

Ad Hoc Task Force on "Competitiveness and the Export Performance of the Euro Area"

Research Report

Competitiveness and the export performance of the euro area

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EUROPEAN CENTRAL BANK

NO. 30 / JUNE 2005

OCCASIONAL PAPER SERIES

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**COMPETITIVENESS
AND THE EXPORT
PERFORMANCE OF
THE EURO AREA**

by a Task Force of the
Monetary Policy Committee
of the European System of
Central Banks



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TASK FORCE OF THE MONETARY POLICY COMMITTEE OF THE EUROPEAN SYSTEM OF CENTRAL BANKS

This report was drafted by an ad hoc Task Force on “Competitiveness and the Export Performance of the Euro Area” of the Monetary Policy Committee (MPC) of the European System of Central Banks. The Task Force was chaired by Filippo di Mauro. The coordination and editing of the report was carried out by the Chairman and the Secretariat, Robert Anderton. The full list of members of the Task Force is follows:

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EXECUTIVE SUMMARY

MOTIVATION

Despite being a large and relatively closed economy in comparison to its individual member countries, the euro area economy is more open than other large economies. Its exports of goods and services to the rest of the world are equivalent to around 20% of nominal GDP compared with about 10% and 13% for the United States and Japan respectively. It might, therefore, be conjectured that one of the reasons for the weak growth recently observed in the euro area could be found in an unsatisfactory performance of exports. In turn, the latter might be presumed to result from the increasing role in international trade of new world players, which seems to have affected the export market shares of several developed economies, including some of the largest euro area countries. The motivation of this report is therefore to provide: (i) a comprehensive assessment of the export performance of the euro area and the euro area countries, both from a historical perspective and relative to major competitors; and (ii) a review of some of the factors underlying this performance, such as: price, technological and structural competitiveness; the product and geographical composition of euro area exports and world demand; as well as FDI activity and the related internationalisation of euro area production.

OVERALL ASSESSMENT

Following the entrance of new world players – most notably Asian emerging economies as well as new EU Member States – developed economies have lost export market shares since the early 1990s, at times substantially. In this respect, the losses for the euro area as a whole were smaller in comparison to the decline in export market shares experienced by some of its major competitors, namely the United States and particularly Japan. This may be surprising considering that this report finds that euro area exports are relatively more specialised in medium-tech products, where competition

from new low-cost entrants may be expected to be fiercer. The United States and Japan instead are comparatively more specialised in high-tech exports, which are intrinsically more dynamic. A number of factors have contributed to the relative resilience of the euro area export share. First, the growth of world demand for medium-tech products remained robust, while the relatively faster growth of demand for high-tech products, which boosted US exports during most of the 1990s, sharply decelerated in the early 2000s. Second, the export shares of the United States and Japan are relatively more exposed to competition from the dynamic Asian exporters – most notably China. Third, the loss of price competitiveness experienced by the euro area since the early 1990s was relatively modest, due partly to the large depreciation of the euro's exchange rate up to 2001. In this context, the profit-smoothing behaviour of exporters over time also limited the impact of the most recent euro appreciation on euro area competitiveness. Fourth, the losses in market shares experienced by some competitors seem to be the result of strategic choices concerning the localisation of production. In particular, Japan substantially increased the use of South-East Asian countries as export platforms to the rest of the world, a strategy which turned out to be export-diverting for Japan. By contrast, the outsourcing of production to the new EU Member States by countries such as Germany has been export-enhancing for the euro area. In this connection, it is important to bear in mind that, as production processes are undergoing substantial transformations associated with the internationalisation of manufacturing, export market shares as indicators of relative export performance across countries may become less meaningful.

The trends in euro area exports over this particular sample period should not be a cause for complacency, particularly as more recently the euro area has experienced losses in export market share. Furthermore, the medium-tech specialisation of the euro area might pose a risk for the future, particularly if the high-tech

sectors were to grow relatively faster and competition from new entrants in medium-tech products were to become fiercer, both in terms of costs and in terms of quality. In this respect, the euro area was found to be lagging its major competitors with regard to measures of technological and structural competitiveness. Some current individual country developments within the euro area may be foreshadowing the potential risks associated with euro area weakness in these areas.

Indeed, the export performance of the euro area is the outcome of some rather different developments at the country level. Germany, France and the Netherlands appear to have shaped the euro area export performance throughout the period, although German export performance has excelled relative to the others in recent years. The latter took place during a period of particularly weak domestic demand in Germany and is partly the result of a spillover of substantial FDI activity, particularly in the new EU Member States, as well as successful ongoing industrial restructuring. Meanwhile, some euro area countries are experiencing clear losses in market shares as a result of the product and market specialisation of their exports, as well as poor price and non-price competitiveness. A clear case is Italy, whose exports suffered from fierce and direct competition from both the new EU Member States and Asia, combined with weak technological competitiveness. By contrast, Spanish exports have been more dynamic than the average, favourably affected for a prolonged period by integration effects related to Spain's accession to the European Union as well as relatively low levels of export prices and labour costs compared with competitors.

Finally, the evidence provided by the report shows that price competitiveness and foreign demand can to a considerable extent explain export developments at the euro area level. This is however not always the case at the country level, where some of the other factors mentioned above also need to be taken into account to explain export developments.

In more detail, the report arrives at the following findings.

THE PRODUCT AND GEOGRAPHICAL COMPOSITION OF EURO AREA EXPORTS

The report finds that the geographical structure of euro area exports shows an “under-specialisation” in fast-growing markets (such as Asian markets) and a “specialisation” in European markets, which are growing relatively slowly with the exception of the new EU Member States. Also, and somewhat contrary to expectations, the specialisation of the euro area in medium-tech products, which account for almost half of euro area exports compared with a third for world exports, helped to support export performance as world demand in medium-tech sectors maintained a robust pace of growth. By contrast, the euro area was unable to capitalise fully on the relatively faster growth of world demand in the high-tech sectors over much of the sample period as high-tech products only represent about one-fifth of euro area exports, compared with almost one-third of world exports. At the same time, euro area exporters benefited from being less exposed to the volatility of the high-tech sector associated with the technology boom and bust of the second half of the 1990s and early 2000s.

TECHNOLOGICAL AND STRUCTURAL COMPETITIVENESS

Among other factors affecting export performance, technological and structural competitiveness are frequently mentioned in the literature. Somewhat surprisingly, such indicators appear to have had only a limited impact in the case of the euro area, despite the report's findings that the euro area seems to underperform relative to major competitors according to these measures of competitiveness. The report analyses only a small sub-set of such indicators, but the results are rather coherent across the different measures. Regarding technological competitiveness, R&D intensity in total manufacturing in the United States and

Japan is about 50% higher than in the euro area. Both patenting and R&D data show that most of the euro area's innovation occurs in medium-technology-intensive sectors, while the share of the high-tech sectors is substantially below that of the United States and Japan. With respect to structural competitiveness, the report looks at two indicators, i.e. educational attainment and the business environment. Although the information content of these indicators might be questioned as they might suffer from comparability problems and may reflect purely subjective judgements as some are based on surveys, both seem to indicate that the euro area is on average in a less favourable position than its main competitors. Labour regulations and relatively heavy taxation, both of households and businesses, are identified as the prime source of disadvantage, inhibiting technological innovation and ultimately possibly hurting export performance. However, further research is needed in order to investigate the link between structural competitiveness and export performance.

To some extent, the relative stability of euro area exports – despite the euro area's underperformance in technological and structural competitiveness – is due to the specific developments over the chosen sample period, particularly the robust and stable world demand for medium-tech products in contrast to the stronger, but more volatile, growth in the high-tech export market. If the world demand for high-tech products had continued to grow as rapidly as in the mid-to-late 1990s, the export share of the euro area may have declined more rapidly in recent years. Accordingly, looking forward, the product composition of euro area exports could be a future source of weakness particularly as new world players such as China seem to be catching-up with the euro area in terms of product sophistication and may pose a serious threat to market share in the coming years.

FDI AND TRADE

The report attributes a critical role to FDI (foreign direct investment) activity and related economic phenomena in explaining euro area

export developments, particularly for some individual euro area countries. In order to understand how FDI by multinational enterprises affects trade dynamics and ultimately export performance, outward FDI is divided into two broad categories. The first, “horizontal” FDI, is in other developed economies – largely in the form of Mergers and Acquisitions (M&As) – and is partly driven by the desire of euro area firms to absorb and acquire new technologies, most notably in the United States. These strategic M&As are identified as possibly making up for the slack in the technological competitiveness of euro area exports mentioned previously, although the evidence on whether this type of FDI is actually trade-enhancing is mixed. The second category is “vertical” FDI, such as in new EU Member States, which is mostly aimed at exploiting low labour costs through the internationalisation of production. Here, the impact on trade is more direct and it is positive. It has mostly involved Austrian, Dutch and particularly German firms, which have shifted some parts of the production process to the new EU Member States and now import intermediate manufacturing goods from these countries, while exports have also benefited. The counterpart of higher euro area trade with the new EU Member States (as yet external to the euro area) has been a decline in the share in intra-euro area trade of some euro area countries. A second impact is that extending the chain of production internationally implies that euro area exports have become more reliant on imported inputs, which is consistent with the increase in the import content of euro area exports from around 38% in 1995 to 44% in 2000, therefore lowering the value added per export unit. While finding evidence of this latter phenomenon across the euro area countries, the report concludes that the value added in the export industry remains relatively high. Finally, FDI inflows into the euro area are an additional source for enhancing the euro area's export performance. An important example of such activities are the FDI flows to Ireland, largely undertaken to create an export platform to reach third markets.

