ISSN 0309-166X

CAMBRIDGE JOURNAL OF ECONOMICS

Volume 21 Number 5 September 1997

Published on behalf of the Cambridge Political Economy Society
by Oxford University Press

CAMBRIDGE JOURNAL OF ECONOMICS

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Cambridge Journal of Economics (ISSN 0309-166X) is published bimonthly in January, March, May, July, September and November for the Cambridge Political Economy Society by Oxford University Press, Oxford, UK. Annual subscription price is US$232. *Cambridge Journal of Economics* is distributed by M.A.I.L. America, 2323 Randolph Avenue, Avenel, New Jersey, NJ 07001, USA. Periodical postage paid at Rahway, New Jersey and additional entry points.

US Postmaster: send address changes to *Cambridge Journal of Economics*, c/o M.A.I.L. America, 2323 Randolph Avenue, Avenel, New Jersey, NJ 07001, USA.

Cambridge Journal of Economics 1997, **21**, 571–592

The use of unit values to discriminate between price and quality competition

Karl Aiginger*

This paper proposes using the unit value of exports to discriminate between markets in which the quantity traded depends more on price competition and those markets in which the quantity traded depends more on non-price competition. The unit value of the exports is a measure available at practically all levels of disaggregation. This measure thus enables us to judge competitiveness for broad industries as well as to trace its sources and structures in narrowly defined product markets. We propose an easy way to discriminate between industries in which low unit values signal low costs and those industries in which high unit values signal high quality or highly processed goods, and we apply this concept of revealed price elasticity (REVELAST) to the German economy.

1. The objective and structure of the paper

This paper proposes a complementary indicator for the assessment of the competitive position of industries. The unit value of exports is the quotient of nominal exports divided into kilograms. We argue that, for some industries, the unit value is a good indicator of price competitiveness, while for other industries it can be a good indicator of the non-price or quality competitiveness. We apply the indicator to determine which part of the German external balance *vis à vis* its main competitors mirrors price competitiveness and which reflects quality competition. We compare the results attained through this indicator with other indicators of the dynamic competitiveness of Germany's economy.

The paper is structured as follows. In section 2, we describe the indicator 'unit value', its role in the competitiveness issue, and its relation to standard economic concepts. In section 3, we present results on the competitive position of Germany according to this indicator. Section 4 presents other studies on the technological position of Germany, and relates them to our assessment according to unit values as well as to the broader concept.

Manuscript received 16 October 1995; final version received 9 February 1996.

* Austrian Institute of Economic Research and University of Linz. The author gratefully acknowledges the research assistance of Dagmar Guttman and Eva Sokoll. I thank D. Audretsch, P. A. Geroski, K. Cowling, M. Landesmann, M. Pfaffermayr, Y. Wolfmayr-Schnitzer, G. Tichy and the participants at workshops in Berlin, Boston, and Linz for valuable comment on earlier drafts.

2. The unit value as an indicator of competitiveness

2.1. Definition and availability of the indicator

The unit value of exports is defined as nominal sales divided into some quantity measure, usually the kilogram. This indicator is also available for imports, in some cases also for domestic production. Most importantly, it is available for a very large number of countries in data banks provided by the United Nations, the OECD or the EU, and it is available at practically all levels of disaggregation: we can calculate unit values for total exports (SITC 0–9), for manufacturing exports (SITC 5–8), and for more than one thousand products at the six-digit industry level.

There are, however, also limits to the availability of unit values. For some industries, the weight in kg is not reported, either because the denominator is reported in a different unit (square metres, volume, pieces etc.) or because there is no denominator available. The reporting behaviour is different from country to country. We have to use techniques which minimise the importance of this difference. Among these techniques is a computational procedure which calculates unit values at the n-digit level only for those sub-industries on the $n+1$-digit level which report prices and quantities. We follow the strategy of keeping to one reporting country as much as possible. For Germany as a reporter, for example, unit values are available for all but five 3-digit industries, comprising more then 90% of German exports.

The range of data published extends up to 1993 but is, however, not fully comprehensive. We concentrate on data for 1992, and check the main results with data ranging back to 1980 and up to 1993, extending in part to 1994. The data refer to bilateral trade flows of main trade partners with unified Germany.

2.2. The relation of the unit value to conventional economic concepts

The measure 'unit value' can, on the one hand, be compared to the concepts of productivity and quality, and, on the other, to the concept of price and costs, depending on specific circumstances and qualifications.

Let us first investigate the relation of the unit value to the concept of partial productivity. We assume a Cobb–Douglas production function $Q = A.L^{\alpha}.K^{\beta}.M.$, where Q, L, K, M are quantities of output, labour, capital and material input. Now we add an output price P and distinguish two types of material, M_u and M_w,—material used (embodied) in the final product, and material not embodied ('waste'). The unit value is defined as $UV = P.Q/M_u$, i.e., nominal output per material 'embodied' in the final product. This appears to be very similar to partial productivity, whereby the numerator is expressed in nominal terms, and the denominator contains the material input, instead of labour or capital. It is not total material, since there is waste, and some material is expended in the production process (oil, chemicals). But the essence remains; the unit value is *output per units of input* (material measured in kilograms). The indicator is, however, much more 'quality oriented', because the numerator incorporates all of the quality elements, such as the premiums for higher sophistication, for specialty production, for related services, etc.[1] We can there-

[1] The unit value also increases with higher market power. We may at first feel uneasy with this, since in the usual structure conduct–performance paradigm, market power is not related to quality. In Schumpeterian models, in the theory of quality ladders, and in the new trade theory, market power is, however, related to innovation, early starting advantages and sucessful vertical differentiation.

fore use the *UV* to assess the quality of a heterogeneous good. The more characteristics a good accumulates (which are valued by consumers or investors), the higher its unit value will be. Like any other measure for partial productivity, the unit value increases, if 'the other inputs' are increased per unit of weight, i.e., more or better labour or capital is added.

However, the unit value can be boiled down to a price, if the quantity unit in which output is measured is identical to the unit in which the input is measured and material is the most important input: if 'one unit of Q' is technically linked with 'one unit of M_u', and the value added is rather low, then the *UV* is the price. Let us assume h kg of concrete are produced with the input of h kg of cement and let wages, capital and other input be very low. In this case the per kg unit value of cement is identical to the price of cement (which is also that of concrete). If economic profits are zero (perfect competition assumption), then the unit value is also identical to average costs. For homogeneous goods, competition drives down the price to marginal costs, and eventually the unit value approaches unit costs. The interpretation is very different if the dimensions of input and output differ widely. For example, a car may ultimately be defined by a bundle of characteristics (speed, power, design, electronics); its value or consumer evaluation is far removed from the weight of the steel embodied. The unit value as the car price per kg is much more a sign of quality or of the efficient use of material than of a price.

2.3. Increasing the focus on quality as the basis for a dynamic evaluation

The notion of quality has become increasingly important in economics during the past decade. At the macroeconomic level, it has become obvious that the advanced industrialised countries can compete with countries well endowed with cheap labour only when they climb up the 'quality ladder', by producing ever more sophisticated products. The competition between Mexico and the US, between the former socialist countries and Western Europe, as well as between China or the Philippines and Japan cannot be countered by lower wages. Grossman and Helpman (1991A, B, C) provide such a model, in which the South is imitating the North, using lower wages to threaten its position by lower wages. The North can regain its advantage through innovation, and both countries are thus consecutively climbing up the quality ladder.

