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Article

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Competition Effects and Terms of Trade Effects of Exchange Rates and International Prices: Evidence for Germany

Kerstin Stahn*

Deutsche Bundesbank

The effects of the latest period of Euro appreciation from 2006 to 2007 on the German economy, especially on exports, are cushioned, in the short run, by the regional pattern of foreign buyers, invoicing practices and hedging activities, enterprises' favorable cost development and their currently comfortable profit situation. In the longer run, volume effects (competition effects) may be expected to occur owing to the incomplete pricing-to-market of exporters and importers. Purchasing power effects on real incomes must also be taken into account. Although these two effects have, in some years, had a rather powerful impact on real income growth, their overall impact was virtually neutral on average over the 1993–2007 observation period.

JEL Codes: F41, F14

Keywords: Germany, exports, exchange rates, pricing behavior, competition effects, terms of trade effects

1 Introduction

Participating in the international division of labor gives an economy the potential to achieve additional growth and greater welfare. The evolution of real net exports and the (commodity) terms of trade can considerably affect the cyclical dynamics, too. The degree of price competitiveness and the gain or reduction in real incomes depend on (nominal) exchange rate movements and, additionally, on changes in the domestic country's price and cost situation relative to prices and costs in the importing countries and in competitor nations.

Both changes in exchange rates and wage cost developments have played a significant role in Germany's export and import markets in the past few years. The sharp hikes in energy prices have probably not so much impaired

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Germany's competitive position since all of Germany's competitors are likely to have been similarly affected, depending on their energy intensity or productivity, as reduced Germany's real income through international redistribution.¹ This paper places focuses more on exchange rate effects, with special attention being paid to exporters' and importers' price-setting behavior.²

We begin by looking at Germany's exposure to the exchange rate movements observed since the beginning of the monetary union. Then, we analyze the relationship between exchange rates and the German economy's price competitiveness, a key determinant of domestic exports. The emphasis here is initially on the short-term impacts of exchange rate changes on German foreign trade, with invoicing practices and hedging activities, the development of corporate costs and profits and the persistence of exchange rate movements all playing a role. We subsequently study the expected medium-term price reactions of German exporters and importers. Lastly, we look at competition effects and terms of trade effects on domestic GDP and real income during the 1993–2007 observation period.

2 The German economy's exposure to exchange rate movements

2.1 Increasing trade openness and new exchange rate regime

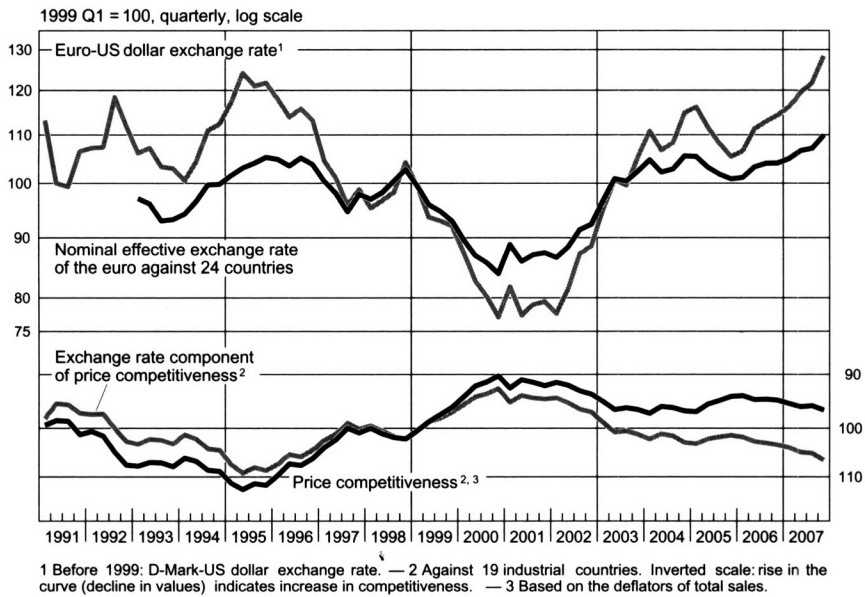
Germany's participation in the international exchange of goods has risen sharply since German unification. Real economic openness of the German economy, measured here as the ratio of total nominal exports and imports of goods and services to gross domestic product (GDP), rose from 47½% in 1995 to 66½% in 2000 to 86½% in 2007, a figure that is very high also by international standards. This reflects, for one thing, the fact that the volume of internationally tradable goods has grown considerably and, for another, that the emerging market economies and the Central and East European countries in transition have given a new boost to the world trade. As a corollary, changes in product prices on the world markets and in exchange rates have gained considerably in structural importance for the German economy.

1 On the other hand, German exporters have benefited from higher energy prices insofar as the associated extra income accruing to the OPEC nations and the Russian Federation have increased these countries' demand for German products. See DEUTSCHE BUNDESBANK (2006).

2 The impact of domestic wage restraint on Germany's foreign trade with its Euro-area partners has been discussed at length by DEUTSCHE BUNDESBANK (2007a).

Moreover, the international exchange rate regime changed decisively upon the introduction of the Euro on 1 January 1999. There have been no more exchange rate-related shifts in competitiveness between Euro-area partners since that time. The exchange rate of the single currency generally reflects the relative performance and stability of the Euro area as a whole; from the point of view of a member state, it can thus – depending on the country’s economic size – be regarded more or less as exogenous.³

Figure 1: Exchange rates and the German economy’s price competitiveness



Source: Deutsche Bundesbank.

The Euro’s external value has fluctuated sharply since 1999. After initially depreciating by just over one-fifth up until October 2000,⁴ the Euro then appreciated steadily by nearly one-third up until December 2004. Following a 7¼% downward correction, the Euro’s effective exchange rate rebounded from March 2006, hitting a subsequently unparalleled peak in December 2007 of 8¾% above its initial rate on 1 January 1999 and 6¼% above its corresponding rate one year previously. Since a rising Euro *per se* entails a

3 Moreover, the role of the Euro as an international investment and reserve currency is entirely different from that of – in isolation – the national currencies in the former EMS.
 4 This is based on the Euro’s nominal effective exchange rate against a group of 24 countries.

deterioration in the German economy's price competitiveness, fears arose last year that external developments might significantly hamper German exports and thus dampen economic activity.

