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MEASURING THE INTENSITY OF QUALITY COMPETITION IN INDUSTRIES

This report highlights the key significance of quality in competition. Europe can increase production and welfare only if it performs well in industries in which the price is not the only factor defining the competitive edge and if it specialises in the upper price segments of each industry. Wages in European manufacturing are higher than in the USA per worker and per hour, and much higher than those in emerging economies in Asia, or in countries applying for accession to the European Union. This is true even after productivity is taken into account. Focusing on quality is a promising strategy to increase standards of living, since Europe has a competitive advantage in quality competition relative to new competitors with cheap labour costs.

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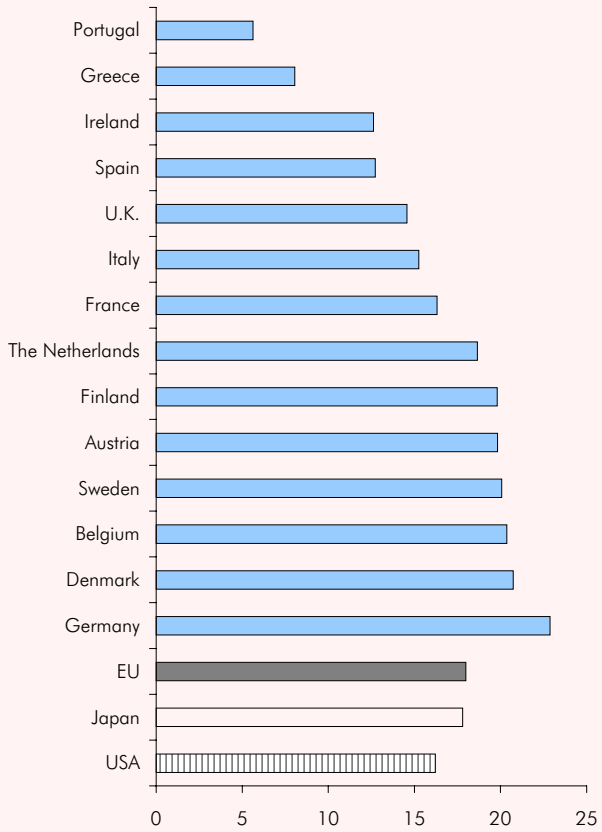
1. Objective and structure of the paper

This paper develops a method to measure the intensity of quality competition in different industries. Quality competition as opposed to price competition is a competitive environment ("mode") in which demand depends on characteristics of goods like reliability, design, durability, flexibility, etc., all of which elements become important when the buyer is willing to spend more for a good if such characteristics are added. Additionally we measure quality by the more conventional indicator of "unit value", and finally by a set of 16 indicators which comprise qualitative elements.

The topic is specifically interesting for the members of the European Union, since these states comprise a high-wage region (see Figure 1 for per-hour labour costs in European countries, in Japan and in the USA). A substantial portion of the high wages, as well as the costs for the social system, education, health and environment can be compensated by higher productivity. Cost increases have been successfully curbed by increasing the efficiency of institutions and markets through reducing transport costs, trade barriers and currency costs. Nevertheless, cost restraints do have a limit, and – as far as factor rewards (wages, profits) are concerned – to a certain extent also contradict the final goal of achieving competitiveness, namely to increase the welfare of European citizens. In addition, new competitors faced with much lower costs are arriving, whether from the emerging economies or the accession countries. These competitors will always have lower absolute costs and, usually even after correcting for productivity differences, also lower unit labour costs. The consequence for a high-wage country is to compete in terms of quality. Here, pressure from the cost side is mitigated, since high-wage countries have a competitive advantage: demand for high-quality goods depends on disposable income and is therefore stronger in rich countries, providing them with a first-mover advantage; additionally, research and skilled labour resources encourage innovation. For firms, quality competition has the advantage that it enables high-cost firms to remain competitive; margins needed for innovation can be earned, and price competition is mitigated. At a country level, high wages then become compatible with competitiveness.

Figure 1: Labour costs per hour in manufacturing, 1997, ECU



Source: WIFO calculations, IW Trends 2/1998.

The study starts out by investigating how Europe is positioned in quality competition in manufacturing[1], and then analyses differences in strategies and countries. The data indicate that there is no immediate danger of European industries losing their mostly quality-based competitive edge in foreign trade vis-à-vis the low-cost providers; Europe enjoys a trade surplus in manufacturing and specifically a large trade surplus vis-à-vis the accession countries and many emerging economies. A large part of this surplus can be attributed to Europe's ability to sell goods in industries in which quality competition is of specific importance. We develop a method which enables us to distinguish empirically between this group and the complementary group where price competition is specifically tough. Within the Triad in general, goods of high quality are traded. Here, Europe is making progress in selling high-quality goods, and making inroads in important fields, although it still has a deficit with regard to fast moving industries and productivity, and is changing at a slow pace only[2]. To push up revenues, Europe has to boost quality and productivity and increase its share of technology-driven industries.

In Chapter 2, we give short definitions of quality, inputs and policy contributing to quality upgrading. Furthermore we introduce the main indicators used in the study and provide overviews of the role of quality in trade, production, and growth theory, industrial organisation, growth and consumption theory, as well as studies which have attempted an empirical assessment of the qualitative competitiveness of countries.

In Chapter 3, we present the unit value of exports as the first main indicator of quality. It is a rather comprehensive measure of the quality of goods produced in different countries. We compare it to per-capita GDP and provide a preliminary overview of Europe's competitiveness according to this concept.

[1] We have concentrated on manufacturing since the methods used to differentiate between high quality and high costs rely on the ability to measure the product physically (by weight).

[2] See these findings summarised in *Aiginger et al.* (1999), *European Commission* (1998, 1999), *Peneder* (forthcoming).

In Chapter 4, we identify the industries in which low prices define the competitive edge and those where high quality is decisive for competitiveness, defining the former as price-elastic industries and the latter as quality-elastic industries. Sectoral exports and imports are then broken down by their Revealed Quality Elasticity (high-RQE industries). We next pinpoint the characteristics which are shared by quality-sensitive industries and the countries which have made a successful transition (inter-industry quality upgrading).

The next two chapters propose a set of indicators which highlight different aspects of quality and can be used in future studies to monitor the position and upgrading of quality for European countries and to summarise the results.

Focusing on the qualitative aspect of competitiveness is important from the policy perspective. It enables us to find weaknesses and strengths which are more important to the future than to the present or past, and reveals that a cost reduction strategy is like a second order strategy. A quality strategy redirects efforts towards research, the upgrading of skills, the use of information and communication technologies and of knowledge-based service inputs.

2. Quality: definitions and main indicators chosen

Quality is a complex phenomenon, for which no generally accepted definition is available which might fit every purpose and all the complexities of real economics. In the first box, we summarise the importance accorded to quality in various economic models, and give an overview of empirical studies in the second box, both at the end of this chapter. The chapter starts out by presenting the concept of quality as it is used in this paper and its link to competitiveness, before introducing the main indicators which will be applied.

Defining quality and competition in quality

For a working definition, we describe a high-quality product as a "good which possesses one or more additional characteristics which are valued by buyers". The characteristics which increase the willingness to pay may be either physically measurable, like speed, capacity, size, and durability; or they may be intangible, like reliability, design, goodwill, and trust. Quality may even arise simply from flexibility in use, compatibility, information, maintenance service, etc.[3]. The consequence of higher quality is to obtain a higher price without losing the market. The phenomenon that goods of different quality are supplied and bought on a given market is called "vertical product differentiation"[4].

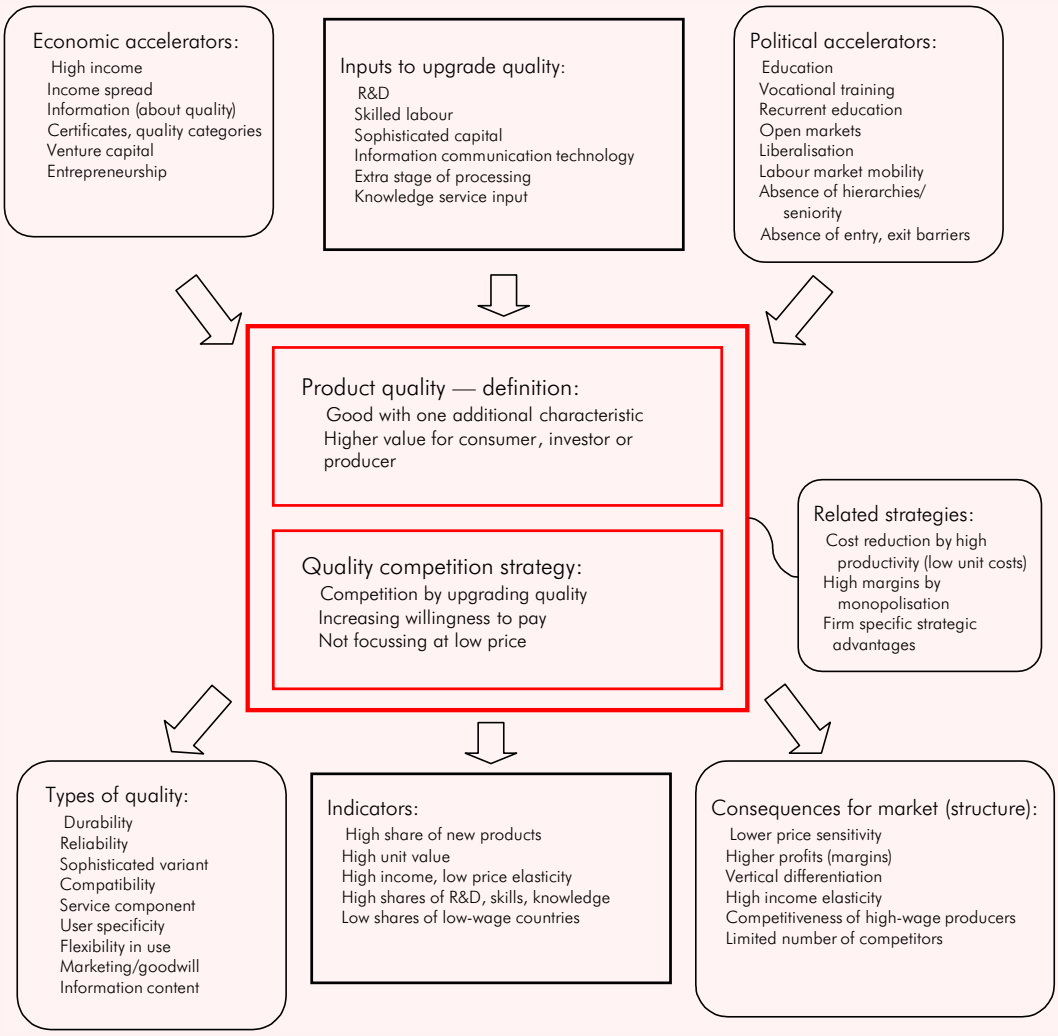
Activities which upgrade quality are more or better skilled labour, machines, more sophisticated material inputs, but also superior organisation at plant or firm level. Research and development, as well as emulation of the best techniques and processes, may be sources of quality upgrading. Marketing may increase the willingness to pay because it provides information on product features or because it changes consumer tastes. In most but not all cases, the quality of output is related to the quality of input. Certification, standards and benchmarking are other techniques of upgrading the quality of processes, as well as the quality of products, and also market functions. The inputs which help to upgrade quality – economic and political accelerators – are summarised in Figure 2, which also shows indicators to signal quality and consequences for market structure.

Quality differs from productivity in that the latter is usually defined in technical (quantitative) terms, like tons per unit of labour input. When, however, value added is used as a numerator, then the prices and quality of output are taken into account. And when we distinguish between several qualifications for labour, the quality of inputs can be incorporated into the denominator of productivity. Nevertheless, productivity studies focus on the quantity of output with respect to the quantity of inputs, trying to do so for indicators which are as homogeneous as possible, while quality explicitly addresses the heterogeneity of outputs produced usually with respect to heterogeneous inputs.

[3] Things become more complicated if the physical product itself is not well-defined, as it is for services, for products of rapid product innovation cycles, or for products which combine many characteristics and uses. *Lefler* (1982, p. 956) presents the intriguing definition that goods are sold at a price per quantity, whereby the "quantity characteristic" does not measure all the economically important characteristics of the good. Milk is sold per quart, automobiles (rented) per mile, tennis lessons per hour. However, the price per unit depends on the amount of unpriced attributes, for example, butter-fat content, make, and service. If, on the contrary, milk were sold according to butter-fat content, high quality would mean less liquid. High quality used here is not an intrinsic concept, but rather is dependent on the costs of explicitly pricing inputs.

[4] Vertical product differentiation is a term commonly used in industrial organisation. Vertical product differentiation exists when all consumers prefer the good of higher quality in the event that all variants are offered at the same price. Horizontal product differentiation in contrast exists when individual consumers differ in their preferences or when an individual consumer has a preference for variety (i.e., prefers two different variants to two units of the favoured variant).

Figure 2: Quality competition: preconditions, types and consequences



Innovations refer to changes in processes and products. New products are usually products of higher quality. But they can nevertheless be relatively cheaper when better materials or a superior production process are used. Tensions between higher quality and lower costs may arise.

Adding a further stage of processing usually increases the quality of a product. The additional stage can make the product more durable, more convenient, more specifically suitable and useful for the consumer, investor or producer. It may involve combining hardware with software, or a tangible product with service or information. In some cases, however, a further stage of processing might reduce the user value by decreasing flexibility or usefulness for a given purpose.

Quality and profitability are closely related, insofar as the quality of products will usually raise profitability, both by decreasing competitive pressure and by increasing the willingness to pay. However, quality is mainly a characteristic of the product and profitability the result of the production process used and the strategy and organisation of a firm. Yet, a conflict may arise between profitability and quality of a product as measured in objective terms when quality raises the product's cost to a greater degree than it raises the consumer's willingness to pay. The economic solution to this quandary is to find a quality level which maximises profits. The resultant "optimal" quality may then be below that assessed as desirable or feasible by technicians or consumer organisations.

