Karl Aiginger

Measuring the Intensity of Quality Competition in Industries

In WIFO - Quarterly, 2001/1

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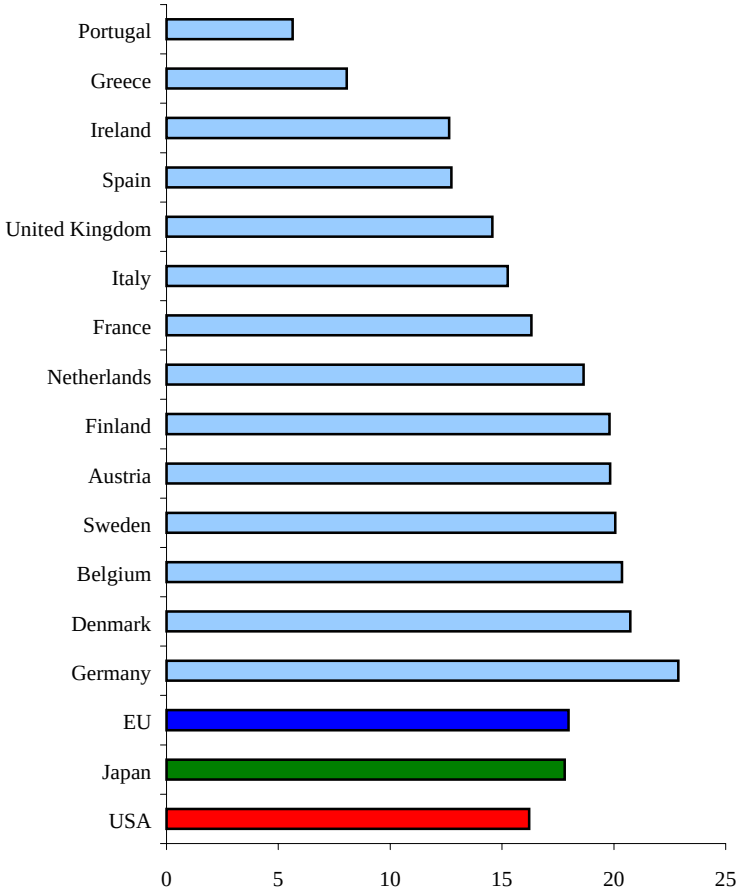
1. Objective and structure the paper[1]

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 characteristic of goods like reliability, design, durability, flexibility etc., all these elements become important if the buyer is willing to spend more more for a good, if this characteristics is added. Additionally we measure quality by the more conventional indicator of the "unit value", and finally by a set of sixteen indicators which comprise qualitative elements.

The topic is specifically interested for the countries of the European Union, since the European Union is a high wage region. See figure 1 for per hour labor costs in European countries, in Japan and in the US. A substantial portion of the high wages, as well as the costs for the social system, education, health and environment can be balanced by higher productivity. Cost increases have been successfully curbed by increasing the efficiency of institutions and markets through the reduction of transport costs, trade barriers and currency costs. Nevertheless, cost restraints have a limit, and - as far as factor rewards (wages, profits) are concerned – to a certain extent also contradict the final goal of competitiveness, namely to increase the welfare of European citizens. In addition, new competitors with much lower costs are arriving, be it the emerging economies or the accession countries. These competitors will always have lower absolute costs and, and usually even after correcting for productivity differences also lower unit labour costs. The consequence for a high wage country is to compete in quality. Here, pressure from the cost side is mitigated, since high wage countries have a competitive advantage: demand for high quality goods depends on disposible income and is therefore stronger in rich countries, providing them with a first mover advantage; additionally, resources in research and skilled labour support 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. For countries, high wages become compatible with competitiveness.

[1] This article was writtten as a part of a Background Report (Europe´s Position in quality Competition; htt ?? for the European Commission, Eneterprise Directorate, for the Report: The competitiveness of European industry, 2000. The author, Karl Aiginger, is grateful for discussions with members of the Scientific Committee (Steve Davies, Ian Miles, Reinhilde Veugelers), with participants at two workshops at WIFO (Paul Baker, Lionel Fontagne, Wolfgang Gerstenberger, Bruce Lyons, Nora Plaisir, Gunther Tichy, Wilhelm Kohler, Michael Landesmann, Klaus Gugler, Rudolf Winter-Ebmer), and for discussions with members of the DG Enterprise (George Lemonidis, Annalisa Ferrando, Isabel Grilo, Anestis Filopoulos, Gerald Petit, Pierre Vigier, Renate Weissenhorn, David White), and to his collegues at WIFO, specifically Peter Egger, Michael Peneder, Michael Pfaffermayr, and Yvonne Wolfmayr-Schnitzer. The work could not have been performed without the programming of Marianne Schöberl and Wolfgang Klameth, the project management by Dagmar Guttmann, and the research assistance of Traude Novak and Eva Sokoll.

Figure 1.1: Labour costs per hour in manufacturing, 1997, ECU/h



Source: WIFO calculations, IW Trends 2/1998.

We investigate how Europe is positioned in quality competition in manufacturing[2], analyse differences in strategies and in countries. The data indicate that there is no immediate danger of European industries losing their mostly quality-based competitive advantages in foreign trade vis-à-vis the low cost providers; Europe has a 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; making inroads in important fields, although it still has a deficit in fast moving industries and productivity, and a slow speed of change[3]. To increase income, Europe has to boost quality and productivity and increase its share of technology driven industries.

[2] We concentrate 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).

[3] See these findings summarised in Aiginger, K., Boeheim, M., Gugler, K., Pfaffermayr, M., Wolfmayr-Schnitzer, Y., "Specialisation and (geographic) concentration of European manufacturing", European Commission, Enterprise DG, Working Paper No.1, Brussels, 1999. European Commission, The competitiveness of European industry 1998, Brussels,

We start by shortly defining quality, inputs and policy contributing to quality upgrading. Furthermore we introduce shortly the main indicators used in the study in chapter 2. We provide overviews on the role of quality in trade, production, and growth theory, industrial organisation, growth and consumption theory, as well as studies which have tried to assess empirically the qualitative competitiveness of countries.

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

In Chapter 4, we investigate in which industries low prices define the competitive edge and in which industries high quality is decisive for competitiveness. We call the first set of industries price elastic industries, the latter quality elastic industries, and report exports and imports of countries in the sector of Revealed Quality Elasticity (high RQE industries). We investigate which characteristics are shared by quality sensitive industries and which countries have shifted into these successfully (inter-industry quality upgrading).

The following 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 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.

1998. European Commission, The competitiveness of European industry 1999, Brussels, 1999. Peneder, M., (forthcoming), "Entrepreneurial Competition and the Location of European Industries", Edward Elgar, Cheltenham.

2. Quality: definitions and main indicators chosen

2.1. Defining quality and competition in quality

Quality is a complex phenomenon and there exist no general accepted definition, which fits every purpose and all the complexities in teal economics. We summarise the importance of quality in economic models in Box 2.1 and give an overview on the empirical studies in Box 2.2, both at the end of this chapter. First we present the concept of quality we use in this paper and its link to competitiveness. Then we introduce the main indicators which we shall apply.

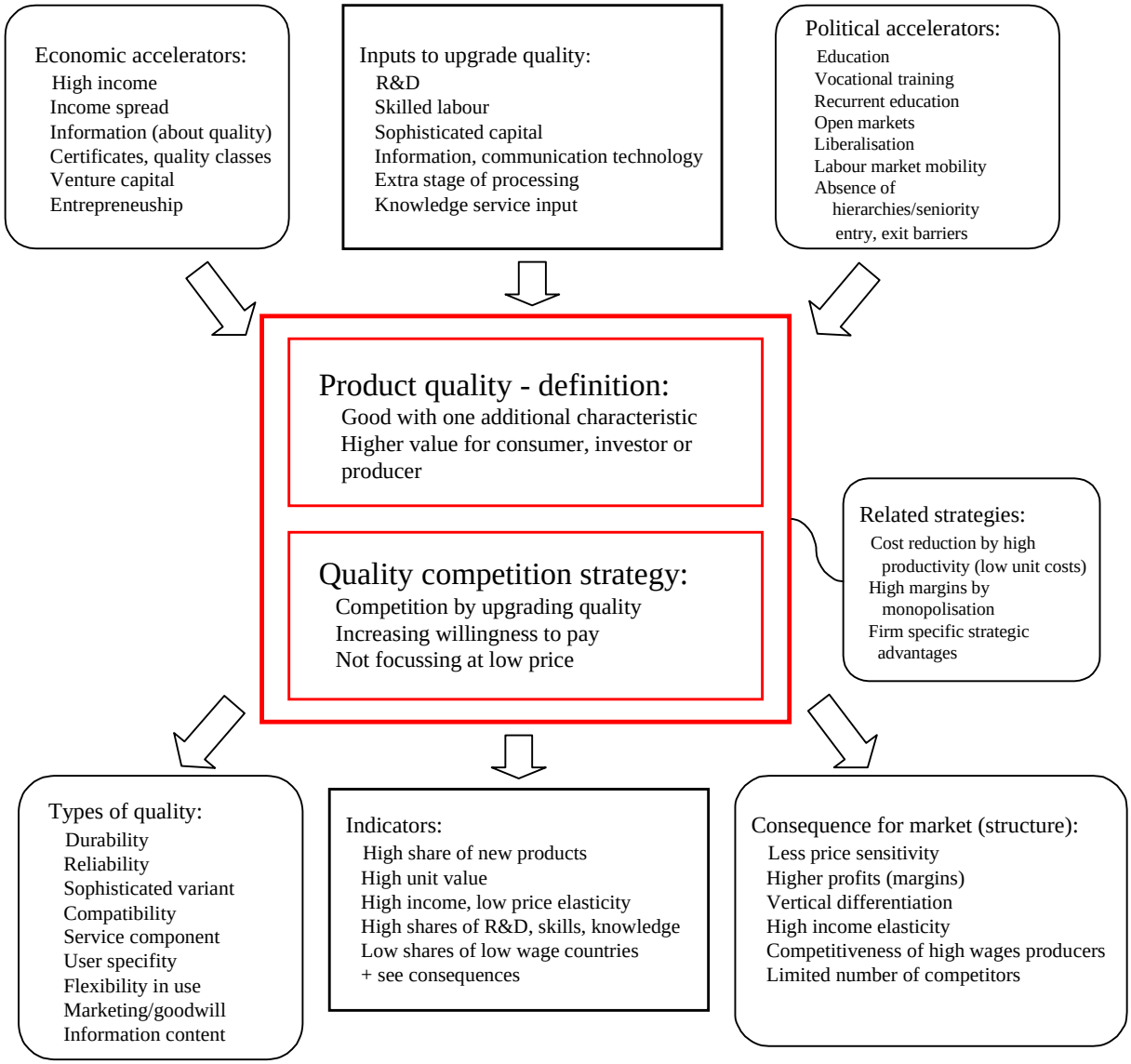
As a working definition, we describe a high quality product as a "good which possesses one or more additional characteristics, which are valued by buyers". The characteristics which increase the willingness to pay may be either physically measurable, like speed, capacity, size, and durability; or they may be intangible, like reliability, design, goodwill, and trust. Quality may even arise simply through flexibility in use, compatibility, information, maintenance contracts etc.[4]. The consequence of higher quality is to allow a higher price without loosing the market. The phenomenon that goods of different quality are supplied and bought on a market is called "vertical product differentiation"[5].