The movement of the Euro's nominal effective exchange rate was dominated by the US dollar, the weight of which on a broader measure – that is taking into account the share of exports to the US in Euro-area exports to non-Euro-area countries as well as indirect competition between Euro-area and US exporters in third markets – is just under 24%.⁵ The Euro-US dollar exchange rate rose by 25% between the launch of EMU and the end of 2007. The Euro's value increased by 11¾% against the US dollar in the past year. In addition, the Euro also appreciated against the pound sterling (9¼%) and the Japanese yen (5%); these currencies' trade weights in the Euro's external value are 20¾% and 10½% respectively. By contrast, the Euro mostly fell against the currencies of the new EU member states, which have evolved into significant trading partners of the Euro area.

2.2 Exchange rates and price competitiveness

Exchange rate movements affect the volume of exports demanded by foreign buyers through export prices. The size of these effects depends on the magnitude and duration of the exchange rate movement itself and on the degree of homogeneity of the traded goods. Additional factors are the regional structure of foreign trade and the development of relative prices and costs.

From the perspective of the German economy, an important feature is that a large percentage of its exports of goods (around 42¾% in 2007) are destined for other Euro-area countries. This export segment is exchange rate-dependent only to the extent that competitors from non-Euro-area countries benefit from the Euro's appreciation against the US dollar and other non-Euro-area currencies. Given this regional focus, movements of the Euro's nominal effective exchange rate therefore have only a muted effect on Germany's foreign trade. Regarding the US dollar, it should be noted that the share of Germany's exports destined for the United States, at 7½% in 2007, is not very large. However, the exchange rate effect is amplified by the fact that certain Asian emerging market economies which, in the past few years, have evolved into major export markets (accounting for 3½% of German exports at the last count), oriented their currencies very closely to

5 For more on the weights, see EUROPEAN CENTRAL BANK (2007).

the US dollar, at least in the past.⁶ Measured by a group of 19 major trading partners of Germany,⁷ the US dollar, including third-market effects, has a weight of around 15% from the point of view of the German economy.

Table 1: Regional and product structure of German foreign trade*

Data for 2006

Product category	Euro area	European countries in transition	Other European countries	North America	Japan	Other Asian countries	OPEC	All seven regions
	Percentage share in total exports of each product category							
Food	60.2	13.1	17.4	3.2	0.6	0.9	1.5	96.9
Textiles	48.9	23.5	15.5	3.3	0.7	2.4	0.6	94.9
Paper products	48.2	16.2	18.2	5.0	0.5	3.4	1.6	93.1
Petroleum products	53.0	11.5	20.2	8.8	0.1	0.6	0.2	94.4
Chemicals	46.2	12.6	13.8	9.7	2.2	6.0	1.5	92.0
Plastic products	44.8	17.8	16.3	7.1	0.9	3.8	1.5	92.2
Metals	43.6	16.9	16.4	7.2	0.9	5.7	3.1	93.8
Machinery	30.0	17.1	13.0	10.7	1.5	12.2	3.6	88.1
Computers	45.8	15.6	23.4	4.0	0.6	2.9	2.8	95.1
Electrical equipments	33.1	16.6	14.1	11.3	2.0	10.6	2.7	90.4
Motor vehicles	39.0	12.7	17.3	15.0	2.3	4.2	2.0	92.5
All products	41.8	14.6	15.7	9.5	1.6	6.6	2.2	92.0
	Percentage share in total imports of each product category							
Food	56.5	8.1	9.0	2.7	0.1	4.2	0.5	81.1
Textiles	23.7	15.7	4.7	1.2	0.4	26.2	0.4	72.3
Paper products	50.9	9.1	29.9	4.4	0.3	1.5	0.0	96.1
Petroleum products	20.6	33.1	25.5	0.7	0.1	0.1	15.7	95.8
Chemicals	56.0	4.5	20.0	11.7	2.0	3.0	0.2	97.4
Plastic products	46.2	25.6	7.8	3.3	3.9	6.7	0.0	93.5
Metals	46.0	20.8	14.6	2.7	0.8	5.9	0.4	91.2
Machinery	39.0	16.3	20.1	7.7	5.9	6.6	0.1	95.7
Computers	21.6	4.9	4.5	8.4	11.4	48.0	0.0	98.8
Electrical equipment	24.1	15.1	11.3	12.5	7.1	25.4	0.3	95.8
Motor vehicles	48.4	18.0	10.5	7.6	6.8	3.5	0.0	94.8
All products	38.4	15.6	15.0	7.2	3.3	11.7	1.4	92.6

* Definition of product categories (SITC two-digit codes) and regions: food (01-09, 11, 41-43), textiles (65, 84), paper products (25, 64), petroleum products (33), chemicals (51-59), plastic products (62), metals (67-69), machinery (72-74), computers (75), electrical equipment (71, 76-77, 87-88), motor vehicles (78); euro area: Austria, Belgium, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain; European countries in transition: Armenia, Azerbaijan, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Federal Republic of Yugoslavia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Mace-

donia, Moldova, Poland, Republic of Belarus, Rumania, Russian Federation, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan; other European countries: Cyprus, Denmark, Malta, Norway, Sweden, Switzerland, United Kingdom; North America: Canada, United States; other Asian countries: Brunei Darussalam, China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand; OPEC: Algeria, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Venezuela.

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6 China and Malaysia are counted here among this group. However, these countries have latterly permitted somewhat stronger movements in their bilateral exchange rates to the US dollar.

7 This list includes, specifically, the Euro-area partners of 2006 as well as Canada, Denmark, Japan, Norway, Sweden, Switzerland, the United Kingdom and the United States.

Despite the Euro's tendency to appreciate against the currencies of major trading partners since the beginning of Stage Three of EMU, German enterprises have managed to maintain strong price competitiveness up to the present, especially through continued wage moderation. The gradual turn towards a more moderate wage policy began already in the mid-1990s, however, after price competitiveness had worsened substantially in the wake of the boom triggered by German unification as a result of overly generous wage agreements in western Germany and a precipitate adjustment of wages in Eastern Germany towards the much higher Western German level. Between the launch of EMU and 2007, unit labor costs in the economy as a whole, in terms of domestic currency, rose by only 1%, whereas 19 major trading partners recorded a 14½% increase on a weighted average and denominated in their respective national currency.