Microeconomics tells us that the willingness to pay, on the part of the consumer, can be increased by horizontal or vertical product differentiation. Horizontal product differentiation leads to a price premium, due either to value placed by consumers on diversification as such (love of variety approach), or because a specific new product comes nearer to the ideal variety preferred by some consumer (preferred variety approach). Product innovation results in a product assessed as superior by all consumers (vertical product differentiation). At a given regional market, products at different prices can coexist, if they have different product attributes. See Tirole (1989) for a model in which different tastes lead to product differentiation, and Shaked and Sutton (1982, 1987) for a model in which income diversity leads to product differentiation. The latter model permits the sequential choice of quality by two firms in the first stage of a game. The first firm chooses the high-quality line and the second firm the low-quality segment; markets are cleared by price competition in the second stage of the game. Prices are different for different qualities in equilibrium, and the number of firms is limited from above, even for a market increasing in size. This model seems especially realistic for modern competition, which includes newcomers in the market of

advanced industrialised nations, for countries in transformation or newly integrated countries.[1]

2.4. The unit value of aggregates, stages of processing

Like other empirical measures, the calculation of unit value is affected by problems of aggregation. The unit values of the aggregate 'road vehicles' is a weighted average of the unit values of cars, trucks, bicycles, where metric tons are used as an implicit weight. The unit value of the subaggregate 'cars', itself is the weighted average of large, medium and small cars, as it is the average of cars of high, medium and low quality.

If production shifts from a low-quality to a high-quality subsegment, the unit value increases. So, in comparing the exports with the imports of a given country, or exports of a country at different points in time, or the exports of different countries for a specific aggregate, we shall implicitly compare aggregates with different structures. But what seems to be a disadvantage if we seek to compare 'pure prices', proves to be an advantage when we seek to assess composition and quality of production. A country with a higher unit value will in some sense supply more quality, perhaps owing to its ability to sell an identical product at a higher price (marketing, advertising, quality), or by specialising in a more highly priced product segment.

The same is true if one additional stage of processing is added. In principle, trade statistics try to separate goods with different stages of processing, by putting raw materials in one product group, semi-finished products in another, and consumer goods in a third. But this is not always the case for more sophisticated products. If the surface of flat steel products is made more durable, if a machine is adapted to the specific circumstances in a factory, the unit values increase in a given statistical category owing to an additional stage of production. What may be a disadvantage if we want to know the 'true' price, is an advantage for assessing the dynamic competitiveness of firms and industries: firms and countries which supply products with more stages of production will be more highly evaluated by consumers and can charge higher prices.

To show how each stage of fabrication and refining increases the unit value, let us look at a chain of products produced from the same basic input, but which are refined

[1] The impact of process innovation on the unit value (as in the case relative to price) may go in either direction. If process innovation leaves the input shares unchanged, and the product is well-defined and homogeneous, then process innovation tends to lower average costs and therefore—for a given profit margin—product prices. There are, however, three cases which can alter this tendency. Firstly, the process innovation may change the market structure; the innovating firm may become monopolist or attain a dominant position (for some time). Secondly, some authors contend that each process innovation will bring forth some complementary product innovation (increase consumer evaluation). Thirdly, the effect of process innovation on the relative use of factor inputs is usually not neutral. If the process innovation increases the amount or quality (sophistication, knowledge) of labour, it will increase the unit value of a given material—output productivity. If, finally, the process innovation increases the quality of the main material used (which determines the weight of the product, say, ores for iron, wood for paper etc.), then the unit value will rise. Material-related progress will allow the reduction of the relation between an output (a car) or between output characteristics (durability, conservation, etc.) and the amount of material required.

Process and product innovation together might theoretically, therefore, increase or decrease the unit value. The combined impact will, however, probably lean towards an increase, since the effect on the cost side effect is ambiguous, while the demand effect is unambiguously positive (enhancement of consumer valuation). As far as the level of the unit values is concerned, it is again the result of cost and demand factors. Low wages and interest rates will allow supply at a lower price and productivity will work in the same direction (with the exceptions referred to above). Demand, higher quality, and a higher degree of product differentiation will increase the price.

and processed at each stage of the production process (figures for Germany, 1992): The unit value of iron ores is \$0·06 /kg, that for flat steel is \$0·47 /kg, steel pipes have a unit value of \$1·03 /kg. The unit value of machines is \$13·21 /kg, for computers it is \$61·1 /kg, for medical instruments the unit value climbs to \$206·64 /kg. Finally, software and intellectual property have theoretically infinite unit values.

2.5. The relevance for the competitiveness issue

Defining the competitiveness of nations is not an innocent issue. There are some authors who deny the importance of this concept (Cooper, 1961; Balassa, 1962; Suntum, 1986), or at least try to play it down (Porter, 1990;[3] Krugman, 1994). There are other authors who focus on external balances only. Most studies try to combine issues of external balance with domestic performance, resulting in definitions such as 'growth without trade imbalances' etc. (see *Europäische Wirtschaft*, 1994; Competitiveness Policy Council, 1994; Schumacher *et al.*, 1995). I have proposed a rather comprehensive definition which includes external balances, domestic economic performance and social and environmental standards (Aiginger, 1987, 1995A, C; Singh, 1987).

An issue which is raised in all these assessments is the split between price competitiveness and technological competitiveness. The first is the ability to produce at low costs, and this is exceedingly crucial in mature, homogeneous markets. The latter is the ability to compete in high tech areas, to innovate, to target the most sophisticated market segment. There are cases, especially in process innovation, where the two aspects lead to the same result: the most efficient country producing at the technology frontier has the lowest cost per unit (if measured in quantities). In other cases, wages and skills may be much higher in one country, but the product is superior to that of competing firms; the firms, therefore, are price setters, and charge their costs plus a Schumpeterian monopoly rent. In this case, any comparison of costs per unit will show a lack of price competition, but price competition is not a meaningful concept here, since there is no real competition for identical products.

The unit value exactly mirrors one or other of these two concepts. If price competition is important, because the products are homogeneous, and the technique is available all over the world, margins are zero and unit values will reflect average costs. If, however, quality, product innovation, and the adaptation of the product to specialised needs are the important success factors, the higher unit value will reflect this ability to set prices, to face inelastic markets. The *UV* will be far from unit costs and reflect technological superiority, at least as far as product innovation is concerned.

3. Discriminating between markets in which unit values reflect costs and markets in which they reflect quality differences

3.1. The hypothesis

We use the following assertion to discriminate between industries in which unit values reflect cost differences and industries in which they reveal quality differences.

If unit values reflect costs and the product is homogeneous, then countries with lower costs should be net exporters in quantities and countries with higher costs should be net import countries. If a country is a net exporter in quantities, despite the fact that it has higher unit

[1] Porter (1990, p. 6ff) comes very close to the position that the phrase 'competitiveness of a nation' makes no sense, stressing that it cannot be that a country is 'competitive in all industries'.

values, then this must be due to quality differences. This assertion makes use of the fact that economic theory tells us that under quite broad circumstances demand is price elastic.[1]

Industries in which the unit values difference and the quantity balance have different signs face price-elastic markets (UV exp $<$ UV imp $\Rightarrow$ Q exp $>$ Q imp and vice versa), industries in which the higher unit values coincide with higher exported quantities are revealed to be 'quality-dominated markets' (UV exp $>$ UV imp $\Rightarrow$ Q exp $>$ Q imp and vice versa). For a specific country we can, furthermore, subdivide the elastic markets and the quality-dominated markets into markets with higher unit values and those with lower unit values to attain a four-quadrant scheme.