The quality of products should be reflected in the company's profits and specifically in sustained above-normal profits. If the market is not regulated or restricted by entry barriers, every advantage gained by a given firm will be rapidly contested by other firms. Only firms which can consistently upgrade quality or which – to use a term taken from strategic management literature – possess a specific non-imitable advantage can accrue higher profits in the long run.

Higher quality is a necessary precondition for high-cost producers to stay competitive[5]. Producing the same quality at a higher price or at lower margins is not feasible in the long run. We have already pointed out that wages in many European countries are higher than in the USA and Japan. This cost gap is even wider when it comes to EU accession countries and to many new competitors in a globalising world. It is possible to cope with higher wages by increasing productivity, but since technology and managerial skills are also spreading through the investment of multinational firms, this strategy is not always feasible. Producing higher quality is an alternative as well as complement to higher productivity. This strategy is, however, easier to pursue in industries in which buyers can and do differentiate between quality types, while there are other markets in which price competition is the most important competitive mode. For this paper, "quality competition" is defined as a competitive environment in which upgrading quality and increasing the customers' willingness to pay is important relative to competing at low prices. Quality-sensitive industries are industries in which quality upgrading rather than low prices define the competitive edge.

Indicators for quality and for quality competition

We use two indicators to assess quality in this paper. The unit value of exports is the main indicator for the "average quality" of an industry. Secondly, we use evidence of the relationship between export and import prices and the reaction of imported and exported quantities to determine whether a specific industry is dominated by price or by quality competition. The share of exports in quality-sensitive industries proves then to be a good indicator of the position of countries on the "quality ladder".

The indicators, which in part highlight different aspects and in part are complementary, are described in more detail in Chapter 6. Here, only the main features are given:

- The unit value of exports: This indicator is defined as nominal exports divided by tons. Higher unit values reflect higher willingness to pay for a given product. One reason for this is the higher quality in a market of vertically differentiated products. The unit value for an aggregate is higher if a country focuses on more sophisticated or more highly processed goods. This indicator could be called "indicator of overall quality" since it comprises many different aspects of product quality. For details and shortcoming of this indicator see Chapter 3.
- The share of exports in quality-sensitive industries: A method is developed to identify industries in which exports depend on quality and not just on prices. This indicator, which reveals the importance of quality, is called RQE (Revealed Quality Elasticity). It defines quality competition as an intrinsic characteristic of an industry (not changing over time or across countries). Countries characterised by large share of high-RQE industries have managed to downgrade industries in which low prices define the competitive edge and to shift exports to quality-elastic industries. The indicator could be called "indicator of inter-industry quality upgrading". For details see Chapter 4.

Summing up, we perceive that the second indicator focuses on industries (which are either quality or price-elastic), whereas the first indicator describes quality within an industry. If the unit value is calculated for total exports it contains in-industry and within-industry specialisation. Although the two indicators already look at quality from different angles, there certainly are more aspects to quality than those captured by them.

[5] Specifically in technology-driven industries quality may not be sufficient for competitiveness. Research, information and communication technology has to be used to enable radical technological innovation. Radical innovation, while usually improving the quality of products, may also refer to processes or changes in input material.

The Importance of Quality in Models

Traditional trade theory explained trade in terms of differences in endowment or productivity in the production of homogeneous goods. The Extended Heckscher-Ohlin Theory added organisation, knowledge and skills, thereby introducing qualitative elements on the input side. Posner and the technology gap group then described technology as the outcome of a continuous process of innovation, taking place at different speeds across countries. Product cycle models highlighted the observation that skills are important in the first stage, capital in the growth phase, and cheap labour in the mature stage, thus connecting stages of the life cycle of products with locational advantages. New products are generated where innovation and skills are abundant. Vernon added that innovations are demand driven, and more likely to be generated in high-income regions[1].

New trade theory models horizontal product differentiation as a source of intra-industry trade. Krugman provides a model in which only the "North" is able – and doomed – to introduce new products, which are then imitated by the low-cost South. This leads to the notions that first, countries are "climbing a quality ladder" and second, that products moving by innovation and imitation between North and South create a "product seesaw" (*Krugman,* 1995, p. 353). In general, "NeoSchumpeterian" models assume that every economy has an unlimited potential to introduce new goods. Fixed costs then have to be implemented to exploit them. The most important input is thought to be innovation (*Romer,* 1993), or physical capital (*Falvey – Kierzkowski,* 1985), or human capital (*Greenaway – Milner,* 1986, *Torstenson,* 1999).

Growth theory links output to the inputs of labour and capital, and to the impact of technological progress, which augments the quantitative inputs. Diminishing returns on capital are prevented in the New Growth Theory by spill-overs, knowledge dissemination and innovation. Vertical product differentiation and a greater, productivity enhancing variety of inputs are common features of these models. Product innovation is presented in innovation theory either as tournament models, in which a patent race has a single winner, or as non-tournament models, in which many firms can potentially improve technology or product quality.

In industrial organisation quality is modelled as vertical product differentiation. The higher quality good supplies more of at least one characteristic valued by consumers[2]. All consumers prefer the good with the higher quality when all variants offered share the same price[3]. The relation between quality and quantity can be modelled in various ways. The simplest is the "repackaging view", implying that higher quality is just higher quantity, e.g., a bulb whose lifetime is twice as long as that of others is equivalent to two bulbs. However, quality and quantity can also be incomplete substitutes or even complements, and costs can be different for different qualities[4]. Three robust results can be seen in many models: Firstly, high-income consumers buy the high-quality variant, and the number of variants produced depends on the income spread. Secondly, firms try to differentiate quality to decrease competitive pressure. Thirdly, in markets with sunk costs and product differentiation, the increase in market size does not lead to fragmentation (with an increasing number of firms).

In consumption theory, the idea of enumerating the attractive features (characteristics) of goods gave rise to the calculation of hedonic price indices (*Lancaster,* 1980). This method is now widely used to break down price increases into "pure inflation" and a price increase reflecting additional quality components. In technology-driven industries, like computers, telephones, and pharmaceuticals, hedonic price techniques are used to reveal that real growth is underestimated and inflation is overestimated even in the general CPI. Indirect information about quality is derived from the degree to which demand rises with income[5].

Of the many related areas in which quality is addressed, we want to note the discussion as to whether a monopoly underprovides quality; whether a market receiving incomplete information may break down with respect to high-quality variants; how quality can be signalled or guaranteed to the incompletely informed consumer; and how quality can be monitored in regulations or auctions. Strategic management focuses on finding the firm-specific factor which defines and guarantees the firm's competitive edge over the long run, be it the quality of management, organisation or its position in the product market. Business economics stresses that quality can mean the best ratio of costs to value (cost/benefit relationship, value approach, degree of excellence at an acceptable price)[6].

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[1] For an overview on the implications of trade theory for specialisation and concentration see *Wolfmayr-Schnitzer* (1999).

[2] Formally, quality can be indexed by s, with a higher index indicating higher quality. Demand, x, now decreases with price, p, and increases with quality, $x = f(p, s)$.

[3] In contrast to this, we have horizontal product differentiation when consumers vary in their tastes or when they love variety as such. In either case, the outside observer cannot rank products according to their desirability.

[4] *Aiginger – Pfaffermayr* (1999) present a model in which demand is homogeneous in quality adjusted prices. Variable costs decrease less than proportionately to increases in price due to higher quality, but the production of higher quality goods involves higher fixed costs. They use unit values to measure quality differences empirically and compare the extent of cost differences between firms which are due to quality differences and those which are due to the inefficient use of the best technology. In *Grupp – Stadler* (1999) the number of innovations determines efficiency; technometric information is used as an indicator of innovation output. This follows Lancaster's approach, according to which key characteristics define the value of differentiated products.

[5] *Theil – Suhm – Meisner* (1981) describe the method used to calculate the average price of a composite in order to assess the quality of goods consumed (the unit value of an aggregate, e.g., coffee consumed by a group, reveals the average quality of the individuals).

[6] *Garvin* (1988) distinguishes five definitions of quality in business economics: innate quality (difficult to define, but easy to recognise), production based (productivity of process), consumer based (fitness for use), manufacturing based (conformance to requirements), value based (price relative to characteristics or value for consumer). See *Schulz* (1999) for a survey on quality definitions in general and on quality monitoring for intangible products (research) in particular.

Empirical Studies on Quality Competition

We summarise only a few of these studies, which try to assess the quality position of countries with respect to the level of aggregates. Industry-specific studies or studies at the firm and plant levels are excluded.

A first group of studies attempts to assess the "qualitative competitiveness" of countries (which means competing by other competitive modes rather than by low prices) by looking at typologies built upon characteristic factor inputs. If a country has a large share of industries characterised as technology driven, then we have some initial evidence of its ability to compete by quality. Numerous classifications of "high-tech industries" are available (for an overview see *Wolfmayr-Schnitzer,* 1997, *Peneder,* 1999). A classification distinguishing between traditional inputs (labour, capital) and inputs which create strategic advantages (research and marketing) has been published by the *European Commission* (1998) and will be used extensively in this report. Another classification splits industries into skill classes mainly used for an indirect assessment of the quality of production and the qualitative competitiveness of countries (*Peneder,* 2000).

The alternative is to assess quality by output indicators. Here the unit value of exports is primarily used, e.g., to study the quality differences between countries (*Wolfmayr-Schnitzer,* 1997, *Aiginger,* 1997A, *Oliveira Martins,* 1998). *Landesmann – Burgstaller* (1999) divide exports into quality segments by looking at the price spectrum at a very disaggregated level of export data.

Part of this approach is to learn from trade relations about the type of competitive process involved. If countries export and import goods in the same industry (intra-industry trade), products must be differentiated and economies of scale must be large enough to balance the transport costs. An interesting stylised fact of many different studies on intra-industry trade is that the largest and still growing part of intra-industry trade comprises vertically differentiated products. The technique used to illustrate this observation is the re-classification of intra-industry trade into a group which includes horizontal intra-industry trade when export and import unit values differ by less than 15 percent, and another group of vertical intra-industry trade when the difference is larger[1]. *Wolfmayr-Schnitzer* (1999) shows that horizontal intra-industry trade (IIT) was rather stable in the EU between 1988 and 1998, while vertical IIT was increasing (and driving the overall increase). Other studies have arrived at similar findings. Methodological issues are involved (bilateral versus multilateral definitions of trade overlap, alternative definitions of overlap, such as two-way trade, etc.), although in general these results raise doubts about the usual stories assumed to be behind IIT (namely the monopolistic competition of horizontally differentiated products).

Aiginger (1997A) develops a method to evaluate the position of countries in the quality segment, calculating a country's share of exports in a sector in which it charges higher prices than its competitors. *Gardiner* (1998) applies time series data on quantities and prices to measure price responsiveness. Sectors in which demand is less responsive to prices depend on quality and technology. The study finds that price elasticity is higher (respectively, the importance of quality lower) for imports than for exports, for the South than for the North, for the periphery than for the core, and that the computer and transport industries have a rather high-price elasticity[2].

[1] This concept is based on *Greenaway – Milner*(1986). Alternatively, *Fontagne – Freudenberg* (1997) propose to distinguish between one-way trade if the difference between exports and imports is less than 10 percent of the other flow, while defining two-way trade to be the case when exports and imports are more similar. – [2] For methods to correct prices and productivity changes from quality see *OECD* (1999B) and *Bils – Klenow* (2000).

3. Europe as provider of quality: a contested quality premium

The unit value as an indicator of quality

The most comprehensive measure of quality available for empirical research is the "unit value". Its usefulness in evaluating quality comes from the fact that all of the following activities tend to increase sales relative to physical weight:

- increasing durability, reliability, compatibility, flexibility,
- using superior material inputs or higher skills,
- making a product more specific to demand,
- refining or further processing a product,
- adding new functions, service or maintenance contracts,
- better design, advertising.

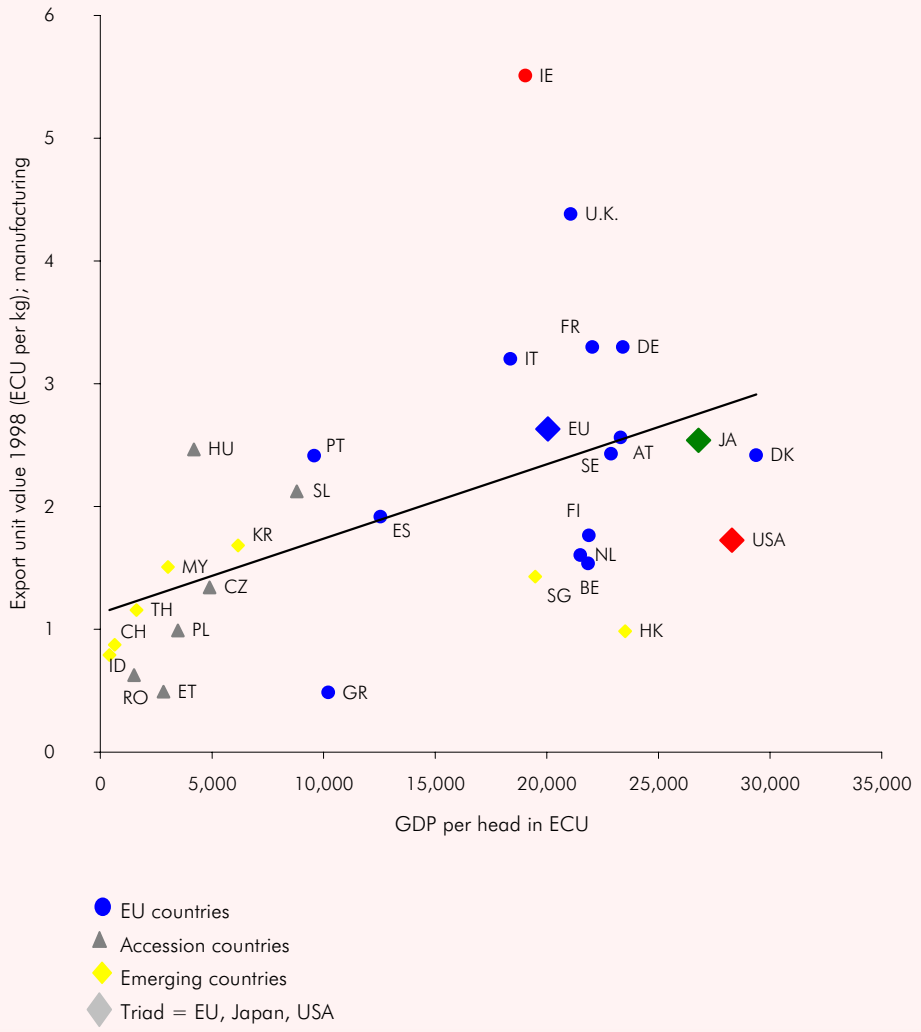
Unit values as indicators of quality have been used in industry studies to assess qualitative competitiveness and to discriminate between different components of intra-industry trade. The advantages of the indicator, its limits, existing statistical problems, as well as the relation of unit values to other concepts are summarised in the box below.