Activities which upgrade quality are more or better skilled labour, machines, more sophisticated material inputs, but also superior organisation on the plant or firm level. Research and development, as well as imitation of the best techniques and processes, may be sources of quality upgrading. Marketing may increase the willingness to pay by providing information about the capabilities of the product or by changing the tastes of consumers. In most, but not all cases, the quality of output is related to the quality of input. Submitting to certifications, setting 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 2.1. It also reports on the indictors which signal quality and consequences for market structure.

[4] Things become more complicated if the physical product itself is not well–defined, as it is for services, for products with rapid product innovations, 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 miles, tennis lessons per hour. However, the price per unit depends on the amount of unpriced attributes, for example, butterfat, makes, and service. If, on the contrary, milk were sold according to butterfat, 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.

[5] Vertical product differentiation is a term in Industrial Organisation. Vertical product differentiation exist, if all consumers prefer the good of higher quality, if all variants were offered at the same price. Horizontal product differentiation in contrast is given if individual consumers differ in their preferences or if even an individual consumer has a preference of variety (prefers two different variants to two units of the favored variant).

Figure 2.1: Quality competition: preconditions, types and consequences



Quality differs from productivity, as the latter is defined usually in technical (quantitative) terms, like tons per one unit of labour input. If, however, value added is used as a numerator, then the prices and quality of output are taken into account. And if 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 homogenous as possible, while quality explicitly addresses the heterogeneity of outputs produced usually with respect to heterogeneous inputs.

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

Adding a further stage of processing usually increases the quality of the product. The additional stage can make the product more durable, more convenient, more specifically suitable and useful for the consumer, investor or producer. A further stage of processing can be to combine hardware with a software; a tangible product with a service or information. There are some cases, where a further stage of processing decreases the user value by decreasing flexibility or compatibility for some purposes.

Quality and profitability are closely related, insofar as the quality of products will usually raise profitability, both by decreasing the competitive pressure as well as by increasing the willingness to pay. However, quality is mainly a characteristic of the product and profitability a result of the production process and the strategy and organisation of firms. There can be a conflict between the quality of the product as measured in objective terms and profitability, if quality raises costs more than it raises the willingness to pay. The economic solution is to find the quality which maximises profits. The resulting "optimal" quality provided may be below that assessed as desirable or feasible by technicians or consumer organisations.

The quality of products should be reflected in the profits and specifically in the persistence of supernormal profits. If the market is not regulated or characterised by entry barriers, each advantage of a specific firm will be contested rapidly 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 competitiveness[6]. Producing the same quality at a higher price or at lower margins is not feasible in the long run. We have shown already that many European countries have higher wages than the USA and Japan, this cost advantage is even larger if compared to accession countries and to many new competitors in the globalising world. It is possible to cope with higher wages by increasing productivity, but since technology and managerial skills are also spreading by the investment of multinational firms, this strategy is not always feasible. Producing a higher quality is an alternative as well as a complement to higher productivity. This strategy is however easier in those industries in which buyers differentiate between quality types, while there are other markets in which price competition is the most important competitive mode. We define as “Quality competition” a competitive environment, in which upgrading quality, and increasing the willingness to pay is important relative to competing at low prices. Quality sensitive industries are those in which quality upgrading rather than low prices define the competitive edge.

[6] 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 usually improve the quality of products too, but may also refer to processes, changes in input material.

2.3 Indicators for quality and for quality competition

We use two indicators to assess quality in this paper. The unit value of exports (UV) is the main indicator on the "average quality" of an industry. Then we use evidence on the relation between export and import prices and the reaction of importated 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 on the position of countries on the "quality ladder".

The indicators which are partly highlighting different aspects and partly complementary are described later in detail, here we give the main features:

- The unit value (UV) of exports: this indicator is defined as nominal exports divided into tons. Higher unit values reflect higher willingness to pay for a given product, one reason for this is the higher quality in a market with vertically differentiated products. The unit value for an aggregate is higher if a country focus on more sophisticated or higher processed goods. We can call this indicator "indicator on 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 reveal in which industries exports are dependant on quality and not only on prices. The indicator reveals the importance of quality is called RQE (Revealed Quality Elasticity). This indicator defines quality competition as an intrinsic characteristic of an industry (not changing over time or across countries). Countries with a large share in high-RQE industries have managed to abandon industries in which low prices define the competitive edge and shifted exports into quality elastic industries. It could be called "indicator on inter industry quality upgrading". For details see chapter 4.

Summing up we see that the second indicator focus on industries (as quality or price elastic), the first indicators on the industry level describes quality within an industry. If the unit value is calculated for total exports it contains industry and within industry specialisation. Though the two indicators already look at quality from different angles, there exist more aspects of quality than those captured by these three indicators. Therefor we present an extended set of indicators in chapter xx.

Box 2.1. The importance of quality in models

Traditional trade theory explains trade in terms of endowment or productivity differences in the production of homogenous 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, more likely to be generated in high income regions[7].

New trade theory models horizontal product differentiation as source of intra-industry trade. Krugman provides a model in which only the "North" is able – and doomed – to introduce new products, which are imitated then by the low cost South. This leads to the notions that first, countries are "climbing up 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, "*Neo Schumpeterian" models* assume that every economy has an unlimited potential to introduce new goods. Fixed costs have to be implemented to exploit them. The most important input is thought to be innovation (Romer, 1993), or physical capital (Falvey, Kierzkovsky, 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 technical progress, which augments the quantitative inputs. Diminishing returns to capital are prevented in the New Growth Theory by spillovers, knowledge dissemination and innovation. Vertical product differentiation and a productivity enhancing, larger 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 one single winner, or as non tournament models, in which many firms can potentially improve technology or product quality.

Industrial organisation models quality as vertical product differentiation. The higher quality good supplies more of at least one characteristic valued by consumers[8]. All consumers prefer the good with the higher quality, if all variants are offered at the same price[9]. The relation between quality and quantity can be modelled in various ways. The simplest is the "repackaging view", implying that higher quality is just a 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[10]. Three robust results can be seen in

[7] For an overview on the implications of trade theory for specialisation and concentration see Wolfmayr-Schnitzer (1999).
[8] Formally, quality can be indexed by s, with an higher index indicating higher quality. Demand, x, now decreases with price, p, and increases in quality, $x = f(p, s)$.
[9] In contrast to this, horizontal product differentiation is given if consumers vary in their tastes or if they love variety as such. In either case, the outside observer cannot rank products according to their desirability.
[10] Aiginger, Pfaffermayr (1999) present a model in which demand is homogenous in quality adjusted prices. Variable costs decrease less than is proportionate 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 the efficiency; technometric information is used

many models: 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 disentangle price increases into a "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[11].

From the many related areas in which quality is addressed, we want to mention 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 over the long run the competitive edge of firms, be it the quality of management, organisation or its position in the product market. Business economics stress that quality can mean the best relation between costs and value (cost benefit relation, value approach, degree of excellence at an acceptable price)[12].

Box 2.2. Empirical studies on quality competition

We summarise only a few of those studies, which try to assess the quality position of countries with respect to the level of aggregates, not industry-specific studies or studies at the firm and plant levels.

A first group of studies attempts to assess the "qualitative competitiveness" of countries (which means competing with other competitive modes rather than with low prices) by looking at typologies built upon characteristic factor inputs. If a country has a large share of industries characterised as technology driven, a first evidence of its ability to compete in quality is given. Numerous classifications of "high tech industries" are available (for an overview see Wolfmayr-Schnitzer, 1997,

as an indicator of innovation output. This follows Lancaster's approach, according to which key characteristics define the value of differentiated products.

[11] Theil, Suhm, Meisner (1981) report the method used to calculate the average price of a composite in order to asses 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).

[12] Garvin (1988) distinguishes 5 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

Peneder, 1999.). A classification distinguishing between traditional inputs (labour, capital) and inputs which create strategic advantages (research and marketing) has been published by European Commission (1998) and will be used in this report extensively. Another classification splits industries into the skill classes mainly used to asses the quality of production and the qualitative competitiveness of countries indirectly (Peneder, 2000A, 2000B). Classifying industries according to the quality of the service input contained is developed in a later part of this report (Michael Peneder).

The alternative is to asses quality by output indicators. Here the unit value of exports is primarily used, for example 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 the competitive process. 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 part, as well as the rising component of intra-industry trade, comprises vertically differentiated products. The technique used to illustrate this observation is the re-classification of intra-industry trade into one group which includes horizontal intra-industry trade when exports and import unit values differ by less than 15%, and into another group of vertical intra-industry trade when the difference is larger[13]. Wolfmayr-Schnitzer (1999) show that horizontal intra-industry trade was rather stable in the EU between 1988 and 1998, while vertical IIT was increasing (and driving the overall increase). This has been the result of other studies, also. Methodological issues are involved (bilateral versus multilateral definitions of trade overlap, alternative definitions of overlap, respectively, 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 (1997) has developed 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. This method is extended and used in Chapter 4. Gardiner (1998) used 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[14].

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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.

[13] This concept is based on Greenaway (1986). Alternatively Fontagne, Freudenberg (1997) propose distinguishing between one way trade if the difference between exports and imports is less than ten percent of the other flow, while defining two way trade to be the case when exports and imports are more similar.

[14] For methods of correcting prices and productivity changes from quality see OECD (1999) and Bils, Klenow (2000).

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

3.1. 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:

(i) Increasing durability, reliability, compatibility, flexibility

(ii) Using superior material inputs or higher skills

(iii) Making a product more specific to demand

(iv) Refining or further processing a product

(v) Adding new functions, service or maintenance contracts

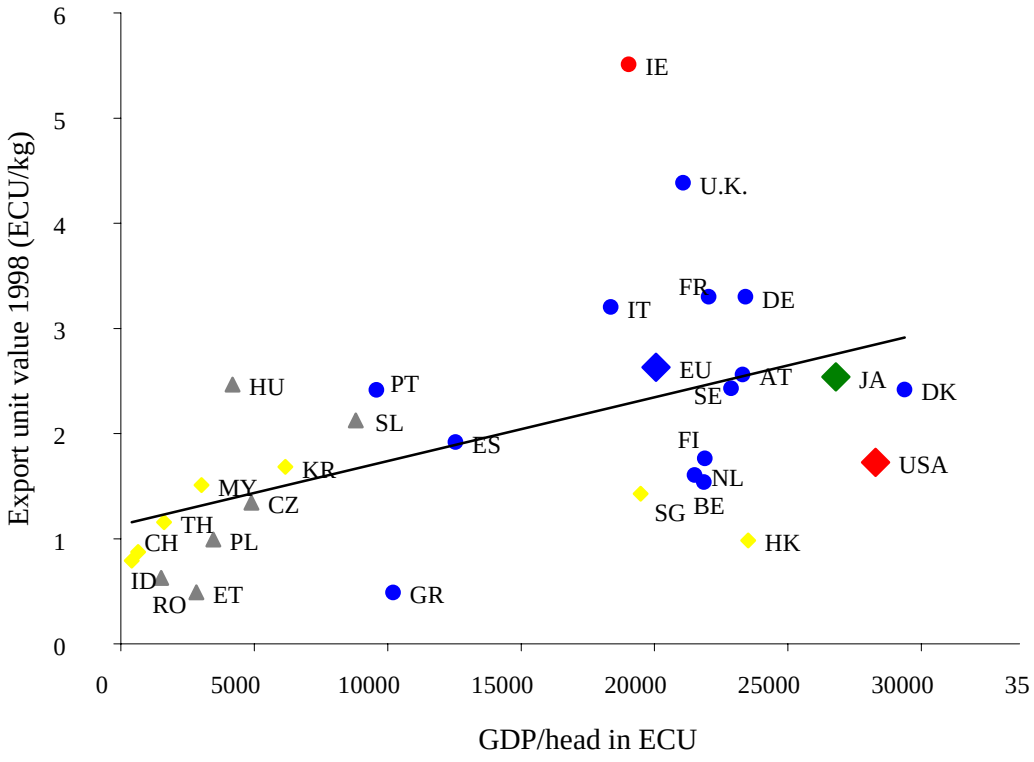
(vi) Better design, advertising.