But this relatively continuous development, which strengthened Germany's price competitiveness, was obscured by volatile swings in nominal exchange rates. Between the beginning of 1999 and autumn 2000, the German economy's price competitiveness – measured on the basis of the deflators of total sales – improved by 10% after taking into account the Euro's depreciation.⁸ In the following years, it fell by 6¾% owing to appreciation effects; over the course of the past year alone it suffered a 2% deterioration. At the end of 2007, however, Germany's position was still 4% better than at the beginning of Stage Three of EMU and 3¾% better than its long-term average. In terms of export growth, however, the exchange rate-related loss of price competitiveness in the past few years has been more than offset by the very dynamic expansion of German export markets. This shows once again that – given a suitably attractive export product profile – this is the principal driving force behind Germany's export performance.

8 The German economy's competitiveness can be fairly accurately gauged by comparison with 19 major trading partners whose deflators of total sales and bilateral exchange rates vis-à-vis the Euro, weighted with the share in total German exports and taking into account third-market effects, are aggregated. Price competitiveness thus shows the price ratio between a domestic basket of goods and a foreign basket of goods. These can be compared by converting the foreign currency-denominated foreign prices into domestic currency units using the appropriate exchange rates. For the concept, see DEUTSCHE BUNDESBANK (2007b).

3 Short-term effects

3.1 Invoicing practices and hedging activities

The particular time horizon under observation is a key element in assessing the impact of an exchange rate-related improvement or deterioration of price competitiveness on real exports. Over the short term, the choice of invoicing currency and the degree of cross-currency hedging play an important role. Where it has been agreed that the delivery contracts for German exports will be invoiced in Euro, it is the foreign buyer who bears the exchange rate risk of an appreciating Euro. By contrast, exporters whose sales are invoiced in US dollars – unless they have hedged their anticipated foreign currency-denominated revenue flows – must expect that a bilateral appreciation of the Euro will cause their export revenues to fall when they settle transactions concluded previously. According to surveys conducted by the IFO INSTITUTE on behalf of the DEUTSCHE BUNDESBANK, 80% of Germany's exports are currently invoiced in Euro and only 13% in US dollars.⁹ Two-thirds of German exports to non-Euro-area countries are invoiced in Euro and one-fifth in US dollars.

German companies invoicing in foreign currencies, moreover, are making widespread use of the possibility of hedging their export revenues against exchange rate risk. According to the Ifo survey results, three-quarters of all foreign currency receivables from export business were hedged against exchange rate-related losses. Enterprises can use hedging products that have standardized maturities and currency amounts and are traded on official exchanges. Alternatively, especially for large projects, customized hedges with maturities lasting over several years are available. In practice, foreign currency receivables are often only partly hedged, either for cost reasons or speculative purposes.

Given the major weight of the Euro as an invoicing currency for German export business and the large share of hedged foreign currency receivables, a depreciation of the US dollar against the Euro therefore squeezes German enterprises' export revenues only to a relatively small extent in the short term. Over the longer term, when the issue is not only fulfilling existing delivery contracts but also concluding new ones, the significance of the invoicing currency is tempered somewhat, because the prices are generally recalculated or renegotiated based on the new exchange rates. In addition,

⁹ See IFO INSTITUTE (2007).

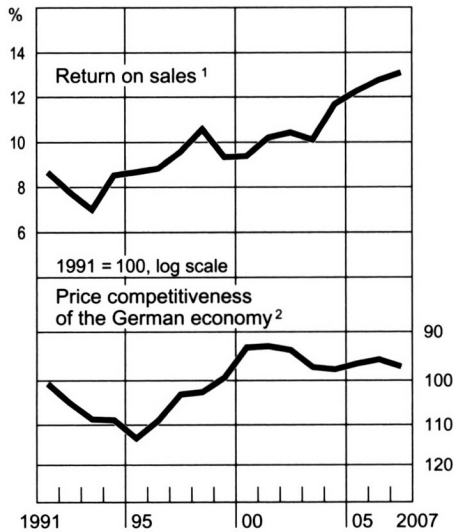
special hedges for new export deals are only possible based on the exchange rate that is then current. If expected export revenue flows are systematically hedged, the costs of hedging the underlying transaction are likely to increase distinctly as the time horizon lengthens.

3.2 Cushioning effect of cost and profit improvements

However, the current appreciation of the Euro generally affects not only firms' export sales but also their costs by reducing the price of the imported intermediate inputs that go into the manufacture of exported goods. These imported inputs latterly made up 45% of exports, as against 31% in 1995.¹⁰ It should be noted in this context that the Euro's exchange rate against the US dollar is more relevant for imports than for exports. Thus the share of Germany's imports from the United States and the countries which oriented their currencies very closely to the US dollar in total German imports, at 13½%, is larger than their share in German exports (11%). In addition, the prices of most commodities (including crude oil) in the world markets are quoted in US dollars. The appreciation-related cost relief, which has been particularly noticeable in Germany's energy bills, was a key factor in ensuring that, all in all, German exporters have coped relatively well with the strengthening Euro in the past few years.

Despite the underlying appreciation-related pressure on Euro-denominated sales prices, especially since 2006, the return on sales of non-financial corporations has risen by 3 percentage points in the last four years to 13¼%. It was thus 3¼ percentage points higher than its average from 1991 to 2007. On the one hand, this means that, given the comfortable profit situation they have now achieved, German exporters can "afford" to forgo price increases (calculated in foreign currency) in the depreciating countries for a protracted period of time in order to maintain their market position in non-Euro-area markets. On the other hand, owing to high capacity utilisation and full order books, many firms could be inclined to pass the Euro appreciation through to local sales prices and thus accept the prospect of an at least temporary slowdown in export sales growth.

¹⁰ See LOSCHKY and RITTER (2007).