- Sector 1 contains price-elastic goods, in which the home country has a high unit value and consequently suffers a trade deficit. Industries in this sector have lost price competitiveness in a market in which prices are important. This part of the deficit can be said to be the consequence of high production costs (*deficit in price competitiveness*).
- Sector 2 contains price-elastic goods in which the home country has a low unit value. This sector yields a trade surplus (*successful price competition*).
- Sector 3 combines the industries in which the quantity exported, despite a higher unit value, exceeds the quantity imported. This has to be the consequence of a quality lead, which is reflected by demand or which signals successful specialisation in the dearest market segment. This sector is the target at which advanced countries aim (*successful quality competition*).
- Sector 4 is an unattractive sector. An industry runs a trade deficit despite low prices. In this sector there have to be some exit barriers (*structural problem area*).

We propose to call price-elastic sectors those sectors in which prices are revealed to dominate the net trade flows, and refer to as quality-dominated sectors, those sectors where quality seems to be the decisive argument. Of course, we do not claim that in the latter sector demand is independent of price for a given quality. If demand q depends on the pure price p and the quality s, then $q = f(p^-, s^+)$, and in the first sector the first component dominates and in the second sector the other dominates. Data reveal implicitly which components dominate for the bilateral flows of a country or for an industry.

3.2. Results for bilateral flows in Germany

We define markets as 3-digit industries and analyse net flows in quantities in Germany's bilateral trade. Results are available for the USA, Japan and the EU in Aiginger

[1] Trying to discriminate between costs and quality as the main determinant of net flows involves some of the well-known problems of empirical testing in trade theory and in economics in general. We shall mention only a few of these problems:

- the assertion that net quantities will be determined by relative prices is an *ex ante* relation; *ex post* prices will eventually be equated by trade;
- that under quite general circumstances there will result a complete specialisation (with zero exports for the more expensive country);
- prices and quantities are not determined by demand alone, but also by supply; realised pairs are therefore either on the demand curve or on the supply curve, involving problems of identification. This argument is mitigated since we use a cross section to divide elastic versus inelastic markets.

We can circumvent some of these problems by accepting that real world data differ from the theoretically determined equilibrium points. Trade includes neighbour trade with a potentially higher price at the border to a high-price country, but total costs are lower than if we import these goods from a low-cost country which is far away. A market is in general homogeneous for the majority of sales in the market, but there is a high-quality niche embedded in each statistical category; actual prices are not in equilibrium etc.

(1995B). Concentration on a specific country has the statistical advantage of consistent reporting and the economic advantage that we come close to the concept of a regional market.

In the bilateral trade *of* Germany *vis à vis* Japan, 88 industries are price elastic (net quantities and net prices have opposite sign), and 65 industries are dominated by quality competition. Germany lacks price competitiveness in 51 price-elastic industries; a deficit of $15 bn is the consequence. The successful price competition sector (low unit values, quantity surplus) includes 37 industries, but creates a deficit in value terms of $0·8 bn. The successful quality competition sector (high unit values, quantity surplus) encompasses 35 industries, but creates a surplus of only $1·0 bn. The structural problem area where prices are lower, but imports nevertheless exceed exports, contains 30 industries and yields a deficit of $2·2 bn, amounting to more than the two successful sectors combined (see Table 1).

In Germany's bilateral trade *vis à vis* the USA, 85 industries are price elastic and 65 are quality dominated. The sector which lacks price competitiveness contains only 31 industries and produces a deficit of $5·3 bn. Successful price competition characterises 54 industries but creates a trade deficit of $5·1 bn. The promising sector of quality production contains 35 industries and creates a surplus of $6·9 bn. The structural problem sector includes 30 industries and produces a $2·2 bn deficit (see Table 2). The majority of the industries (90 of 159) are non-price elastic in Germany's trade with other EU countries. There is a trade deficit due to higher unit values, amounting to $16 bn and a trade surplus of $11·7 bn in industries enjoying successful price competition. But a $66·6 bn surplus is created in the sector most desirable for an advanced economy, in 77 industries in which the quantity exported is higher than imports, despite a higher unit value. The deficit of $3·8 bn in the structural problem segment is still quite large, but it is very small in relation to the successful quality competition (see Table 3).

In relation to Switzerland, there is virtually no sector in which Germany is too expensive; successful price competition creates a surplus of $3·3 bn, structural problem areas result in a deficit of $·3 bn. Successful quality competition can be observed in 33 industries, creating a $3·7bn surplus, which is practically identical with Germany's net position towards Switzerland. The majority of industries are price elastic (104:53) (see Table 4).

3.3. Assessing the technological position

If we look at the unit values of total manufacturing (SITC 5–9), Germany has a lower mean unit value for exports (relative to imports) in its bilateral trade with Japan ($10·96 /kg vs. $16·96 /kg), with the USA ($6·73 /kg vs. $ 9·69 /kg) and with Switzerland. It has a higher unit value of exports with most other EU countries, with Austria and, of course, with the former socialist countries and developing countries.

The negative relation of German manufacturing *vis à vis* the leading countries is not the result of low quality, but rather a lack of concentration on high value-added products. At the 3-digit level the number of industries in which Japanese exports have the higher unit value is only 67, while Germany has a higher unit value in 86 industries. At the 2-digit level, Japanese export unit values surpass German exports unit values in 18 out of 33 industries.

The three electronic industries are primarily responsible for this result. Computers, telecommunications and electrical machinery (SITC 75, 76, 77) together comprise 39% of Japanese exports to Germany, but only 9% of Germany's exports to Japan. The

Table 1. *German–Japanese trade (country-specific revealed price elasticity)*

	exports bn $	exports unit value	imports bn $	imports unit value
high unit value/quantity deficit				
781 Pass. motor vehicles ex. bus	2,601·2	24·5	5,915·7	10·2
784 Parts for tractors, motor vehicles	341·9	22·3	580·6	12·9
874 Measure, control instruments	216·1	150·9	371·0	137·8
• 51 industries; balance		−$15 bn		
high unit value/quantity surplus				
515 Organic-inorganic compounds	211·3	21·1	176·0	18·4
541 Medicines, etc., ex. grp. 542	404·4	148·1	89·12	33·0
726 Printing, bookbinding mach.	159·7	36·4	52·6	27·7
• 35 industries; balance		+$1 bn		
low unit value/quantity surplus				
514 Nitrogen-funct. compounds	175·3	7·3	101·8	9·7
542 Medicines	301·0	22·2	116·3	388·4
728 Other machines	199·6	30·8	178·1	55·3
• 37 industries; balance		−$0·8 bn		
low unit value/quantity deficit				
772 Electric switch relay circuits	77·0	57·0	342·0	95·2
774 Electro-med. X-ray equip.	89·7	126·6	139·7	135·1
778 Electric mach., app. nes	155·6	37·0	874·2	44·2
• 30 industries; balance		−$2·2 bn		