POSSIBLE RISKS

Complacency regarding euro area exports should be avoided as the more recent and ongoing significant losses in euro area export market share, combined with divergences in export performance across the euro area countries, suggest that exports remain vulnerable. In particular, the recent strong export growth of Germany has been offset by a rather weak export performance by some of the other euro area countries. Looking forward, the under-specialisation of the euro area in the potentially faster-growing high-tech sectors represents a possible risk of future export underperformance. From this perspective, and bearing in mind its well-known structural rigidities, the key question is whether the euro area can in the future move rapidly and flexibly towards sectors which are expanding in terms of both exports and innovation. As regards FDI and outsourcing, although these have helped to foster the euro area's export performance, this may not necessarily continue to be the case in the future. In particular, the outsourcing process related to vertical FDI may represent an eventual future source of weakness for euro area trade, should the Japanese experience of transferring larger shares of manufacturing abroad, and the associated declines in export share, represent the way forward. However, under this scenario, euro area GNP may be enhanced once the earnings from those investments and the senior staff employed abroad in connection with the subsidiaries and affiliates are taken into account. Although there may be significant adjustment costs in the short run, the overall welfare implications of a process that reallocates internationally the production of goods and services should be beneficial in the longer run, given that production is assumed to move according to comparative advantages.

POLICY

Against the background of rapid changes in the structure of both euro area exports and world trade, various aspects of export developments

need to be closely monitored within the economic analysis underlying the ECB's assessment of price stability over the medium term, particularly given the more recent deterioration in export performance suggested by the decline in export market share since 2002. In this context, the findings of the report provide policy-makers with critical inputs regarding: (i) issues related to the product and geographical specialisation of euro area exports; (ii) divergences in export performance across the euro area countries due to differences in price as well as technological and structural competitiveness; and (iii) changes in the relationships between exports, imports and domestic activity resulting from outsourcing and the internationalisation of production.

Finally, the report indicates that further structural reforms in the labour and product markets of the euro area countries are necessary in order to cope with the challenges arising from globalisation and to speed up the adjustment process, thereby enhancing the ability of euro area firms to move flexibly towards expanding sectors, as well as helping to contain cost pressures and improve competitiveness. The globalisation of production is already having an impact on cost developments in the euro area, although with differences across countries, and the growth and price impacts of this transition phase need to be carefully observed.

STRUCTURE OF THE REPORT

Chapter 1 provides an overview and assessment of the price competitiveness and export performance of the euro area and the larger euro area countries, as well as an evaluation of how standard equations have been able to explain actual export developments. Chapter 2 carries out a constant market share analysis for the euro area and thereby sheds light on the reasons for movements in aggregate export market shares by looking at the sectoral and geographical composition of euro area exports. Chapter 3 looks at the evolution of the

technological competitiveness of the euro area and major competitors – proxied by patenting activity and R&D expenditure – and analyses some structural indicators of competitiveness using survey data. Chapter 4 then looks at the impact of FDI on competitiveness and export performance. Finally, Chapter 5 summarises the main findings of the report, but also critically evaluates their importance and implications.



I EURO AREA EXPORT PERFORMANCE AND PRICE COMPETITIVENESS¹

I.1 INTRODUCTION

The aim of this chapter is to provide an overview of recent developments in the export performance and price competitiveness of the euro area. While gauging the export performance of the euro area against the benchmark of major competitors, we assess the extent to which price competitiveness and foreign demand explain export behaviour, or whether other factors, broadly defined as non-price competitiveness, should also be taken into account. An analysis for the five largest euro area countries is also carried out in order to provide an indication of divergences in export performance across the individual euro area countries.

I.2 THE EURO AREA AND ITS MAJOR COMPETITORS

I.2.1 EXPORT MARKET SHARES FOR THE EURO AREA AND MAJOR COMPETITORS

Taking into account “third-market effects”², the three major export competitors of the euro area are the United States, the United Kingdom and Japan.³ In order to ascertain how the euro area has performed with respect to these main competitors we look at the relative evolution of its export market share.

Measuring market shares is not a straightforward task, since a number of different indicators can be used, each measure having its own merits and, therefore, deserving some analysis. For example, developments in export shares expressed in volume terms may have a bearing on real GDP growth and can be expected to react directly to changes in price competitiveness. Meanwhile, developments in export shares in value terms contain information about the potential import “buying power” of an economy and can stem from changes either in export volumes or in relative prices. In this chapter the analysis is mostly restricted to developments in market shares in

volume terms, while later in the report we will look at export shares in terms of values due to their availability at a more detailed level (Box 1 at the end of this chapter describes the various concepts of export market share used in this report). Moreover, the market share can be computed as a total indicator (i.e. the share of a country’s exports in the total market for exports⁴), or as an indicator that weights the geographical export markets according to their importance in the exports of the country under analysis.⁵ Therefore, the latter measure is the one that will mostly be used in this chapter⁶, while Chapter 2 uses the total measure in order to evaluate the impact of the geographical and product composition of exports on market share.

Overall, when compared with its major competitors, the euro area accounts for the largest share of world exports and has experienced a relatively smaller decline in export market share since the early 1990s. Chart 1 shows the shares of world exports in terms of both values and volumes for the euro area and major competitors. In value terms, the euro area accounted for 23% of world exports of goods and services in 2003, followed by the United States (14%), Japan (8%), and the

1 By Filippo di Mauro and Laurent Maurin, with contributions from Thomas Warmedinger.

2 Third-market effects capture the competition faced by euro area exporters in foreign markets by exporters from third countries.

3 The weights in the nominal effective exchange rate (EER) of the euro capture the effect of competition in third markets. The EER-23 index, which is based on 23 partner countries, shows that the United States, the United Kingdom and Japan have the largest weights of 26.19, 19.18 and 11.45 respectively. Meanwhile, China has the fourth largest weight of 6.93. These weights were published in the September 2004 issue of the ECB’s Monthly Bulletin.

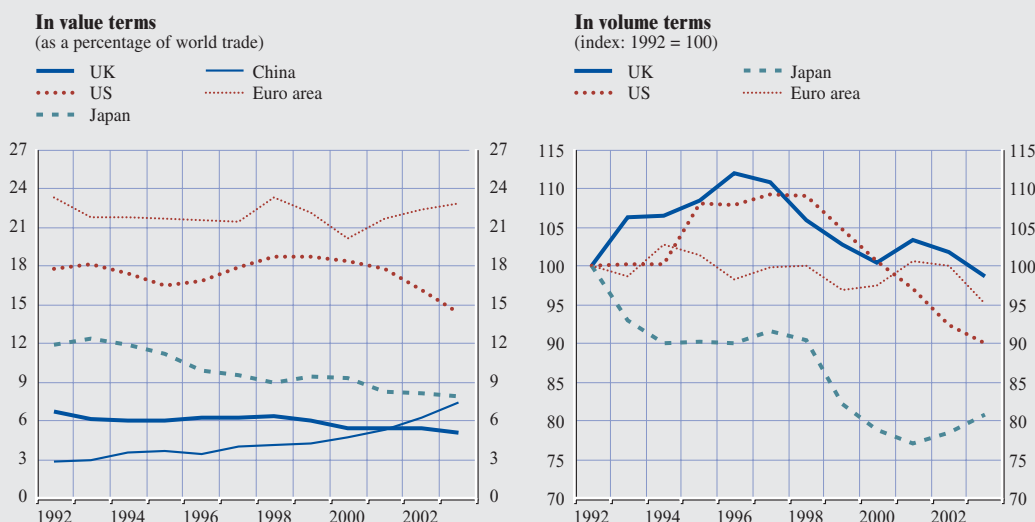
4 In the case of a large country, the total market for exports is usually taken to be equal to the world imports (or exports) minus the country’s imports.

5 Chapter 5 discusses some of the limits of export market share as an indicator of export performance.

6 In practice, this measure is proxied by a ratio of the country’s exports to a weighted average of imports of its main destination markets, i.e. only the geographical composition of exports is taken into account.

Chart I Export market shares

(annual data)



Source: ECB computations based on IMF Direction of Trade Statistics and Eurostat External Trade Statistics.