Figure 2: Enterprises' profitability and price competitiveness

1 Ratio of corporate profits to gross output. — 2 Against 19 industrial countries. Based on the deflators of total sales. Inverted scale: rise in curve (decline in values) indicates increase in competitiveness.

Source: Deutsche Bundesbank.

3.3 Temporary versus permanent exchange rate changes

Whether or not firms will tolerate reduced export revenues owing to currency appreciation depends, among other things, on whether they see the shifts in exchange rates as being temporary or permanent. If they regard the Euro's appreciation as merely transient, exporters can hold prices in their sales markets constant as long as their variable unit costs are covered. Or they may opt to temporarily "cross-subsidize" their exports to those countries from their profits in domestic business or revenue from intra-Euro-area trade. Major shifts in exchange rates that are regarded as permanent, by contrast, cause exporters to rethink their strategic behavior. Owing to the relatively volatile nature of exchange rate movements, however, it is hard for market participants to decide early on whether the change is temporary or permanent. This continues to hold even though the volatility of both the Euro's nominal effective exchange rate and the Euro-

US dollar exchange rate has, on the whole, shown a visible downward tendency over the past few years.

Following the recent surges in the Euro's external value, there has been much public talk of a "maximum tolerance level" with regard to the Euro-US dollar exchange rate, the breaching of which would massively harm either total German export activity or the export performance of particular sectors. However, the method of deriving such a maximum tolerance level is usually left in the dark. It frequently comes across as being more of a supposed upper limit. This is also suggested by the fact that this limit has continuously been pushed higher and higher in the past few years as the Euro has been appreciating further. Enterprises appear to have been unexpectedly successful at adjusting to changing exchange rate-related scenarios. At most, each enterprise may be assumed to have its own individual maximum tolerance level for the exchange rate, the breaching of which will trigger evasive action at the production, cost and investment level.

To some degree, exporters can offset exchange rate-related losses in price competitiveness by adjusting their intermediate inputs. Firms can, for instance, transfer their business at fairly short notice to suppliers from countries whose currencies have depreciated against the Euro or otherwise provide cost advantages. Medium- to long-term strategies are aimed more at restructuring production and revising the firm's internal policies for choosing production sites. In this way the share of imported intermediate inputs from low-cost countries can be increased at the expense of domestically generated value added – made more expensive by currency appreciation – or else manufacturing can be shifted partly to other, lower-cost countries in order to be able to sell the final products at competitive Euro prices without any (major) losses in revenues. An important element of this strategy is "natural hedging", which has been practiced, for instance, by the German automotive industry and its suppliers particularly in the past 15 years by establishing manufacturing capacity in the United States. This means not only that products are delivered to the local buyers without any exchange rate risk but that, if the Euro appreciates, exchange rate-related losses from German exports to the USA are offset within the firm through exports to Europe. Such a hedge can also be achieved by buying equity stakes or existing manufacturing sites.

4 Price setting by German foreign trade firms

For the aforementioned reasons, exchange rate movements have a noticeable impact on prices in the respective foreign sales markets only after a time-lag. To a lesser extent, this also holds for imports. Instead of passing the appreciation through to local prices directly and completely, foreign trade enterprises pursue a pricing-to-market policy at times.¹¹ The motivation for this behavior is that, if a firm raises its own sales price relative to those of its competitors, its sales will tend to fall depending on the market form and the degree of homogeneity of the traded good. The tougher the competition in the respective sales market, the less the firm's own revenues and costs play a key role in short-term price-setting and the more its competitors' prices play a role. Such behavior is more or less pronounced across the various product types depending on the market and competitive situation.¹² Enterprises with pricing scope will also review their price calculations after an exchange rate shock since it is often advantageous in terms of earnings to combine the adjustment of prices and quantities.

4.1 Exporters' price-setting behavior

An exporting enterprise that is faced with an appreciating domestic currency can thus try to lower its export price (in domestic currency) in order to prevent part of the otherwise expected drop in sales (and capacity adjustments). The intensity of the price reaction is determined primarily by the price sensitivity of foreign demand for goods and the (potentially new) profile of the (marginal) cost of domestic production. It therefore comes as no surprise that such pricing-to-market behavior can vary considerably depending on the sector or product category. Empirical studies have shown that, in the case of food, motor vehicles and computers, that is products that are traded on highly competitive markets, up to between one-quarter and one-third of the shifts in exchange rate parities are factored into export prices (in domestic currency) over the long term.¹³

11 This pricing strategy corresponds to the extended Dixit-Stiglitz model, which assumes imperfect monopolistic competition according to the Chamberlin model and strategic behavior on the part of the foreign trade enterprises. For the theoretical derivation see DORNBUSCH (1987) and STAHN (2007).

12 Significant factors here include the degree of concentration or market segmentation.

13 See STAHN (2007). This study analyzes the exchange rate's impact by means of the exchange rate component of the indicator of the price competitiveness of the German economy against 19 major trading partners, with the exception of export prices for computers. Therefore, the small exchange rate effect observed for some product categories might be attributable to the fact that the group of 19 industrial countries no longer completely reflects the regional composition of foreign competitors. In addition, the estimation approach does not capture the influence of exchange rates on domestic manufacturing costs.

On the whole, export prices calculated in Euro, as a weighted average of the sectors studied, are adjusted to include only around one-eighth of each respective change in exchange rates.¹⁴ An appreciating Euro thus makes German export products more expensive relative to some competing products in the respective foreign sales markets. Given a high level of capacity utilisation, such an adjustment strategy makes sense, especially if foreign demand is growing dynamically and price sensitivity is held to be relatively low. However, an increase in pricing-to-market means that exchange-rate fluctuations have to be cushioned more strongly by changes in the profit margin, which *per se* pushes down the return on capital. Given that real capital, too, is now exposed to an international competition for returns, over the long term enterprises may be expected to devise strategies to maintain or restore their return on capital.