Unit values differ widely across Europe

Unit values of exports in manufacturing differ between 5.5 ECU per kg in Ireland and 0.43 ECU per kg in Greece (1998). This range of 10 : 1 is much higher than that for per-capita GDP, which differs by less than 3 : 1 between European countries. The high range can be attributed to the combined result of the specialisation of countries in industries and of the position of countries within the individual industries. Countries specialising in capital-intensive industries and in less processed goods have lower unit val-

ues than countries with high shares in technology-driven industries and in upper price segments within industries.

Figure 3: Unit value highlights climbing up the quality ladder



Source: WIFO calculations using Eurostat for EU members, FTW, OECD for others. See appendix for a list of abbreviations. The line helps to relate unit values relative to GDP graphically but should not be interpreted as a regression line (indicating causality). The positions of the EU countries with higher income are very different, indicating heteroskedasticity. AT . . . Austria, BE . . . Belgium, CH . . . China, CZ . . . Czech Republic, DE . . . Germany, DK . . . Denmark, ES . . . Spain, ET . . . Estonia, FI . . . Finland, FR . . . France, GR . . . Greece, HK . . . Hong Kong, HU . . . Hungary, ID . . . Indonesia, IE . . . Ireland, IT . . . Italy, KR . . . Korea, MY . . . Malaysia, NL . . . The Netherlands, PL . . . Poland, PT . . . Portugal, RO . . . Romania, SE . . . Sweden, SG . . . Singapore, SL . . . Slovenia, TH . . . Thailand, UK . . . U.K.

Ireland combines a high share of technology-driven industries (60 percent of exports) with positioning (78 percent) in the highest price segment. The U.K. achieves the second highest export unit value through concentration in engineering industries (technology-driven industries and the machinery industry). Three other large countries follow, each having export unit values close to each other: Germany, France and Italy report unit values between 2.1 and 2.5 ECU per kg. Denmark, Austria and Sweden all hold middling positions. Belgium and the Netherlands had – together with Greece – unit values of about or below 2 in 1998.

Greece is specialised in rather heavy, capital-intensive products, which per se have lower unit values: basic metals, mineral products, petroleum and chemicals have unit values below 0.5 ECU per kg and amount to one third of Greek exports. Additionally, 75 percent of these exports are in the medium and low-price segments. The positions of the Netherlands and Belgium are also biased downwards by chemicals, petroleum and steel, although these two countries have higher shares in the higher price segments and in technology-driven industries.

Unit Values and Their Use

The unit value is defined as the nominal value divided by physical volume. For the databases used in this report, it is the gross value of exports or imports in ECU divided by kilogramme. The unit value in general depends on demand and prices, but specifically it reflects changes in quality, shifts to higher product segments and to other value enhancing features (service component, design, advertising). Therefore, unit value is often applied as an indicator in attempts to measure quality and vertical product differentiation.

Like any other comprehensive indicator, it has its pros and cons. Among its advantages is its availability at nearly every level of disaggregation (6-digit industries or even 9-digit industries), for any country, and even for bilateral country-to-country trade flows. It is not available for production. For some industries, some information is missing (differing from country to country), implying careful programming techniques required for the correct treatment of nominators and denominators.

As far as interpretation of the unit value is concerned, it is fascinating to note that most of the components which add value are included. Industries which make intensive use of physical capital exhibit rather low unit values. Since capital is, e.g., used in basic steel industries or in basic chemicals for large-scale production, capital-intensive industries rank lower and skill-intensive ones higher in unit values as compared to productivity or value added per employee. This can also be seen as an advantage when we understand that developed countries rely mostly on skills in their efforts to achieve a competitive edge. On the other hand, some industries have intrinsically higher unit values, even though they are neither high tech nor use skilled labour nor have physical capital involved. This holds, e.g., for textile and apparel industries in which the unit values are high, since the weight in tons is low. Here, re-processing also poses a problem. Goods are shipped to low-wage countries and return at a somewhat higher unit value, implying that the high-wage country exports the lower-quality product (as compared to the re-imported good). Reservations about the use of unit value also hold for precious metals, where supply is scarce relative to demand. Therefore, jewellery, leather, furs, footwear and apparel are among the top industries, as far as absolute unit value is concerned, without, e.g., any indication of the use of skilled labour or research. However, in general high-tech or high-skill industries – like aircraft and spacecraft, watches and clocks, TV and radio transmitters and instruments – are also among the industries with the highest export unit values.

A problem in using unit values is that high values could indicate high quality or high costs. A technique proposed by *Aiginger* (1997A)[1] enables us to disentangle costs and quality at least partially. If unit values reflect costs, the quantity exported must be low for the high-cost country. If it reflects quality, then exports are predicted to be high for the country with the higher unit value. Another objection to the use of unit value is that unit values may include the higher margins created by market power. The greatest market power is primarily expected on domestic markets. If unit values on the international market contain market power, this will be based on a major innovation. And if some firms succeed in becoming world monopolists and are not challenged over a long period of time, they will produce in various countries.

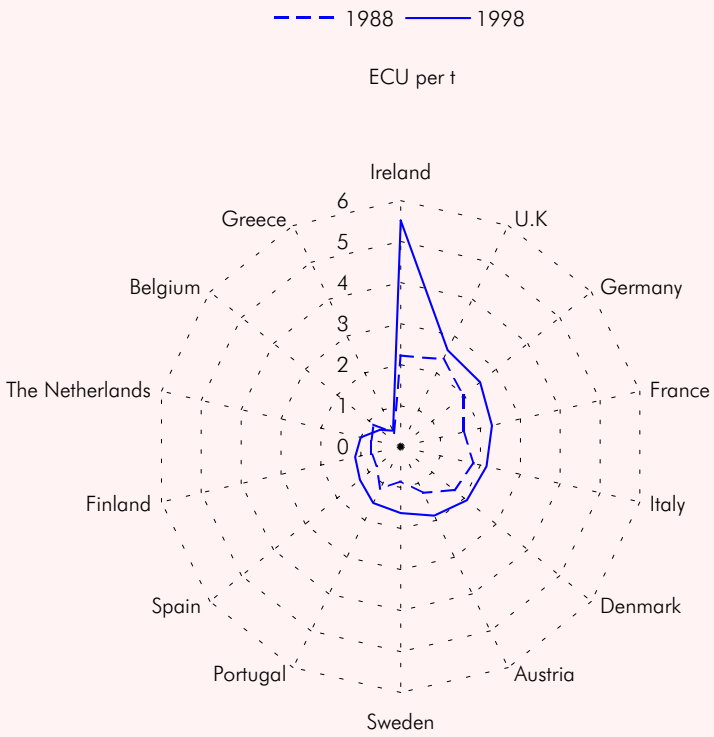
Unit values of exports and imports are not fully comparable, since both are measured at the border. Imports include trade costs from the point of origin to the border, exports those from the mill to the border. In the last ten years the reporting mode has shifted from customs agencies to firms. A lot of noise and inconsistency at the product level has arisen from this, but the rich data set enables us to cope with many outliers and errors. In most cases, distortions can be eliminated and an evaluation of the quantitative impact can be made by a careful second look at the data, or by making fuller use of the wealth of data available. In general we use total exports when we focus on the comparison of European countries, and "extra" exports when we focus on the comparison between the EU and the USA and Japan.

[1] Aiginger shows that the unit value is near to being a measure of productivity when the product is homogeneous and the number of workers needed to produce one unit of output is relatively constant. But the unit value approaches a pure price or consumer valuation when the product or service is differentiated and the value is related to the input unit (counselling fee per hour, construction fee per square metre or per kilogramme of cement).

Over time, the largest increase in unit value was registered in Ireland, which, after being second to the U.K. in 1988, is now the number one (see Figure 4). Next in the dynamics of export unit value is Sweden, which doubled its export unit value, and shifted from the lower end of country rankings to a position in the middle. Greece and the Netherlands increased their unit values at a lesser rate than other countries. Belgium is the only country in which the unit value decreased in absolute terms. If we compare changes in the unit value with the indicators of speed of change earlier in this report, we see that approximately the same speed of change between sectors in production (Ireland, Greece) can be used for different strategies concerning quality position. In general the standard deviation of unit value across countries increased over the last ten years[6].

[6] Unit value is higher in the northern countries as compared to the southern countries, due to the positions of Ireland and the U.K. It does not differ between the core and periphery, or between high- and low-income countries. This is the result of continuing to place Ireland among the low-income countries and of the fact that the positions of Spain and Portugal are more favourable in this indicator due to the weight of the textile industries. It is slightly higher in large countries (2.2 versus 1.8 ECU per kg) than in small countries.

Figure 4: Dynamics of export unit value in EU countries



Source: WIFO calculations using Eurostat (total trade).

To some extent, high-income countries import low-priced goods, exchanging these for high-quality goods (substitution effect). However, a high-quality exporter also needs a sophisticated input, and it is this second effect which dominates[7]. The same two countries have extreme positions for import unit values as well as for export unit values. There are, however, also differences in the hierarchies of export and import unit values:

- France, Italy and Portugal are ranked lower in import unit values, due to cheap imports from non-EU states. This is partly also the case for Germany, due to imports from accession countries.
- Sweden and Finland have a much higher ranking in the import unit values, since they import goods for their large and growing technology sector (intra-industry trade), while exports of basic goods still play a certain role.

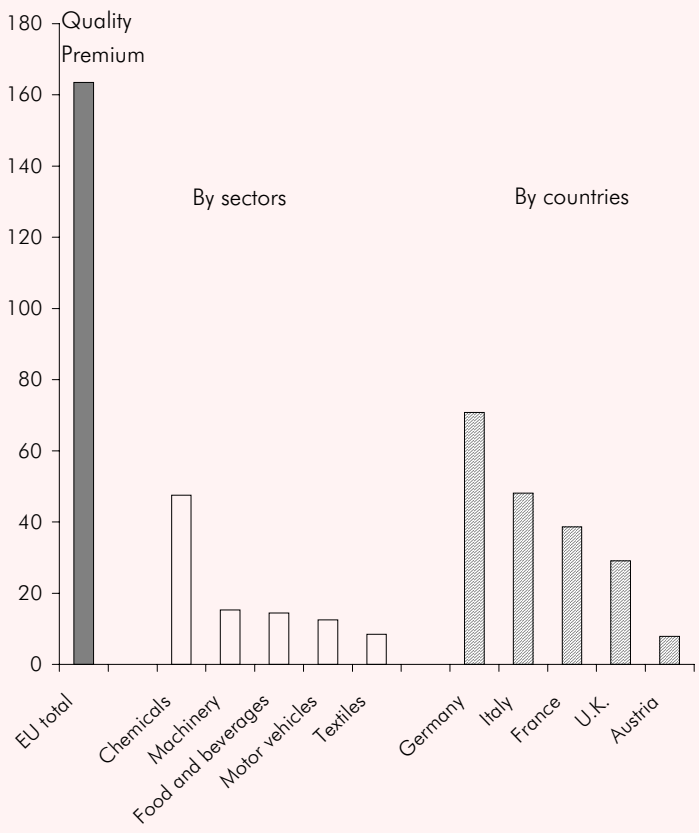
The quality premium in European exports

European exports in manufacturing (extra trade) amounted to ECU 665 billion in 1998; imports to only ECU 579 billion. The result was an export surplus of ECU 86 billion, or more than three times as high as ten years before (ECU 25 billion). The export surplus can be attributed to a quality premium in exports: the export unit value, 2.25 ECU per kg, is 31 percent higher than the import unit value. The extent of the premium can be assessed by a hypothetical calculation: if the exports were priced as low as the imports, European exports would be ECU 161 billion less. We call this gap the quality premium[8].

[7] The unit values of exports and imports are closely related ($R = 0.82$), with the relationship of GDP to import unit values somewhat weaker than that to exports. This means that export unit values and import unit values are both climbing the quality ladder, and imports also containing an element which replaces the lower segments of production by imports from low-cost countries.

[8] With exports priced at the unit value of imports, Europe would have a trade deficit of ECU 77 billion (1998). The quality premium is in general defined as exports minus hypothetical exports (if price were the same as for imports). This calculation can be done on any level of aggregation.

Figure 5: Creation of quality premium by sectors and countries, 1998, billion ECU



Source: WIFO calculations using Eurostat. Quality premium: EU export minus hypothetical exports if they were priced at import prices.