Note: The chart in value terms refers to trade in goods in US dollars at current prices; world trade is defined as half the sum of total imports plus exports net of euro area countries' imports, and includes trade related to oil. For the United States, the United Kingdom and Japan, the chart in volume terms is based on national accounts data (goods and services), while for the euro area it is based on external trade statistics (goods). Foreign demand is based on ECB computations (where foreign demand is defined as a country-specific export-weighted sum of foreign import volumes of goods and services).

United Kingdom (5%).⁷ In terms of the evolution of market shares over time, the main trends are broadly similar regardless of whether they are expressed in terms of values or volumes.⁸ Regarding the euro area, its market share (in extra-euro area markets) has remained relatively stable over time, displaying only a small decline over the period 1992-2003 (see also Annex I, Table 3), although its export volume share fell rapidly at the end of the sample period due to the appreciation of the euro that started in 2002. The US market share instead rose over most of the 1990s, but experienced losses at the end of the 1990s and in the early 2000s which more than offset the initial gains. Japan's market share fell rather rapidly in terms of both values and volumes, which may be related to the relocation of part of Japan's production facilities to other Asian countries. Finally, the United Kingdom experienced a marginal decline in its share over the whole period, which was more pronounced during the late 1990s.

1.2.2 PRICE COMPETITIVENESS

Price competitiveness is a major determinant of export market shares. In this report we measure it mostly using relative export prices⁹, although alternative measures are considered briefly later in this section.

Looking first at the comparison with competitors, price competitiveness developments were overall

⁷ These figures are computed on the basis of IMF and Eurostat data. IMF Direction of Trade Statistics (DOTS) provide figures for the total exports of each country in dollar terms. In order to take out intra-euro area exports from both world exports and euro area exports, Eurostat External Trade Statistics (ETS) have been used. Note that because trade data in value terms are expressed in US dollars, developments in market shares are mechanically influenced by changes in the USD exchange rate (see Chapter 2 on this issue).

⁸ We stress that only the main trends are broadly similar as export shares in values and volumes can differ for a variety of reasons. For example, export shares expressed in value terms may respond somewhat differently to movements in exchange rates in comparison to shares expressed in volume terms.

⁹ In this section, relative export prices are defined as the ratio of a weighted sum of competitor export prices to domestic export prices (with both terms expressed in domestic currency). Therefore, an increase in relative export prices represents a gain in price competitiveness, which should result in a gain in export market share according to the traditional view of trade.

somewhat unfavourable for the euro area over the 1992-2003 period (see Chart 2, left panel). This is surprising considering that the 30% depreciation of the euro between 1992 and 2000 could have potentially translated into a gain in relative price competitiveness, while conversely the most recent euro appreciation had a negative impact (see Chart 2, right panel).

In turn, the United States experienced a large loss in relative price competitiveness between 1995 and 2001 in line with the 20% dollar appreciation over that period, followed by a partial reversal of these losses as the dollar depreciated between 2001 and 2003. As was the case for the euro area, exchange rate developments in Japan did not appear to be reflected in relative export prices, as the latter improved substantially in the period 1992-2003 despite the significant yen appreciation (Chart 2; right panel). Note that during part of this period the Japanese economy experienced deflation. Changes in relative export prices are also affected by the product composition of exports relative to competitors and, as we will see in Chapter 2, Japan is relatively more specialised in high-tech products where prices

might be falling in some sectors. Overall, excluding Japan, price competitiveness did not exhibit any major trends over the sample period for the euro area and its main competitors, although for the euro area and Japan developments in competitiveness appeared to be somewhat decoupled from movements in exchange rates.

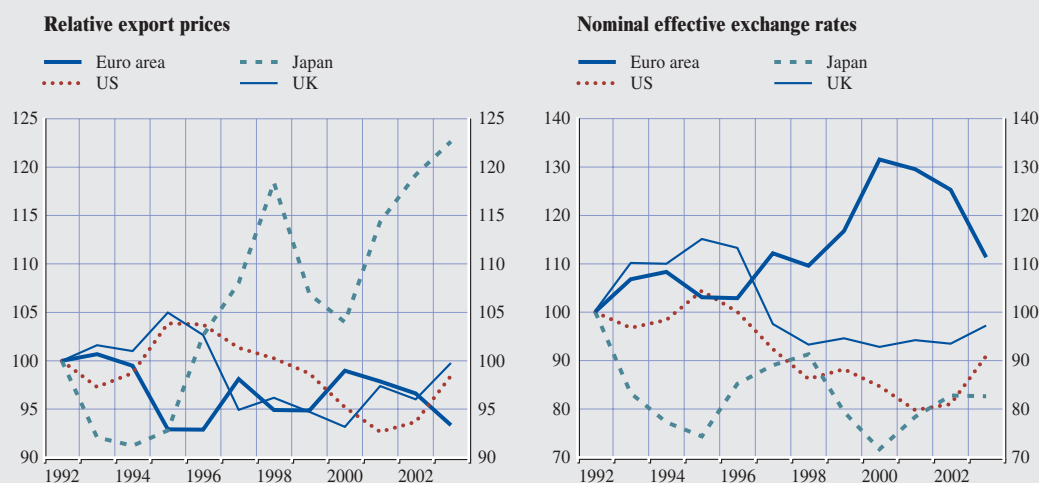
Movements in the price competitiveness of the euro area can be more clearly understood if we look at the various components of the relative export price as well as alternative measures of competitiveness (Chart 3). The left-hand panel of Chart 3 clearly shows that the potential gains in euro area price competitiveness resulting from the 30% depreciation of the euro in the period 1992-2000 were largely offset by the rapid increase in euro area export prices, which roughly matched the rise in competitors' export prices in euro terms.¹⁰

As the euro appreciated, euro area export prices only partially followed declining competitor

¹⁰ Although competitors' prices in foreign currency hardly rose over this period, they substantially increased in euro terms due to the depreciation of the euro.

Chart 2 Price competitiveness and exchange rates

(index: 1992 = 100; annual data; in euro)

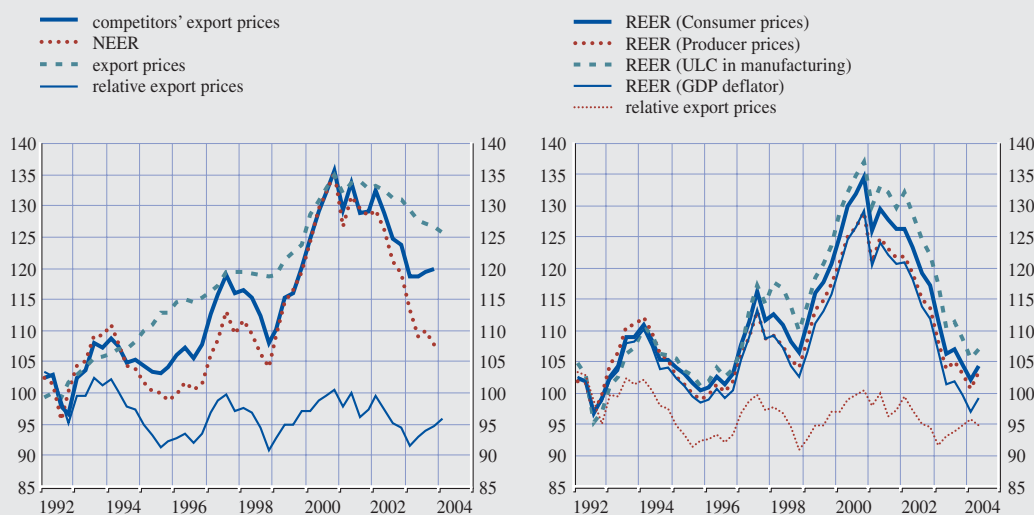


Source: ECB computations based on IMF and Eurostat data.

Note: An increase in the series represents a gain in relative export price competitiveness or a depreciation of the exchange rate. The nominal effective exchange rate of the euro refers to the official "narrow" index (12 trade partners).

Chart 3 Price competitiveness: determinants and alternative measures

(index: 1992=100; quarterly data; in euro)



Source: ECB computations based on IMF and Eurostat data.

Note: Export prices refer to extra-euro area exports of goods. Relative export prices equal competitors' export prices divided by extra-euro area export prices (an increase reflects a gain in price competitiveness). NEER is the nominal effective exchange rate of the euro with an inverted scale (i.e. an increase indicates a depreciation of the euro). Data used for relative export prices are identical to those in Chart 2 apart from the different frequency and length of period.

prices resulting in a loss in euro area price competitiveness in the period 2001-04. Some of the behaviour of euro area export prices over the sample period can be explained by changes in profit margins. As shown in Chart 3 (right panel), while export competitiveness worsened between 1992 and 2000 if measured by relative export prices, it actually improved if proxied by other indicators, such as relative unit labour costs. Accordingly, the considerable rise in euro area export prices in the period 1992-2000 and the associated lack of improvement in the euro area's relative export prices were mostly due to increases in euro area export profit margins rather than rising costs.¹¹ By contrast, the exchange rate pass-through to price competitiveness for competitors appears to have been relatively closer to unity.¹²

1.2.3 RELATIVE EXPORT PRICES AND REAL EXPORT MARKET SHARES

In basic models of trade, changes in relative export prices and foreign demand are the main variables usually used to explain changes in export volumes. This section takes a closer look at the explanatory power of these two

variables by investigating the relationship between relative export prices and real export market shares. We find that, overall, there is a strong positive relationship between movements in these two series, while other factors might also help to explain movements in market share at particular points in time.