4.2 Importers' price-setting behavior

When importers set their prices in Euro, exchange rates are important insofar as their own costs depend on the exchange rate at which they can obtain their imported goods. The less price-elastic domestic demand for the imported product is, the more strongly domestic importers react to exchange rate fluctuations. Econometric analyses for Germany show that between one-tenth and four-fifths of exchange rate movements, depending on the product category, are reflected in import prices over the long term.¹⁵ Import prices for computers, paper products, metals, machinery, electrical equipment and petroleum products show an exchange rate pass-through of one-third or more. In the case of product categories with a large share of commodities, the exchange rate pass-through is particularly high as commodities are priced in US dollars in the global markets and the demand for these goods is largely price-inelastic in the short and medium term.¹⁶ Accordingly, a virtually complete pass-through can be demonstrated for imported petroleum products.

14 By contrast, the cost pass-through is generally greater than pricing-to-market since at least two-fifths of the changes in manufacturing costs are passed through to export prices over the long term, depending on the particular product category.

15 The estimations of import prices produce relatively robust results for the exchange rate pass-through. Since the domestic competitors' prices themselves are dependent on import prices, however, the pricing-to-market effect could not be analyzed for each product category.

16 The impact of exchange rates is determined based on the Euro-US dollar exchange rate for textiles, petroleum products, metals, computers and electrical equipment and using the exchange rate component of price competitiveness for the other product categories. The Euro-US dollar rate impacts additionally on food, paper products, plastic products and chemicals by including a commodity effect.

On the whole, it transpires that German importers adjust their Euro-denominated prices far more strongly to exchange rate movements than do exporters.¹⁷ This is partly because commodities and semi-finished goods are more important for imports than for exports. Had the Euro not appreciated against the US dollar, the costs of purchasing crude oil and petroleum products as well as other commodities would, at any rate, have risen even more strongly than was actually the case.

5 Significance of competition effects and terms of trade effects

5.1 Competition effects

Where exchange rate movements change the relationship between domestic and foreign prices (converted to domestic currency), they trigger, via substitution processes, shifts in the structure of domestic expenditure and in foreign trade which, in turn, influence domestic economic growth (competition effect). If the competitiveness of the domestic economy deteriorates, such as through a rise in domestic prices relative to foreign prices (an effect that can also be caused by an appreciating domestic currency), foreign buyers will tend to substitute goods produced in their countries or third countries for export products manufactured in Germany, whereas German buyers will increasingly replace domestic products and thus domestic value added with imported goods and thus with foreign value added. Both effects cause net exports and domestic output to contract. Conversely, these effects may cause GDP to expand via net exports given an improvement in domestic competitiveness.

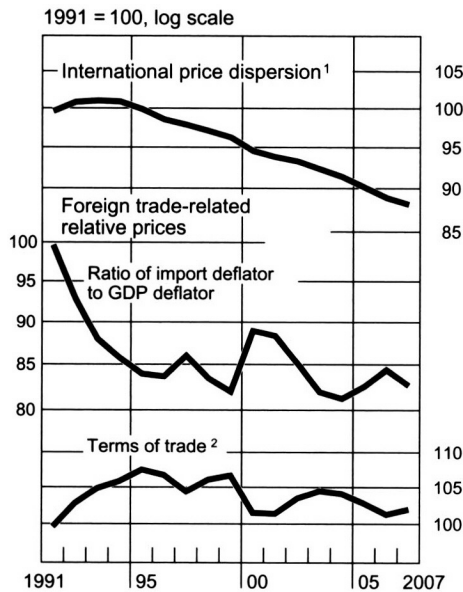
The size of this competition effect depends not only on the extent of the change in relative prices and the level of foreign trade flows but also on how strongly domestic export and import volumes react to shifts between domestic and foreign prices.¹⁸ Empirical studies show that, in terms of amount, the elasticity of German exports to changes in this price ratio aver-

17 The (commodity) terms of trade would thus improve in the event of an appreciation. In theory, this is the reaction that occurs when the product of supply elasticities from export and import markets is greater than the product of demand elasticities. See ROBINSON (1937).

18 For exports, the price ratio is adequately represented by the indicator of the German economy's price competitiveness against 19 major trading partners based on the deflators of total sales. For imports, the ratio of the import deflator to the GDP deflator is used. The elasticities of the foreign trade-relevant price ratios were derived from estimations of exports and imports of goods and services as defined in the national accounts over the period 1992–2006.

ages 0.25 over the long term.¹⁹ This means that, if domestic prices rise by 1% relative to foreign prices, real exports go down by 0.25%. This relatively small influence is due partly to the fact that the share of relatively price-inelastic goods in the range of German exports is quite high. Exports to non-Euro-area countries, in particular, respond relatively weakly to price competitiveness.

Figure 3: International relative prices



1 Ratio of domestic deflator of total sales to the trade-weighted deflators of total sales of 19 industrial countries in local currency. — 2 Based on the national accounts deflators.

Source: Deutsche Bundesbank.

Econometric studies also find evidence that the responsiveness of German exports, especially to non-Euro-area countries, to relative prices has decreased since German unification in comparison with the 1980s.²⁰ This could

19 Similar elasticities are estimated by DANNINGER and JOUST (2007) and by ALLARD (2005) for Germany and by the EUROPEAN COMMISSION (2007) for the Euro area.

20 See STAHN (2006). In the pre-1980s period, the observed price sensitivity of export demand was likewise higher than in the 1990s. In their estimates for the 1955–1970 period, GOLDSTEIN and KHAN (1978) calculated a value amounting to 0.83. The long-term results of many other studies investigating the pre-1980s period point in this direction, too. See the overview presented by GOLDSTEIN and KHAN (1985).

be due to the fact that domestic exporters' pricing-to-market behavior has grown in importance since the 1990s, thereby reducing appreciation-related losses in the German economy's measured price competitiveness.²¹ However, it should be pointed out that the underlying indicator used here does not contain the currencies of all non-Euro-area countries. Thus the Asian emerging markets, which to date have oriented their currencies closely to the US dollar, are not recorded, which means that the US dollar may be underweighted.²²

For German imports of goods, the elasticity to the relevant price ratio can be quantified at 0.21.²³ This likewise relatively small effect is attributable to the fact that the largely price-inelastic categories of commodities and semi-finished goods make up a significant share of German imports.²⁴ To the extent that rising import prices are related to the increase in the prices of energy and commodities, domestic buyers can substitute foreign goods by domestic products only to a limited degree.