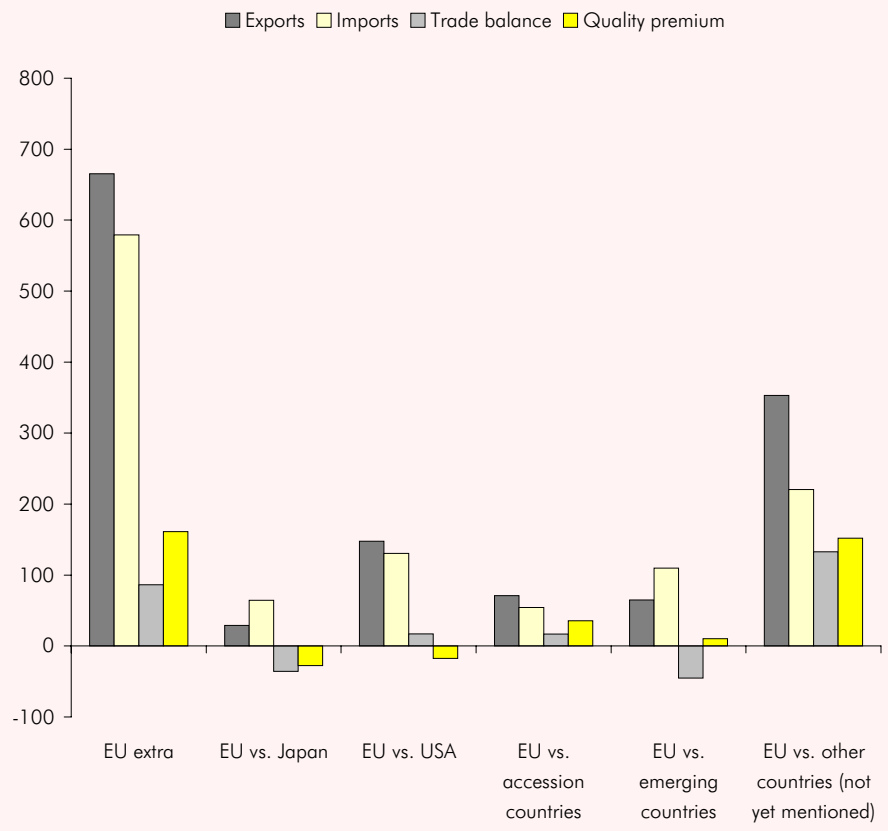
Roughly half of this "quality premium" in European trade comes from specialisation in high unit value industries (structure), and roughly half from higher unit values within the same industries (within premium). The largest part of the quality premium is accrued in the chemical industry (ECU 47.5 billion), followed by machinery, food, motor vehicles, and textiles (see Figure 5). Relatively high premiums apply to tobacco and leather, which are leaders of the marketing-driven and labour-intensive industries; in technology-driven industries[9], exports are valued 15 percent lower than imports. Of a total of 22 sectors, export unit value is higher than import unit value in 19 sectors (exceptions are apparel, basic metals and other transport); of altogether 93 industries, this is the case in 69 industries. Seen from a country perspective, 11 of the 14 countries have higher export unit values (in extra trade), the largest in Germany, Italy, France, the U.K. and Austria.

The premium comes from trade with non-Triad countries. Export unit values are twice as high as import unit values in trade with accession countries and are large in trade with emerging countries (see Figure 6). In its trade with the USA, Europe has a surplus, but exports are priced 12 percent lower than imports. Half of this bilateral trade is in technology-driven industries, and the unit value of European exports is 40 percent lower than that of imports from the USA. In 47 out of 93 industries, European exports are more highly valued, specifically in labour-intensive and marketing-driven industries, but these two groups account for only one fifth of exports. The export unit value for Europe versus Japan is only half its import unit value. This is due to the extreme concentration of Japanese exports on industries with high unit values (engineering industries). If we look at individual industries, the unit values of European exports are higher in 45 industries and specifically in technology-driven and mainstream industries. However, since these

[9] WIFO typology; see *European Commission* (1998) or *Peneder* (1999).

industries account for 80 percent of European imports from Japan, and only 55 percent of exports, the total unit value of imports is 12.1 ECU per kg (versus 6.1 for exports).

Figure 6: Regional destination of exports and quality premium, 1998, billion ECU



Source: WIFO calculations using Eurostat.

Compared to 1988, the ratio of unit values of exports divided by unit values of imports for European manufacturing was lower in 1998, and hence the relative quality premium fell from 68 percent to 31 percent. This mirrors the catching-up process of, e.g., the accession countries whose exports now totals about half of the EU's export unit value, while they accounted for only one fifth ten years earlier. On the other side of the quality spectrum, the USA has increased its unit value in bilateral trade at a greater rate than Europe. Europe in turn has managed to slightly narrow its large gap in trade with Japan.

Relation to other indicators (GDP per capita)

Export unit values correlate with GDP per capita, since quality demanded and endowments, as well as the competitive position, change with higher income and productivity. Figure 3 illustrates this relationship, as well as some interesting outliers[10]. Less favourable rankings in export unit value relative to per-capita GDP are shown for Belgium, Denmark, Finland and the Netherlands, indicating the high share of capital-intensive industries in these countries. Greece ranks before many accession countries and emerging economies in per-capita GDP, which reflects its income from tourism, but is behind them in the unit value of exports[11]. Better positions according to export unit values are shown for Italy, Portugal, France and the U.K., partly due to their higher share of non-European exports (longer distance to the destination shifts trade to higher unit value

[10] To the EU countries, we added six accession countries, eight emerging countries, the USA and Japan. The choice of countries was determined by the availability of unit value data at a disaggregated level. We used COMEXT for EU countries (total trade) and FTW (UN) for non-EU countries. The rank correlation coefficient between export unit values and GDP per head is $R = 0.47$ which is significant at the 95 percent level.

[11] Hungary and Slovenia have rather high export unit values, ranking higher relative to per-capita figures. The Philippines and Korea are emerging countries with rather high export unit values.

positions). The performances of Portugal and Italy[12] have also been influenced by the intrinsically high unit values attributable to textile industries. For the U.K. and France, the high share of technology-driven industries and engineering industries pushed up the unit values relative to per-capita GDP.

For the USA and Japan, the unit value of exports ranks lower than per-capita GDP. In 1998, Japan was among the top countries in per-capita GDP, but placed only eighth in export unit value; the USA fell from third place to 16th in unit values between 1988 and 1998[13]. The export unit values for both countries are lower than for the EU. This implies that in trade with their neighbours, both countries rely to a higher degree on price-elastic, low-unit value goods. In their bilateral trade with Europe their export unit values are higher than that for European exports.

Summing up our observations, unit values are a comprehensive primary indicator of quality, but the information given must be complemented with data on the structure of industries, the position within industries, the nature and quality of inputs, as well as patents, certificates, or shares of differentiated products as indicators of the quality of outputs.

4. The importance of quality for specific industries

Quality as an exogenous characteristic and strategic result

The importance of quality competition varies between industries. In homogeneous industries, consumers and firms buy the goods from the cheapest source; any firm which undercuts the price will boost demand for its products (i.e., demand is price-elastic). In heterogeneous industries, goods are differentiated by locations and product characteristics, both horizontally and vertically. The heterogeneity can come from a variety of tastes or specific characteristics of demand. Product differentiation, however, is not necessarily an objective fact, unchangeable over time. It may, e.g., be the result of a firm's strategy to prevent fierce price competition or of attempts by an industry to remain competitive when facing competition from a low-cost supplier. The importance of this strategy will differ by countries and will change over time, and increase if the costs for a key input rise.

For this paper, we categorise industries by those for which prices are important and those where non-price factors (which we summarised as quality) are paramount. Next we develop a tool for an ultimate classification of industries, although we are aware that firms can implement various strategies to influence the importance of prices, and that the role of the competitive mode will differ over time and across countries. We relate the ranking of industries by quality to factors expected to influence the competitive mode. Finally, we investigated whether the European Union and its member states are specialised in quality-intensive industries.

The method and first results

If prices are important in an industry, countries with high prices should be expected to sell low quantities and those with low prices should sell large quantities. On the other hand, if countries charge high prices and are nevertheless able to sell high quantities, the product must have some characteristics (specifically design, service, reliability) which make customers willing to pay the high price. We apply this simple idea to the existing trade data and classify industries by three sectors: sector 1, in which quality is revealed to play an important role (high-RQE sector); sector 2, with moderate price elasticity; and sector 3, in which price dominates (low-RQE sector). For the method applied, see the box below.

In the majority of industries, price competition dominates. The range of our indicator is between 25 percent in the cement industry and 53.5 percent in general purpose machinery. This means that in the cement industry 25 percent of bilateral relations in the reporting countries are not dominated by price. In general purpose machinery (a still heterogeneous subindustry of the machinery sector), a slight majority of bilateral trade relations is dominated by quality.

[12] If we exclude textile industries from the calculation of export unit values, then Italy and Portugal lose one position in the ranking within the hierarchy (in the EU). The unit value of exports changes from 2.15 to 1.79 ECU for Italy and from 1.53 to 1.19 ECU for Portugal.

[13] Unit values depend on the exchange rate. However, the dollar/ECU rate was the same in 1988 and 1998, whereas the low-unit value for Japan in 1998 was influenced by the low value of the yen in that year.

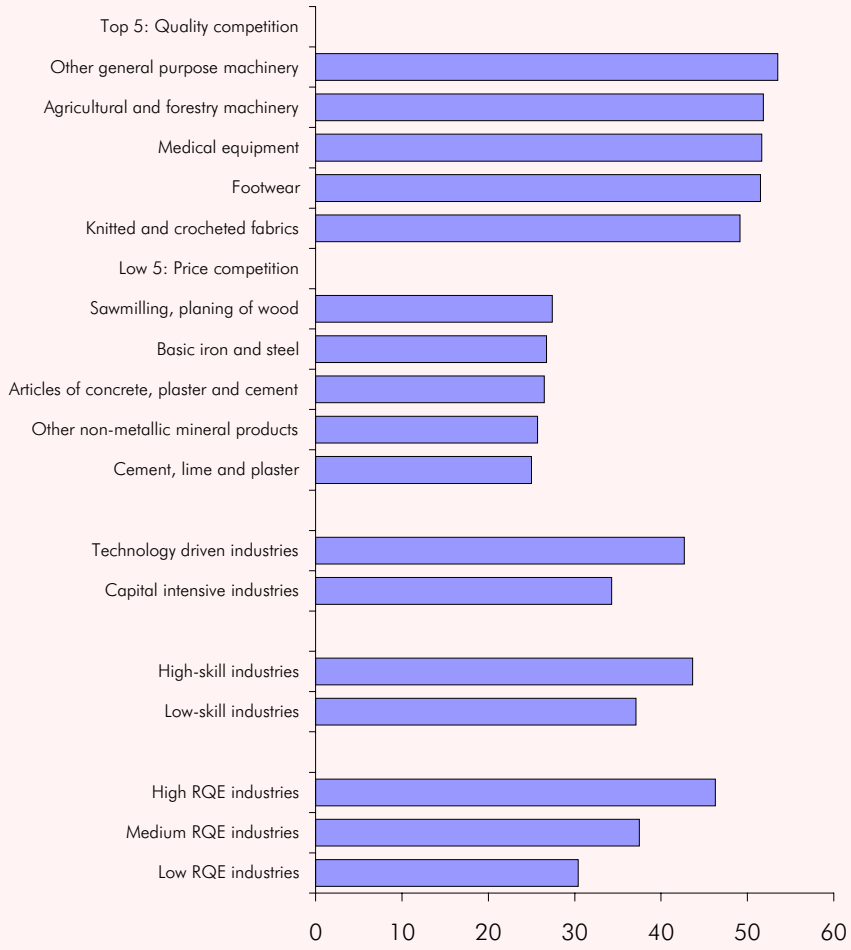
Classifying Industries According to Revealed Quality Elasticity (RQE)

The following method was used to gain information on the relative roles of quality and prices. Industries are considered price-elastic when higher prices (or more precisely: higher unit values in exports relative to imports) are associated with lower quantities (more precisely: lower exported quantities relative to imported quantities). Industries are considered quality elastic when their signs for (net) prices and (net) quantities are the same. The signs were calculated for bilateral trade between EU countries and 30 other countries (including the EU partners, the USA, Japan, eight emerging countries and six accession countries) in 1998. The share of identical signs indicates the importance of quality. The indicator can theoretically range from 100 (all bilateral relationships of prices and quantities have an identical sign) to 0 (all have opposite signs), empirically the indicator ranges from 53.5 to 25.0 percent.

The indicator is rather smooth in the sense that there seems to be no critical value separating different modes. We therefore grouped exactly one third of the industries in a category which we call industries with "high Revealed Quality Elasticity" (for short: high-RQE), one third in a middle category (medium-RQE or moderately price-elastic industries) and the last 31 industries in a price-elastic group (called low-RQE). The cut-off points are 42.3 percent for the difference between high and medium and 34.5 percent for the threshold between medium and low. The cut-off points were determined according to the symmetry in the number of industries in each category and have no intrinsic interpretation[1]. Subtracting the share of price-elastic industries from that of quality-elastic industries yields a balance indicator (net RQE = high RQE – low-RQE). The indicator is derived from export data, but used to characterise the competitive mode typical for all sales.

[1] In the unweighted average of industries, 38 percent of the signs are positive.

Figure 7: The importance of quality in different industries: Revealed Quality Elasticity (RQE)



Source: WIFO calculations using Eurostat. RQE: share of positive signs in bilateral relations between net prices and net quantity (1998, EU versus 30 countries).

Typical industries in which quality dominates are engineering industries like machinery, equipment, instruments, motor vehicles and other. Of the eleven technology-driven industries, eight fall into the high-RQE sector. RQE is 42.7 in this group. The three technology-driven industries not classified as quality-elastic are computers, audio and video equipment and electronic components. The common characteristic of these three industries is that they have reached a phase in their development in which production of standard products has to a large extent been shifted to low-cost suppliers, and price competition increases for the best selling products. This does not mean that the bulk of research and product development and the production of new products does not remain in high-income countries. These industries are characterised by a high globalisation rate and a rather low share of intra-EU imports. 14 of the 23 marketing-driven industries are revealed to be quality-elastic, and only four are found to be price-elastic. Quality is revealed to be of the greatest importance in footwear, games and toys, tobacco and watches.