Table 2. *German–US trade (country-specific revealed price elasticity)*

	exports bn $	exports unit value	imports bn $	imports unit value
high unit value/quantity deficit				
641 Paper and paperboard	184·1	1·3	193·4	0·7
752 Automatic dat process. equip.	385·1	226·6	2,240·9	159·9
792 Aircraft, assoc. equip.	719·3	1,077·6	3,226·9	308·6
• 31 industries; balance		−$5·3 bn		
high unit value/quantity surplus				
724 Textile, leather machines	732·0	27·4	31·7	22·6
781 Pass. motor vehicles ex. bus	3,603·3	20·9	902·1	10·3
784 Parts for tractors, motor veh.	872·1	16·3	253·0	13·2
• 35 industries; balance		+$6·9 bn		
low unit value/quantity surplus				
713 Internal comb. pstn engines	1,042·8	11·7	186·4	16·4
714 Engines, motors non-elect.	732·8	221·0	685·6	627·2
728 Other machines	733·8	25·0	196·7	25·7
• 54 industries; balance		−$5·1 bn		
low unit value/quantity deficit				
541 Medicines, etc., ex. grp. 542	313·6	47·6	406·9	92·8
759 Parts for office mach.	422·3	112·9	1,230,4	195·4
874 Measure, contorl instr.	705·0	110·0	1,002·1	176·6
• 30 industries; balance		−$2·2 bn		

Table 3. *German–EU trade (country-specific revealed price elasticity)*

	exports bn $	exports unit value	imports bn $	imports unit value
high unit value/quantity deficit				
641 Paper and paperboard	4,277·7	1·1	6,129·4	0·9
752 Automatic dat process. equip.	4,031·3	117·9	4,689·8	100·9
792 Aircraft, assoc. equip.	9,514·1	600·6	9,541·9	547·7
• 40 industries; balance		−$16·0 bn		
high unit value/quantity surplus				
781 Pass. motor vehicles ex. bus	32,312·7	12·9	16,179·9	11·5
784 Parts for tractors, motor veh.	13,794·9	8·5	8,493·9	6·7
874 Measure, control instruments	4,780·6	103·4	2,628·9	80·6
• 77 industries; balance		+$66·6 bn		
low unit value/quantity surplus				
713 Internal comb. pstn engines	4,152·7	10·6	3,464·2	16·4
772 Elec. switch relay circuit	5,925·1	40·8	2,488·1	627·2
782 Goods, spec. transport veh.	4,007·0	9·1	3,327·7	25·7
• 29 industries; balance		−$11·7 bn		
low unit value/quantity deficit				
514 Nitrogen-funct. compounds	1,684·7	3·1	1,693·4	3·4
553 Parfumery, cosmetics, etc.	1,033·6	7·5	1,164·5	11·1
821 Furniture, cushions, etc.	3,867·2	5·2	4,599·6	5·7
• 13 industries; balance		−$3·8 bn		

Table 4. *German–Swiss trade (country-specific revealed price elasticity)*

	exports bn $	exports unit value	imports bn $	imports unit value
high unit value/quantity deficit				
542 Medicines	587·3	88·8	423·6	40·2
641 Paper and paperboard	246·3	1·4	232·1	0·9
716 Rotating electric plant	216·9	19·6	185·1	14·8
• 15 industries; balance		−$0·1 bn		
high unit value/quantity surplus				
781 Pass. motor vehicles ex. bus	1,862·0	16·4	33·3	9·6
784 Parts for tractors, motor veh.	361·0	13·4	142·6	6·5
892 Printed matter	555·6	7·3	185·4	6·3
• 33 industries; balance		+$3·7 bn		
low unit value/quantity surplus				
772Elec. switch relay circuit	464·2	43·3	455·1	75·2
821 Furniture, cushions, etc.	581·5	5·8	207·5	8·0
893 Articles, nes. of plastics	396·4	6·7	239·2	7·3
• 89 industries; balance		−$3·3 bn		
low unit value/quantity deficit				
726 Printing, bookbinding mach.	145·8	15·2	344·1	25·9
778 Elec. mach. app., nes	383·0	26·6	442·4	30·6
874 Measure, control instr.	414·2	112·0	535·0	137·6
• 20 industries; balance		−$1·3 bn		

unit value of these industries is five to tenfold that of average exports. It is not the case that Germany does not sell quality products in these areas; the unit values of German exports are higher than that of Japanese exports in two of the 3-digit electronic sectors and in ten of the fourteen 3-digit electronic industries. But Japanese industry concentrates much more strongly on these sectors, while German industry exports a broad spectrum of goods including those with low unit values.

As far as the US is concerned, a portion of the lower German export unit value again can be attributed to the smaller electronic sector on the export side. Electronic industries (defined as SITC 75, 76, 77) amount to 29% on the import side, and comprise 13% of German exports, the deficit being larger than that *vis à vis* Japan. Within the electronic sectors, German imports are higher priced in all three 2-digit industries, but only in five of the fourteen 3-digit industries. Part of the difference can be attributed to the industries 'other vehicles' (especially aircraft, SITC 79), scientific equipment (specifically, measurement and control instruments, SITC 87), and optical instruments (photo supplies, SITC 88): in all these sectors, US exports have higher unit values, as well as higher shares in the country's exports). Germany has a definite advantage in two important sectors, namely road vehicles and special industrial machines: 37% of exports can be attributed to these two categories, and only 23% of the imports. And the prices are much higher for the exports (30–100%). On the 3-digit level, German exports have higher unit values in 85 industries and lower ones in 77 industries. So the overall picture is similar in the bilateral trade flows with the US and Japan: the lower unit value in the aggregate comes from the non-concentration of exports in those sectors in which the unit value is high.

The tentative conclusion provided by the analysis of unit values on the technological position is that Germany enjoys a high degree of competitiveness. It has a higher unit value in exports relative to imports with respect to most countries and for total exports. It has a rather large sector of quality-oriented products with low price elasticity. It may have a slight disadvantage in its trade with the most advanced countries (US, Japan, Switzerland), but this is not due to low quality, rather to insufficient concentration and a somewhat less competitive position in electronics and telecommunications.

4. Evidence of quality ladders, price elasticity and product differentiation

4.1. Extending the evidence

Our goal in this section is to make some extensions. First, we shall investigate whether high-income countries have higher export unit values, thereby looking at whether the empirical data are roughly in line with the quality ladder hypothesis. Then we shall extend our technique to discriminate between price and non-price competitiveness to a larger set of countries. We start from the assumption that if an industry is price elastic, it should be so for most bilateral flows. We shall then search for econometric evidence on the price elasticity, and, finally, we shall check the robustness of the results.

4.2. The unit value hierarchy and GNP: evidence of the quality ladder

If we examine the aggregate unit values of the exports (all industries, SITC 5–8) of various countries, we see a significant relation between unit values and per capita GDP. This is to be expected, since costs, as well as quality, increase in line with GDP per head. Switzerland traditionally has the highest export unit values, as well as in import unit values, where the exports are higher priced and/or of higher quality. Germany,

France and Italy follow with rather high export unit values. Spain and Greece, followed by the Eastern European countries, have low unit values. An exception in the hierarchy is Ireland, which has a very high export unit value, owing to the role it plays as a host to subsidiaries of multinational firms in high unit value sectors. (Ireland is attractive to the so-called 'mobile technological intensive industries', such as computer parts, chemicals, etc.)

