The Degree of Dependence of German Exports on the Real External Value of the D-Mark

German industry is highly export oriented. Consequently, fluctuations in the exchange rate of the D-Mark exert a direct impact on a substantial proportion of industrial output and induce adjustment reactions. This report examines the relationship between foreign demand for German industrial goods, the exchange rate and economic growth abroad over an extended period and for the leading export branches.

Approach

Incoming orders are used as the indicator of the foreign demand for the products of a particular industry.[1] Incoming orders react more sensitively to changes in economic activity abroad and exchange-rate fluctuations than exports.

The exchange rate of the D-Mark against Germany's leading trading partners is expressed by the real external value of the D-Mark against the currencies of 18 industrialised countries[2] (cf. figure 1). Looking at the trends over the past 20 years, the real external value of the D-Mark has moved more or less in parallel vis-à-vis the 18 industrialised countries and vis-à-vis the EU.[3] By contrast, the external value of the D-Mark against the US-dollar has been characterised by far greater fluctuations. Yet because of the special importance of trading relations within Europe for German industry resulting from the process of European integration, the fluctuations of the dollar exchange rate have little effect on the external value of the D-Mark against all 18 industrialised countries (cf. table 1).

In measuring the degree of dependence on economic growth abroad, it is necessary to distinguish between branches whose demand comes from all sectors of the economy and those whose demand is determined by industry. In the case of branches from the former category, GDP abroad can be taken as the explanatory variable; in the case of branches from the second category, industrial output abroad is the appropriate indicator.

Fluctuations in the external value of the currency and the demand changes this induces abroad can lead to changes in export prices expressed in domestic currency. The extent of the price reaction depends on the parity change and the elasticity of demand with respect to changes of the real external value of the currency. In estimating price adjustment it is also assumed that firms set their export prices with regard to domestic producer prices and the economic situation abroad.

The object of study is the long-run dependencies between these variables within the framework of error correction models (multi-variate time series models). The estimated results are presented in tables 2 and 3. They are to be interpreted as long-run elasticities; in other words, they indicate the strength of the reaction to changes in determining variables that is to be observed on average.[4] The study focuses on those branches of

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[1] Volume index of incoming foreign orders. Up to and including 1990, the figures relate to West Germany, from 1991 onwards to Germany as a whole. For the industries considered, the shift in area does not lead to a break in the incoming-order figures because east Germany accounted for a minimal proportion of total foreign demand.

[2] On the basis of the prices of overall turnover. The precise way in which the external value is calculated is described in the Monthly Report of the German Bundesbank, April 1989.

[3] The now 15 Member States of the EU were incorporated into the analysis on their respective accession to the EU.

[4] For example, an elasticity of incoming orders with respect to the real external value of −1 means that incoming foreign orders increase on average by 1% if the real external value of the D-Mark falls by 1%. If the elasticity figure is greater than unity, the reaction of incoming orders is considered to be "elastic"; if it is less than unity the reaction is "inelastic".

Figure 1

Real External Value of the D-Mark on the Basis of the Prices of Total Turnover
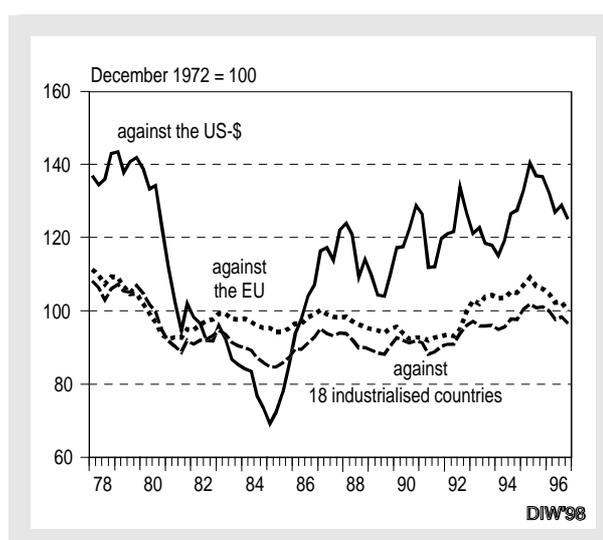
Sources: German Bundesbank; DIW calculations.