At the bottom end of the list – industries revealed as price-elastic – are capital-intensive industries: concrete, cement, steel, mineral products and sawmills rank as the bottom five. Of the eleven capital-intensive industries, only one (motor vehicle parts) is revealed as quality-elastic; the average indicator is 34.3.

For labour-intensive industries, a slight majority is classified as price-elastic. Of the 22 labour-intensive industries, nine fall into the low-RQE sector. Some of these are from the textile sector, some from industries which produce building materials with high labour cost shares. Labour-intensive industries which produce metal-based investment goods (machine tools, motor parts) are classified as high-RQE industries.

A digression into processing in the textile industries

There is, however, a group of industries revealed by our tool to be quality dependant, which nevertheless does not match our a-priori expectations. Goods from textile related industries, including the textile industry proper, as well as the apparel and leather industries, fall among the quality-elastic products. Among these, "footwear" and "knitted and crocheted fabrics" are among the top ten when ranked according to the quality indicator. These industries are characterised by a rather sharp split between fashion products (which are still produced in EU countries) and a lower-quality range subject to fragmentation and re-processing. High-wage countries export some fraction of the (often capital intensive) input and make use of cheap labour for re-processing. If the product exported and re-imported after processing remains classified in the same industry, a deficit in quantities (imported quantity is higher because part of the input is produced in the country in which re-processing takes place) results for the high-wage EU country, occurring jointly with lower prices (the price of the re-imported goods is higher because re-processing increases the value according to weight). Higher prices plus large quantities are a sign of quality competition. In this case, however, "the other factor" (which dominates over price as a competitive mode) is not higher quality but higher processing. This example highlights the limits of the concept applied. The phenomenon has been discussed earlier in an assessment of the qualitative competitiveness of accession countries in *Wolfmayr-Schnitzer* (1997).

Industry characteristics related to the importance of the quality mode

Theory predicts that quality competition will be more important for more sophisticated products, for higher product differentiation, for industries with sunk costs and under high pressure from globalisation. We use rank correlations[14] to show whether industries revealed as quality-intensive match these expectations.

The strongest correlation exists between RQE and the degree of product sophistication, as measured by unit value (see Figure 8). The level of export unit values and RQE is significantly related. Considering the naturally skewed distribution of unit values, the median unit value in high-RQE industries is 9.76 ECU per kg, the figure for low-RQE industries is 1.65 ECU per kg. But product differentiation is also a significant factor: three types of standard deviation of the export unit value are all significantly related to our indicator of the competitive mode, namely those representing regional, product, and combined types of product differentiation[15].

[14] Rank correlations are more robust, specifically since some of the data are in categories and some are quantitative variables which are considerably skewed. We stress that correlation reveals whether phenomena are related, while they do not impose a direction of causality.

[15] Three types of variation were tested: the first indicator (product differentiation 1) calculates the standard deviation of export unit values of each three-digit industry for each of the EU countries (each country in industry i versus the world); this indicator represents the model according to which a country could be considered as one firm, each producing a different quality of, let us say, steel. The standard deviation measures the width of the vertical differentiation. The second indicator (product differentiation 2) calculates the standard deviation across products within an industry (products are 6-digit exports; if there are n 6-digit units in a 3-digit unit, it is

Quality competition is also positively related to the degree of globalisation[16]; this is partly due to the fact that highly globalised industries are dominated by quality competition (games and toys, watches, instruments), but to an even greater extent to the fact that capital-intensive industries with high transport costs (like cement, bricks, glass, furniture, domestic appliances) are dominated by price competition. Industries which were ex ante classified as sensitive to Single Market effects are dominated more by quality competition. Beverages and pharmaceuticals are highly differentiated and have lower trade volumes than typical capital-intensive industries like pulp and paper and steel, in which trade surged during the first stage following the elimination of customs. A positive relationship between quality competition and research and skill inputs does exist, but is not significant[17]. Price competition is higher than expected in capital-intensive sectors.

It is interesting to see to which industry characteristics the indicator on quality competition is not related. First and foremost, there is no smooth relationship between the importance of quality and productivity or high wages. The reason for this is that quality is related to skills specifically in the technology-driven industries. However, value added per hour and wages per employee are also high in capital-intensive industries in which price competition is of significant importance. Cement, steel, and basic chemicals are industries with high wages, but which are nevertheless ranked as price-elastic[18].

Europe's trade surplus comes from quality-sensitive industries

The overall trade surplus of the EU is achieved by the quality-elastic sector. More exactly, of the total EU trade surplus of ECU 134 billion in 1998, the sector of quality-sensitive industries created a surplus of ECU 149 billion; trade in moderately price-elastic industries was balanced, and in price-elastic industries the EU suffered a trade deficit of ECU 18 billion. Thus, the surplus in quality competition covered the deficit of the price-elastic industries and created a trade surplus (see Table 1).

The positions of countries differ according to their individual income position, competitive advantage and industry structure:

Germany and France have an overall trade surplus, attributable completely to surpluses in the high-RQE sectors, with deficits or balanced trade in the others. In both countries, the car industry contributes prominently to this surplus. In Germany, machinery is the next largest sector, dominated by quality competition; aircraft and beverages assume the corresponding position in France. Ireland enjoys a surplus about equally large in high- and medium-quality industries.

Belgium, the Netherlands and Denmark had a trade surplus in 1998, but are specialised in industries with medium or high price elasticity. The U.K. has a deficit in all three sectors, the smallest in the quality-intensive sector, the highest in the price sensitive sector. All four countries are thus specialised (relatively) in quality-sensitive industries.

Spain, Portugal, Austria and Greece have deficits in all three sectors, with the highest deficit in industries in which quality competition is important (Austria is in the moderate price sensitive sector).

Sweden and Finland enjoy surpluses in the high- and in the low-quality sectors, but have less favourable positions in the moderately price-elastic industries. While for Finland the greatest surplus is in the price sensitive industries (pulp and paper), Sweden has its greatest surplus in the quality-sensitive industries (telecom apparatus).

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a standard deviation across n products). This indicator assumes that the European Union is one large region producing many different products in a specific industry, maybe in decentralised plants. The third indicator (product differentiation 3) combines both aspects and calculates the standard deviation across countries and product groups ($14 \times n$ for each 3-digit industry); it combines aspects of geographic and product-specific heterogeneity. All three indicators of product differentiation simplify the complicated relationship between firms, countries, industries and regions at different levels.

[16] Globalisation or openness is defined as the share of imports plus exports to value added in the Triad (as a proxy for production).

[17] As far as research is concerned, we have already mentioned that audio and video equipment, office machinery and valves are technology driven, but price-elastic and that some textile products, as well as tobacco and pesticides, are revealed as quality-elastic but have low research inputs. High-skill industries in which price competition is of great importance are office machinery, and weapons and ammunition; low-skill industries in which quality is of great importance are some food industries and some textile industries (in which fashion, as well as re-processing, plays a leading role).

[18] Additionally the – possibly misleading – classification of some textile industries as high-quality industries prevents a closer relationship since the products are produced with cheap wages in low-productivity plants.

Figure 8: Determinants of the importance of quality (RQE)

Source: WIFO calculations using Eurostat. Rank correlations with RQE indicators; $R = 0.173$ has a 90 percent degree of significance, $R = 0.250$ has a 95 percent degree of significance. Factor intensities are measured as factor shares in total value added (capital, labour) or net turnover (R&D, advertising).

Increasing surplus, slightly converging structure

Between 1988 and 1998, Europe's overall trade surplus increased from ECU 22 billion to ECU 134 billion. The lion's share came from the increase in the surplus of the high-RQE sector from ECU 53.9 billion to ECU 148 billion. The deficit in the low-RQE sector was reduced and a small deficit in the medium-RQE sector turned into a small surplus. The most significant switch towards the high-quality sector occurred in Ireland and Spain, while the trade surplus in the quality sector decreased in Belgium and Italy. Sweden decreased its specialisation in the price intensive sector most sharply, followed by Austria and Finland. All three countries contributed to a decline in the per-country differences according to this indicator.

Table 1: Shares of trade and trade balance according to competitive mode (RQE)

	Exports				Imports				Trade balance			
	High-RQE	Medium-RQE	Low-RQE	Total	High-RQE	Mdium-RQE	Low RQE	Total	High-RQE	Medium-RQE	Low RQE	Total
	Percentage shares in total exports			Million ECU	Percentage shares in total imports			Million ECU	Million ECU			
1988												
Belgium	38.0	27.9	34.1	70,532	35.2	30.9	33.9	65,223	3,883	– 518	1,944	5,308
Denmark	35.1	46.9	18.0	19,677	32.3	33.4	34.3	20,490	292	2,389	– 3,493	– 813
Germany	46.8	28.2	25.0	267,083	35.5	32.5	31.9	181,764	60,300	16,224	8,795	85,319
Greece	32.5	29.0	38.5	3,521	34.4	38.6	27.0	9,886	– 2,255	– 2,794	– 1,315	– 6,365
Spain	40.6	27.2	32.2	33,270	41.0	31.0	28.0	41,997	– 3,734	– 3,961	– 1,033	– 8,727
France	47.0	28.8	24.3	133,407	39.3	32.8	27.9	145,250	5,482	– 9,221	– 8,103	–11,843
Italy	46.1	30.8	23.2	107,563	34.8	32.9	32.3	102,578	13,819	– 623	– 8,212	4,985
Ireland	29.5	52.7	17.8	15,071	32.4	40.5	27.1	12,216	491	2,995	– 631	2,855
The Netherlands	28.3	40.3	31.4	77,517	33.8	33.8	32.3	76,864	– 4,027	5,227	– 547	653
Austria	34.5	26.8	38.7	23,766	42.6	27.3	30.1	27,665	– 3,592	– 1,183	876	– 3,899
Portugal	44.8	21.8	33.4	9,211	45.3	30.5	24.2	13,295	– 1,903	– 2,038	– 144	– 4,085
Finland	37.7	23.8	38.5	36,025	40.5	31.4	28.1	35,435	– 794	– 2,552	3,936	590
Sweden	25.0	16.5	58.5	17,801	42.6	29.4	27.9	15,728	– 2,262	– 1,688	6,023	2,073
U.K.	42.2	33.4	24.4	98,068	37.4	30.4	32.2	142,094	–11,765	–10,506	–21,755	–44,025
EU	42.0	30.4	27.5	912,510	37.0	32.1	30.9	890,485	53,934	– 8,251	–23,658	22,025
1998												
Belgium	43.5	24.0	32.5	144,320	44.9	23.8	31.3	132,342	3,374	3,146	5,459	11,978
Denmark	38.8	41.3	19.8	38,034	38.1	31.5	30.4	37,971	298	3,761	– 3,995	63
Germany	55.2	23.0	21.9	428,395	41.9	30.3	27.7	334,146	96,193	– 3,056	1,111	94,248
Greece	33.6	27.0	39.4	7,876	46.4	27.0	26.6	21,961	– 7,541	– 3,798	– 2,745	–14,085
Spain	49.0	24.0	27.0	85,140	48.1	23.8	28.1	97,340	– 5,059	– 2,757	– 4,384	–12,200
France	53.6	25.2	21.2	265,606	47.1	27.2	25.8	252,121	23,573	– 1,491	– 8,597	13,485
Italy	49.4	28.3	22.3	209,016	43.2	24.8	31.9	168,053	30,687	17,404	– 7,129	40,962
Ireland	37.1	41.9	21.1	51,866	35.1	44.2	20.7	33,858	7,342	6,747	3,919	18,008
The Netherlands	32.5	40.2	27.3	150,415	34.5	37.4	28.2	143,543	– 590	6,790	672	6,872
Austria	44.0	25.6	30.4	51,001	43.8	28.0	28.2	57,604	– 2,774	– 3,088	– 741	– 6,603
Portugal	48.2	21.3	30.6	21,549	47.2	27.3	25.4	30,266	– 3,922	– 3,691	– 1,104	– 8,717
Finland	48.4	18.4	33.2	67,367	40.8	30.3	28.9	52,111	11,381	– 3,400	7,276	15,256
Sweden	33.5	17.6	48.9	38,208	40.1	32.4	27.5	25,176	2,679	– 1,420	11,773	13,032
U.K.	48.5	30.3	21.3	211,350	43.9	30.3	25.8	249,803	– 7,120	–11,832	–19,501	–38,454
EU	48.2	27.1	24.7	1,770,142	43.0	29.1	27.8	1,636,296	148,519	3,314	–17,986	133,846

Source: WIFO calculations using Eurostat. High-RQE . . . share of 31 industries with high Revealed Quality Elasticity, medium-RQE . . . share of 31 industries with moderate price elasticity, low-RQE . . . share of 31 price-elastic industries (low Revealed Quality Elasticity).