We made calculations for 13 countries, in which the 3-digit industries, consistently reporting price and quantities, remained identical. For these countries, we regressed the unit value of exports, the unit value of imports, and finally the relation of these two values on the per capita GDP.[1]

The coefficient for exports is significantly positive and the *unit value– income elasticity* is 1·12, thus implying that a rise in GNP per capita of 1% increases the export unit value by 1·12% (t = 2·44). The coefficient for import unit values is low (0·22, t = 1·40) and not significant. The relation of export to import unit values is again significantly positive related to GNP. These results are consistent with the notion that countries (or the domestic production thereof) climb up a quality ladder during the course of economic development. The regression results are not independent of the number of countries included in the sample. An enlargement of the sample to include countries with greater variations in income per capita increases the significance of the results, since countries in Central and Eastern Europe have very low unit values, the same being true for developing countries.[2]

4.3. Price elasticity in 3-digit industries (revealed by the balances of 18 countries)

In the previous section, we discriminated between industries dominated by price competitiveness and industries dominated by quality competition, by employing the bilateral trade flows of one country. This gave us a scheme of country-specific revealed price elasticity. Here, we try to discriminate between industries on the basis of the trade flows of 18 countries (EU–12, USA, Japan, Canada, plus the transition countries of the Czech Republic, Hungary and Poland). The test we conducted involved calculating in how many countries the sign of the quantity balance for each specific 3-digit industry was the opposite of the sign for the price differences (markets with high price elasticity),

[1] All variables were used in logs. The following results were obtained in a regression for 13 countries with comprehensive reporting:

ln UV exp =	10·02 +	1·12	ln GNP/head	R^2 = 0·35
	(2·22)	(2·44)		
ln UV imp =	1·01 +	0·22	ln GNP/head	R^2 = 0·20
	(0·66)	(1·40)		
ln (UV exp/UV imp) =	9·01	0·90	ln GNP/head	R^2 = 0·27
	2·00	(2·00)		

We want to stress that these figures should only be used to demonstrate the relationship between unit values and per capita income. Though we made some tests for the robustness of the relation, it must be kept in mind that there is no unilateral causality and that there may be some intervening variables. The results should encourage a more elaborate testing of the quality-ladder hypothesis.

[2] This finding also shows why the Kaldor paradox came up. In the face of studies which tried to show that countries with lower prices are more competitive, Kaldor found a perverse relationship between unit labour cost and trade performance. This is because fast-growing countries enjoy higher income growth and eventually become high-cost countries. As a consequence, fast-growing countries increase the quality of their products, as reflected in increasing unit values. Of course, some countries and some industries focus more on process innovation and/or focus on holding costs down, while others focus on product upgrading and quality competition. So trade balances differ across countries and cross-section regressions yield positive price elasticities at a moment in time.

and how often the quantity balance and the price difference had the same sign (markets with low price elasticity, revealed quality dominance). This allows us to get a ranking of industries according to the importance of price versus quality in determing the net quantity position (industry-specific revealed price elasticity). For the results, see Appendix.

For 110 of the industries, a positive price difference corresponds to a negative trade balance in the majority of the 18 bilateral flows. There are, however, 40 industries in which the majority of countries have a positive price elasticity. These sectors of 'revealed quality dominance' cluster in the machinery industry and in special parts of the chemical industry. Within the machinery sector (defined rather widely as SITC 7), 18 3-digit industries are quality dominated. Six out of eight special industry machine sectors and six out of nine general purpose industrial machine industries are quality dominated. Interestingly, the majority of the electrical machinery sectors are driven by price differences: either these goods are more standardised (not made to order), or the price differences are so large that they dominate quality differences. For all the bilateral balances combined, we have 40 industries with a majority of positive signs, and 110 with a majority of negative signs. The proportion of revealed quality domination (the number of countries with a positive sign in a specific industry) is related positively to the skill intensity of industries and negatively to the capital intensity.[1]

4.4. Regression results for 'quasi demand functions'

Another way to assess the role of unit values is to treat them as prices and to estimate 'quasi demand curves', by explaining quantity balances through price differences (cross-section analysis for the year 1992).

More specifically, we regress Germany's quantitative trade balance (its logarithmic transformation) on the relative unit values and on such structural characteristics as skill, capital and labour intensity, and research and development, as well as energy intensity (see Table 5).

$$\ln (q \text{ exp}/q \text{ imp}) = f \ln (UV \text{ exp}/ UV \text{ imp}) \quad (1)$$

$$\ln (q \text{ exp}/q \text{ imp}) = f [\ln (UV \text{ exp}/ UV \text{ imp}), LI, CI, RDI, EI, Skill] \quad (2)$$

The price elasticity is negative and significant for all the bilateral flows. It is larger than 1 for the flows Germany vs. the US and Germany vs. Japan. For these flows, relative prices can explain 36%, respectively 32% (as measured by R^2, of the total variation of relative exports, in tons). The elasticity is only 0·79 for the bilateral trade of Germany with its EU partners and 0·51 for its trade with Switzerland, only 18%, resp. 10%, of the variation in these flows is explained. Here quality differences, and intra-industry specialisation seem to play a greater role than in the exports to the US and Japan. Trade surpluses corresponds to low capital intensity and high energy intensity in Germany's trade with the US and Japan, to high labour intensity in its trade with the US, but to low labour intensity and high research and development in Germany's trade with Japan. The results for the critical variable (price elasticity) do not change if we add

[1] The rank correlation between the number of countries for which an industry has a positive sign (higher unit values go with positive net quantities) and skill intensity is significantly negative; that with capital intensity is significantly positive. This result holds in multivariate equations. Labour intensity and research intensity are not significant in the multivariate regression. Taken alone, research intensity is positively related to quality dominance, but its ranking is very similar to that of skill.

Table 5. *Explanations of net quantity balances (bilateral German exports 1992)*

	$RCQ = f(RCP, SI, CI, LI, RDI, EI)$						
	RCP	*SI*	*CI*	*LI*	*RDI*	*EI*	R^2
Germany–Austria	–0·985**						0·246
	(0·137)						
	–1·038**	–0·007	–0·039	–0·052**	0·013	0·291	
	(0·137)	(0·042)	(0·036)	(0·019)	(0·027)	(0·044)	
Germany–USA	–1·420**						0·357
	(0·152)						
	–1·249**	0·115**	–0·062	0·083**	0·006	0·124**	0·480
	(0·150)	(0·048)	(0·039)	(0·021)	(0·030)	(0·050)	
Germany–Japan	–1·191**						0·316
	(0·141)						
	–1·064**	0·098	–0·167**	–0·082**	–0·070	–0·018	0·387
	(0·150)	(0·067)	(0·056)	(0·032)	(0·043)	(0·071)	
Germany–EU	–0·787**						0·182
	(0·133)						
	–0·823**	–0·035	0·014	0·017	–0·010	0·081**	0·305
	(0·131)	(0·019)	(0·016)	(0·009)	(0·013)	(0·020)	
Germany–Switzerland	–0·511**						0·096
	(0·125)						
	–0·509**	0·081**	0·008	0·037**	0·060**	–0·035	0·217
	(0·120)	(0·038)	(0·032)	(0·017)	(0·025)	(0·041)	

Notes: **Significant at 95%; but remember that conditions for OLS may be violated.

$$RCP = \ln \frac{UV_{EXPi}/UV_{IMPi}}{UV_{EXPtot}/UV_{IMPtot}}$$

$$RCQ = \ln \frac{Q_{EXPi}/Q_{IMPi}}{Q_{EXPtot}/Q_{IMPtot}}$$

SI = skill intensity.
CI = capital intensity.
LI = labour intensity.
RDI = R&D intensity.
EI = energy intensity.

a set of factor intensities (following the Heckscher–Ohlin explanation of trade flows) to the simple demand equation (see Equation 2).