Unit values as indicators of quality have been used in industry studies for assessing qualitative competitiveness and for discriminating 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 Box 3.1.

3.2. Unit values differ widely across Europe

Unit values of exports in manufacturing differ between 5.5 ECU/kg in Ireland and 0.43 ECU/kg in Greece (1998). This range of ten to one is much higher than that for per capita GDP, which differs by less than three to one between European countries. The high amplitude 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 values than countries with high shares in technology driven industries and in upper price segments within industries.

Figure 3.1: Unit value highlights climbing up the quality ladder



Source: WIFO calculations using EUROSTAT for EU members, FTW, OECD for others. See annex for a list of abbreviations. The line helps to relate unit values relative to GNP graphically but should not be interpreted as a regression line (indicating causality). The position of the EU member countries with higher income are very different, indicating heteroscedasticity.

Ireland combines a high share of technology driven industries (60% of exports), with positioning 78% in the highest price segment (see Chapter 5 for a definition of price segments). The UK 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/kg. Denmark, Austria and Sweden all hold moderate positions. Belgium and the Netherlands had – together with Greece – unit values of about or below two 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/kg and amount to one third of Greek exports. Additionally, 75% of these exports are in the medium and low price segments (see Chapter 5). 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.

Box 3.1: Unit values and their use

The unit value is defined as nominal value divided into physical volume. For the data banks used in this report, it is the gross value of exports or imports in ECU divided by kilogram. 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 comprehensive indicator, it has advantages and disadvantages. Among the 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 for the correct treatment of nominators and denominators.

As far as the interpretation of the unit value is concerned, it is fascinating that most of the components which add value are included. Industries intensively using physical capital exhibit rather low unit values, since capital is used for example in basic steel industries or in basic chemicals for large scale production. So capital intensive industries rank lower and skill intensive 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 the competitive edge. On the other hand, some industries have intrinsically higher unit values, while they are neither high tech, nor do they use skilled labour, nor is physical capital involved. For example, this holds for textile and apparel industries in which the unit values are high, since the weight in tons is low. Here, reprocessing also poses a problem. Goods are shipped into low wage countries and return at a somewhat higher unit value, indicating 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 for example 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 was that high values could indicate high quality or high costs. A technique proposed in Aiginger (1997)[15] enables us to disentangle costs and quality at least partially. If

[15] Aiginger, K., The use of unit values to discriminate between price and quality competition, *Cambridge Journal of Economics*, vol. 21, 1997, pp. 571-592. Aiginger shows that the unit value is near to being a measure of productivity, if the product is homogenous and the number of workers needed to produce one unit of output is relatively constant. But the unit

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.

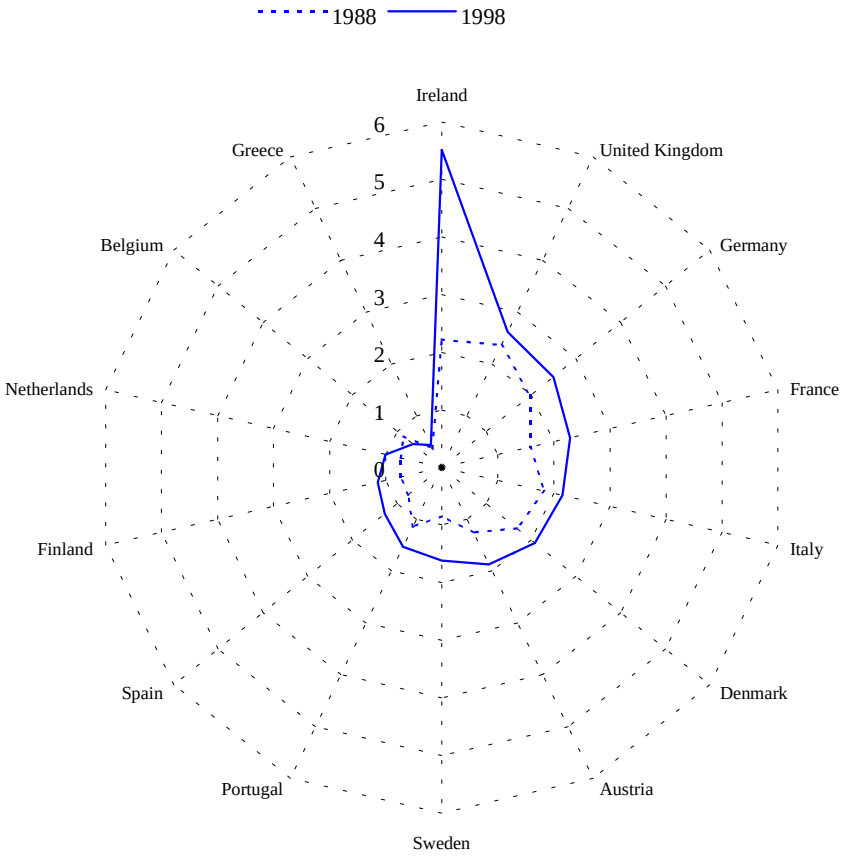
Unit values of exports and imports are not fully comparable, since both are measured at the border. Imports include trade costs from the point of origin to the border, exports from the mill to the border. The reporting mode has shifted in the last ten years from customs agencies to firms. A lot of noise and inconsistency on the product level have arisen from these features, but the rich data set enables us to cope with many outliers and errors. But in the most cases, a careful second look at the data, or the exploitation of the very rich data can eliminate distortions or enable an evaluation of their quantitative impact. In general we use total exports if we focus on the comparison of European countries, We use however Extra exports if we focus on the comparison between the EU and the US and Japan.

Over time, the largest increase in unit value was registered in Ireland, which was second to the UK in 1988 and is now the leader (see Figure 3.2). 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 less 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 on 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[16].

value approaches a pure price or consumer valuation if the product or service is differentiated and the value is related to the input unit (counselling fee per hour, construction fee per square meter or per kilo cement).

[16] Unit value is higher in the Northern countries as compared to the Southern countries, due to the positions of Ireland and the UK. 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 vs. 1.8 ECU/kg) than in small countries.

Figure 3.2: Dynamics of export unit value in member 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. This second effect dominates[17]. The same two countries have the 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:

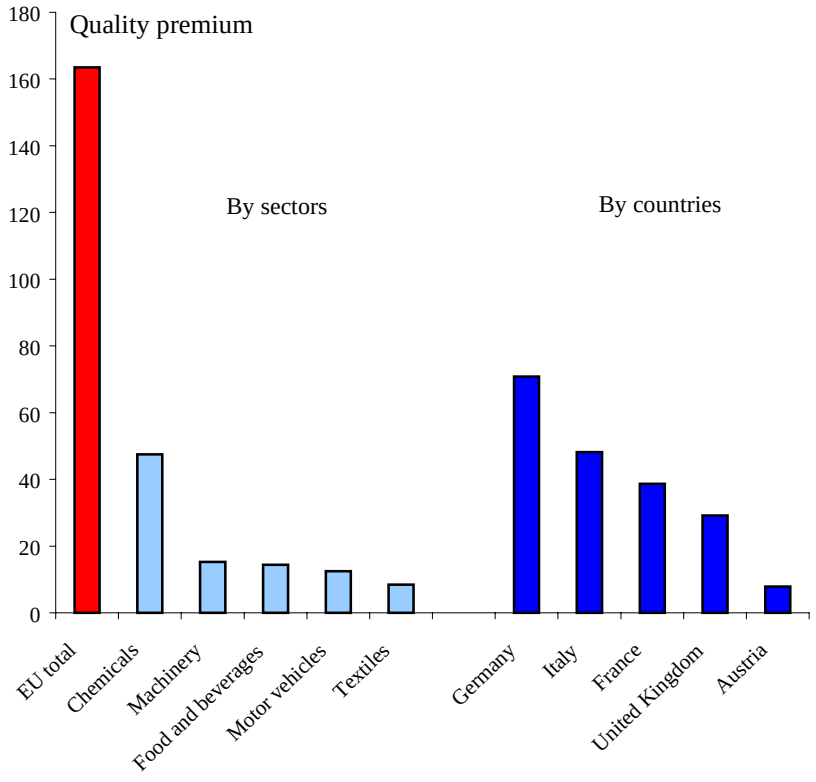
- France, Italy and Portugal are ranked lower in import unit values, due to cheap imports from non member countries. This is partly also the case for Germany, due to imports from accession countries.
- Sweden and Finland have a much higher ranking in the import unit values, since they are importing goods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

[17] The unit values of exports and imports are closely related (R = 0,82), with the relation of import unit values somewhat weaker than that of exports, when compared to GDP. This means that export unit values and import unit values are both climbing up the quality ladder, with the imports also containing an element which substitutes the lower segments of production with imports from low cost countries.

3.3. The quality premium in European exports

European exports in manufacturing (extra trade) amounted to 665 bn ECU in 1998; imports to only 579 bn ECU. This results in an export surplus of 86 bn ECU, which is more than three times as high as ten years before (25 bn ECU). The export surplus can be attributed to a quality premium in exports: the export unit value, 2.25 ECU/kg, is 31% 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 161 bn ECU less. We call this the quality premium[18].