5. Europe's Competitiveness in the Triad according to the mode of competition

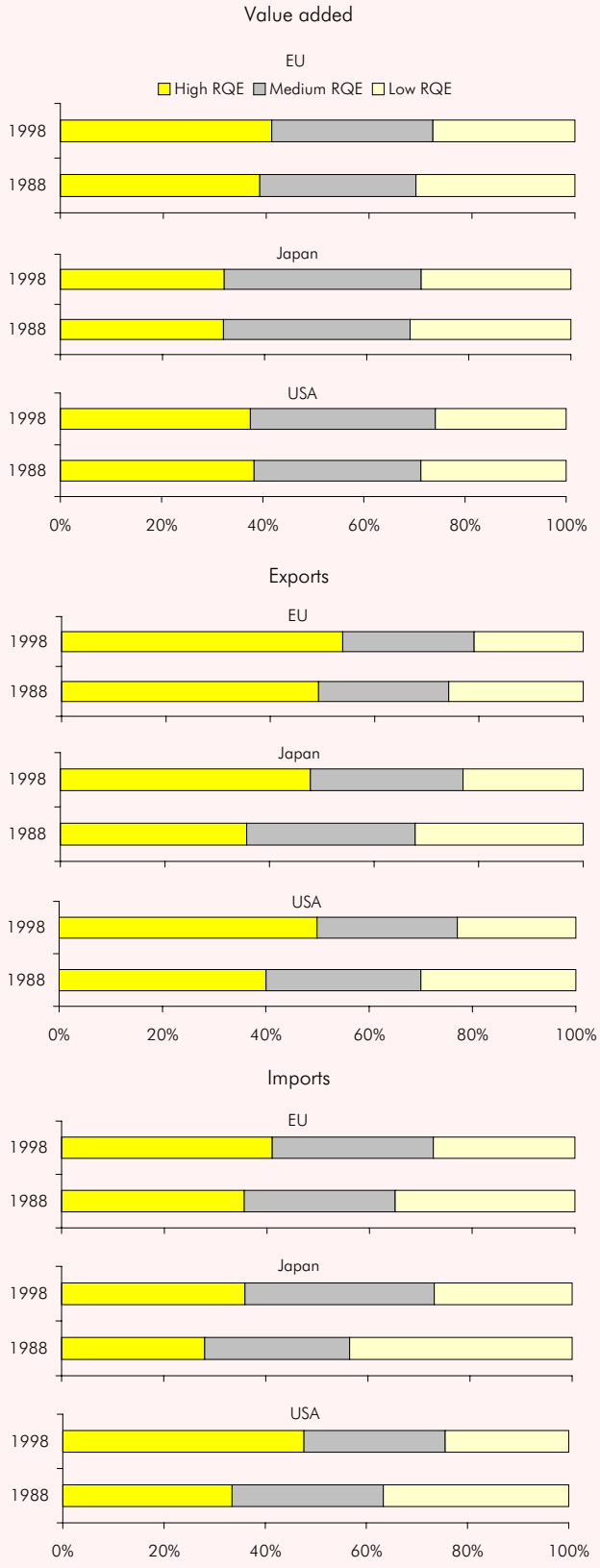
Next, we will compare Europe's share of quality-sensitive industries to those of the USA and Japan. Extending the comparison to value added helps us to prove the robustness of the results (Figure 9). We then focus on the bilateral flows between Triad countries.

Europe has the highest share in quality-intensive industries in production and exports. As far as production is concerned, Europe attained this position over the last ten years by slowly extending its share in quality-elastic industries and by reducing its share in price-elastic industries. The net RQE is 13.5 for Europe versus 2.8 for Japan and 11.7 for the USA. Within this generally positive picture, there are two signs that the rate of change in Europe is insufficient: the USA has a lower share of price-elastic industries in production, and is shifting its exports and imports faster from price to quality-intensive sectors. Today, 48 percent of U.S. imports but only 41 percent of European imports and 35.9 percent of the Japanese ones are in the quality-sensitive industries. This indicates that demand may be shifting to quality-intensive industries in the USA faster than in Europe and Japan.

The favourable picture for quality competition projected by the share of quality-sensitive industries is in contrast to that drawn by the share of technology-driven industries, where imports by Europe from the USA are higher than exports (and unit values in this group are unfavourable for Europe). The difference comes from classifying several machinery and car industries as quality-elastic[19]. In general, the high share of technology-driven industries in the USA (see Figure 9), their high unit value and their growing share of domestic demand, together constitute a second challenge for future competitiveness in the high-quality sectors for Europe.

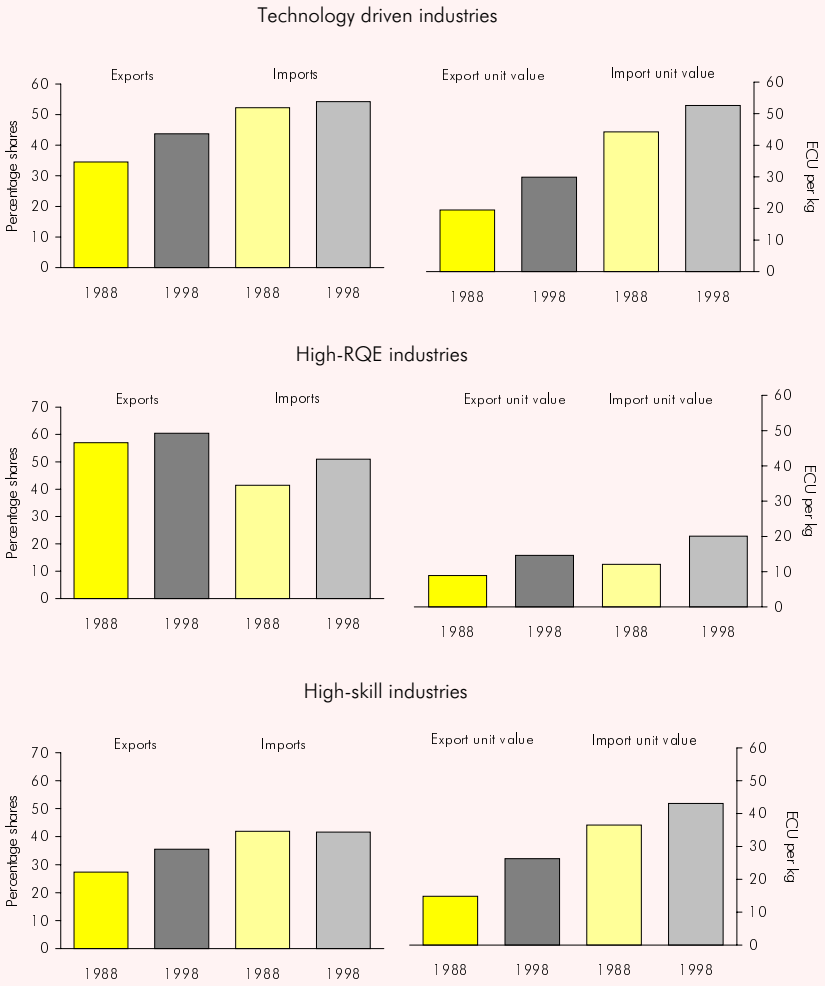
[19] The picture drawn by quality indicators therefore is more similar to that by skills.

Figure 9: Share of quality-sensitive industries (RQE) in the Triad



Source: WIFO calculations using Eurostat. Value added data for USA, Japan: 1997.

Figure 10: Bilateral trade of the EU and the USA according to technology, quality sensitivity and skills (shares of exports and imports left scale; unit values in ECU per kg right scale)



Source: WIFO calculations using Eurostat.

6. A monitoring system for quality upgrading

The analysis has so far focused on two indicators of quality: the share of quality-sensitive industries, and the unit values. The theoretical models, the evasiveness of the definition and the results presented all indicate that there are many aspects of quality. Not all of them will be correctly and completely reflected by the main indicators. We are aware that the quality of products derives from the use of sophisticated inputs and that quality competition has consequences for market structure and world wide competition. We use this knowledge to propose an extended set of indicators, which may be used to learn more about the position of countries in quality competition and which could be used to monitor a country's position in climbing the quality ladder.

The indicators in the box above highlight different aspects of quality. Indicators 1, 2, and 7 to 12 use industry classifications developed either in this report or in previous reports, to classify industries by categories, independent of the period and the country chosen. The change over time for these indicators reveals "inter-industry change" to a sector whose industries are considered to rely intrinsically more on quality, using research, skilled inputs, and knowledge-based services. We apply the classifications to structure exports and value added, therefore smoothing them for problems connected to a single variable. Indicator 3 (net PPS) reports shares of exports in the highest and lowest price segment within individual industries. The exports in the segments are then summed up and shares of total exports in theses sectors are calculated (high PPS, medium PPS, low PPS). If we then deduct the share of exports in the low-price segment from that in the high-price segment, we get the net position (net PPS). This indicator highlights shifts within industries ("intra-industry change"), as do to some extent the unit value indicators

4 to 6 (these depend also on shares of industries). Indicators 13 to 16 highlight shares in industries with product differentiation and greater openness to trade; these structural facts describe the opportunity or necessity to upgrade quality.

A Set of Indicators to Monitor the Quality Position

1. Share of quality-intensive industries in value added (net RQE production)
2. Share of quality-intensive industries in exports (net RQE exports)
3. Share of exports in high-quality sectors of industries (PPS, net)
4. Export unit value
5. Import unit value
6. Relative unit value (export unit value relative to import unit value)
7. Share of value added in sunk-cost industries[1] (technology and marketing driven)
8. Share of exports in sunk-cost industries (technology and marketing driven)
9. Share of value added in skill-intensive industries
10. Share of exports in skill-intensive industries
11. Share of value added in industries with high content of knowledge-based services
12. Share of exports in industries with high content of knowledge-based services
13. Share of value added in industries with high product differentiation (PD)[2]
14. Share of exports in industries with high product differentiation (PD)[2]
15. Share of value added in globalised industries (openness)
16. Share of exports in globalised industries (openness)

[1] See Appendix for definition. – [2] Standard deviation of exports of individual EU countries (3-digit level).

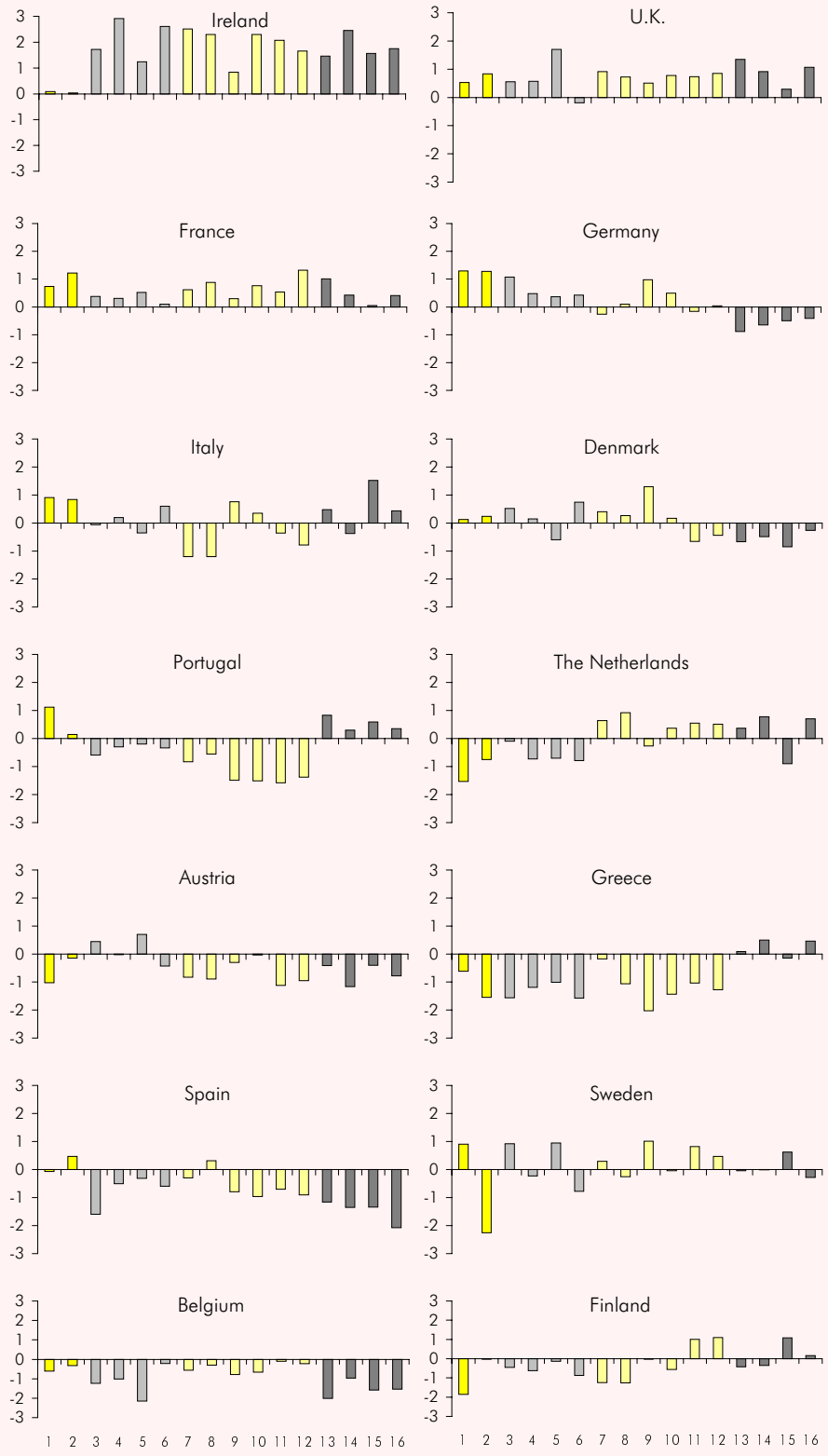
Some of the indicators are more closely related to each other; thus indicators of export shares and of production shares, which are calculated according to the same methods, usually correlate. Even in this case, they are far from providing redundant information, since errors in data may be cancelled out or differences in domestic demand and international competitiveness are highlighted. Information on factor inputs, skills and knowledge content overlap, but again provide information about different core competencies. The unit value of the exports proves to be the single most comprehensive indicator relative to most other indicators[20], even if these indicators themselves are weakly correlated. Its best matches are with the position in price segments (net PPS), the share of high-skill industries and the quality-sensitive industries[21], while it relates least well to knowledge-based services, product differentiation and globalisation. The share of high-skill industries and the position in price segments are the second and third most comprehensive indicators. Least important in the overall ranking are the share of quality-sensitive industries in exports, product differentiation, sunk-cost shares and globalisation, but only the first is insignificant and all correlation coefficients are closely bundled.