Table 1

Exports by Germany's Leading Export Industries

in DM billions

	Automobiles and parts		Engineering		Chemical industry		Electricity genera-tion and distribu-tion equipment		Radio, TV and communications technology		Office and computing machinery	
	1989	1994	1989	1994	1989	1994	1989	1994	1989	1994	1989	1994
OECD	102.3	97.7	82.9	73.7	67.3	72.0	23.0	26.4	16.8	18.3	14.8	14.0
EU (15)	76.1	69.8	60.0	50.0	51.5	52.6	17.7	20.1	14.2	14.9	12.4	10.5
France	11.9	11.0	12.2	10.5	9.7	10.2	2.8	3.5	2.9	3.0	2.5	2.3
Italy	12.0	10.0	7.9	6.0	8.9	8.2	2.7	2.8	2.9	2.9	1.3	1.1
Great Britain	15.8	13.2	8.9	6.7	6.6	7.0	2.4	3.3	1.9	2.5	2.2	2.2
USA	13.0	13.5	9.8	11.7	5.2	7.0	1.9	2.4	1.1	1.5	1.1	1.6
Non-OECD	12.7	20.6	24.0	36.0	16.5	19.4	4.4	9.0	3.5	7.8	1.3	2.0
Asia/Australasia	3.2	6.7	7.7	15.2	4.8	6.8	1.3	3.0	1.8	4.0	0.4	0.4
Total	115.0	118.2	106.9	109.7	83.8	91.4	27.5	35.3	20.3	26.1	16.1	15.9

Source: DIW foreign trade data.

German industry in which exports account for an above-average share of output. They include:

– automobiles and parts (export share in 1996: 50%);
– engineering (44%),
– the chemical industry (43%),
– the production of electricity generation and distribution equipment (34%),
– radio, TV and communications technology (39%),[5] and
– the production of office and computing machinery (37%).

The results in detail

At around 17%, the automobile industry (incl. parts) accounts for the largest single share of total exports by German industry.[6]

The analysis shows that there is a stable long-run relationship between the volume of incoming foreign orders for automobiles and parts, the real external value of the D-Mark and GDP abroad.[7] As the real external value of the D-Mark rises, incoming orders from the rest of the world decline (and vice versa), as recent trends

[5] The following branches also had an export share in excess of 30% in 1996: metal production and working, medical and precision mechanics, optics and other road vehicle construction. They were not considered here, however, due to the lack of available data over the entire period resulting from the change in the classification from the SYPRO to the WZ 93.

[6] The figure relates to exports between January and April 1997, according to the Federal Statistical Office.

[7] The demand for automobiles and parts comes from business, government and households. Consequently, it is overall economic performance abroad that is central for estimating the influence of economic developments abroad on the demand for German automobiles and parts.

have shown (cf. figure 2[8]). All in all, the producers of automobiles and parts lose an average of 1% of their foreign orders for a 1% increase in the external value of the D-Mark, and vice versa (cf. table 2). The loss of orders would be even greater if producers were to hold their export prices constant. In fact, however, they generally cut their prices by somewhat more than one half

[8] In order to reveal more clearly the contrary movements in incoming foreign orders and the real external value of the currency, the incoming orders were adjusted in the figure to their linear deterministic trend.

Figure 2

Automobile and Parts Production

Incoming foreign orders and real external value[1] of the D-Mark (moving averages)
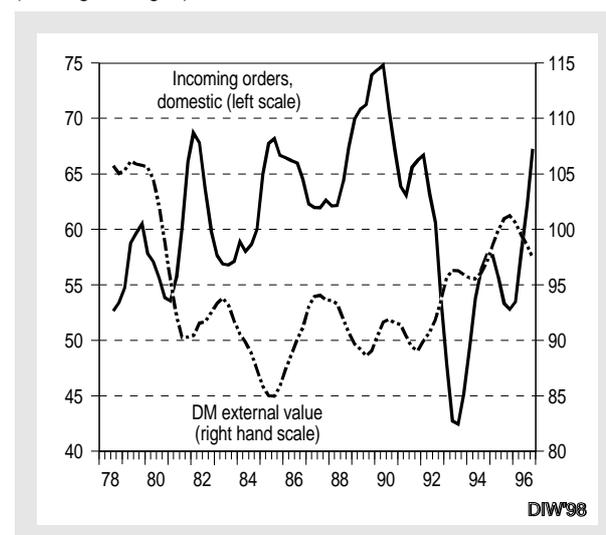
1) Adjusted to trend (initial values 1991 = 100); until 1990: West Germany; after 1991: Germany.
Sources: German Bundesbank; Federal Statistical Office; DIW calculations.