The relative price effects on the markets for exports and imports boosted nominal net exports in six of the years of the 1993–2007 period.²⁵ A comparison between the overall competition effect and its exchange rate-induced component shows that the shifts in relative prices caused by differences in cost developments at home and abroad triggered considerable demand stimuli in Germany's favor.²⁶ The appreciation-related negative impacts on Germany's net exports were mostly cushioned substantially or

21 See STAHN (2007).

22 Additionally, there may be an aggregation problem if bilateral exports, which are determined by the relevant price ratios, have diverged.

23 Comparable results are obtained by STIRBÖCK (2006) for Germany and the EUROPEAN COMMISSION (2007) for the Euro area. This meets the sufficient condition for the normal reaction of real net exports to changes in foreign trade-related prices, namely that price-adjusted imports calculated in domestic currency units react negatively to the relevant price ratio. It is based on the Marshall-Lerner condition, which can also be theoretically derived for the Keynesian variant of a macroeconomic model of an open economy in which the level of production is determined exclusively by demand owing to infinitely price-elastic supply functions. See for example JARCHOW and RÜHMANN (1994).

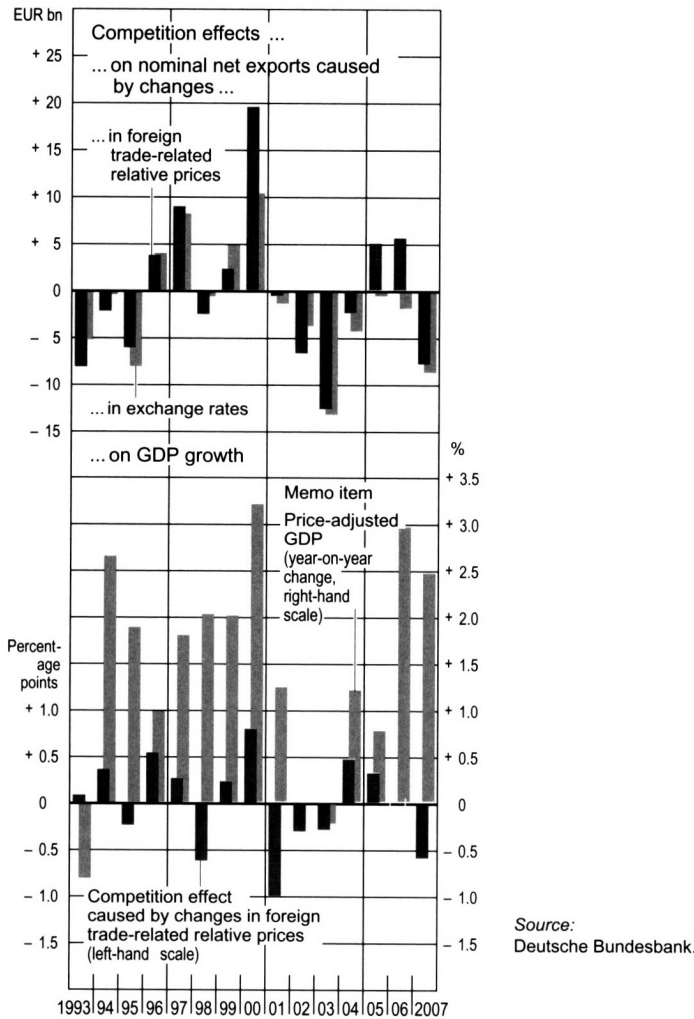
24 Goldstein and Khan (1976) find a stronger price responsiveness of import demand (0.65) during the period 1955–1970 as well. This result is consistent with many other studies which analyze the long-term impact of relative prices for the pre-1980s period. See GOLDSTEIN and KHAN (1985). Thus, during the 1990s as well as before the 1980s, elasticity optimism existed with regard to net exports.

25 The influence of relative price changes on nominal net exports is identified by adjusting nominal exports and imports *per se* for the competition effect. In order to determine the impact on real economic growth, these adjusted exports and imports are initially deflated using the respective price index and then aggregated with real domestic absorption to form a measure of total demand. The competition effect is calculated as the difference between the growth rates of real GDP and the real total demand thus calculated; the result may be interpreted as a (positive or negative) stimulus for economic growth.

26 It was found empirically that exports and imports react roughly similarly strongly to the exchange rate component of price competitiveness, in terms of amount, than to the respective relative prices.

even overcompensated.²⁷ All in all, the average net impact of competition effects on GDP growth over the reporting period was practically neutral.

Figure 4: Competition effects on German foreign trade



27 Simulations using the Bundesbank's macroeconomic model are another way of gauging the competition effects of exchange rate shifts. These indicated that a permanent 10% appreciation of the Euro against the US dollar will initially cause Germany's real GDP to drop by 0.2%. The growth losses will abate somewhat again in the second and third years. This is connected with the fact that domestic prices will fall with a time-lag owing to appreciation; this will lead per se to an improvement in the German economy's price competitiveness and an increase in household real disposable income and thus counteract the initial (negative) appreciation stimulus.

5.2 Terms of trade effects

Competition effects are supplemented by changes in the purchasing power of incomes which accrue to domestic sectors through changes in the ratio of a country's export and import prices, also known as the terms of trade. The preceding analyses have shown that exchange rate movements are also capable of influencing the ratio between a country's foreign trade prices. However, nominal exchange rates are only one (of many) determinants of the terms of trade, which means that an appreciation of the domestic currency does not necessarily lead to an improvement in the terms of trade.

The (commodity) terms of trade state the number of units of an imported good that can be exchanged for a unit of an export commodity.²⁸ It can thus also be interpreted as a measure of welfare which shows the intensity of the benefits of the free international trade of goods. For a given volume of exports, changes in the terms of trade lead to purchasing power effects in that movements in export and import prices either enlarge or narrow domestic sectors' real income.²⁹ This can be captured in the national accounts as the real value of GDP.