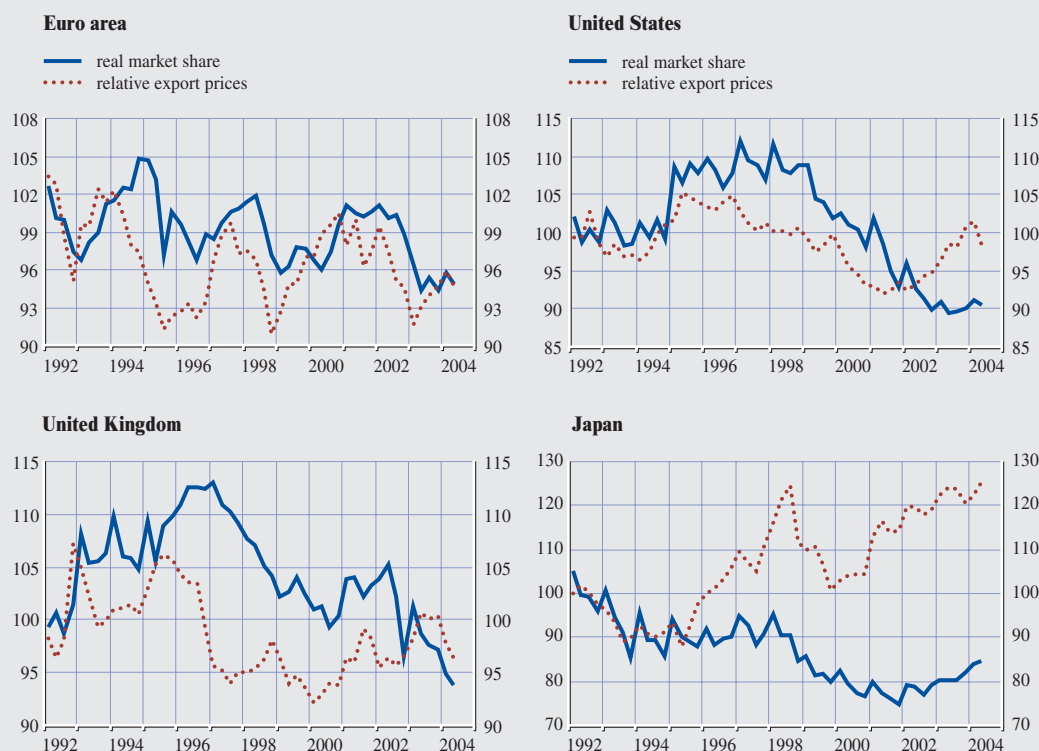
Chart 4 shows the relationship between relative export prices and real market shares for the period 1992-2003 for the euro area and its major competitors. After allowing for lagged responses, it seems that, as expected, relative export prices correlate positively with export market shares for the euro area and the United States, and to a lesser extent for the United Kingdom, although the relationship may not be

11 See Anderton, di Mauro and Moneta (2004) for a detailed description of euro area export price determination and the variation of export profit margins, which shows that the exchange rate pass-through to extra-euro area export prices is approximately 50%.

12 Spencer (1984) reports the close-to-unity exchange rate pass-through for US export prices which is attributed to the high degree of monopoly power of large-country exporters such as the United States. In addition, the pass-through may be higher for US companies as they tend to invoice their exports in dollars.

Chart 4 Export market share (in volume terms) and price competitiveness

(index: 1992 = 100; quarterly data; seasonally adjusted)



Source: Eurostat: External Trade Statistics and national accounts; ECB.

Note: Relative export prices equal a weighted average of competitor export prices divided by domestic export prices (an increase reflects a gain in price competitiveness). The real export market share is derived as the volume of exports divided by a weighted average of import volumes for major trading partners. Foreign demand and competitors' export prices are computed by the ECB.

stable over time. In particular, despite the significant loss in US price competitiveness in the period 1995-2001, the US export market share remained remarkably stable in the period 1995-99, although it eventually declined quite significantly from late 1999 onwards. Similarly, the US export market share also seemed to be somewhat unresponsive to the substantial US gain in price competitiveness in the period 2001-03. Likewise, the corresponding delayed response to the loss in euro area price competitiveness over the same period is also puzzling. In addition, the United Kingdom lost export market share in the period 2002-03 despite the significant gains in price competitiveness that began in 2000. As we shall see in subsequent chapters, some of these

puzzling developments – particularly for the United States – may be partly related to the product composition of world demand and differences in the export product specialisation of different economies.

A very interesting case in this regard is Japan, where considerable losses in export market share took place in spite of strong gains in competitiveness measured by relative export prices. Besides the fact that this relative price indicator might be influenced by differences in the product composition of exports, structural factors – most notably the outsourcing of production by Japan to other Asian countries which are then used as export platforms for Japanese companies – seem to be partly behind

the losses in export share.¹³ Under these circumstances, where production processes are undergoing substantial transformations associated with outsourcing and the internationalisation of production, export market shares as indicators of export performance are less meaningful.

1.3 THE EURO AREA AND ITS FIVE LARGEST ECONOMIES

Although the analysis for the euro area as a whole in the previous section was done only for extra-euro area exports, when it comes to individual euro area countries their export performance is a combination of developments in both intra and extra-euro area markets. Therefore, this section mainly focuses on total (i.e. intra plus extra) export behaviour, although mention will also be made of the behaviour of extra-euro area exports at the country level. The country analysis provides information about both heterogeneities in the export performance across individual countries as well as cross-country differences in the ability of price competitiveness and foreign demand to explain export performance.

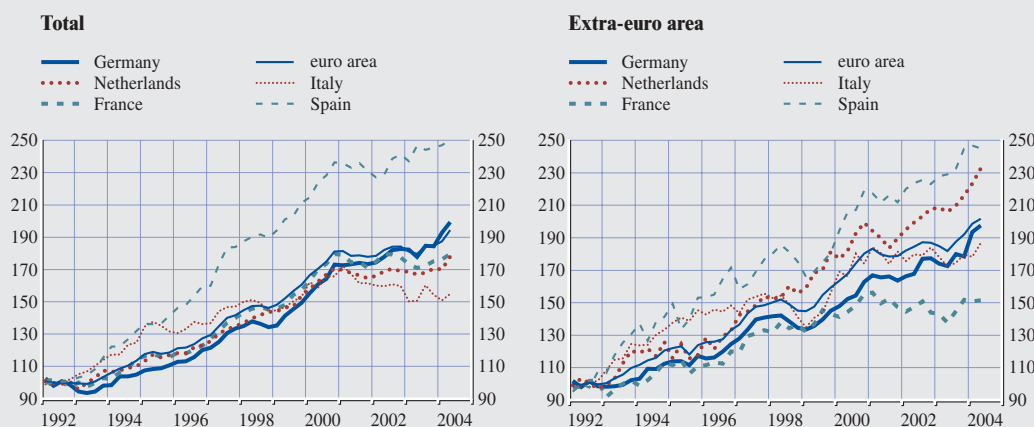
1.3.1 TOTAL EXPORTS, EXTRA-EURO AREA EXPORTS AND EMU

Chart 5 shows that for the euro area as a whole, during the entire period, movements in extra-euro area exports were similar to total exports (i.e. including intra-area trade). This implies that the growth rates of intra and extra-euro area exports have been similar both before and after the establishment of Economic and Monetary Union (EMU). Overall, exports almost doubled between the early 1990s and 2000, to broadly stabilise thereafter, due to both the slowdown in world trade and subsequently the appreciation of the euro.

13 Japan consistently lost export market share in the 1990s. For example, Japan's share of the US electronics market fell from 33% in 1990 to just 12% by 2001 (Loy, 2002). Evidence suggests that this reflects the success of Japanese Multinational Corporations (MNCs) in setting up production bases in Asia – to take advantage of low costs and differences in relative factor endowments – and then using these countries as export platforms to third markets. This hypothesis is supported by Fung (2004) who shows that Japanese MNCs exported 21.3% of their total sales in China and Hong Kong to third markets and 26.5% for Asia as a whole. Lipsey (1999) provides similar supporting evidence. Meanwhile, Bayoumi and Lipworth (1997) provide a more general description of changes in the structure of Japanese exports and imports.

Chart 5 Export volumes

(index: 1992=100; quarterly data; seasonally adjusted)



Source: Eurostat.

Note: Total exports refer to goods and services as recorded in national accounts statistics. Extra-euro area exports refer to goods only as recorded in External Trade Statistics.