These explanations of the bilateral flows need to be taken further; here we conclude that for the majority of products at a disaggregated level, net exports in quantities occur in those industries in which unit values are lower. Price competition seems to be more important for German trade with the US and Japan; in Germany's trade with its EU partners, quality competition (and intra industry trade) prevails.

4.5. The persistency of the results

The data reported thus far refer to 1992. They are measured in international dollars and depend to some extent on exchange rates. For this reason, and since we are interested not only in the status of competitiveness but also in its evolution over time, we shall now analyse the unit values for total manufacturing for the period of 1980 to 1993 (Table 6).

Germany's unit value of total exports is higher during each single year between 1980

Table 6. *Export and import unit values over time*

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
BRD[a] vs Japan														
Export *UV*	5·6	4·6	4·2	4·1	3·5	4·7	5·7	8·8	9·0	9·0	11·5	10·7	10·5	12·2
Import *UV*	6·4	7·6	7·5	7·4	8·1	7·5	9·9	12·1	14·4	14·1	15·6	15·3	16·9	15·8
Relation	0·8	0·6	0·5	0·5	0·4	0·6	0·5	0·7	0·6	0·6	0·7	0·7	0·6	0·7
BRD vs USA														
Export *UV*	4·0	2·8	3·1	3·5	3·0	3·6	5·2	5·8	5·1	5·6	6·5	5·8	6·7	6·3
Import *UV*	5·1	6·0	6·4	6·3	7·1	7·6	7·3	7·1	9·5	9·5	9·8	9·9	9·6	11·5
Relation	0·7	0·4	0·4	0·5	0·4	0·4	0·7	0·8	0·5	0·5	0·6	0·5	0·6	0·5
BRD vs EU														
Export *UV*	2·1	1·9	2·0	1·8	1·7	1·8	2·4	2·9	3·0	3·0	3·6	3·5	3·7	3·2
Import *UV*	1·7	1·4	1·4	1·3	1·2	1·3	1·7	2·1	2·2	2·2	2·6	2·7	2·8	2·5
Relation	1·2	1·3	1·3	1·4	1·3	1·3	1·3	1·3	1·3	1·3	1·3	1·2	1·3	1·2
BRD vs Switzerland														
Export *UV*	2·7	2·3	2·4	2·2	2·0	2·1	3·0	3·6	3·8	3·5	4·2	4·2	4·3	4·1
Import *UV*	3·7	3·2	3·1	2·8	2·6	2·8	4·0	5·0	5·0	4·9	5·7	5·5	5·6	4·8
Relation	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·7	0·8
BRD vs Austria														
Export *UV*	2·9	2·4	2·4	2·2	2·1	2·2	3·2	3·7	3·7	3·7	4·4	4·2	4·6	4·3
Import *UV*	1·4	1·2	1·3	1·2	1·2	1·2	1·7	2·1	2·2	2·2	2·6	2·7	2·8	2·5
Relation	1·9	1·9	1·8	1·7	1·7	1·7	1·8	1·7	1·6	1·6	1·6	1·5	1·5	1·7
BRD vs total														
Export *UV*	2·3	2·0	2·1	2·0	1·8	1·9	2·6	3·1	3·2	3·3	3·9	3·7	4·0	3·5
Import *UV*	1·9	1·7	1·6	1·5	1·5	1·6	2·0	2·4	2·6	2·6	3·0	3·0	2·9	2·7
Relation	1·1	1·1	1·2	1·2	1·2	1·2	1·3	1·2	1·2	1·2	1·2	1·2	1·3	1·2

Note: [a] Until 1989 West Germany.

and 1993 than its unit value of imports. The relation starts with 1·18 in 1980, increases to 1·30 in 1986 and then remains constantly around this mark, with a somewhat higher relation in 1992 and a lower one in 1993 (1·34, 1·29 $/kg).

The same stability can be seen for the bilateral unit values vs. the US, Japan and Switzerland (always lower for German exports) and vs. Austria, and the 11 remaining EC countries (always higher for German exports). There is no general trend to be seen, neither a catching up of Germany vs. the countries with higher unit values, nor a decline of Germany's superiority vs. the countries with lower unit values. No change is to be seen between the data referring to the Federal Republic of Germany (West Germany, up to 1989) and those for unified Germany.

The following tentative results can be drawn from these figures. 1992 is a representative year. The results do not depend significantly on fluctuations of exchange rates. And the structural, technological or cost relations indicated by unit values are very stable over time. For the case of Germany, specifically, they do not depend on whether the data refer to the former Federal Republic of Germany or to unified Germany.

5. Other assessments and limitations of the approach

We claim that the unit value is a complementary indicator for assessing the competitiveness of countries. The other approaches employ indicators of productivity, innovation and marketing (Schumacher *et al.*, 1995), of research input and output (Gehrke and Grupp, 1994; OECD, 1994), or calculate market shares for specific high-tech industries. For the general evaluation, we again want to follow Schumacher *et al.* (1995) in their fairly positive conclusion: 'The general verdict on the technological competitiveness of West Germany looks rather positive. This holds true, especially for the main measures of economic performance, such as income and productivity growth, as well as for the terms of trade.' Schumacher *et al.* concede that Germany seems to be losing with respect to one indicator, namely the declining specialisation of production and exports in high-tech industries. This is explained in a positive way: technology spreads from high-tech sectors to other industries, increasing the competitiveness of all firms utilising the technology.

This picture conforms with that given by the unit value, which is positive for the majority of German industries. The advantage of the unit value approach continues to be that this indicator supplies more specific information. Advantages and disadvantages may be pinned down to a specific 3-digit or even 4-digit industry; differentiation in price and non-price components, as well as disaggregation in the bilateral trade flows with different countries is possible. (See the very good performance in qualitative competitiveness of German industries with the EU, and the less favourable performance with Japan and Switzerland.)

Several limitations of the unit value approach have to be kept in mind. The unit value does not only tell us about the price and about the quality; it is also influenced by aggregation problems. This problem is less severe than for most other indicators used in empirical economics, and the problem can be mitigated by going further 'down' in the statistics to further levels of disaggregation. The fact remains that we should not be too confident that we have really arrived at a level which would be considered by an economist as the ideal concept of 'market'. Therefore, we should not use the unit value as the final and only means of discrimination between two 'pure' forms of competition, either price elastic or quality oriented. The data in the appendix also suggest this

conclusion, since the signs are not identical for the specific industries within all the bilateral trade relations. Further research will perhaps cluster industries into those with more quality elements, and those with more price elements. Peneder (1995) has used a series of indicators (unit values, revealed comparative advantage ratios, market shared etc.) to cluster Austrian industries into those with very high competitiveness and those with a low profile. A first look at industrial profiles indicates that many non-electrical machine industries, as well as equipment industries, are at the top of the quality ranking, while many basic goods industries, semi-finished product industries and also textile industries, are at the bottom.