Table 2

Long-run Elasticities[1] of the Volume of Incoming Foreign Orders with Respect to the Real External Value of the D-Mark[2] and Economic Developments Abroad

	Explanatory variables	
	Real external value of the D-Mark	Economic developments abroad
Automobiles and parts	−1.03	1.37
Engineering	−0.41	0.89
Chemical industry	−1.33	1.61
Electricity generation and distribution equipment	−0.39	1.39
Radio, TV and communications technology	−0.60	2.22
Office and computing machinery	−2.36	2.20

1) The parameter values given are significant. — 2) Against the currencies of 18 industrialised countries on the basis of the prices of total turnover.
Sources: OECD, German Bundesbank, Federal Statistical Office, DIW calculations.

of the increase in the real external value (cf. table 3). The elastic reaction by incoming orders to changes in the external value shows that, in each product category, automobiles are goods that are seen by consumers as relatively good substitutes. On top of this comes the fact that the market for automobiles and parts is relatively transparent; product characteristics are relatively well known, so that it is possible to make reliable price/quality comparisons. Moreover, there is no need for a significant period to elapse between the planning and realisation of automobile purchases. German automobile producers attempt to offset exchange-rate- induced price cuts by purchasing their inputs on the international market. This form of adjustment has been one factor that has enabled German firms to maintain their share of world trade in automobiles and parts.

Engineering (cf. figure 3), the second most important German export industry, accounting for just under 16% of total exports, produces primarily investment goods; demand for such products comes from industry. Accordingly, the influence of economic trends abroad on this branch is best measured with respect to foreign industrial output.

An increase in foreign industrial output of 1% is associated with a 0.9% increase in foreign demand for German machinery. This is a surprisingly weak reaction for investment-good producers, as the demand for such goods generally fluctuates more strongly than that for industrial products as a whole.

The reaction of incoming orders to changes in the real external value is also relatively weak. A revaluation of the D-Mark by 1% is associated with a decline in incoming foreign orders of just 0.4 per cent (cf. table 2). This result is underlined by the fact that German engineering firms do not attempt to cushion a currency revaluation by reducing their export prices to any significant extent (cf. table 3).

The rather limited dependence on the real external value of the D-Mark in this industry is due to the characteristic orientation of German engineering, which focuses on custom production of machines and specialities. It is difficult to make price comparisons for specialised products. The market for such specialities is characterised, among other things, by the small number of global producers that are in a position to meet demand. Within this group, German producers have a dominant position. Moreover, a period of many months separates the placement of the order from completion of the plant, a period during which the external value may be subject to substantial fluctuations. Consequently, the external value of the currency is of secondary importance as a competitive factor, compared with the situation in other industries. Alongside the innovativeness of German pro-

Table 3

Long-run Elasticities[1] of Export Prices with Respect to the Real External Value of the D-Mark[2], Domestic Producer Prices and Foreign Demand

	Explanatory variables		
	Real external value of the D-Mark	Domestic producer prices	Economic developments abroad
Automobiles and parts	−0.65	0.59	–
Engineering	−0.10	0.84	0.13
Chemical industry	−0.15	0.71	–
Electricity generation and distribution equipment	−0.32	0.95	–
Radio, TV and communications technology	−0.54	–	0.24
Office and computing machinery	−0.20	1.93	–

1) The parameter values given are significant. Non-significant values are indicated by "–". — 2) Against the currencies of 18 industrialised countries on the basis of the prices of total turnover.
Sources: OECD, German Bundesbank, Federal Statistical Office, DIW calculations.

Engineering

Incoming foreign orders and real external value[1] of the D-Mark (moving averages)
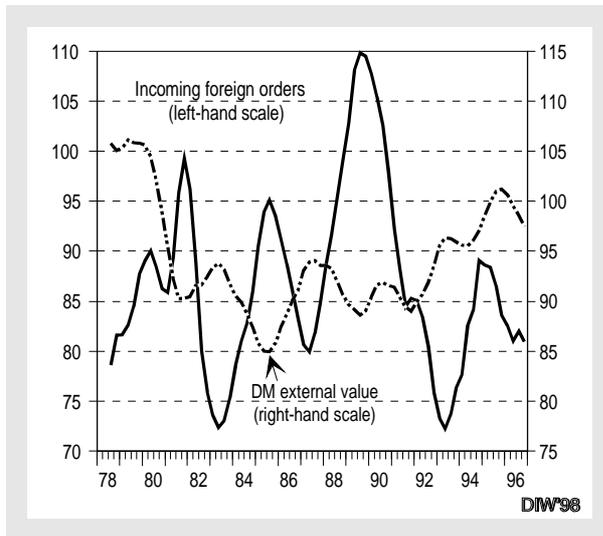
1) Adjusted to trend (initial values 1991 = 100); until 1990: West Germany; after 1991: Germany.
Sources: German Bundesbank; Federal Statistical Office; DIW calculations.