The real value of GDP is a purchasing power-based volume that shows the quantity of consumer and capital goods that corresponds to a certain level of value added. By contrast, price-adjusted GDP captures real value added (at previous-year prices). Consequently, the terms of trade effect represents the foreign trade-induced gain or loss in purchasing power to the domestic economy resulting from shifts in the ratio of export prices to import prices; it is calculated as the difference in the rates of change between the real value of GDP and price-adjusted GDP. A positive (negative) terms of trade effect measures the added gain (or loss) of purchasing power to domestic sectors – measured as units of price-adjusted GDP – along with the value equivalent of the volume of output.

In order to reflect changes in purchasing power in the real value of GDP, exports and imports – unlike real GDP – are price-adjusted using a uniform price index instead of the special export or import deflator.³⁰ To this end, the FEDERAL STATISTICAL OFFICE uses the price index of final domestic de-

28 Here, the terms of trade are calculated based on the export and import deflators taken from the national accounts.

29 It is therefore also called a "measure of well-being" or "enjoyment income". See LINDERT (1986) or VANEK (1962).

30 See UNITED NATIONS (1993) or EUROSTAT (1996).

mand, which reflects the structure of the purchases of goods and services for which the national income is used, thereby revealing the entire gain or loss in purchasing power.³¹ The use of this measurement concept leads to purchasing power effects if export and import prices move differently than the price index of domestic demand.³² In Germany, this is particularly evident in the case of sharp fluctuations in the prices of commodities, since this category of goods is much more important for imports than for domestically produced goods.

It may be expected, moreover, that changes in purchasing power-related income induced by the terms of trade may also impact on the sectoral income distribution and – given specific spending propensities – on real domestic demand. The distribution of income between private consumption and corporate investment may be changing.³³ The better, for instance, companies are able to pass through increased costs caused by terms of trade to domestic buyers – that is, the more they are able to maintain their profit margins – the stronger the impact of purchasing power losses caused by a deterioration of the terms of trade will be on the real disposable incomes of domestic households.

An appreciation or a depreciation of the domestic currency can also lead to valuation-induced wealth effects. Decisive factors include the country's net position and the currency structure of foreign assets and liabilities. According to estimated figures, Germany's net foreign assets fell in the past year owing to currency appreciation effects by approximately €70 billion vis-à-vis the end of 2006. Enterprises and individuals saw their wealth decline by roughly €60 billion. This represented around 3% of total disposable income of all domestic sectors. It is difficult, however, to determine the impacts on domestic absorption which this triggers. This may also be related to the extent to which economic agents regard such revaluations as tempo-

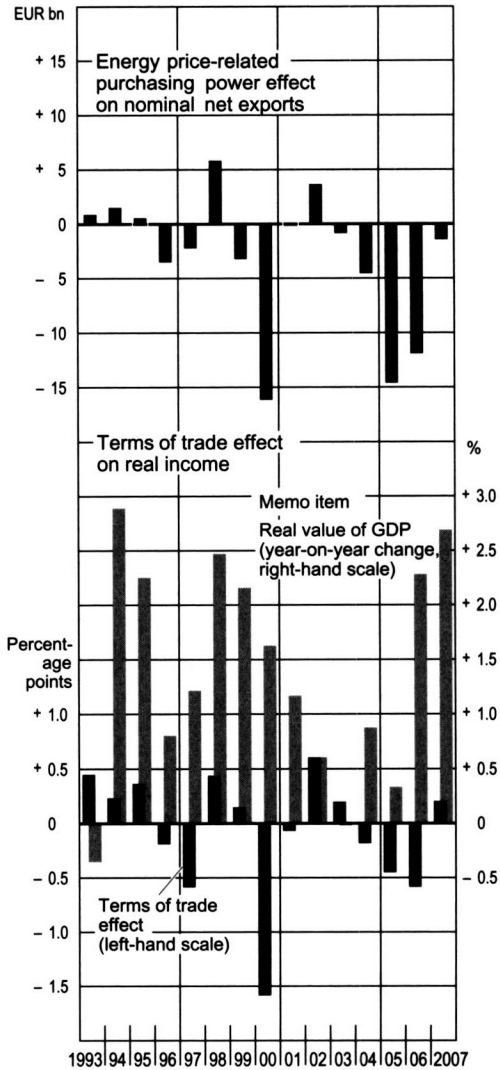
31 There are different approaches to calculating terms of trade effects. The approach currently used by the Federal Statistical Office is also called the real value method. Prior to the introduction of deflating on the basis of previous year's prices in the national accounts, the Federal Statistical Office applied the component method, in which both foreign trade flows are adjusted using the average of the export and import deflators. See MAYER (2001) and IFO INSTITUTE (2000). In the United States, command-basis income measures, in which exports and imports are deflated by import prices, are used. See SESKIN and PARKER (1998).

32 The terms of trade effect can change even at a constant price level if export and import values grow. The greater the degree of openness already achieved and the faster the acceleration of the external integration of an economy, the greater the potential for terms of trade effects is.

33 In this connection, LAURSEN and METZLER (1950) posited the thesis that households tend to lower their saving ratio in order to temper a purchasing power-induced decline in consumption. However, this effect is only a second-round effect.

rary or permanent. Moreover, wealth effects play a minor role in German private consumption.³⁴

Figure 5: Terms of trade effects



Source: Deutsche Bundesbank.

34 See DEUTSCHE BUNDESBANK (2007c) and HAMBURG, KELLER and HOFFMANN (2005).

Purchasing power-related real income effects are caused particularly by changes in the prices of commodities, especially crude oil and natural gas. This is largely because import prices react relatively strongly to changes in international commodity prices.³⁵ The energy price-induced purchasing power effect can be calculated by valuing the previous period's nominal net energy imports with the change in the prices of energy imports. Since the mid-1990s the purchasing power loss associated with rising energy prices has averaged around $\frac{1}{4}\%$ of GDP or disposable income of all domestic sectors per year. The strongest purchasing power losses were felt in the years 2000 and 2005–06, when energy import prices rose by $79\frac{1}{4}\%$, $38\frac{1}{4}\%$ and $21\frac{1}{2}\%$ respectively. By contrast, energy price-related purchasing power gains were recorded in only five of the years in the reporting period. The overall terms of trade effect was positive in eight individual years since 1993. This was related mostly to the appreciation of the domestic currency. The Euro's rise against the US dollar in 2007 likewise contributed to an improvement in the terms of trade by approximately $\frac{3}{4}\%$ even though the world market prices for commodities once again jumped sharply.