It would be technically possible to combine the information supplied by the 16 country ratings into a super-ranking, e.g., by averaging the ranks over the indicators. We do not follow this approach, mainly because looking at the detailed rankings provides us with better information on sources, strengths and weaknesses in quality competition. Rather, we present the indicators in country profiles in Figure 11. Upward bars denote that a country is positioned better according to an indicator than the (unweighted average) of the other EU countries. The indicators are standardised (by subtracting the mean and correcting for different standard deviations across indicators) so that the length of the bars shows the extend of the lead or lag and is also comparable between 1988 and 1998.

[20] This can be shown by calculating the average of the correlations with each other indicator, or by relating it to an indicator which additively summarises all positions.

[21] Export unit values are closely related to "relative unit values" of course, which link export unit values to import unit values.

Figure 11: Country profiles in quality positions 1998 (16 standardised indicators; see the box above)



Source: WIFO calculations using Eurostat. Each indicator is standardised by substracting mean and deviding by standard deviation. The indicators therefore show the relative position of the country to the EU average.

Ireland is above average in all 16 indicators, and takes the top position in 12 of the 16 indicators. Exceptions are the share in quality-sensitive industries, reflecting the spe-

cialisation in price-elastic, technology-driven industries and in high-skill industries. The U.K. is also ranked highly according to many indicators primarily due to high marks in unit values and in sunk-cost industries, while it has a middle position only in the share of skill-intensive industries, quality-dominated industries and in relative unit value (since imports have the highest unit value). France and Germany follow; both have lost some ground since 1988. Both are not specialised in industries with a high degree of product differentiation. France is positioned among the middle of the countries in the high-price segment. Germany has a rather low share in technology-driven industries. Sweden and Finland are climbing the quality ladder according to many indicators, but are still losing some ground due to their large shares in the pulp and steel industry, and are ranked – as is the case for Austria – lower than according to per-capita GDP. Portugal and Italy rank better than in per-capita income because of the intrinsically high-unit value of the textile industry (if textile industries are excluded, Portugal falls by one or two places in the rankings). Assessed by input structure, Portugal ranks similar to its per-capita GDP. Belgium, Greece and Spain are specialised in price-elastic, low-tech industries and in the low-quality segment within industries; they did catch up in some industries, but not in the aggregate. Belgium is far behind in the quality indicators relative to GDP and lost rank in all indicators except skill and service inputs. Its excellent position in dynamic industries has so far contributed an insufficient proportion of manufacturing. Austria, which is third in per-capita GDP, is around the 10th place among the quality indicators, with industry structure as well as the low share of technology-driven industries contributing to this modest ranking. Only upgrading within industries, and consequently the unit value of Austrian EU exports are in the upper part of the country rankings, contributing to the fifth highest share of the quality premium (in absolute terms, ECU).

The indicators in general show no convergence in quality between the countries; if anything, there is a slight divergence. Dispersion increased for 10 of the 16 indicators between 1988 and 1998. Standard deviation decreased for two rankings according to quality sensitivity – one for product differentiation and one for globalisation; for three indicators, dispersion was constant.

The set of indicators presented highlights, firstly, that there are many different aspects of quality and that firms and countries can choose between different strategies to upgrade quality. Secondly, the indicators can be used as a basis for more in-depth studies on the competitiveness of countries. Thirdly, it allows to check progress over time and to relate it to policy factors in future analyses.

7. Summary: Europe as a contested provider of quality

The importance of quality competition

This report highlights the key significance of quality in competition. Europe can increase production and welfare only if it performs well in industries in which the price is not the only factor defining the competitive edge and if it specialises in the upper price segments of each industry. Wages in European manufacturing are higher than in the USA per worker and per hour, and much higher than those in emerging economies in Asia, or in countries applying for accession to the European Union. This is true even after productivity is taken into account. Costs of transactions have been curbed or cut in Europe by the Single Market. Trade barriers have been removed and transaction costs will further decline by monetary union. A pure cost reduction strategy has limits insofar as beyond the elimination of inefficiencies within the systems, lower wages, lower expenses for health, education, the social system, and the environment have a negative impact on the desired standards of living. Focusing on quality is a promising strategy, since Europe has a competitive advantage in quality competition relative to new competitors with cheap labour costs: high European incomes favour product differentiation and boost demand for goods in the upper quality segments. Skilled labour, training, stable labour relations, research input and the use of information technology improves the quality of processes and products.

We define quality as one or several additional characteristics of a good valued by buyers. Those may be features such as reliability, durability, compatibility, capacity, flexibility, or design. Such a characteristic may be objective or subjective, physical or intangible. The important point is that consumers are willing to pay more for goods which include one or more of these qualities. Markets in which firms compete by upgrading quality (quality competition) are to some extent sheltered from price competition. There is no convergence towards a similar price, since the market is differentiated by quality segments. For high-wage countries, this has the advantage that they can be competitive despite of higher costs; for firms, the advantage is that prices may exceed marginal costs over the long term. This is possible by and enhances innovation, research, and investment in physical and human capital, which are the engines of further growth. Quality competition is defined as an environment in which the competitive edge is not only de-

fined by the price, but by the race for acquiring further characteristics of goods valued by the consumer or by the firm using this product as an input.

Europe is a provider of quality

We can summarise the competitive strength of the EU with regard to quality by calculating a "quality premium". The unit value of EU exports is 31 percent higher than in its imports, giving Europe an additional export value in extra-EU trade of about ECU 160 billion. The quality premium is defined as the difference between the reported export value and the value that would result if exports were priced at import prices. More than one half of the premium is created in five industries: chemicals, machinery, food, cars and textiles. The largest contributions to the premium are made by Germany, Italy, France, the U.K. and Austria.

The quality premium is gained through trade with non-Triad countries (accession countries, emerging economies, other countries). However, many of these countries are catching up; imports from accession countries are priced at one half of Europe's exports into these regions, while the equivalent figure was one sixth in 1988. This development is contributing to a decline in the relative quality premium of the EU.

The other challenge comes from competition with high-productivity countries. The unit value for the EU for total exports is larger than that for the USA and about the same as that of Japanese exports. However, Europe has higher import unit values in its bilateral trade with both the USA and Japan. In the case of the EU and USA, the reason for this is the excellence of U.S. exports in technology-driven industries: here the import unit value for the EU is nearly double that of EU exports into the USA. This quality component furnishes the USA's share of exports in this sector with a 10 percentage points advantage over Europe's share in exports (while the EU exports more in quantities). As regards the trade between the EU and Japan, Europe has a higher export unit value in technology-driven as well as in mainstream industries, but Japan is concentrating its exports in the high-unit value sectors, such that the unit value for manufacturing exports to Europe is higher for Japan.

The EU's position within the Triad as seen from the quality indicators is better than from the perspective of productivity comparisons and from the share of high-tech industries. This comes from the excellent position of Europe in mainstream and engineering industries: 41 percent of EU production is in quality-sensitive industries, 3 percentage points more than in the USA and 9 points more than in Japan. The same ratio exists for exports. The speed of change away from price sensitive sectors is, however, slower, specifically in imports, indicating that shifts in consumption may be faster in the USA. This trend is seen specifically in technology-driven or ICT industries.

Quality competition needs quality inputs and changes market structure

Product quality depends on inputs and changes the competitive environment. The position of countries with respect to exported and imported quality is similar. Countries with higher shares of skilled labour, higher shares of technology-driven sectors, and higher shares of information and communication technology are ranked higher in product quality. The relationship works both ways: sophisticated inputs are needed for climbing the quality ladder, and higher incomes then enable more intense research, education and implementation of modern techniques. Successful quality competitors export highly differentiated products and are actively engaged in globalised industries.

Quality competition directs policy efforts

In a nutshell, the main result is that the EU is positioned as a provider of high quality; it upgrades quality continuously, as is called for by a high-income country. However, the long-run position in quality competition is challenged at both ends of the quality spectrum: first by economies which are catching up and secondly by competitors at the technological edge. The policy consequence of this primary result is to increase the speed of upgrading, and to remove the barriers to structural change. Factors important for quality competition are, on the input side, research, innovation, skilled labour, knowledge-intensive services, and information and communication technologies. For the policy front this mandates that education, research policy, information on quality have to be strengthened, and markets in general have to be made more efficient. Europe has lower shares of expenditure for research and information technologies, and in general a lower rate of change. These trends differ across countries and Europe is catching up or even forging ahead in some future oriented technological areas.

Strategies to upgrade quality can focus on shifting to those industries in which quality determines the competitive edge (inter-industry change), or on specialisation in the high-price segments within industries. Costs and benefits differ, and opportunities depend partly on the existence and location of firms. Successful examples exist for both strategies. Important for both strategies is the openness of economies as well as the functioning of input and output markets. Certificates are only one example of how markets can

be made to perform better through the provision of more information. The cautious use of regulatory schemes seems to be another precondition for quality upgrading, as venture capital and financial markets work as accelerators for changing structure.

Quality upgrading is important for all countries, since new competitors are constantly arriving which operate at lower costs. This does not mean that the level of quality has to be the same for all EU countries. Demand for quality depends on income; comparative advantages are different across countries. Ireland is an excellent example of how a former low-income country can combine excellent skills, with foreign capital, and regional and structural policy to excel in quality competition. Sweden and Finland are countries which have fought economic crises successfully by increasing research and boosting the telecoms industry. In general, the differences between European countries with respect to quality competition have not been levelled over the past ten years, hinting at a high potential for further upgrading in all countries.

Table 2: Industries with top and low importance of quality

NACE		RQE	Product differentiation 1			RQE	Product differentiation 1
1510	Meat products	M	L	2670	Cutting, shaping, finishing of stone	L	L
1520	Fish and fish products	M	L	2680	Other non-metallic mineral products	L	L
1530	Fruits and vegetables	L	L	2710	Basic iron and steel, ferro-alloys (ECSC)	L	L
1540	Vegetable and animal oils and fats	L	L	2720	Tubes	L	L
1550	Dairy products; ice cream	H	L	2730	Other first processing of iron and steel	M	L
1560	Grain mill products and starches	M	L	2740	Basic precious and non-ferrous metals	L	L
1570	Prepared animal feeds	M	L	2810	Structural metal products	M	L
1580	Other food products	M	M	2820	Tanks, reservoirs, central heating radiators and boilers	H	M
1590	Beverages	H	L	2830	Steam generators	L	M
1600	Tobacco products	H	H	2860	Cutlery, tools and general hardware	M	M
1710	Textile fibres	M	M	2870	Other fabricated metal products	L	L
1720	Textile weaving	H	M	2910	Machinery for production, use of mech. power	M	M
1740	Made-up textile articles	L	M	2920	Other general purpose machinery	H	M
1750	Other textiles	M	M	2930	Agricultural and forestry machinery	H	M
1760	Knitted and crocheted fabrics	H	M	2940	Machine-tools	H	H
1770	Knitted and crocheted articles	M	H	2950	Other special purpose machinery	H	M
1810	Leather clothes	M	H	2960	Weapons and ammunition	L	H
1820	Other wearing apparel and accessories	H	H	2970	Domestic appliances n.e.c.	L	M
1830	Dressing and dyeing of fur; articles of fur	M	H	3000	Office machinery and computers	M	H
1910	Tanning and dressing of leather	H	M	3110	Electric motors, generators and transformers	L	M
1920	Luggage, handbags, saddlery and harness	H	H	3120	Electricity distribution and control apparatus	H	H
1930	Footwear	H	H	3130	Isolated wire and cable	L	M
2010	Sawmilling, planing and impregnation of wood	L	L	3140	Accumulators, primary cells and primary batteries	L	H
2020	Panels and boards of wood	L	L	3150	Lighting equipment and electric lamps	M	M
2030	Builders' carpentry and joinery	M	L	3160	Electrical equipment n.e.c.	M	H
2040	Wooden containers	L	L	3210	Electronic valves and tubes, other electronic comp.	M	H
2050	Other products of wood	L	M	3220	TV, and radio transmitters, apparatus for line telephony	H	H
2110	Pulp, paper and paperboard	L	L	3230	TV, radio and recording apparatus	L	H
2120	Articles of paper and paperboard	L	L	3310	Medical equipment	H	H
2210	Publishing	L	H	3320	Instruments for measuring, checking, testing, navigating	H	H
2220	Printing	M	H	3340	Optical instruments and photographic equipment	H	H
2300	Coke, refined petroleum and nuclear fuel	M	H	3350	Watches and clocks	H	H
2410	Basic chemicals	L	M	3410	Motor vehicles	H	M
2420	Pesticides, other agro-chemical products	H	M	3420	Bodies for motor vehicles, trailers	H	M
2430	Paints, coatings, printing ink	H	L	3430	Parts and accessories for motor vehicles	H	M
2440	Pharmaceuticals	H	H	3510	Ships and boats	M	H
2450	Detergents, cleaning and polishing, perfumes	M	M	3520	Railway locomotives and rolling stock	H	H
2460	Other chemical products	H	M	3530	Aircraft and spacecraft	H	H
2470	Man-made fibres	M	L	3540	Motorcycles and bicycles	L	H
2510	Rubber products	L	L	3550	Other transport equipment n.e.c.	M	M
2520	Plastic products	M	L	3610	Furniture	M	M
2610	Glass and glass products	L	L	3620	Jewellery and related articles	H	H
2620	Ceramic goods	M	L	3630	Musical instruments	M	H
2630	Ceramic tiles and flags	M	M	3640	Sports goods	M	M
2640	Bricks, tiles and construction products	L	L	3650	Games and toys	H	M
2650	Cement, lime and plaster	L	L	3660	Miscellaneous manufacturing n.e.c.	L	H
2660	Articles of concrete, plaster and cement	L	L				

RQE . . . Revealed Quality Elasticity, Product differentiation 1 . . . standard deviation of exports of individual EU countries (3-digit level), H . . . high, M . . . medium, L . . . low.