ducers, this is clearly one of the reasons why, with only slight fluctuations, German engineering products have accounted for a constant share of world trade since 1970, in the face of sharp movements in the real external value of the D-Mark.

Our research reveals that foreign incoming orders in the chemical industry – which accounts for just under 14% of German industrial exports – react highly negatively to a rise in the real external value of the currency (cf. figure 4 and table 2), and highly positively to changes in industrial output abroad[9] (cf. table 2).

The export prices of the chemical industry are closely oriented towards domestic prices (cf. table 3). Changes in the real external value of the D-Mark lead to only marginal price corrections. Given the relatively homogeneous nature of chemical products in each product category and the resulting high price elasticity of demand, it might be expected that firms would seek to offset changes in the real external value by changing their export prices, in order to stabilise the volume of incoming foreign orders. The chemical industry has not adopted this approach, however, but has rather allowed the volume exported to fluctuate. Such behaviour is explained partly by the large extent to which production

[9] Around two-thirds of the output of the chemical industry consists of inputs. Industry is its most important "consumer". Accordingly, as with engineering, it is changes in industrial output abroad that are central for estimating the influence of economic developments abroad.

is performed abroad; it accounts for more than two-thirds of the turnover of the German chemical industry. A multinational company producing in, say, Germany and the USA can at least partly offset declining turnover in Germany resulting from D-Mark appreciation against the US-dollar by rising sales from its US production. Changes in the external value of the D-Mark lead to sub-stitution processes within the concern between produc-tion in Germany itself and that performed abroad.

The estimates for the industry producing electricity generating and distributing equipment[10] show that incoming foreign orders decline by 0.4% in conjunction with a 1% rise in the external value of the German cur-rency (cf. figure 5). As is the case in engineering, this branch exhibits a weak reaction by foreign incoming orders to changes in the real external value of the D-Mark. Firms seek to avoid a sharper reaction in quanti-tative orders by means of a (relatively minor) adjust-ment of their export prices – by a third of the extent of the change in the exchange rate. Thus the real external value appears to be of relatively subordinate importance for the success of German producers in this branch on world markets. In Germany this industry is dominated

[10] This branch accounts for more than 5% of German industrial exports. The products of the branch consist of investment and inter-mediate goods sold very largely to industrial firms. Consequently, it is industrial output abroad that is central for measuring the degree of dependence on economic developments abroad.

Chemical Industry

Incoming foreign orders and real external value[1] of the D-Mark (moving averages)
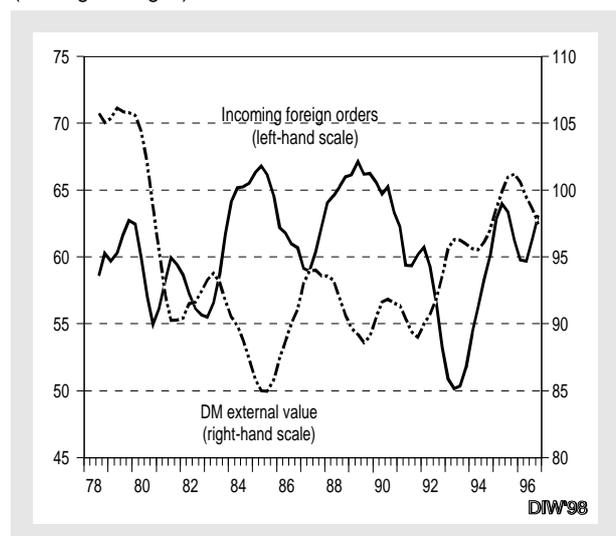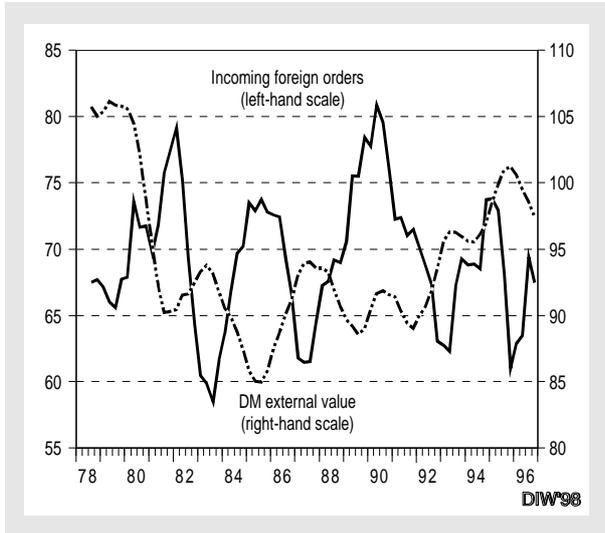