5.3 Overall effects

When assessing the effects of terms of trade and competition on the real value of GDP, it must be taken into account that the component effects often run in opposite directions.³⁶ This is connected with the fact that the terms of trade and the ratio of the domestic deflator of total sales to the trade-weighted foreign deflators of total sales – converted into domestic currency – change mostly in the same direction in periods without major commodity price fluctuations; with respect to the real value of GDP, this thus leads to countervailing impacts. In the 1993–2007 observation period, the overall effects were located in the range of -1 to $+\frac{1}{2}$ percentage point. Given an annual average increase in the real value of GDP of $1\frac{1}{4}\%$, the competition and terms of trade effects exerted quite a strong macroeconomic impact in some years. In all, the competition effect overcompensated for the effects of the terms of trade in five of the 11 years in which they bore the opposite sign. In 2007, growth of the real value of GDP declined by $\frac{1}{2}$ percentage

35 Empirical studies show that the pass-through of crude oil prices to import prices for petroleum products is nearly complete. One-third of the changes in the world market prices for iron and steel are passed through to import prices of metal products. For other product categories, the pass-through rate of selected commodity prices is up to one-seventh.

36 In contrast to real GDP, here nominal exports and imports, adjusted for the competition effect, are deflated using the price index of final domestic demand. The competition effects with regard to real GDP and the real value of GDP, however, differ only marginally.

point on balance because the competition effect was much stronger than the terms of trade effect. For seven years, a positive overall effect of the foreign trade-related price changes on real income can be observed. On average of this period, the total impact on real income of the price changes relevant to foreign trade, however, was virtually neutral. This is also consistent with the finding that the German economy's export activity fundamentally depends much more on the growth of export markets and the attractiveness of exporters' product profile than merely on exchange rate changes.

6 Summary

In 2007, the Euro appreciated distinctly against key currencies. This aroused fears that the stronger Euro might have a highly adverse effect on German business activity. However, the regional pattern of Germany's foreign trade, established invoicing practices and enterprises' hedging activities as well as their favorable cost development by international standards and their currently comfortable profit situation have so far done much to cushion the effects of appreciation, especially on exports. Nonetheless, volume effects may be expected to occur over the longer term, as exporters and importers will not be able to completely factor lasting exchange rate shifts into their prices. However, there is empirical evidence that the exchange rate elasticity of German foreign trade, particularly exports, has declined over the past few years.

With regard to demand, shifts in relative prices in the markets for exports and imports, which in the past few years were caused not just by changes in exchange rates but also by energy price increases and by relative wage cost moderation in Germany, can affect foreign trade, and thus economic growth, via their impact on competitiveness (competition effects). Additional effects result from purchasing power-related income gains or losses (known as terms of trade effects) which generally tend to counteract the competition effects. On balance, the competition and terms of trade effects exerted quite a strong macroeconomic impact in some years. On average over the period 1993–2007, the total impact of the price changes relevant to foreign trade on real income, however, was virtually neutral.

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die dank China und Indien wachsende Nachfrage nach natürlichen Ressourcen das Land mit dem «Fluch» des Ressourcenreichtums. Denn dieser Wohlstand vermindert die Erfolgsaussichten eines diversifizierteren Wachstums basierend auf erneuerbaren Ressourcen wie dem Humankapital. Aufbauend auf internationalen Paneldaten erforschen wir den Einfluss von Ressourcenreichtum, ausländischen Direktinvestitionen und Humankapital auf den Anteil «skill»-intensiver Produkte an den Ausfuhren. Ausländische Direktinvestitionen und Humankapital erhöhen diesen Anteil, während Ressourcenreichtum ihn verkleinert. Wir nutzen unsere Ergebnisse zum Vergleich von Indonesien mit Thailand und Malaysia. Indonesiens Anteil von «skill»-intensiven Exporten wäre grösser gewesen, hätte es höhere Niveaus in ausländischen Direktinvestitionen und handwerklichen Fertigkeiten erreicht. Seine Bilanz bei der Anhäufung dieser Elemente und sein relativer Ressourcenreichtum verhindern jedoch die Auffächerung von Indonesiens Produktion und Handel. Diese Befunde berücksichtigend präsentieren wir abschliessend verschiedene Politikoptionen.

Competition Effects and Terms of Trade Effects of Exchange Rates and International Prices: Evidence for Germany

Kerstin Stahn

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The effects of the latest period of Euro appreciation from 2006 to 2007 on the German economy, especially on exports, are cushioned, in the short run, by the regional pattern of foreign buyers, invoicing practices and hedging activities, enterprises' favorable cost development and their currently comfortable profit situation. In the longer run, volume effects (competition effects) may be expected to occur owing to the incomplete pricing-to-market of exporters and importers. Purchasing power effects on real incomes must also be taken into account. Although these two effects have, in some years, had a rather powerful impact on real income growth, their overall impact was virtually neutral on average over the 1993–2007 observation period.

Die Effekte der jüngsten Euro-Aufwertungsphase von 2006 bis 2007 auf die deutsche Wirtschaft, insbesondere die Exporte, werden kurzfristig durch die regionale Struktur des Außenhandels, die Fakturierungsusancen und Absicherungsmaßnahmen, die günstige Kostenentwicklung in den Unternehmen sowie ihre derzeit komfortable Gewinnsituation abgedeckt. Langfristig ist zu erwarten, dass sich aufgrund des unvollständigen Pricing-to-Market der Exporteure und Importeure Mengeneffekte (Wettbewerbseffekte) einstellen werden. Darüber hinaus sind Kaufkrafteffekte beim Realeinkommen in Rechnung zu stellen. Obwohl diese beiden Effekte in einigen Jahren einen recht starken Einfluss auf das Wachstum des Realeinkommens ausgeübt haben, war ihre Wirkung im Durchschnitt des Beobachtungszeitraums von 1993 bis 2007 insgesamt praktisch neutral.

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