By contrast, at the country level, export performance was quite different for total exports in comparison to extra-euro area exports (Chart 5). Interestingly, since around the time of EMU, the disparities between total and extra-area export growth across most of the five largest euro area countries have increased.¹⁴ For Germany, Italy and the Netherlands, since the late 1990s exports to destinations outside the euro area have grown faster than their total exports. The opposite occurred for France. Meanwhile, the relatively low total export growth for Italy after the launch of the euro was mainly due to weak export growth within the euro area, partly related to gains in euro area market penetration by new EU Member States. For Spain, total and extra-euro area exports increased at similar rates since the early 1990s and at a much stronger pace than

for the other large euro area countries, probably due to both the trade benefits of EU membership and the depreciation of the peseta at the beginning of the 1990s.

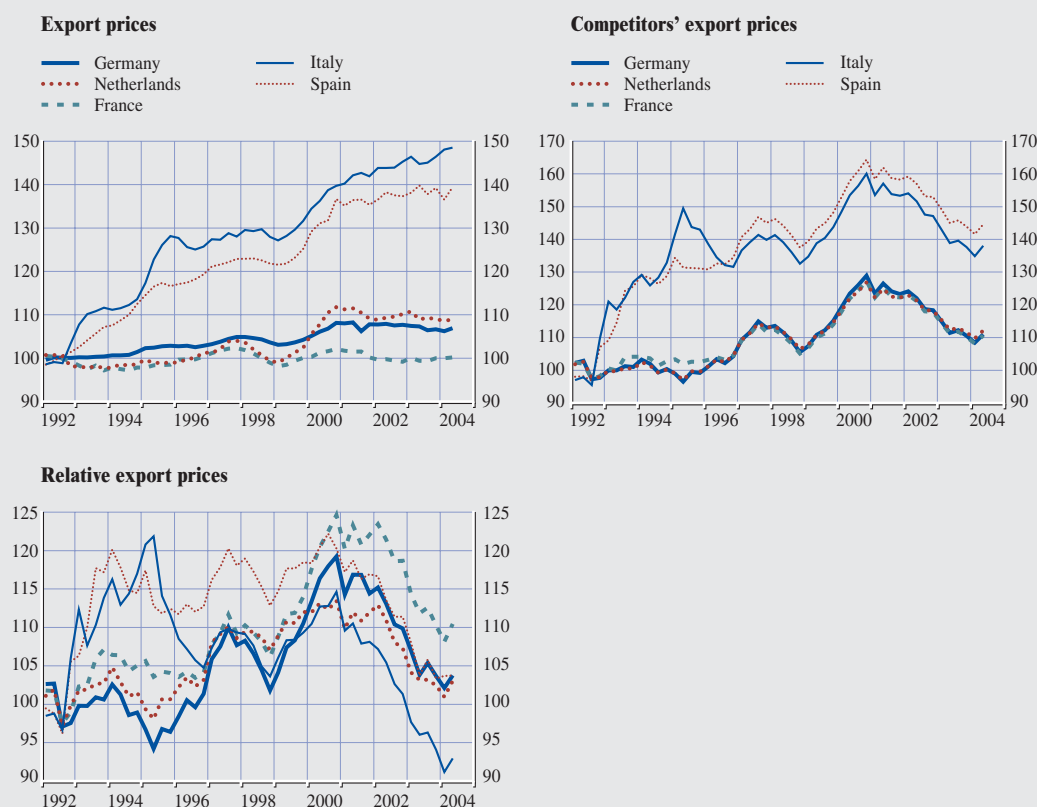
1.3.2 RELATIVE EXPORT PRICE COMPETITIVENESS OF THE EURO AREA COUNTRIES

Overall, there has been some divergence in price competitiveness across the five largest euro area countries, as measured by their

¹⁴ The divergence in intra-euro area export performance at the country level may reflect factors such as the process of industrial concentration and restructuring, possibly further stimulated by EMU. In this context, the existence of such asymmetries across the individual euro area countries has to be seen in a positive light as it strengthens the euro area as a whole. In general, these points raise questions which are beyond the scope of this paper, but may form the basis for future research.

Chart 6 Determinants of price competitiveness

(index: 1992 = 100; quarterly data)



Source: Eurostat and ECB.

Note: Figures refer to total trade in goods and services. Relative export prices are a weighted average of competitor export prices divided by domestic export prices (an increase reflects a gain in price competitiveness).

respective relative export prices (see Chart 6). The key reason for such divergence is clearly the considerable increases in export prices for Spain and Italy, while German and Dutch export prices grew marginally and French prices were virtually flat (see Chart 6). Spain and Italy experienced a sharp improvement in their price competitiveness in the early 1990s due to the depreciation of the peseta and the lira over this period which pushed up competitors' export prices (in euro) for these two countries. However, the improvement in competitiveness for Italy was short-lived due to rapidly increasing export prices. By contrast, although increasing, Spanish export prices did not grow as fast as their competitors', hence the peseta depreciation in the early 1990s provided a more sustainable boost to Spanish competitiveness.

Since 2002, owing to the appreciation of the euro, all of the five euro area countries experienced a strong decline in price competitiveness. However, by 2004, their price competitiveness – with the exception of Italy – was better than at the beginning of 1992. France experienced the strongest improvement in price competitiveness due to its export prices remaining virtually flat over the whole period, whereas these prices increased slightly for Germany and the Netherlands. Overall, while movements in relative export price competitiveness across the largest five euro area countries were converging in the run-up to EMU, they diverged somewhat after EMU was established in 1999.

1.3.3 THE ROLE OF PRICE COMPETITIVENESS AND FOREIGN DEMAND IN EXPLAINING EXPORT GROWTH

Since our earlier analysis showed that price competitiveness and foreign demand appear not to have captured entirely developments in export growth, we now carry out a more formal investigation into their explanatory power. Our analysis is based on national accounts data and export volume specifications used by the ECB and NCBs at the country level to construct and maintain the ECB's Area-Wide Model (AWM) and Multi-Country Model (MCM).¹⁵ First, we

look at the evolution of real market shares using these data, followed by an analysis of the export equations' residuals in order to see how well they explain export performance since 2000. Finally, using a "contribution analysis" we evaluate the relative contributions of different factors to explain export growth (Annex I, Section 2.1).

1.3.4 REAL MARKET SHARES

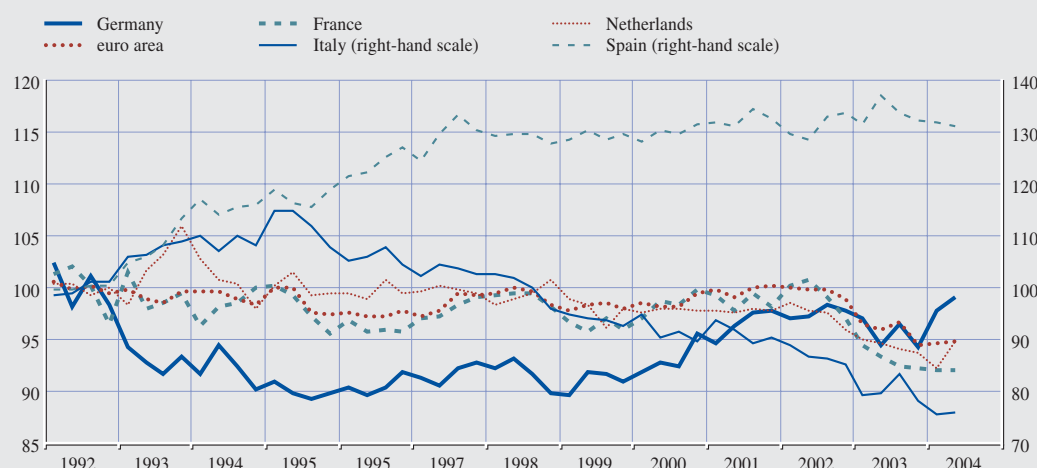
Chart 7 plots the real market shares for the euro area and the five largest euro area countries and shows that the broad trends roughly correspond – if one excludes some specific episodes – with the developments in relative export prices described above.¹⁶ Like in Chart 1, we again see a decline in the euro area's export volume market share at the end of the sample period due to the appreciation of the euro which began in 2002. Chart 7, however, is based on national accounts data for exports of goods and services including cross-border intra-euro area trade, while Chart 1 is based on extra-euro area exports of goods. The most striking outcomes at the country level again concern Italy and Spain. Both of these countries experienced strong gains in market shares in the first half of the 1990s due to the improvements in price competitiveness resulting from exchange rate depreciations, and in the case of Spain also due to integration effects related to its accession to the European Union in 1986. However, Italy then shows a steady decline in export market share corresponding with a deterioration in price competitiveness, while Spain sustained its earlier improvement in competitiveness and continued to gain export market share until the late 1990s. The trade-boosting impacts of Spain's EU membership gradually become

¹⁵ Accordingly, the export data at the country level refer to total exports (i.e. intra plus extra-euro area exports of goods and services).