6. Summary

The unit value is a indicator which can be used to provide complementary information on the competitiveness of firms and industries. One of its advantages is that information on nominal exports and imports, as well as on traded quantities, is available for practically all countries and for the majority of products. Analyses may therefore be conducted for bilateral trade and at any desired level of aggregation. A disadvantage, revealed in previous research, was that the unit value can in some industries be an indicator of costs—a low unit value may provide information on low costs and high efficiency—and in other industries, it can be an indicator of quality, when a high unit value provides information as to additional product characteristics and a high degree of sophistication. The unit value shares this problem with any price information: prices can reflect costs in competitive industries and generic products, but it can also indicate quality, specialty production and, finally, innovation and ingenuity when we are dealing with high-tech products and such services as consulting.

We propose an easy way to split industries into those where the unit value predominantly signals costs and those where it signals quality. If a low unit value of exports leads to a quantity surplus (UV exp $<$ UV imp $\Rightarrow$ Q exp $>$ Q imp and vice versa) then it is revealed that the cost side dominates, since economic theory tells us that most goods are price elastic. If a high unit value leads to a quantity surplus (UV exp $>$ UV imp $\Rightarrow$ Q exp $>$ Q imp and vice versa), then demand is dominated by quality, since economic theory tells us that prices can be higher for a good, only if the market is vertically differentiated and one firm concentrates on the higher quality segment. Models of vertical differentiation are available, which describe this situation as a two-step game of firms choosing sequentially the quality level during the first stage, and then competing in a vertically differentiated oligopoly. At the macroeconomic level, the theory of quality ladders describes the situation in which more developed countries always innovate, while less developed countries imitate. Each time the second country catches up, the leading country has to climb up another step of the quality ladder to regain a higher degree of market power and to compensate for its higher wages.

Roughly two-thirds of the 3-digit industries are dominated by price competition, and one-third by quality competition. Quality dominated the bilateral trade flows specifically in the machinery industry and in some subsectors of the chemical industry. The picture is similar for Germany and for 18 other countries (OECD plus three countries in transition). The 3-digit industries in which quality dominates are the skill-intensive industries; price competition dominates in sectors with high capital intensity.

We demonstrate the usefulness of unit values for a tentative assessment of the competitiveness of the German economy. The unit value of German exports is lower

than that of imports in relation to Japan and the US, but higher than in relation to the rest of the EU countries. The lower unit value as compared to that of the two leading countries comes from the higher concentration of these countries on the electronic industries, and is stable over time. In the bilateral flows with Switzerland, Ireland, and Great Britain, the unit value of exports is lower. In trade with other EU countries, with Austria, and with the countries of Central and Eastern Europe, the unit value of exports is higher.

Dividing the markets according to price competition and quality dominance, with respect to German trade flows, yields the following picture: *Vis à vis* Japan, Germany has a large trade deficit, which is due to industries in which Germany lacks price competitiveness (higher unit values are responsible for a net deficit of $15 bn). *Vis à vis* the US, Germany has a considerable trade surplus, which to a minor extent can be attributed to successful price competition and to a larger extent to sectors in which larger quantities can be exported, despite a higher unit value. *Vis à vis* other EU countries, lacking price competition leads to a deficit of $16 bn, structural problem areas to $4 bn, while industries with qualitative leads yield a surplus of $67 bn. Industries with successful price competition add $12 bn, so that Germany enjoys a large total surplus. In the trade between Germany and the other EU countries, the number of industries with quality competition is larger than the number of industries with price competition.

The impression created by the analysis of unit values coincides with the assessment of the technological position arrived at using other indicators. The technological position can be assessed through the study of innovation data, market shares in high/medium/low-tech industries, etc. The overall picture is that Germany enjoys a good technological position, but concentrates on medium-tech industries. There may be a slight technological gap between Germany and the leaders, especially in particular industries (such as electronics and telecommunications). The unit values underline the good position of Germany in markets with quality competition and specifically with the other EU countries. The strength of this indicator is that the information on price or quality competition can be further disaggregated for nearly any requested definition of a geographical or product market.

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Appendix

Ranking of the SITC 3-digit industries according to price versus quality competition (industry specific revealed price elasticity). Criterion: number of countries in which a specific price–quantity relation is revealed

SITC		Negative sign	Positive sign	Difference pos-neg	Ranking
784	Parts, tractors, motor veh.	3	11	8	1
687	Tin	5	12	7	2
722	Tractors	4	11	7	2
726	Printing, bookbinding mach.	4	11	7	2
745	Oth. non-elec. mach., tool, nes	3	10	7	2
553	Perfumery, cosmetics, etc.	5	11	6	6
591	Insecticides, etc.	6	11	5	7
721	Agric. machines, ex. tractors	5	10	5	7
725	Paper, pulp-mill machines	5	10	5	7
744	Mechanical handlng. equip.	5	10	5	7
531	Synth. colours, lakes, etc.	7	11	4	11
582	Plastic plate, sheets, etc.	6	10	4	11
613	Furskins, tanned, dressed	6	10	4	11
711	Steam gener. boilers, etc.	5	9	4	11
781	Pass. motor veh. ex. buses	5	9	4	11
655	Knit., crochet. fabric, nes	7	10	3	16
728	Oth. mach. parts, spcl indust.	6	9	3	16
735	Parts, nes, for mach.-tools	6	9	3	16
741	Heating, cooling equip., parts	5	8	3	16
749	Non-elect. mach. parts, etc.	6	9	3	16
533	Pigments, paints, etc.	6	8	2	21
572	Polymers of styrene	7	9	2	21
574	Polyacetal, polycarbonate	7	9	2	21
597	Preprd additives, liquids	8	10	2	24
653	Fabrics, man-made fibres	8	10	2	24
723	Civil engineering equip.	6	8	2	24
792	Aircraft, assoc. equip.	6	8	2	24
811	Prefabricated buildings	7	9	2	24
873	Metres, counters, nes	6	8	2	24
884	Optical goods, nes	5	7	2	24
551	Essen. oil, perfume, flavr	8	9	1	31
562	Fertiliser, except group 272	7	8	1	32
625	Rubber tyres, tubes etc.	7	8	1	32
629	Articles of rubber, nes	7	8	1	32
657	Special yarn, textile fabric	7	8	1	32
662	Clay, refrct constr. material	7	8	1	32
675	Flat-rolled, alloy steel	8	9	1	32
733	Mach.-tools, metalworking	7	8	1	32
742	Pumps for liquids, parts	7	8	1	32
747	Taps, cocks, valves, etc.	7	8	1	32
522	Inorganic chem. elements	6	6	0	41
525	Radioactive materials	0	0	0	41
541	Medicines, etc. exc. group 542	0	0	0	41
542	Medicines	0	0	0	41
583	Monofilament of plastics	8	8	0	41
642	Paper, paperboard, cut etc.	8	8	0	41
667	Pearls, precious stones	0	0	0	41
681	Silver, platinum, etc.	0	0	0	41

