						47		Retailing
						48		Railways
						49		Shipping, waterways...
						50		Other transport
						51		Communications (post)
						52		Credit instit. and assu.
						53		Rented dwellings
						54		Other services
						55		Public sector

A = Sectors of the DIW input-output table

B = *Industries of the Systematische Warenverzeichnis für die Industriestatistik*

APPENDIX II

Solution of the model

Equations (6a) and (5) can be rewritten in matrix notation as :

$$\hat{p}_N = A'_{CN}\,\hat{e}_C + A'_{NN}\,\hat{p}_N + B'_{C+N,N}\,\hat{e}_{C+N} + D_N\,\hat{w}_N \qquad (II\text{-}1)$$

$$\hat{s}_C = (I - A'_{CC})\,\hat{e}_C - A'_{NC}\,\hat{p}_N - B'_{C+N,C}\,\hat{e}_{C+N} - D_C\,\hat{w}_C \qquad (II\text{-}2)$$

where

$$\hat{s}_C = \begin{bmatrix} s_1\,\hat{\psi}_1 \\ \cdot \\ \cdot \\ \cdot \\ s_C\,\hat{\psi}_C \end{bmatrix} ; \quad \hat{p}_N = \begin{bmatrix} \hat{p}_{C+1} \\ \cdot \\ \cdot \\ \cdot \\ \hat{p}_{C+N} \end{bmatrix} ; \quad \hat{w}_C = \begin{bmatrix} \hat{w}_1 \\ \cdot \\ \cdot \\ \cdot \\ \hat{w}_C \end{bmatrix} ; \quad \hat{w}_N = \begin{bmatrix} \hat{w}_{C+1} \\ \cdot \\ \cdot \\ \cdot \\ \hat{w}_{C+N} \end{bmatrix}$$

The vectors $\hat{e}_C$, $\hat{e}_N$ have percentage revaluation in all entries. A_{CC}, A_{CN}, A_{NC}, and A_{NN} are the submatrices of the matrix for intermediary demand A :

$$A = \begin{bmatrix} A_{CC} & A_{CN} \\ A_{NC} & A_{NN} \end{bmatrix}$$

The first C columns and rows refer to interindustry transaction within the competitive sector ; the interpretation of the other submatrices is obvious.

D_C and D_N are diagonal matrices whose elements are the shares of wages in the value of output of industry i.

Without wage adjustments ($\hat{w}_C = \hat{w}_N = o$) equations (I-1) and (II-2) can be solved for :

$$\hat{p}_N = \left[I_N - A'_{NN}\right]^{-1} A'_{CN}\, \hat{e}_C + \left[I_N - A'_{NN}\right]^{-1} B'_{C+N,N}\, \hat{e}_{C+N} \qquad (II-3)$$

$$\hat{s}_C = \left[I_C - A'_{CC}\right] \hat{e}_C - A'_{NC}\, \hat{p}_N - B'_{C+N,C}\, \hat{e}_{C+N} \qquad (II-4)$$

With complete wage adjustment one has

$$\hat{w}_C = Z_{C,C+N}\, \hat{p}_{C+N}$$

$$\hat{w}_N = Z_{N,C+N}\, \hat{p}_{C+N} \qquad (II-5)$$

where Z is a matrix of the weights of prices in the general price index for industrial goods.

Substituting into (II-1) and (II-2) yields the solution :

$$\hat{p}_N = \left[I_N - A'_{NN} - D_{NN}\, Z_{NN}\right]^{-1} \left[A'_{CN} + D_{NN}\, Z_{NC}\right] \hat{e}_C + \left[I_N - A'_{NN} - D_{NN}\, Z_{NN}\right]^{-1} B'_{C+N,N}\, \hat{e}_{C+N} \; ; \qquad (II-6)$$

$$\hat{s}_C = \left[I_C - A'_{CC} - D_{CC}\, Z_{CC}\right] \hat{e}_C - \left[A'_{NC} + D_{CC}\, Z_{CN}\right] \hat{p}_N - B'_{C+N,C}\, \hat{e}_{C+N} \qquad (II-7)$$

The solution of equations (6b) and (5) is analoguous.