Figure 3.3: Creation of quality premium by sectors and countries 1998 (bn ECU)



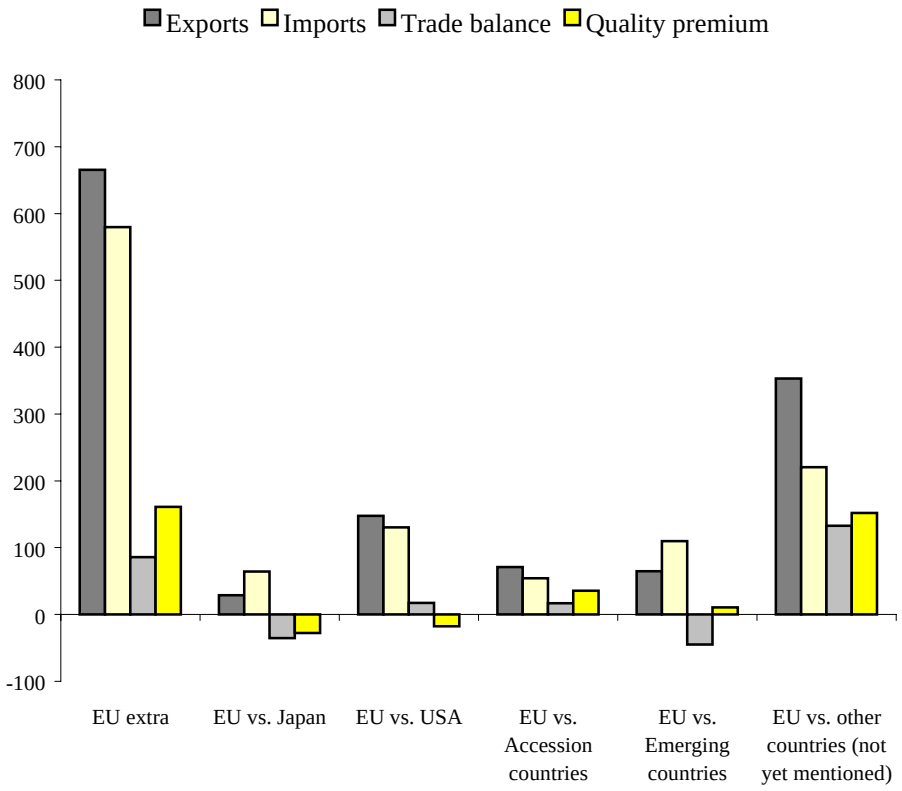
Remark: Quality premium: difference of exports of EU if they were priced at import prices only.
Source: WIFO calculations using EUROSTAT.

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 (47.5 bn ECU), followed by machinery, food, motor vehicles, and textiles (see Figure 3.3). Relatively high premiums are given in tobacco and leather. They are highest in marketing driven and labour intensive industries; in technology driven industries[19], exports are valued 15% lower than imports. From a total of 22

[18] With exports priced at the unit value of imports, Europe would have a trade deficit of 77 bn ECU(1998). The quality premium is in general defined as exports minus hypothetical exports (if price like imports). This calculation can be don on any level of aggregation.
[19] WIFO typology, see European Commission 1998 or Peneder, M., "Intangibles Investment and Human Resources. The new WIFO Taxonomy of Manufacturing Industries", WIFO Working Papers, no. 114, May 1999.

sectors, export unit value is higher than import unit value in 19 sectors (exceptions are apparel, basic metals and other transport); from 93 industries, in 69. Seen from the country perspective, 11 of the 14 countries have higher export unit values (in extra trade); the largest are for Germany, Italy, France, the United Kingdom and Austria.

Figure 3.4: Regional destination of exports and quality premium 1998 (bn ECU)



Source: WIFO calculations using EUROSTAT.

The premium comes from trade with non triad countries. Export unit values are twice as high as the import unit values in the trade with accession countries and are large in trade with emerging countries (see Figure 3.4). In trade with the USA, Europe has a surplus, but exports are priced 12% lower than imports. Half of this bilateral trade is in technology driven industries and the unit value of European exports is 40% 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 of the import unit value. This is due to the extreme concentration of Japanese exports on industries with high unit values (engineering industries). If we look into individual industries, the unit values of European exports are higher in 45 industries and specifically in technology driven and mainstream industries. However since these industries account for 80% of European imports from Japan, and only 55% of exports, the total unit value of imports is 12.1 ECU/kg (vs. 6.1 for exports).

Compared to 1988, the ratio of the unit values of exports divided by the unit values of imports for European manufacturing is lower in 1998, and hence the relative quality premium fell from 68% to 31%. This mirrors the catching up process, for example of the accession countries whose exports now total about half of Europe'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 more than Europe in bilateral trade. Europe has reduced a small part of its large gap in trade with Japan.

3.4 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 3.1 has illustrated this relation, as well as some interesting outliers[20]. Less favourable rankings in export unit value relative to GDP per capita are shown for Belgium, Denmark, Finland and the Netherlands, indicating the high share of capital intensive industries in these countries. Greece is in front of many accession countries and emerging economies in GDP per capita, which reflects its income from tourism, but is behind them in the unit value of exports[21]. Better positions according to export unit values are shown for Italy, Portugal, France and the United Kingdom, partly due to their higher share of non European exports (longer distance to the destination shifts trade to higher unit value positions). The performances of Portugal and Italy[22] have additionally been influenced by the intrinsically high unit values attributable to textile industries. For the UK and France, the high share of technology driven industries and engineering industries pushed up the unit values relative to GDP per capita.

For the USA and Japan, the unit value of exports ranks lower than GDP per capita. In 1998, Japan was among the top countries in GDP per capita, but placed only eighth in export unit value; the USA fell from third place to 16th in unit values between 1988 and 1998[23]. 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 bilateral trade with Europe the export unit values are both for the USA and Japan 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.

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[20] We used the same set of countries as in the next chapters. To the EU members, we added six accession countries, eight emerging countries, the USA and Japan. The country choice depended on the availability of unit value data at a disaggregated level. We use COMEXT for EU countries (total trade) and FTW (UN) for non-EU countries. The rank correlation coefficient between export unit values and GDP/head is R=0.47 which is significant at the 95% level.

[21] 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.

[22] If we exclude textile industries from the calculation of export unit values, then Italy and Portugal fall 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.

4. The importance of quality for specific industries

4.1. Quality as an exogenous characteristic and strategic result

The importance of quality competition differs 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 (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 taste or specific characteristics of demand. Product differentiation, however, is not necessarily an objective fact, unchangeable over time. It may for example be the result of a firm's strategy to prevent fierce price competition or of the attempts of an industry to remain competitive, facing the competition of a low cost supplier. The importance of this strategy will differ for countries and will change over time, increasing if the costs for an important input rise.

We split industries into those in which prices are important and into those in which non price factors (which we summarise as quality) are important. We develop a device with which we can classify industries once and for all, although we know 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 according to quality to factors expected to influence the competitive mode. Finally, we investigate whether the European Union and its member countries are specialised in quality intensive industries.

The method and first results

If prices are important in an industry, countries with high prices should 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 create a willingness to pay. We apply this simple idea to the existing trade data and split industries into three sectors: sector one, in which quality is revealed to play an important role (High RQE sector); sector two, with moderate price elasticity; and sector three, in which price dominates (low RQE sector). For the method applied, see Box 4.1.

[23] Unit values depend on the currency situation. However, the dollar/ECU relation was the same in 1988 and 1998. However, the low unit value for Japan in 1998 was influenced by the low value of the Yen in that year.

Box 4.1: Classifying industries according to Revealed Quality Elasticity (RQE)

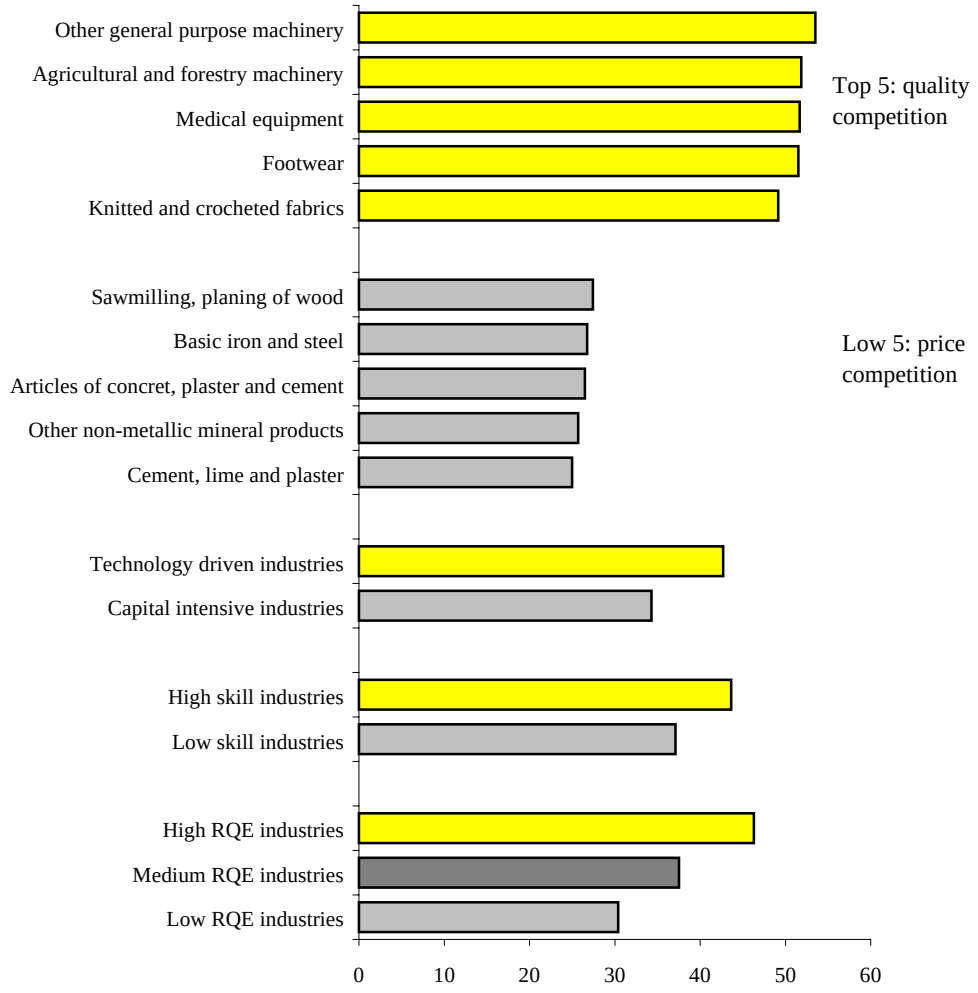
We use the following method to gain information about the relative role of quality and prices respectively. Industries in which higher prices (more exactly: higher unit values in exports relative to imports) are associated with lower quantities (more exactly: lower exported quantities relative to imported quantities) are revealed to be price elastic. Industries in which the signs of (net) prices and (net) quantities are the same are revealed to be quality elastic. The signs are calculated for the bilateral trade of the EU countries vis-à-vis thirty countries (including the EU partners, the USA, Japan, 8 emerging countries and 6 accession countries) in 1998. The share of identical signs indicates the importance of quality. The indicator can theoretically lie between 100 (all bilateral relations of prices and quantities have an identical sign) and 0 (all have opposite signs), empirically the indicator ranges from 53.5% to 25.0%.

The indicator is rather smooth in the sense that there seems to be no critical value separating different modes. We therefore group exactly one third of the industries into 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 into a price elastic group (called low RQE). The cut-off points are 42.3% for the difference between high and medium and 34.5% for the border between medium and low. The cut-off points are determined according to the symmetry in the number of industries in each category and have no intrinsic interpretation[24]. 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 characterize the competitive mode typical for all sales.

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

[24] In the unweighted average of industries, 38% of the signs are positive.