1) Adjusted to trend (initial values 1991 = 100); until 1990: West Germany; after 1991: Germany.
Sources: German Bundesbank; Federal Statistical Office; DIW calculations.

Figure 5

Production of Electricity Generation and Distribution Equipment

Incoming foreign orders and real external value[1] of the D-Mark (moving averages)

1) Adjusted to trend (initial values 1991 = 100); until 1990: West Germany; after 1991: Germany.
Sources: German Bundesbank; Federal Statistical Office; DIW calculations.

by the field of automation technology, in which customised solutions are of prime importance.

The radio, TV and communications technology branch, which accounts for 4% of German industrial exports, produces intermediate goods (electronic components), investment goods (telecommunications equipment and plant) and consumer durables (consumer electronics goods). Thus demand for the goods produced by the branch comes from industry, service companies, government and private households.

The analysis reveals a systematic correlation between incoming foreign orders, the real external value of the D-Mark and the economic growth abroad (cf. figure 6). The estimates indicate that incoming foreign orders tend to fall by 0.6% when the external value of the D-Mark rises by 1%. To some extent the producers of radio, TV and communications technology products offset the negative impact of real currency appreciation by reducing their export prices. Such a reaction is particularly common for the producers of components, as their products are relatively homogeneous and are produced and traded worldwide. Input sourcing is also global, and can be swiftly diverted in such a way that lower sales prices can be offset by the opportunity to purchase cheaper inputs offered by the exchange-rate appreciation. At the same time, the general trend towards lower prices for components narrows the scope for cutting prices in response to D-Mark appreciation.

Orders for telecommunications systems have in recent years come largely from newly industrialising Asian countries. In most cases this involves public infrastructure projects, involving the development of entire systems. In this area the real external value of the D-Mark has a far less important influence on foreign orders than in the field of electronic components.

Incoming orders in the field of telecommunications systems depend to a great extent on economic growth abroad; it is this fact that is responsible for the relatively high degree of dependence on economic activity abroad estimated for the branch as a whole. The estimations indicate that firms also respond to demand changes abroad by varying their export prices (cf. table 3). They raise (lower) their export prices in phases characterised by dynamic (weak) economic development abroad.
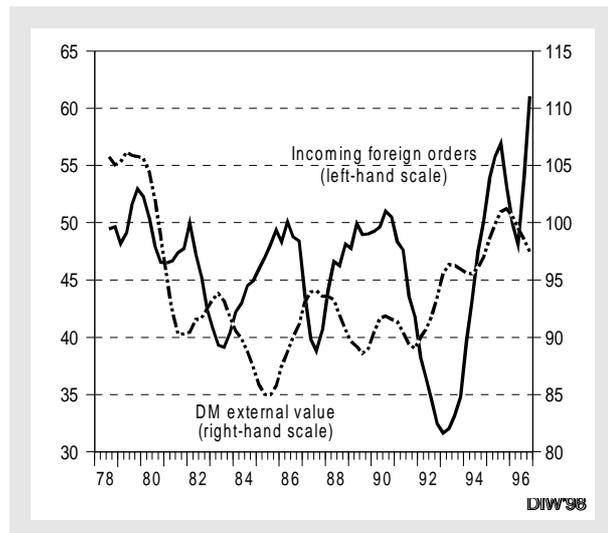
The office and computing machinery branch, accounting for just under 3% of German industrial exports, produces goods that are deployed throughout the economy. Foreign demand for such products consequently depends on GDP trends abroad.

The distinctive feature of office and computing machinery compared with the other branches considered here is the high degree of dependence of incoming foreign orders on the real external value of the D-Mark (cf. figure 7). The volume of incoming orders falls by more than 2% in response to a 1% rise in the external value of the D-Mark, and vice versa.