SITC		Negative sign	Positive sign	Difference pos-neg	Ranking
751	Office machines	7	7	0	41
774	Electro-medical, X-ray equip.	8	8	0	41
783	Road motor vehicles, nes	7	7	0	41
786	Trailers, semi-trailers, etc.	7	7	0	41
874	Measure, control instruments	7	7	0	41
885	Watches and clocks	0	0	0	41
896	Works of art, antiques, etc.	0	0	0	41
897	Gold, silverware, jewl, nes	0	0	0	41
635	Wood manufactures, nes	7	6	−1	57
679	Tubes, pipes, etc. iron, steel	6	5	−1	57
691	Metallic structures, nes	9	8	−1	57
694	Nails, screws, nuts, etc.	9	8	−1	57
712	Steam turbines	8	7	−1	57
713	Intrnl combus. pstn engin.	8	7	−1	57
714	Engines, motors non-elect.	8	7	−1	57
724	Textile, leather machines	7	6	−1	57
727	Food-process. mach. non-dom.	8	7	−1	57
772	Elec. switch. relay. circuit	8	7	−1	57
778	Electric. mach. appart., nes	6	5	−1	57
782	Goods, spec. transport veh.	7	6	−1	57
851	Footwear	7	6	−1	57
872	Medical instruments, nes	8	7	−1	57
892	Printed matter	7	6	−1	57
514	Nitrogen-funct. compounds	9	7	−2	72
581	Plastic tube, pipe, hose	9	7	−2	72
689	Misc. non-ferr. base metal	7	5	−2	72
695	Tools	7	5	−2	72
699	Manufact. base metal, nes	7	5	−2	72
716	Rotating electric plant	8	6	−2	72
718	Oth. power-generating mach.	8	6	−2	72
761	Television receivers, etc.	8	6	−2	72
898	Musical instruments, etc.	7	5	−2	72
899	Misc. manufactured goods, nes	2	0	−2	72
677	Railway track iron, steel	10	7	−3	82
731	Metal removal work tools	9	6	−3	82
737	Metalworking machinery, nes	9	6	−3	82
743	Pumps nes, centrifuges, etc.	9	6	−3	82
775	Dom. elec., non-elec. equipment	8	5	−3	82
633	Cork manufactures	10	6	−4	87
654	Oth. textile fabric, woven	11	7	−4	87
678	Wire of iron or steel	11	7	−4	87
746	Ball or roller bearings	10	6	−4	87
748	Transmissions shafts, etc.	10	6	−4	87
881	Photograph. appar., etc., nes	9	5	−4	87
883	Cine. film exposd, developed	9	5	−4	87
893	Articles, nes, of plastic	10	6	−4	87
895	Office, stationery supplies	9	5	−4	87
573	Polymers, vinyl chloride	10	5	−5	96
592	Starches, inulin, etc.	10	5	−5	96
593	Explosives, pyrotechnics	10	5	−5	96
621	Materials of rubber	11	6	−5	96
659	Floor coverings, etc.	10	5	−5	96
682	Copper	10	5	−5	96

SITC		Negative sign	Positive sign	Difference pos-neg	Ranking
683	Nickel	11	6	–5	96
686	Zinc	11	6	–5	96
692	Containers, storage, transp.	10	5	–5	96
764	Telecomm. equip. parts, nes	9	4	–5	96
791	Railway vehicles, equip.	9	4	–5	96
793	Ship, boat, float. structures	9	4	–5	96
515	Organic–inorganic compounds	11	5	–6	108
554	Soap, cleaners, polish, etc.	11	5	–6	108
579	Plastic waste, scrap etc.	12	6	–6	108
641	Paper and paperboard	11	5	–6	108
651	Textile yarn	11	5	–6	108
663	Mineral manufactures, nes	10	4	–6	108
763	Sound recorder, phonograph	10	4	–6	108
785	Cycles, motorcycles, etc.	10	4	–6	108
894	Baby carriage, toys, games	10	4	–6	108
575	Oth. plastic, primary form	11	4	–7	117
656	Tulle, lace, embroidery, etc.	12	5	–7	117
672	Ingots etc. iron or steel	12	5	–7	117
673	Flat-rolled iron, etc.	11	4	–7	117
674	Flat-rolled plated iron	12	5	–7	117
676	Iron, steel bar, shapes etc.	11	4	–7	117
812	Plumbing, sanitary, equip., etc.	11	4	–7	117
882	Photo. cinematograph suppl.	10	3	–7	117
891	Arms and ammunition	9	2	–7	117
511	Hydrocarbons, nes, derivs	10	2	–8	126
512	Alcohol, phenol, etc. derivs	10	2	–8	126
523	Metal. salts, inorgan. acid	11	3	–8	126
524	Other chemical compounds	11	3	–8	126
532	Dyeing, tanning materials	13	5	–8	126
571	Polymers of ethylene	12	4	–8	126
612	Manufact. leather etc., nes	12	4	–8	126
634	Veneers, plywood, etc.	11	3	–8	126
661	Lime, cement, constr. material	11	3	–8	126
664	Glass	11	3	–8	126
671	Pig iron, spiegeleisen, etc.	12	4	–8	126
697	Household equipment, nes	11	3	–8	126
752	Automatic data proc. equip.	11	3	–8	126
871	Optical instruments, nes	11	3	–8	126
516	Other organic chemicals	11	2	–9	140
693	Wire products excl. elect.	12	3	–9	140
759	Parts, for office machin.	12	3	–9	140
776	Transistors, valves, etc.	10	1	–9	140
821	Furniture, cushions, etc.	12	3	–9	140
842	Women's, girls' cloth., exc. knit.	12	3	–9	140
598	Misc. chemical products, nes	12	2	–10	146
652	Cotton fabrics, woven	14	4	–10	146
685	Lead	14	4	–10	146
771	Elect. power mach. parts	12	2	–10	146
773	Electr. distrib. equip., nes	13	3	–10	146
813	Lighting fixtures, etc., nes	13	3	–10	146
841	Men's, boys' clothing,exc. knit.	13	3	–10	146
846	Clothing access., fabric	13	3	–10	146
513	Carboxylic, acids, derivs	13	2	–11	154

SITC		Negative sign	Positive sign	Difference pos-neg	Ranking
665	Glassware	13	2	–11	154
684	Aluminium	13	2	–11	154
696	Cutlery	13	2	–11	154
762	Radio-broadcast receiver	12	1	–11	154
658	Textile articles, nes	13	1	–12	159
831	Trunk, suitcases, bag., etc.	13	1	–12	159
843	Men's, boys' clothing, knit.	14	2	–12	159
845	Other textile apparel, nes	13	1	–12	159
844	Women's, girls' clothing, knit.	15	1	–14	163
848	Clothing, non-txtl; headgear	14	0	–14	163
611	Leather	15	0	–15	165
666	Pottery	16	0	–16	166

Notes: Negative sign: quantity balance and unit value difference have opposite signs (indicator of price competition); positive sign: quantity balance and unit value difference have the same sign (revealed dominance of quality).

Ranking: 1 = industry with the most positive signs in flows of 18 countries.

18 countries: EU (12 members), US, Canada, Japan, Hungary, Poland, Czech Republic.

nes = not elsewhere specified.

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Printed in the UK by Henry Ling Ltd, at The Dorset Press, Dorchester, Dorset.

CAMBRIDGE JOURNAL OF ECONOMICS
Volume 21 Number 5 September 1997

Please visit the journal's World Wide Web site at http://www.oup.co.uk/cameco