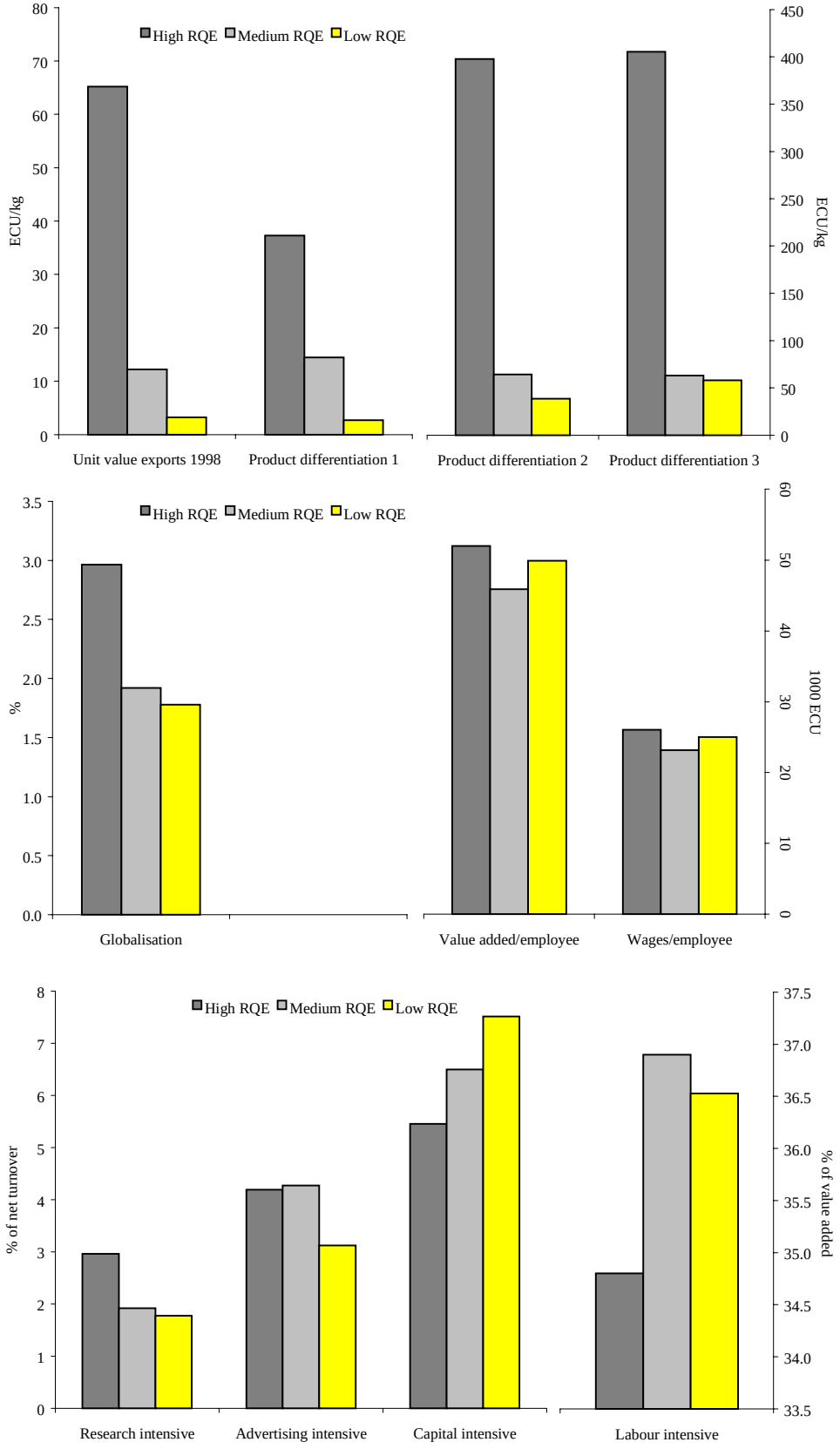
Figure 4.1: The importance of quality in different industries: Revealed Quality Elasticity (RQE)



Remark: RQE = Share of positive signs in bilateral relations between net prices and net qualities (1998, EU vs. 30 countries).
Source: WIFO calculations using EUROSTAT.

Many industries in which quality dominates are engineering industries like machinery, equipment, instruments, motor vehicles and other. Of the 11 technology driven industries, 8 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 apparatus and electronic components. The common characteristic of these three industries is that they have reached the phase of development in which the 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 the high globalisation rate and the rather low share of intra EU imports in these industries. Fourteen of the 23 *marketing driven* industries are revealed to be quality elastic, only four are revealed to be price elastic. Quality is revealed to be of greatest importance in footwear, games and toys, tobacco and watches.

Figure 4.2: Structural characteristics behind the competitive mode in quality sensitive and price sensitive industries



Product differentiation 1: Standard deviation of country exports (3 digit)
Product differentiation 2: Standard deviation of EU exports (total exports, 6 digit)
Product differentiation 3: Standard deviation of bilateral exports (3 digit)

Source: WIFO calculations using EUROSTAT.

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 11 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. Figure 4.2 shows that the highest labour intensity (share of wages & salaries in total value added) is in the medium RQE class.

A digression on processing in the textile industries

There is, however, a group of industries revealed by our device as quality dependant, which 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" find a position among the top ten, when ranked according to the quality indicator. These industries are characterised on the one hand 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. The high wage country exports some fraction of the (often capital intensive) input and makes use of cheap labour for reprocessing. 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. This phenomenon has been discussed earlier in an assessment of the qualitative competitiveness of accession countries in Wolfmayr-Schnitzer (1997).

4.3 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[25] to show whether the industries revealed as quality intensive fit these expectations.

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

The strongest correlation exists between RQE and the degree of product *sophistication*, as measured by unit value (see Figure 4.3). 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/kg, the figure for low RQE industries is 1.65 ECU/kg. The unit value is an indicator of the sophistication of the products. Significant is also the relation to *product differentiation:* 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[26].

Quality competition is also positively related to the degree of globalisation[27]; 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 classified ex ante as sensitive to Single Market Effects are dominated more by quality competition. Beverages and pharmaceuticals are highly differentiated and had 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 relation between quality competition and research and skill inputs exists, but is not significant[28]. 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 relation 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 ranked as price elastic[29].

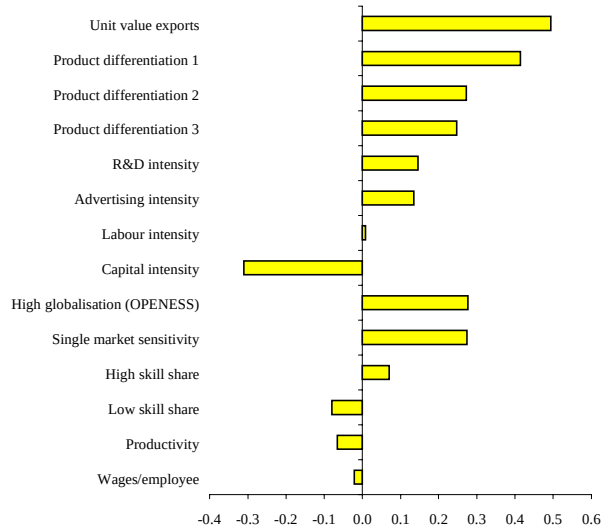
[26] Three types of variation were tested: the first indicator calculates the standard deviation of export unit values of each 3 digit industry for each of the 14 member countries (each country in industry i versus the world), this indicator represents the model according to which a country could be considered 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 calculates the standard deviation across products within an industry (products are 6 digit exports, if there are n six digit units in a three digit unit, it is 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 combines both aspects and calculates the standard deviation across countries and product groups (14 x 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.

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

[28] As far as research is concerned, we have already mentioned that audio video apparatus, 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 reprocessing, plays a leading role).

[29] Additionally the – possibly misleading – classification of some textile industries as high quality industries is preventing a closer relation, since the products are produced with cheap wages in low productivity plants.

Figure 4.3: Determinants of the importance of quality (RQE)



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

4.4 Europe's trade surplus comes from quality sensitive industries

The total trade surplus of the EU comes from the qualitative elastic sector. More exactly, the total trade surplus for the EU was 134 bn ECU in 1998. The sector of quality sensitive industries created a surplus of 149 bn ECU, trade in moderately price elastic industries was balanced. In price elastic industries, the EU suffered a trade deficit of 18 bn ECU. Thus, the surplus in quality competition covered the deficit of the price elastic industries and created a trade surplus (see Table 4.1).

The positions of the countries differs according to their individual income positions, competitive advantage and industry structures:

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 UK 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.

Table 4.1a: Shares of trade and trade balance according to competitive mode (RQE) 1998

	Exports				Imports				Trade balance (mio ECU)			
	High RQE	Medium RQE	Low RQE	Total exports (mio ECU)	High RQE	Medium RQE	Low RQE	Total imports (mio ECU)	High RQE	Medium RQE	Low RQE	Total balance
Belgium	43.5	24.0	32.5	144319.9	44.9	23.8	31.3	132341.9	3374.0	3145.5	5458.6	11978.0
Denmark	38.8	41.3	19.8	38034.4	38.1	31.5	30.4	37971.0	297.5	3760.8	-3995.0	63.3
Germany	55.2	23.0	21.9	428394.5	41.9	30.3	27.7	334146.3	96192.9	-3055.9	1111.1	94248.2
Greece	33.6	27.0	39.4	7875.6	46.4	27.0	26.6	21960.7	-7541.1	-3798.4	-2745.5	-14085.0
Spain	49.0	24.0	27.0	85139.9	48.1	23.8	28.1	97340.2	-5059.4	-2756.6	-4384.3	-12200.3
France	53.6	25.2	21.2	265606.0	47.1	27.2	25.8	252120.6	23573.5	-1491.0	-8597.0	13485.4
Italy	49.4	28.3	22.3	209015.6	43.2	24.8	31.9	168053.4	30686.8	17404.1	-7128.8	40962.2
Ireland	37.1	41.9	21.1	51866.1	35.1	44.2	20.7	33858.4	7341.8	6746.8	3919.2	18007.7
The Netherlands	32.5	40.2	27.3	150415.1	34.5	37.4	28.2	143542.9	-590.1	6790.3	672.0	6872.2
Austria	44.0	25.6	30.4	51001.4	43.8	28.0	28.2	57604.4	-2774.1	-3088.3	-740.7	-6603.0
Portugal	48.2	21.3	30.6	21548.7	47.2	27.3	25.4	30265.6	-3922.2	-3690.7	-1104.0	-8716.9
Finland	48.4	18.4	33.2	67367.4	40.8	30.3	28.9	52111.1	11380.7	-3400.2	7275.8	15256.3
Sweden	33.5	17.6	48.9	38207.9	40.1	32.4	27.5	25176.0	2678.8	-1420.3	11773.4	13031.9
United Kingdom	48.5	30.3	21.3	211349.7	43.9	30.3	25.8	249803.4	-7120.4	-11832.4	-19501.0	-38453.7
EU	48.2	27.1	24.7	1770142.2	43.0	29.1	27.8	1636295.8	148518.8	3313.8	-17986.1	133846.4

Table 4.1b: Shares of trade and trade balance according to competitive mode (RQE) 1988