¹⁶ In a similar fashion to the calculation for the euro area, the market share is computed by dividing export volumes by a weighted sum of the import volumes of selected destinations, weighted according to their importance in the individual country's export markets. Details of these weights and those used in the calculation of relative export price competitiveness are provided in Annex I. The annual developments in real market share for the euro area countries are shown in percentage change terms in Annex I.

Chart 7 Real market shares for the euro area and its five largest economies

(in volume terms; index: 1992=100; quarterly data)



Source: Eurostat (national accounts) and ECB.

Note: The chart refers to total (intra+extra-euro area) exports of goods and services based on national accounts data and ECB computations for foreign demand. The latter is defined as a country-specific export-weighted sum of foreign (intra+extra-euro area) import volumes of goods and services.

weaker over time resulting in a levelling-off of Spain's market share towards the end of the 1990s. However, relatively low levels of labour costs and export prices in comparison to major competitors, combined with the ongoing process of convergence which may imply a continued movement towards a higher ratio of exports to GDP in line with other euro area countries, may also help explain Spain's ability to maintain its higher export share in recent years.

Meanwhile, the German and especially the French and Dutch market shares moved more closely together in line with analogous movements in their price competitiveness. Germany lost market share in the first half of the 1990s, partly due to a loss in competitiveness but possibly also due to restructuring of the economy after reunification. Thereafter, in comparison to the other large euro area countries, Germany gained relatively more market share in response to the depreciation of the euro after its launch and managed to maintain its share despite the losses in competitiveness arising from the euro appreciation from 2002 onwards.

This is possibly in part the result of higher trade integration with the new EU Member States, driven by the outsourcing of production and the associated rise in FDI. The increase in the share of the new EU Member States in German trade was to some extent accompanied by a displacement of some intra-euro area trade, which may partly account for the decline in export share of countries like Italy.¹⁷ Finally, France and the Netherlands experienced fairly stable market shares over most of the sample period, including very weak responses to the depreciation of the euro in the period 1999-2000 and significant losses following the euro appreciation from 2001 onwards.

1.3.5 MCM EXPORT EQUATIONS: RESIDUALS

In order to assess more precisely the role of selected determinants in explaining export performance, we look at the export equations estimated for the largest euro area countries in the Multi-Country Model (MCM) of the ECB.

¹⁷ However, one should be cautious in partly attributing the loss in Italy's share to competition from the new EU Member States as other euro area countries which might also have been expected to experience export losses due to such competition (e.g. Spain) maintained their market share.

Table 1 Long-run parameters for the Area-Wide Model and the Multi-Country Model

	Trend term	Elasticity of price competitiveness	Constraint on foreign demand
Euro area (Area-Wide Model)	NO	-0.58	YES (1)
France	YES	-0.54	YES (1)
Germany	YES	-0.42	YES (1)
Italy	NO	-0.42	YES (1)
Netherlands	YES	-0.35	YES (1)
Spain	YES	-0.58	YES (1)

Source: ECB.

Note: The equations refer to total (intra+extra-euro area) export volumes of goods and services.

Exports are modelled primarily as a function of foreign demand and some measure of price competitiveness. In most cases the elasticity for foreign demand is constrained to be equal to one in the long run, which implies that real market shares remain stable unless there are movements in competitiveness or other explanatory variables (see Table 1).¹⁸ As regards the relative price elasticity, it varies from -0.35 (Netherlands) to -0.58 (Spain, euro area).

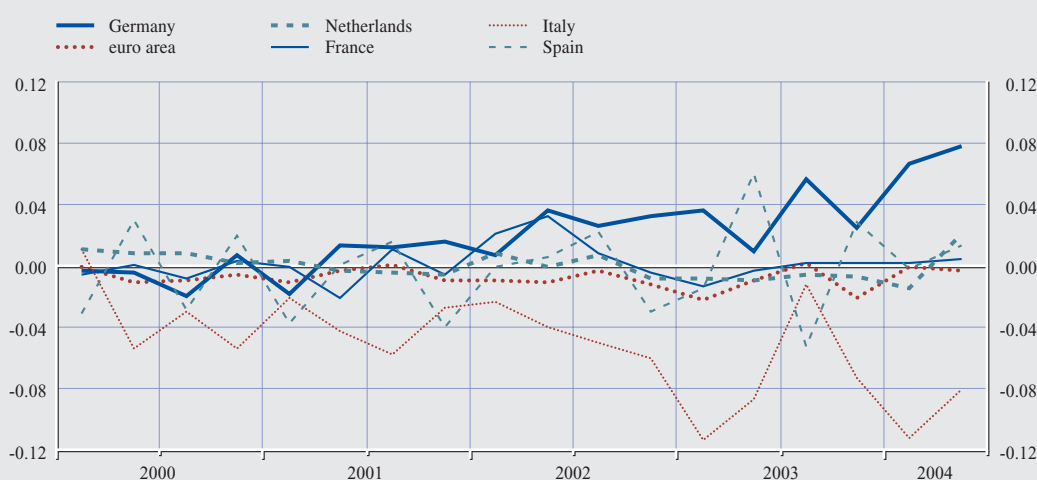
demand and price competitiveness (see Chart 8). The most striking feature of the residuals is that they clearly show both an underestimation of German exports since the beginning of 2002, i.e. a better than expected performance, and an overestimation of Italian exports since the beginning of 2001. Overall, the residuals suggest that factors other than price competitiveness may also play a role in explaining the export growth of some euro area

The residuals of the export equations and the inclusion of trend terms can give some indication as to whether export developments have to be attributed to factors other than foreign

¹⁸ However, some of the equations also include trend terms which can represent an underlying gain or loss in share. The equations for Germany, France and the Netherlands include small negative time trends, while the equation for Spain has an elasticity for world demand of 1.2.

Chart 8 Export volume equations: analysis of residuals

(as a percentage of total exports; quarterly data)



Source: ECB.

Note: The equations refer to total (intra+extra-euro area) export volumes of goods and services. A positive residual indicates that actual exports are above what is predicted by the equation. For more details of the Multi-Country Model (MCM) of the ECB, see Annex I.

countries. The small residual for the euro area as a whole, which is obtained using the Area-Wide Model of the ECB, suggests that price competitiveness explains rather satisfactorily movements in the euro area's export market share.¹⁹

1.3.6 MCM EXPORT EQUATIONS: A CONTRIBUTION ANALYSIS

In contrast to the residual analysis above, the contribution analysis quantifies how individual factors can explain export growth. The contribution analysis methodology and results are described in detail along with charts in Annex I. The major findings are as follows.

As regards the euro area, the growth of world demand turns out to be the most important determinant of export growth over the sample period 1992-2003 (see Chart 9). A key result which confirms our earlier analysis is that over the sample period the increase in the euro area's export deflator partly counterbalances the rise in competitors' prices due to the protracted euro depreciation.

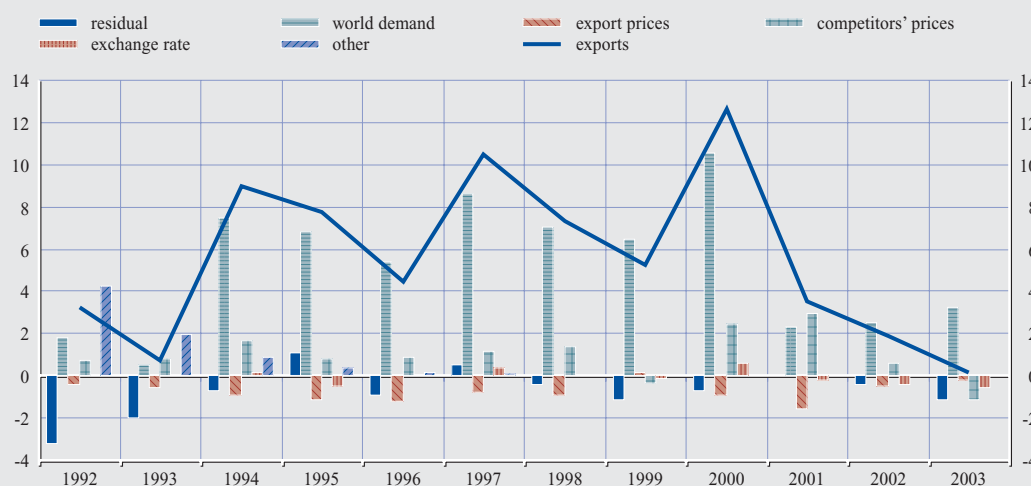
whose exports were most affected by foreign demand (Germany, France and the Netherlands); and second those where competitiveness instead plays a more prominent role (Spain and Italy). Regarding the first group, improvements in competitiveness – especially in the second half of the 1990s – also had a role in explaining export performance for Germany and France. Turning to the second group, Italy lost all of its competitiveness gains resulting from the exchange rate depreciation in the early 1990s due to rapid growth in its export deflator. Considerable negative residuals in the early 2000s confirm that competitiveness can only partly account for the weak Italian export growth, indicating that factors other than price competitiveness may also play a role. The contribution of these negative residuals is also relatively large in comparison with the other factors affecting Italian export performance. As we shall see in subsequent chapters, Italy's intra-euro area exports seem to have been displaced by increasing competition from new EU Member States, partly because the latter countries also specialise in relatively low-tech products.