Appendix: Abbreviations used

RQE – Revealed Quality Elasticity: industry specific indicator on the impact of quality versus price as competitive mode; theoretically between 100 (if only quality matters) and 0 (if only prices matter), empirically between 53 and 25.

High (medium, low) RQE: share of 31 industries with highest (medium, lowest) value of the indicators; high-RQE industries also called quality-sensitive industries, medium-RQE as moderately price-elastic industries, low-RQE as price-elastic industries.

Net RQE: share of high-RQE minus share of low-RQE.

PPS: position (share) in price segments industries; high PPS is the share (of exports, imports, value added) in the highest price (quality) segment, medium PPS, low PPS shares in medium and low-price segment, respectively.

Globalisation (openness): share of imports plus exports in value added in the Triad (EU, Japan, USA).

Technology-driven industries: industries with typically high research input (cluster analysis, WIFO typology 1).

Marketing-driven industries: industries with high input of advertising (cluster analysis, WIFO typology 1).

Sunk-cost industries: technology-driven plus marketing-driven industries.

References

Abd-el-Rahman, K., "Firms' Competitive and National Comparative Advantages as Joint Determinants of Trade Composition", Weltwirtschaftliches Archiv, 1991, 127(1), pp. 83-97.

Aiginger, K. (1997A), "The Use of Unit Values to Discriminate Between Price and Quality Competition", Cambridge Journal of Economics, 1997, 21(5), pp. 571-592.

Aiginger, K. (1997B), "A Framework for Evaluating the Dynamic Competitiveness of Countries", Structural Change and Economic Dynamics, 1997, pp. 159-188.

Aiginger, K., "Do Industrial Structures Converge? A Survey on the Empirical Literature on Specialisation and Concentration of Industries", WIFO Working Papers, 1999, (116).

Aiginger, K. (2000A), "Europe's Position in Quality Competition". European Commission, DG Enterprise, Working Paper, 2000.

Aiginger, K. (2000B), Country Profiles in Manufacturing, Eurostat, 2000.

Aiginger, K., Böheim, M., Gugler, K., Pfaffermayr, M., Wolfmayr-Schnitzer, Y., "Specialisation and (Geographic) Concentration of European Manufacturing", European Commission, DG 3, Brussels, Working Paper, 1999, (1).

Aiginger, K., Pfaffermayr, M., "Product Quality, Cost Asymmetry and the Welfare Loss of Oligopoly", International Journal of the Economics of Business, 1999, 6(2), pp. 165-180.

Aghion, P., Howitt, P., "A Model of Growth Through Creative Destruction", NBER Working Paper, 1990, (3223).

Bils, M., Klenow, P.J., "Quantifying Quality Growth", NBER Working Paper, 2000, (7695).

Buigues, P., Ilzkovitz, F., Lebrun, J.F., "Social Europe", European Economy, Special Edition, 1994.

Dixit, A.K., Stiglitz, J.E., "Monopolistic Competition and Optimum Product Diversity", American Economic Review, 1977, 67, pp. 297-308.

European Commission, The Competitiveness of European Manufacturing 1998, Brussels, 1998.

European Commission, The Competitiveness of European Manufacturing 1999, Brussels, 1999.

Falkinger, J., "Towards a Quality Centred Economic Analysis", Kyklos, 1992, (45), pp. 469-482.

Falvey, R., Kierzkowski, H., "Product Quality, Intra-Industry Trade and (Im)perfect Competition", in Kierzkowski, H. (Ed.), Protection and Competition in International Trade, Blackwell, Oxford, 1985.

Feenstra, R.C., "New Product Varieties and the Measurement of International Prices", American Economic Review, 1994, 84(1), pp. 157-177.

Flam, H., Helpman, E., "Vertical Product Differentiation and North-South Trade", American Economic Review, 1987, 77(5), pp. 810-822.

Fontagne, L., Freudenberg, M., "Intra-Industry Trade: Methodological Issues Reconsidered", CEPII, 1997, (97-1).

Fontagne, L., Freudenberg, M., Gordo, E., Martin, C., Peridy, N., Trade Pattern inside the Single Market, Report for the European Commission, Brussels, 1997.

Fujita, M., Krugman, P., Venables, T, The Spatial Economy, M.I.T. Press, 1999.

Gabrisch, H., Segnana, L., Trade Structure and Trade Liberalisation, Institute for Economic Research, Halle, 1999.

Gardiner, B., Analysis of EU Trade-Price Elasticities by Sector and Country, Cambridge, U.K., 1998.

Garvin, D.A., Managing Quality, New York, 1988.

Ghemawat, P., Resources and Strategy: An Industrial Organisation Perspective, Harvard Business School, 1991 (mimeo).

Greenaway, D., Hine, R.C., "Intra-Industry Specialisation, Trade Expansion and Adjustment in the European Economic Space", Journal of Common Market Studies, 1991, (29), pp. 603-622.

Greenaway, D., Hine, R.C., Milner, C., "Vertical and Horizontal Intra-Industry Trade: A Cross Industry Analysis for the United Kingdom", The Economic Journal, 1995, (105), pp. 1505-1518.

Greenaway, D., Milner, C., The Economics of Intra-Industry Trade, Blackwell, New York, 1986.

Grossman, G.M., Helpman, E., "Quality Ladders and Product Cycles", The Quarterly Journal of Economics, 1991, pp. 557-586.

Grupp, H., "Science, High Technology and the Competitiveness of EU Countries", Cambridge Journal of Economics, 1995, 19, pp. 209-223.

Grupp, H, Stadler, M., Technological Change and Market Growth: An Empirical Assessment Based on the Quality Ladder Approach, Tübingen, 1999 (mimeo).

Heckscher, E., "The Effect of Foreign Trade on Distribution of Income", Ekonomisk Tidskrift, 1919, pp. 497-512; reprinted in Ellis, H.S., Metzler, L.A. (Eds.), A.E.A. Readings in the Theory of International Trade, Blakiston, Philadelphia, 1949, pp. 272-300.

Helpman, E., "The Size of Regions", in Pines, D., Sadka, E., Zilcha, I. (Eds.), Topics in Public Economics: Theoretical and Applied Analysis, Cambridge University Press, Cambridge, 1997.

Helpman, E., Krugman, P., Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy, Harvester Wheatsheaf, Brighton, 1985.

Hirsch, S., Location of Industry and International Competitiveness, Oxford, 1967.

Krugman, P.R. (1979A), "A Model of Innovation, Technology Transfer, and the World Distribution of Income", Journal of Political Economy 1979, (87), pp. 253-266.

Krugman, P.R. (1979B), "Increasing Returns, Monopolistic Competition, and International Trade", Journal of International Economics, 1979, (9), pp. 469-479.

Krugman, P.R., "Technological Change in International Trade", in Stoneman, P. (Ed.), Handbook of the Economics of Innovation and Technological Change, Blackwell, Oxford, 1995, pp. 342-365.

Krugman, P.R. (1991B), "Increasing Returns and Economic Geography", Journal of Political Economy, 1991, (99), pp. 483-499.

Krugman, P.R. (1991C), Rethinking International Trade, M.I.T. Press, Cambridge, MA, 1991.

Krugman, P.R., Venables, A.J., "Globalisation and the Inequality of Nations", NBER Working Paper, 1995, (5098).

Krugman, P.R., Venables, A.J., "Integration, Specialisation, and Adjustment", European Economic Review, 1996, (40), pp. 959-967.

Lancaster, K., Variety, Equity, and Efficiency, Columbia University Press, New York, 1979.

Lancaster, K., "Intra-Industry Trade under Perfect Monopolistic Competition", Journal of International Economics, 1980, (10), pp. 151-175.

Landesmann, M., Brugstaller, J., "Vertical Product Differentiation in EU Markets: the Relative Position of East European Producers", WIIW, Research Report, 1999, (234).

Lankhuizen, M., "Shifts in Foreign Trade, Competitiveness and Growth Potential: From Baltics to 'Bal-techs'"?, Research Policy, 2000, (29), pp. 9-29.

Lefler, K.B., "Ambiguous Changes in Product Quality", American Economic Review, 1982, 72, pp. 956-967.

Linder, S.B., An Essay on Trade and Transformation, New York, 1961.

Markusen, J.R., Venables, A.J., "Multinational Firms and the New Trade Theory", Journal of International Economics, 1998, (46), pp. 183-203.

Muent, G., Grupp, H., Changes in Technological and Trade Specialisation Among Open Economies, 1996 (mimeo).

Murphy, K.M., Shleifer, A., "Quality and Trade", Journal of Development Economics, 1997, (53), pp. 1-15.

Nelson, R.R., "Why Do Firms Differ, and How Does it Matter?", Strategic Management Journal, 1991, 12, pp. 61-74.

Nicoletti, G., Scarpetta, S., Boylaud, O., "Summary Indicator of Product Market Legislation with Extension to Employment Protection Legislation", OECD, Economics Department Working Paper, 1999, (226).

OECD (1999A), "The Contribution of Information and Communication Technologies to Output Growth", STI Working Paper, 1999.

OECD (1999B), Science and Technology Scoreboard, Paris, 1999.

Oliveira Martins, J., Slovakia. Country Report, OECD, Paris, 1998.

Peneder, M., "Intangible Investment and Human Resources. The New WIFO Taxonomy of Manufacturing Industries", WIFO Working Papers, 1999, (114).

Peneder, M., "Intangible Assets and the Competitiveness of European Industries", in Buigues, P., Jacquemin, A., Marchipont, F. (Eds.), Competitiveness and the Value of Intangible Assets, Edward Elgar, Cheltenham, 2000, pp. 117-153.

Peneder, M., "Entrepreneurial Competition and the Location of European Industries", Edward Elgar, Cheltenham (forthcoming).

Peteraf, M.A., "The Cornerstone of Competitive Advantage: a Resource-Based View", Strategic Management Journal, 1993, 14, pp. 179-191.

Posner, M., "International Trade and Technological Change", Oxford Economic Papers, 1961, (13), pp. 232-341.

Romer, P.M., "Increasing Returns and Long-Run Growth", Journal of Political Economy, 1986, (94), pp. 1002-1037.

Romer, P.M., "Endogenous Technological Change", Journal of Political Economy, 1990, (98), pp. 71-102.

Romer, P.M., "New Goods, Old Theory and the Welfare Costs of Trade Restrictions", NBER Paper, 1993, (4452).

Schulz, I., Zum Qualitätsbegriff in der angewandten Sozial- und Wirtschaftsforschung, Vienna, 1999.

Stadler, M., "Dual Labour Markets, Unemployment and Endogenous Growth", IFO-Studien, 1999, (45), pp. 283-301.

Taylor, S.M., "Quality Ladder and Ricardian Trade", Journal of International Economics, 1993, (34), pp. 225-243.

Theil, H., Suhm, F.E., Meisner, J.F., "The Quality of Consumption, International Consumption Comparisons", Studies in Managerial Economics, 1981, 30.

Torstenson, R.M., "Growth, Knowledge Transfer and European Integration", Applied Economics, 1999, 31, pp. 97-106.

Venables, A.J., "Equilibrium Locations of Vertically Linked Industries", International Economic Review, 1996, (37), pp. 341-359.

Venables, A.J., "The International Division of Industries: Clustering and Comparative Advantage in a Multi-Industry Model", CEPR Discussion Paper, 1998, (1961).

Vernon, R., "International Investment and International Trade in the Product Cycle", The Quarterly Journal of Economics, 1966, (80), pp. 190-207.

Wolfmayr-Schnitzer, Y., The Competitiveness of Transition Countries, OECD, AEPC, Paris, 1997.

Wolfmayr-Schnitzer, Y., "Economic Integration, Specialisation and the Location of Industries. A Survey of the Theoretical Literature", WIFO Working Papers, 1999, (120).

Yarrow, G.K., "Welfare Losses in Oligopoly and Monopolistic Competition", Journal of Industrial Economics, 1985, 33(4), pp. 515-529.

Measuring the Intensity of Quality Competition in Industries – Summary

We can summarise the competitive strength of the EU with regard to quality by calculating a "quality premium". The unit value of EU exports is 31 percent higher than in its imports, giving Europe an additional export value in extra-EU trade of about ECU 160 billion. The quality premium is defined as the difference between the reported export value and the value that would result if exports were priced at import prices. More than one half of the premium is created in five industries: chemicals, machinery, food, cars and textiles. The largest contributions to the premium are made by Germany, Italy, France, the U.K. and Austria.

The quality premium is gained through trade with non-Triad countries (accession countries, emerging economies, other countries). However, many of these countries are catching up; imports from accession countries are priced at one half of Europe's exports into these regions, while the equivalent figure was one sixth in 1988. This development is contributing to a decline in the relative quality premium of the EU.

The other challenge comes from competition with high-productivity countries. The unit value for the EU for total exports is larger than that for the USA and about the same as that of Japanese exports. However, Europe has higher import unit values in its bilateral trade with both the USA and Japan. In the case of the EU and USA, the reason for this is the excellence of U.S. exports in technology-driven industries: here the import unit value for the EU is nearly double that of EU exports into the USA. This quality component furnishes the USA's share of exports in this sector with a 10 percentage points advantage over Europe's share in exports (while the EU exports more in quantities). As regards the trade between the EU and Japan, Europe has a higher export unit value in technology-driven as well as in mainstream industries, but Japan is concentrating its exports in the high-unit value sectors, such that the unit value for manufacturing exports to Europe is higher for Japan.

The EU's position within the Triad as seen from the quality indicators is better than from the perspective of productivity comparisons and from the share of high-tech industries. This comes from the excellent position of Europe in mainstream and engineering industries: 41 percent of EU production is in quality-sensitive industries, 3 percentage points more than in the USA and 9 points more than in Japan. The same ratio exists for exports. The speed of change away from price sensitive sectors is, however, slower, specifically in imports, indicating that shifts in consumption may be faster in the USA. This trend is seen specifically in technology-driven or ICT industries.