Figure 6

Radio, TV and Communications Technology

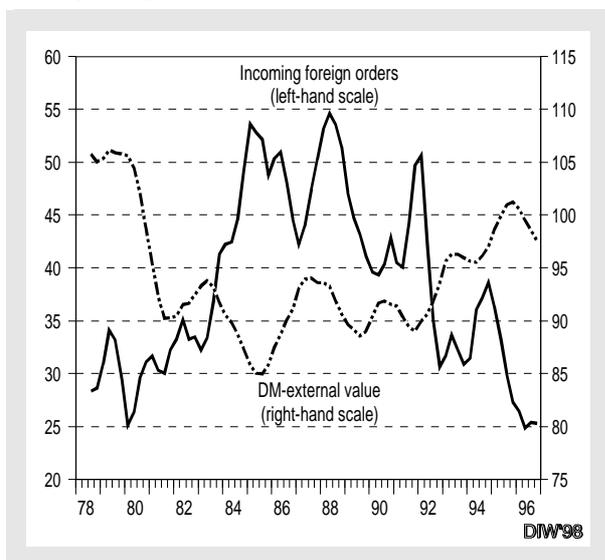Incoming foreign orders and real external value[1] of the D-Mark (moving averages)

1) Adjusted to trend (initial values 1991 = 100); until 1990: West Germany; after 1991: Germany.
Sources: German Bundesbank; Federal Statistical Office; DIW calculations.

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Figure 7

Office and Computing Machinery

Incoming foreign orders and real external value[1] of the D-Mark (moving averages)

1) Adjusted to trend (initial values 1991 = 100); until 1990: West Germany; after 1991: Germany.
Sources: German Bundesbank; Federal Statistical Office; DIW calculations.

The results of the estimation suggest that price adjustment in response to changes in the real external value of the currency is relatively inelastic. It can be assumed that this result is distorted, however. This is because of the strong secular trend towards falling prices in this industry, which overshadows the influence of other factors. The trend towards falling prices reflects the speed of technological development, the large number of producers on the PC market owing to the low barriers to market entry, and the increasing demand for office machinery by private households, for which the price is the decisive criterion.

Germany's share of world trade in office machinery – compared with that for manufacturing industry as a whole or the other branches considered here – is very low, and has declined almost continuously since 1973. Unlike German automobile and parts producers, firms in this branch have been largely unable, due to the constant pressure on prices for non-exchange-rate-related reasons, to offset exchange-rate-related losses in market share by adjusting their export prices.

Conclusion

The estimations show that the influence on the volume of incoming foreign orders exerted by economic trends abroad tends to be greater than that of the real external value of the currency. These findings are broadly in line with earlier studies by German economics research institutes. On the other hand, the estimations do reveal that the impact of economic growth abroad and the external value of the D-Mark on incoming foreign orders varies from industry to industry. The greater the degree of homogeneity of products in competition with one another, the easier it is to compare prices and quality. The elasticity of demand with respect to changes in price or the exchange rate is then relatively high. This is the case – within product categories – in the chemical industry and the production of automobiles and parts. Yet there is a difference between these two industries regarding the response by firms to the high elasticity of demand with respect to changes in the external value of the currency: the chemical industry accepts such demand fluctuations, whereas the producers of automobiles and parts seek to counter this effect by varying their export prices.

Reactions are different when the products competing on the world market are non-homogeneous. Where it is not individual products, but rather entire systems, that are on offer, it is difficult to make price/quality comparisons. Price – and thus also the external value of the currency – plays a less important role when placing an order than is the case with relatively homogeneous products. Moreover, meeting a complex order can often take months, if not years, further reducing the importance of the current exchange rate. In such cases, the long-term elasticity of incoming orders and export prices with respect to the real external value of the currency is relatively low. This applies especially in engineering and the production of electricity generation and distribution equipment.

The example of the chemical industry shows that the reaction of external trade to changes in the external value of the D-Mark declines in importance for individual firms, the more highly globalised they are, i.e. the greater their productive capacity for similar products abroad.

In all the industries considered, exports to the EU play a central role. This fact, alongside the results presented above, suggest that a single European currency area would exert a steadying influence on German foreign trade. Firms would avoid the costs of medium-term adjustment to changing parities in Europe, and those incurred by insuring against exchange-rate risks. Accordingly, a single currency area in Europe could have a positive effect on the growth of German exports.

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