	Exports				Imports				Trade balance (mio ECU)			
	High RQE	Medium RQE	Low RQE	Total exports (mio ECU)	High RQE	Medium RQE	Low RQE	Total imports (mio ECU)	High RQE	Medium RQE	Low RQE	Total balance
Belgium	38.0	27.9	34.1	70531.5	35.2	30.9	33.9	65223.2	3882.6	-518.4	1944.1	5308.3
Denmark	35.1	46.9	18.0	19677.3	32.3	33.4	34.3	20490.1	291.7	2388.9	-3493.4	-812.8
Germany	46.8	28.2	25.0	267083.1	35.5	32.5	31.9	181764.4	60300.3	16223.5	8794.8	85318.6
Greece	32.5	29.0	38.5	3521.0	34.4	38.6	27.0	9885.5	-2255.3	-2793.9	-1315.4	-6364.5
Spain	40.6	27.2	32.2	33269.7	41.0	31.0	28.0	41997.1	-3733.7	-3961.1	-1032.7	-8727.4
France	47.0	28.8	24.3	133406.7	39.3	32.8	27.9	145249.6	5481.6	-9221.3	-8103.3	-11842.9
Italy	46.1	30.8	23.2	107563.0	34.8	32.9	32.3	102578.2	13819.5	-623.0	-8211.7	4984.8
Ireland	29.5	52.7	17.8	15070.7	32.4	40.5	27.1	12216.0	490.7	2994.5	-630.5	2854.7
The Netherlands	28.3	40.3	31.4	77517.0	33.8	33.8	32.3	76863.5	-4027.1	5227.4	-546.8	653.5
Austria	34.5	26.8	38.7	23766.0	42.6	27.3	30.1	27665.4	-3592.4	-1182.8	875.8	-3899.4
Portugal	44.8	21.8	33.4	9211.0	45.3	30.5	24.2	13295.5	-1902.6	-2038.4	-143.5	-4084.5
Finland	37.7	23.8	38.5	36024.6	40.5	31.4	28.1	35434.9	-794.2	-2552.1	3935.9	589.7
Sweden	25.0	16.5	58.5	17800.9	42.6	29.4	27.9	15728.3	-2262.3	-1688.3	6023.2	2072.6
United Kingdom	42.2	33.4	24.4	98068.1	37.4	30.4	32.2	142093.6	-11764.6	-10505.9	-21754.9	-44025.4
EU	42.0	30.4	27.5	912510.4	37.0	32.1	30.9	890485.4	53934.2	-8250.8	-23658.4	22025.0

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).

Source: WIFO calculations using EUROSTAT.

Spain, Portugal, Austria and Greece have deficits in all three sectors, with the highest deficit in industries in which quality competition is important (Austria: 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 Finland has its largest surplus in

the price sensitive industries (pulp and paper), Sweden has its greatest surplus in the quality sensitive industries (telecom apparatus).

Increasing surplus, slightly converging structure

Between 1988 and 1998, Europe's overall trade surplus increased from 22 bn ECU to 134 bn ECU; The lion's share came from the increase in the surplus of the high RQE sector from 53.9 bn ECU to 148 bn ECU. 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 contributed to a decline in the country differences according to this indicator.

5. The competitiveness in the triade according to the competitive mode

We now 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 5.1). 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 vs. 2.8 for Japan and 11.7 for the US. Within this generally positive picture, there are two signs that the speed 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. Now, 48% of USA imports are in quality sensitive industries, while only 41% of European imports and 35.9% of the Japanese 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 of 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.[38] In general, the high shares of technology driven industries in the USA (see Figure 5.2), their high unit value and their increasing share in domestic demand, is the second contest for future competitiveness in the high quality sectors for Europe.

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[30] With the exception of Spain, where the shares are stable. Spain is the only country in which the HQS decreased; it could also cut its share of low quality exports, switching into the middle quality category. In 3 countries - the new members Sweden, Finland, and Austria- data on unit values and therefore on price position are not available for 1988.

[31] More exactly: the five top industries, in which the exports of a country are large and the countries position their exports specifically in the high quality segment (criteria: minimum net PPS of 30%). We report those industries which have a rather high export share: if the largest five in exports fulfil the criteria, these are listed; if not, we go down the scale for industries with lower export shares.

[32] The position of Ireland in the high price segment is far stronger than any effect which could come from transfer prices only.

[33] These are the rank correlations over the country positions in RQE and PPS; the rank correlation was higher in 1988, the rank correlations for the change between 1998 and 1988 is (insignificantly) negative (–0.22).

[34] Wages per capita in manufacturing are also positively related to the quality position of countries, but not significantly. Quality position and growth seem unrelated. The reason for this is that the low income countries are growing fast, but are positioned in the lower half of the quality ranking. Macro growth and increases in quality are related at least for the unit value indicator.

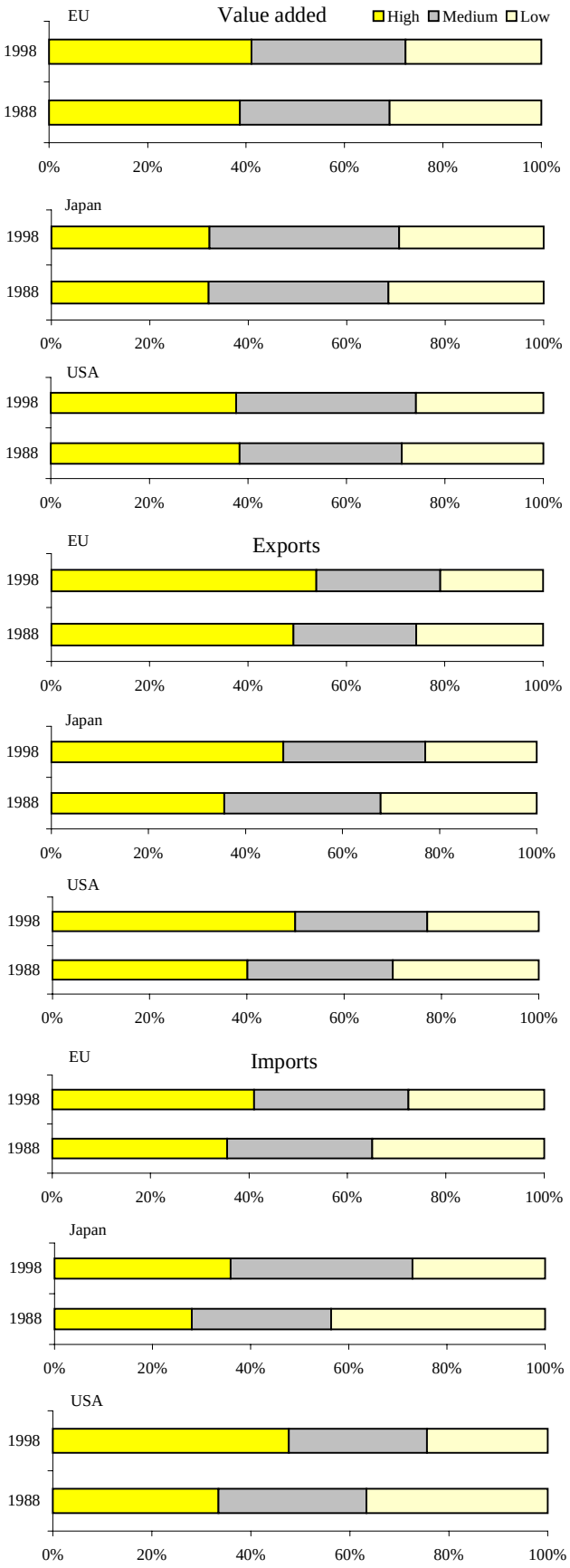
[35] All twelve correlations are positive (2 years, 2 indicators for regulation, three quality indicators) indicating that the results are not products of chance. All correlations are univarate rank correlation. We refrain from multivariate regressions sincefor most variables we cannot expect one sided causality

[36] One statistical explanation is that in large countries goods produced in the centre have a longer transport route to the border.

[37] A correlation with openness is insignificant. A slightly positive relation is revealed with venture capital activity, a slightly negative one with mergers, but all are so low and differ according to indicator that the results should not be interpreted. No correlation between quality position and speed of change is to be detected, since speed of change is high in some low income countries. Speed of change and change of quality position are correlated at least for the PPS indicator.

[38] The picture drawn by quality indicators therefor is more similar to that by skills

Figure 5.1: Share of quality sensitive industries (RQE) in the Triad

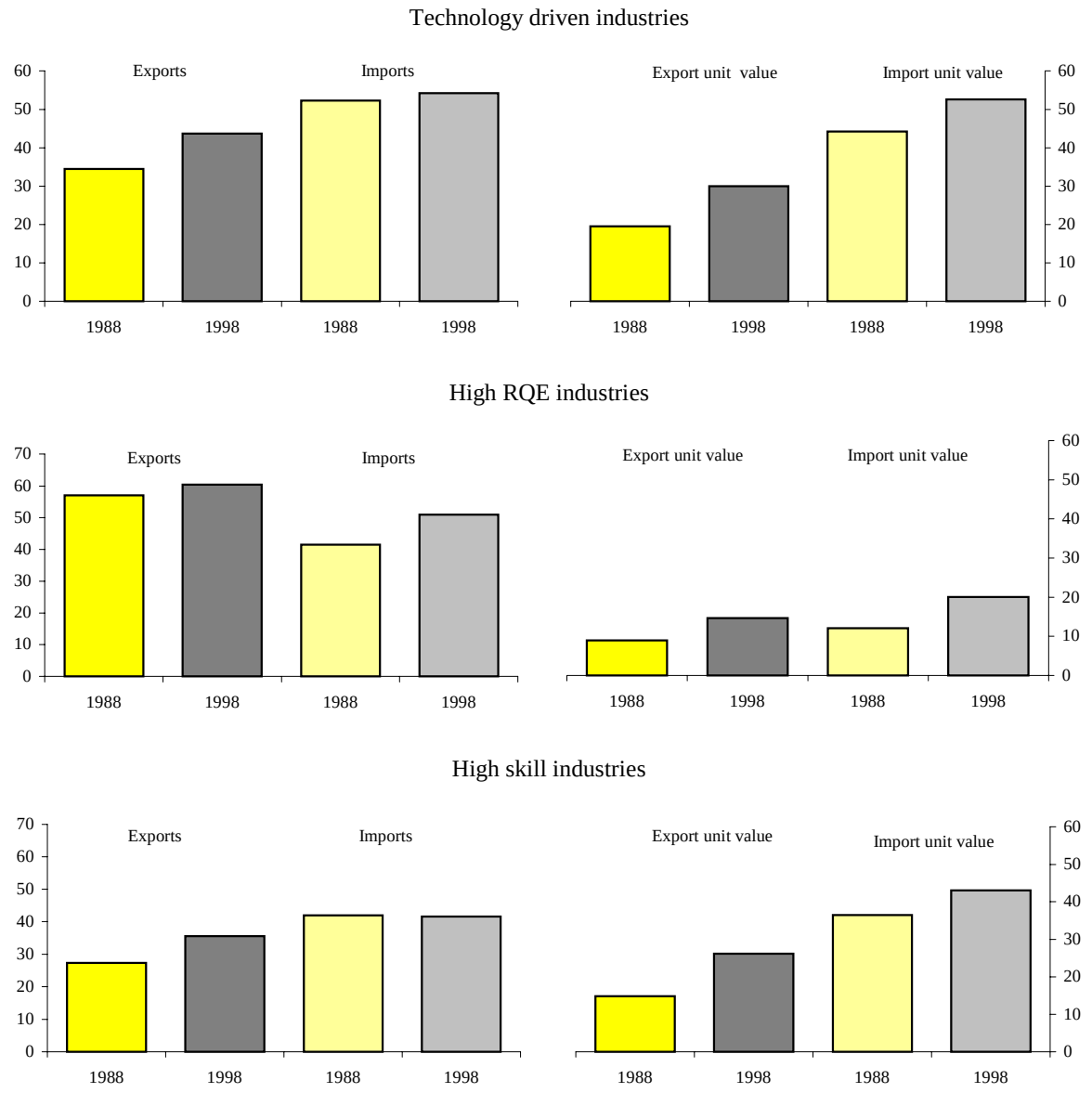


Remark: Value added data for USA, Japan for 1997

Source: WIFO calculations using EUROSTAT.