With respect to the euro area countries, we can distinguish between two groups: first, countries

19 Although the results also depend on the specific measure of competitiveness used in the individual country models.

Chart 9 Contribution analysis of the euro area export equation

(percentages; quarterly data)



Source: ECB.

Note: For more details of the Multi-Country Model (MCM) of the ECB and the contribution analysis for individual countries, see Annex I.

Box I

CONCEPTS OF EXPORT MARKET SHARE

This box explains the different concepts of export market share used in this report as well as differences in the data used to construct them. As already mentioned in the report, all measures are broadly consistent in terms of overall results, although at times they may diverge somewhat. The box is also intended to help guide readers to the specific charts in the report where the different measures of export share are used.

Export market share indicators differ with respect to the measure of world exports used: in particular, whether they are computed as a total indicator (i.e. the share of a country's exports in the total market for exports), or as an indicator that weights the geographical export markets according to their importance in the exports of the country under analysis. Export market share indicators differ also with respect to whether they are presented in terms of volumes or values. More specifically, the market share in volume terms is defined in this report as an index of the ratio of a country's export volumes to its foreign demand, where the latter is estimated as a weighted average of the import volumes of major trading partners, with the weights being equal to the share of each destination in total exports. The market share in value terms, instead, is defined as the ratio of the value of a country's exports to an unweighted measure of the value of world exports.

The following provides the definitions of the export shares used in the specific charts in the report:

Chart 1 (left panel) shows export shares in value terms for exports of goods at current prices (the numerator), with world trade (the denominator) defined as half the sum of total imports plus exports net of euro area countries' imports.

Chart 1 (right panel) shows an index of export market shares in volume terms using annual data. For the United States, the United Kingdom and Japan, the share uses exports based on national accounts data (goods and services), while for the euro area it is based on external trade statistics (goods) for extra-euro area exports. Foreign demand (the denominator) is based on ECB computations.

Chart 4 shows an index of export market shares in volume terms using quarterly data. The index is the same as that shown in *Chart 1* (right panel).

Chart 7 shows an index of export market shares in volume terms using quarterly data for the euro area and the five largest euro area countries. The data refer to total (intra plus extra-euro area) exports of goods and services based on national accounts data and ECB computations for foreign demand. The latter is defined as a country-specific export-weighted sum of foreign (intra plus extra-euro area) import volumes of goods and services.

Chart 10 in chapter 2 shows the version of the euro area's export market share in value terms which is used in the constant market share analysis in that Chapter, and compares it with the value share shown in *Chart 1* (left panel) over a longer sample period. Although these two value shares are derived in the same way conceptually, the share used in Chapter 2 uses a different

data source and also excludes exports for some products and destinations. More specifically, Chart 10 uses the World Trade Analyzer database compiled by Statistics Canada, while Chart 1 uses IMF data. In terms of the geographical breakdown, the value share used in Chapter 2 covers exports to the 14 most important destination markets for the euro area covering about 95% of its total exports (6 individual countries and 8 geographical areas). In terms of products, the value share used in Chapter 2 excludes both exports of fuels (SITC 3) and “other goods not elsewhere specified” (SITC 9), mostly to avoid distortions resulting from highly volatile oil prices, etc.

1.4 CONCLUSIONS

Overall, the results show that the export market share of the euro area (in extra-euro area markets) has recorded only a small decline over the period 1992-2003, in comparison to some of its major competitors, like the United States and particularly Japan. However, complacency regarding euro area exports should be avoided as the more recent losses in euro area export market share, combined with divergences in export performance across the euro area countries, suggest that euro area exports remain vulnerable.

These export developments for the euro area and its main competitors occurred against the background of significant differences in the way exchange rate movements have translated into changes in price competitiveness and eventually into export market shares. Regarding the first link, the exchange rate pass-through to price competitiveness appears to have been relatively closer to unity for the US and UK, as measured by relative export prices. Less so for the euro area, where exporters seem to absorb strong swings in the exchange rate at least partially by increasing export profit margins during depreciations and reducing them during appreciations. Regarding the role of price competitiveness and foreign demand, it appears that these can to a considerable extent explain export developments at the euro area level, but this is not always the case for individual euro area countries. Changes in relative export prices are more closely related to changes in market share for the euro area than for other main competitors, with a particularly poor

relationship between these variables for Japan. The latter is partly due to strategic choices regarding the localisation of production, and the use of other Asian countries as export platforms, which also renders export market shares as indicators of export performance less meaningful. Invariably, for all of the countries considered there are some episodes where the relationship between price competitiveness and exports is weak, indicating that other factors, which we broadly define as non-price competitiveness, may also play a role and need to be considered when assessing export performance. This is the case, for instance, of the delayed responses in market share to changes in price competitiveness for the US from the mid-1990s onwards. This broad conclusion seems to be confirmed by the persisting residuals resulting from estimated export equations for some of the euro area countries and, in particular, by a “contribution analysis” applied to the variables and parameters of these equations.

Among the largest euro area countries, Germany’s and especially France’s and the Netherlands’ export performance (in intra plus extra-euro area markets) moved closely together throughout the period, although German export performance has excelled relative to the others in recent years. Spain and Italy, instead, were clearly different to the rest by over- and underperforming respectively relative to this group of countries.

2 A DISAGGREGATED ANALYSIS OF THE EXPORT PERFORMANCE OF THE EURO AREA AND EURO AREA COUNTRIES²⁰

2.1 INTRODUCTION

Chapter 1 mostly dealt with the relationship between export performance and price competitiveness. Such an approach does not, however, yield useful policy-related information regarding the impact of the pattern of specialisation in different sectors and geographical markets on an economy's aggregate export market share. Accordingly, the main aim of this chapter is to analyse – through the so-called “constant market share analysis” – whether euro area exporters have, on average, out- or under-performed competitors in selecting high-growth destination markets and sectors.

Given the above objectives and the data available, the empirical work is carried out on the external exports of goods of the euro area – in value terms – excluding volatile components such as oil. Using these data, the aggregate export market share of the euro area declined from 26% to 23% during the period 1985-2001, which is a stronger decline from the early 1990s than that depicted in Chart 1 in Chapter 1. This difference notwithstanding, the analysis of the chapter is fully consistent and entirely complementary with that conducted in the other chapters.

The chapter begins by explaining the methodology of the constant market share analysis (CMSA) and the dataset. This is followed by an overview of the major results of the CMSA showing in a systematic way how the product and geographical composition of exports, as well as their competitiveness, contributed to developments in the euro area's export market share. The next two sections describe in detail the sectoral and geographical specialisation of euro area exports along with an analysis of how export demand in these products and destination markets has grown over time. Against this background, we then

shed light on how the euro area's export performance was shaped by the individual euro area countries by illustrating their differences in terms of product and destination market specialisation, while the next section carries out the same analysis for the euro area's major competitors. The chapter also investigates some of the possible implications of the euro area's specialisation in medium rather than high-tech exports, particularly the question whether this implies some downward pressure on its export prices (see Box 2), caused by competition from new low-labour-cost export competitors such as China (see Box 3).

2.2 CONSTANT MARKET SHARE ANALYSIS: METHODOLOGY AND DATA CONSIDERATIONS

The following analysis of the euro area export performance uses annual merchandise exports (to extra-euro area markets) in value terms over the period 1985-2001. Exports are disaggregated into 12 sectors and 14 destinations, while data related to specific goods (like fuels and “other products not elsewhere specified”) are excluded from the analysis (see below). Hence there are some important differences with Chapter 1, which limits comparability. First, data are only available in value terms and a subset of total exports is used instead of total exports in volume terms as presented in Chapter 1. Second, the data only extend up to 2001, thereby excluding the most recent period. As a result, for the period 1985-2001, the euro area's export market share actually declined from 26.0% to 23.0%, compared with the more marginal decline depicted in Chart 1 in Chapter 1. Nevertheless, the broad trends are virtually identical to those shown in the previous chapter, while the highly disaggregated data used in this chapter provide rich insights into trends in sectoral and geographical specialisation.

20 By Ildeberta Abreu, Laurent Maurin, Sonia Pokutova and Roberto Tedeschi, with Box 3 contributed by Jian-Guang Shen.

2.2.1 METHODOLOGICAL BACKGROUND

The general idea behind the CMSA is that the product and geographical structure of a country's exports can affect its total export growth. In simple terms, if the euro area is more (less) specialised in export products and destination markets where demand is weak (strong) in comparison to other products and markets, then the euro area's aggregate export market share will tend to decline. The CMSA builds on this idea by providing a breakdown of a country's export performance into the separate components that are due to the product and destination market composition of its exports as well as other factors (such as competitiveness).