Figure 5.2: Bilateral trade Europe vs. the USA according to technology, quality sensitivity and skills

(shares of exports and imports; unit values in ECU/kg)



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 know on the other hand, that the quality of products comes 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 learn more about the position of countries in quality competition and which could be used to monitor the country position in climbing up the quality ladder.

Box 6.1: A set of indicators to monitor the quality position

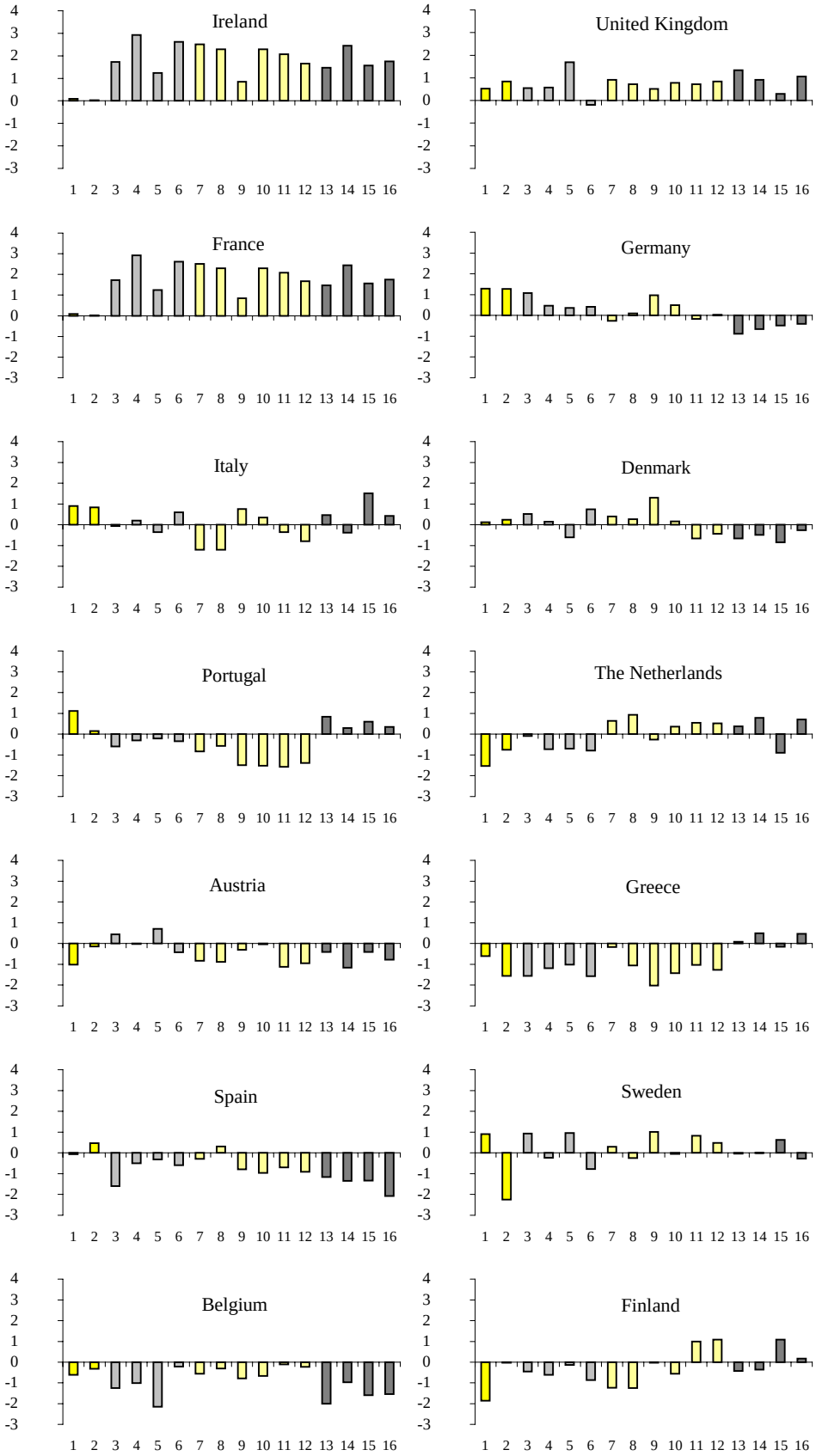
1. Share of quality intensive industries in value added (net RQE production)
2. Share of quality intensive industries in exports (net RQE exports)
3. Share of exports in high quality sectors of industries (PPS, net)
4. Export unit value (export UV)
5. Import unit value (import UV)
6. Relative unit value (export UV/Import UV)
7. Share of value added in sunk cost industries (technology + marketing driven)
8. Share of exports in sunk cost industries (technology + 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 contents of knowledge-based services
12. Share of exports in industries with high contents of knowledge-based services
13. Share of value added in industries with high product differentiation (PD)[39]
14. Share of exports in industries with high product differentiation (PD)[40]
15. Share of value added in globalised industries (Openness)
16. Share of exports in globalised industries (Openness)

The indicators in Box 6.1 highlight different aspects of quality. Indicators 1, 2, and 7 – 12 use industry classifications developed either in this report or in previous reports, to classify industries into categories, independent of the period and the country chosen. The change over time for these indicators reveals "inter-industry change" into 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 for problems connected to a single variable. Indicator 3 (net-PPS) reports shares of exports in the highest and lowest price segment within the 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 4-6 (these depend also on shares of industries). Indicators 13-16 highlight shares in industries with product differentiation and greater openness to trade; these structural facts describe the opportunity, respectively necessity to upgrade quality.

Some of the indicators are more closely related to each other, so 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 cancel out or differences in domestic demand and international competitiveness may be 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[41], even if these indicators themselves are weakly correlated. It fits best to the position in price segments (net-PPS), to the share of high skill industries and to quality sensitive industries[42], 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 close together.

[39] Standard deviation of exports of individual EU countries (3 digit level).
[40] Standard deviation of exports of individual EU countries (3 digit level).
[41] 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.
[42] Export unit values are closely related to "relative unit values" of course, which relate export unit values to import unit values.

Figure 6.1: Country profiles in quality positions 1998 (standardised indicators; Box 6.1)



Remark: 16 indicators (see Box 7.1); each indicator is standardised by substracting mean and dividing into the standard deviation. The indicators therefore show the relative position of the country to the EU average.

Source: WIFO calculations using EUROSTAT.

It would be technically possible to combine the information supplied by the sixteen country rating into a superranking for example by averaging the ranks over the indicators. We do not follow this approach first since looking at the detailed rankings informs better about sources, strengths and weaknesses in quality competition. We present the indicators in country profiles in Figure 6.1. Upward bars denote that a country is positioned better according to a specific indicator than the (unweighted average) of the other EU members. The indicators are standardised (by substracting the mean and correcting for different standard deviation across indicators) so that the length of the bars show the extend of the lead or lag and is also comparable between 1988 and 1998.

Ireland is above average in all 16 indicators, and takes the top position in 12 of the 16 indicators. Exceptions are the shares in quality sensitive industries reflecting the specialisation in price elastic technology driven industries and in high skill industries. The UK is also highly ranked 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 a little 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 up the quality ladder according to many indicators, still loosing 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 income per capita 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 intensive, 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 ranks in all indicators except skill and service inputs. Its excellent position in dynamic industries (see Chapter 5.4 and Figure 5.3) contributes only a too small proportion of manufacturing so far. Austria, which is third in GDP per capita, is around the 10th place in the quality indicators, where industry structure as well as the low share of technology driven industries 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 15 indicators between 1988 and 1998. The indicators where the standard deviation decreased were the 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 firstly highlights 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 becomes possible 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

(1) This report highlights the key significance of quality in competition. Europe can increase production and welfare only if it produces 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 decreased in Europe by liberalisation, deregulation, increasing the mobility of inputs and the efficiency of markets. Trade barriers have been removed and transaction costs will further decline in the Monetary Union. A pure cost reduction strategy has limits insofar, as beyond the pure elimination of inefficiencies within the systems, lower wages, less 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 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.

(2) We define quality as one or several additional characteristics of a good, which is valued by buyers. It can have different dimensions such as reliability, durability, compatibility, capacity, flexibility, or design. The characteristic added may be objective or subjective, physical or intangible. Important is the consequence that consumers are more willing to pay 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 to an unique price, since the market is differentiated according to 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 permanently. This is enabled by and enhances innovation, research, and physical and human investment, which are the engines of further growth. We define as quality competition an environment in which the competitive edge is not only defined by the price, but by the race for acquiring further characteristics of goods valued by the consumer or the firm using this product as an input.

Two main indicators of quality

(3) We use two main indicators to assess the position of Europe in quality production: the *unit value of exports,* and the share in industries in which *quality is important*. The first indicator is comprehensive in the sense that all the dimensions of quality mentioned, as well as shifts into higher valued, quality sensitive industries, will increase these indicators. The second indicator defines industries as *quality elastic,* if the price does not determine the exported quantity in bilateral trade, and as *price elastic,* if it does (a lower price leads to a higher quantity exported and v.v.). The share of a country in quality elastic industries minus the share of a country in price elastic industries provides an indicator of *Revealed Quality Elasticity* of a country (net RQE*).*

Differences in industry response to price and quality

(4) As expected, in technology driven as well as in high skill industries, price competition has been mitigated. There are notable exceptions for some high tech industries, which have shifted part of their production of maturing products to emerging countries. Capital intensive industries are very price sensitive in general, even if some countries with specialised, small- or medium-sized firms can compete in higher valued niches. The importance of quality competition to a specific industry relates closely with the level of sophistication of the product (measured by the unit value) and the degree of product differentiation. No unequivocal relation exists between the degree of quality competition and the wage level in industries or productivity, since quality increases with higher skills but decreases strongly with (physical) capital intensity. This highlights the fact that quality indicators are necessary complements to indicators of productivity (or per capita wages).

Climbing up the quality ladder

(5) Europe is a provider of medium and high quality products. The total trade surplus of the EU is created in quality sensitive industries; 50% of exports are in the upper price segment; the unit value of exports is higher than that of imports (creating a "quality premium"); for all of these three indicators, as well as for imports, the EU is climbing up the quality ladder, upgrading the quality of exports and, complementarily that of imports, as incomes grow. Additionally, the positions of the individual member countries relate to their income positions.

(6) There are large differences across countries: the unit value of exports ranges between 0.4 ECU/kg in Greece and 5.5 ECU/kg in Ireland; the share of quality sensitive industries ranges between 33.5% in Sweden and 55% in Germany; the share of exports in the highest price segment ranges between 25% in Spain and 78% in Ireland. The quality indicators relate to per capita GDP, but also give many additional insights not reflected in this overall measure of economic activity. The closest relation is between GDP per capita and the position in quality segments.

Differences in strategy and speed

(7) Germany is among the top three countries according to all three indicators, the United Kingdom follows close, France ranks among the upper half, with respect to all three indicators, while Greece, Belgium and the Netherlands are ranked lower. But other countries appear to choose between the strategy of shifting into less price elastic industries (inter-industry quality upgrade) or moving into higher price segments within industries (intra-industry quality upgrade). Ireland has the highest export unit value and is positioned in the highest price segment in all of its main exporting industries. However, it is also specialised in those technology driven industries in which prices are moderately or increasingly important - computer, audio & video apparatus and electronic components - achieving a medium rank according to the share of quality sensitive industries only. Spain, on the other hand, is still exporting in the low segments of many industries, but has attracted plants in the car industry, in which quality defines the competitive edge. Upgrading within industries is more pronounced in Sweden, Ireland, Austria, France, and Italy. Spain and Portugal are better ranked according to the size of their quality sensitive sectors, indicating an inter-industry quality strategy. The analysis show that countries with high growth and high speed of change can move at different speed in quality upgrading: Ireland moved into the highest quality segments, Greece switched between industries.

(8) The largest change over the past 10 years occurred in Ireland, which climbed to the first position in unit value and in the high price segment (and also in the share of technology driven, skill-intensive and knowledge-intensive industries). Sweden and Finland changed their industry structures quickly, but still achieves only medium positions in the quality ranking. Excellence in the telecom sector is not yet fully reflected in the data, and the share of the capital intensive sector is still large in production and exports. Italy shifted from an above average ranking to a middle position. Belgium lost ranks according to all three indicators and is positioned in the lowest third, The Netherlands and Greece still have a large share of capital intensive industries. The standard deviation of the country positions did decrease for the industry shares according to the competitive mode, but increased for the other indicators, indicating that there is no convergence in quality across European countries (this is confirmed by the extended set of indicators).

Europe is a provider of quality

(9) We can summarise the competitive strength of the EU with regard to quality by calculating a "quality premium". The unit value of European exports is 31% higher than its imports, giving Europe an additional export value in extra trade of about 160 bn ECU. The quality premium is defined as the difference between the reported export value and that which 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 UK and Austria.

(10) 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.

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

(12) Europe'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% of European production is in quality sensitive industries, three points more than in the USA and nine points more than in Japan. The same relation 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

(13) 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 relation goes in both directions: sophisticated inputs are needed for climbing up the quality ladder, and higher incomes then enable an intensification of research, education and the implementation of modern techniques. Successful competitors in quality export highly differentiated products and are actively engaged in globalised industries. These findings are used to construct an extended set of quality indicators.

(14) Each single indicator of quality can only highlight a few aspects of quality. We propose a comprehensive scheme of 16 indicators to monitor the position of countries in quality competition. Some of them refer to inputs used, some to characteristics of the market structure revealing the impact of quality. We apply typologies to monitor production shares additionally to export shares. These extensions provide a broader view of the quality position, and circumvent problems which may arise from the exclusive use of export data.

Quality competition directs policy efforts

(15) In a nutshell, the main result is that Europe is positioned as a provider of high quality; it upgrades quality continuously, as is needed by a high income country. However, the long run position in quality competition is contested 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 forced, and markets in general have to be made more efficient. Europe has lower shares of expenditures in research and information technologies, and in general a lower speed of change. These trends differ across countries and Europe is catching up or even forging ahead in some future oriented technological areas.

(16) Strategies to upgrade quality can focus on shifting into 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 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.

(17) Quality upgrading is important for all countries, since new competitors with lower costs are constantly arriving. This does not mean that the level of quality has to be the same for European 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 telecom. In general, the differences of the European countries with respect to quality competition have not decreased over the past 10 years hinting at a high potential for further upgrading in all countries.

Annex 1: 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 an 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.

High PPS is the share (of exports, imports, value added) in the highest price (=quality) segment; medium PPS, low PPS shares in medium, low price segment.

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 (Clusteranalysis, WIFO Typology 1).

Marketing driven industries: Industries with high input of advertising (Clusteranlalysis, WIFO Typology 1).

Sunk cost industries: Technology driven plus marketing driven industries.

BE:	Belgium	CZ:	Czech Republic
DK:	Denmark	HU:	Hungary
DE:	Germany	PL:	Poland
GR:	Greece	RO:	Romania
ES:	Spain	SL:	Slovenia
FR:	France	ET:	Estonia
IT:	Italy	KR:	Korea
IE:	Ireland	HK:	Hong Kong
NL:	Netherlands	MY:	Malaysia
AT:	Austria	SG:	Singapore
PT:	Portugal	TH:	Thailand
FI:	Finland	ID:	Indonesia
SE:	Sweden	CH:	China
UK:	United Kingdom		

Annex 2: Industries with top and low importance of quality

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

RQE: Revealed Quality Elasticity
Product differentiation 1: Standard deviation of exports of individual EU countries (3 digit level)

H = high RQE/product differentiation
M = medium RQE/product differentiation
L = low RQE/product differentiation

References

Abd-el-Rahman, K., Firms' competitive and national comparative advantages as joint determinants of trade composition, Weltwirtschaftliches Archiv, 127 (1), 1991, pp. 83–97.

Aiginger, K., The Use of unit values to discriminate between price and quality competition, Cambridge Journal of Economics, vol. 21, no.5, September 1997A, pp. 571-592.

Aiginger, K., A framework for evaluating the dynamic competitiveness of countries, Structural Change and Economic Dynamics, 1997B, pp. 159-188.

Aiginger, K., "Do industrial structures converge? A survey on the empirical literature on specialisation and concentration of industries", WIFO Working Papers, no.116, 1999.

Aiginger, K., Europe´s Position in Quality Competition. Working paper European Commission, DG Enterprise 2000

Aiginger, K., Country profiles in Manufacturing, EUROSTAT, 2000

Aiginger, K., Boeheim, M., Gugler, K., Pfaffermayr, M., Wolfmayr-Schnitzer, Y., "Specialisation and (geographic) concentration of European manufacturing", European Commission, DG 3, Working Paper no.1, Brussels, 1999.

Aiginger, K., Pfaffermayr, M., Product quality, cost asymmetry and the welfare loss of oligopoly, International Journal of the Economics of Business, vol. 6, no. 2, 1999, pp. 165-180.

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

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

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

Dixit, A.K., Stiglitz, J.E., Monopolistic competition and optimum product diversity, American Economic Review (67), 1977, 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 (45), 1992, 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, vol. 84 (1), March 1994, pp. 157-177.

Flam, H., Helpman, E., Vertical product differentiation and North- South trade, American Economic Review, 77 (5), 1987, pp. 810-822.

Fontagne, L., Freudenberg, M., "Intra-industry trade: methodological issues reconsidered", CEPII 97-1, 1997.

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", MIT Press, 1999.

Gabrisch, H., Segnana, L., "Trade structure and trade liberalisation", Institute for Economic Research, Halle, December 1999.

Gardiner, B., "Analysis of EU trade-price elasticities by sector and country", Cambridge, UK, 1998.

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

Ghemawat, P., "Resources and strategy: an industrial organisation perspective", mimeo, Harvard Business School, 1991.

Greenaway, D., Milner, Ch., "The economics of intra-industry trade", Blackwell, New York, 1986.

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

Greenaway, D., Hine, R.C., Milner, Ch., Vertical and horizontal intra-industry trade: a cross industry analysis for the United Kingdom, The Economic Journal, (105), 1995, pp. 1505-1518.

Grossman, G.M., Helpman, E., Quality ladders and product cycles, The Quarterly Journal of Economics, May 1991, pp. 557–586.

Grupp, H., Science, high technology and the competitiveness of EU countries, Cambridge Journal of Economics (19), 1995, pp. 209–223.

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

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

Helpman, E., The size of regions, in Pines, D., Sadka, E., and I. Zilcha (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., A model of innovation, technology transfer, and the world distribution of income, Journal of Political Economy (87), 1979a, pp. 253-266.

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

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

Krugman, P.R., "Rethinking International Trade", MIT Press, Cambridge, Mass., 1991c.

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

Krugman, P.R., Venables, A.J., Integration, specialisation, and adjustment, European Economic Review (40), 1996, 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 (10), 1980, pp.151-175.

Landesmann, M., Brugstaller, J., "Vertical product differentiation in EU markets: the relative position of east European producers", WIIW, Research Report 234.

Lankhuizen, M., Shifts in foreign trade, competitiveness and growth potential: form Baltics to "Bal-techs"?, Research Policy (29), 2000, pp. 9-29.

Lefler, K.B., Ambiguous changes in product quality, American Economic Review, vol. 72, 1982, 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 (46), 1998,pp. 183-203.

Muent, G., Grupp, H., "Changes in technological and trade specialisation among open economies", mimeo, 1996.

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

Nelson, R.R., Why do firms differ, and how does it matter?, Strategic Management Journal, vol. 12, 1991, pp. 61-74.

Nicoletti, G., Scarpetta, S., Boylaud, O., "Summary indicator of product market legislation with extension to employment protection legislation", Economics Department Working Paper no. 226, OECD, Paris, 1999

OECD, "The contribution of information and communication technologies to output growth", STI Working Paper, OECD, Paris, 1999.

OECD, "Science and technology scoreboard", OECD, Paris, 1999.

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

Peneder, M., "Intangibles Investment and Human Resources. The new WIFO Taxonomy of Manufacturing Industries", WIFO Working Papers, no. 114, May 1999.

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

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

Peteraf, M.A., The cornerstone of competitive advantage: a resource- based view, Strategic Management Journal, vol. 14, 1993, pp. 179-191.

Posner, M., International trade and technological change, Oxford Economic Papers(13), 1961, pp. 232-341.

Romer, P.M., Increasing returns and long-run growth, Journal of Political Economy(94), 1986, pp. 1002-1037.

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

Romer, P.M., "New goods, old theory and the welfare costs of trade restrictions", NBER Paper (4452), Cambridge, Mass., 1993.

Schulz, I., "Zum Qualitätsbegriff in der angewandten Sozial- und Wirtschaftsforschung, Wien, Februar 1999.

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

Taylor, S.M., Quality ladder and Ricardian Trade, Journal of International Economics)34), 1993, pp. 225–243.

Theil, H., Suhm, F.E., Meisner, J.F., The quality of consumption, International Consumption Comparisons, vol. 30, Studies in Managerial Economics, North Holland, 1981.

Torstensson, R.M., Growth, knowledge transfer and European integration, Applied Economics, vol. 31, pp. 97-106, 1999.

Venables, A.J., Equilibrium locations of vertically linked industries, International Economic Review (37), 1996, pp. 341-359.

Venables, A.J., " The international division of industries: clustering and comparative advantage in a multi-industry model", CEPR Discussion Paper (1961), 1998.

Vernon, R., International investment and international trade in the product cycle, The Quarterly Journal of Economics (80), 1966, 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", WIFO Working Papers, no. 120, 1999.

Yarrow, G.K., Welfare losses in oligopoly and monopolistic competition, Journal of Industrial Economics XXXIII (4), 1985, pp. 515-529.