The CMSA decomposes the actual variation in the aggregate export market share (the *total effect*) into two main parts:²¹

A *structure effect* – the hypothetical change in the aggregate export market share which would have occurred if the euro area share in world markets had remained constant in each product/destination market.

A *competitiveness effect* – the difference between the actual change in the export share and the above-mentioned structure effect.

The *structure effect* is further decomposed into three terms (see Annex II for more details):

- a *product effect*, which measures whether the relative specialisation of euro area exports is directed towards dynamic products in world demand;
- a *market effect*, which measures whether the export specialisation of the euro area in terms of destination markets is directed towards dynamic export market destinations; and
- a residual term called the *mixed structure effect* comprising the interaction effects between the product and market structure.

2.2.2 THE DATASET

The CMSA calculations are performed using export-of-goods data for both the euro area (intra-euro area trade is excluded) and the world, disaggregated to the Standard International Trade Classification (SITC) 3-digit level.²² The basic analysis is conducted excluding exports of fuels and “other goods not elsewhere specified”, mostly to avoid distortions resulting from highly volatile oil prices. Exports are separated into 12 broad product groups, which are then allocated according to their technological intensity into 3 broad categories (i.e. low, medium and high-tech).²³ In terms of geographical breakdown, exports cover the 14 most important destination markets for the euro area covering about 95% of its total exports (6 individual countries and 8 geographical areas). Chart 10 shows the euro area export market share used in this chapter (i.e. based on 12 product groups and 14 destinations) along with the total export value share used in Chart 1 (left panel) in Chapter 1. Overall, the evolution over time of the two export shares is rather similar in the period 1985-2001, although the export share used in this chapter displays a somewhat stronger decline.

One important point to note is that exports are in USD value, hence developments in market share are mechanically influenced by changes in the USD exchange rate. For instance, if the share of trade denominated in USD is smaller in the euro area than in world exports, an appreciation of the USD will result – ceteris

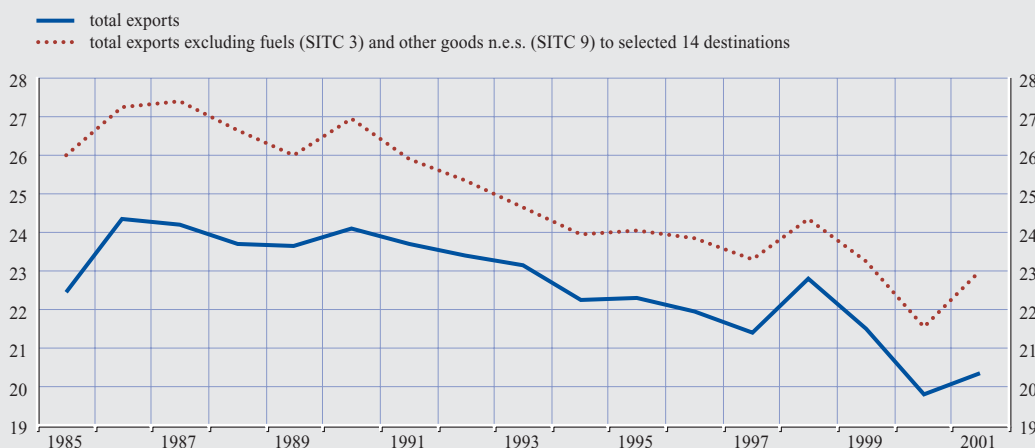
²¹ As mentioned in the detailed description of the CMSA methodology in Annex II, the technique has several drawbacks, mostly related to its empirical implementation. Some of the choices to be made, for instance regarding the level of product and market disaggregation or the appropriate reference against which to judge the export performance of a country, can have a considerable impact on the value and sign of the various effects. Therefore, results should be interpreted with caution.

²² See Annex II for a detailed description of the data.

²³ Table 1 in Annex II provides details of the classification of sectors into high, medium and low-tech sectors. Although the classification is based on those used in the literature, it has some weaknesses given the broad nature of the classification (e.g. the technological intensity of some individual products might be classified somewhat differently if the classification was carried out at the 3 or 4-digit level).

Chart 10 Euro area export market share

(in value terms)



Sources: WTA, ECB calculations.

Note: The "Total exports" share is equivalent to that shown in Chart 1 in Chapter 1 (i.e. the non-weighted measure in value terms), with the exception that the present chart uses WTA data, while Chart 1 uses IMF data (hence there are some minor differences). "exports excluding fuels (SITC 3) and other goods n.e.s. (SITC 9) to selected 14 destination markets" is the export share series used in this chapter based on WTA data.

paribus – in a decline in the euro area's market share.

2.3 CONSTANT MARKET SHARE ANALYSIS: RESULTS FOR THE EURO AREA

This section starts by giving an overall assessment of the constant market share analysis which shows that two-thirds of the loss in the euro area's export market share was due to the structure effect and one-third to the competitiveness effect. We then break down the structure effect into the contributions of its

two main components, namely the product and market effects, followed by an analysis of the individual factors that contributed to these impacts. Finally, we identify which sectors and geographical markets are responsible for the negative competitiveness effect.

2.3.1 OVERALL ASSESSMENT

As mentioned above, over the period 1985-2001, the euro area's export market share declined from 26% in 1985 to 23% in 2001, with the decline mostly concentrated during the 1990s. This is equivalent to lower growth of

Table 2 Main results of the constant market share analysis of euro area exports

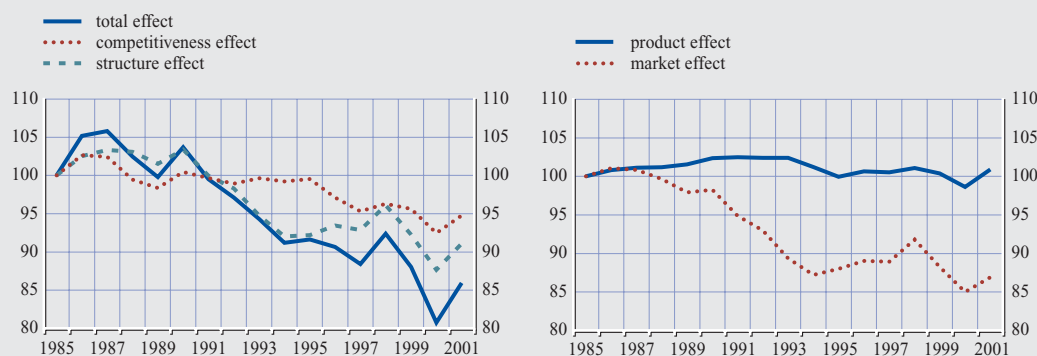
(as a percentage of total; period averages)

	1985-89	1990-94	1995-99	2000-01	1985-2001
Share of euro area exports in world exports	26.7	25.4	23.8	22.3	24.9
Growth of euro area exports (gEA)	12.4	7.0	5.5	3.8	7.5
Growth of world exports (gW)	12.4	8.7	6.1	4.7	8.3
Total effect (TE) $TE = SE + CE = g_{EA} - g_W$	0.0	-1.7	-0.7	-0.9	-0.9
Structure effect (SE) $SE = PE + ME + MxE$	0.4	-1.9	0.1	-0.5	-0.5
product effect (PE)	0.4	-0.1	-0.2	0.3	0.1
market effect (ME)	-0.5	-2.3	0.3	-0.7	-0.8
mixed structure effect (MxE)	0.5	0.4	0.0	-0.1	0.2
Competitiveness effect (CE)	-0.4	0.2	-0.7	-0.4	-0.3

Sources: WTA, ECB calculations.

Chart 11 Components of the total and structure effects

(index: 1985 = 100)



Sources: WTA, ECB calculations.

Note: The decomposition of the structure effect (right panel) does not show the mixed structure effect.

euro area exports by 0.9% *per annum* compared with world export growth, which is shown in the overview of the CMSA results as the negative “total effect” in Table 2 (far right column). Two-thirds of the total effect results from a negative structure effect, while the competitiveness effect accounts for one-third of the decline.

The negative structure effect is due to the market effect as the product effect had a roughly neutral impact. The latter result implies that the product composition of the euro area’s exports played a broadly neutral role in fostering export performance over most of the years (Chart 11). By contrast, the market effect tells us that export performance was hampered by a relatively low weight in euro area exports of the most rapidly growing geographical markets. This appears to be very

relevant during most of the period, especially in the first half of the 1990s and after the Asian crisis in 1998.

2.3.1.1 Contribution analysis of the product effect

Although the overall product effect was more or less neutral, euro area exports of medium-tech products provided a positive contribution to the product effect, which was broadly offset by a strong negative contribution of exports in the high-tech sectors (Table 3). In more detail, the positive impact from the medium-tech sectors was partly due to the fact that the euro area specialises in this type of export product, combined with world demand for these exports growing in line with the average growth of world exports during the period 1985-2001. By contrast, the euro area is less specialised in high-tech sectors and was therefore unable to

Table 3 Contribution to the product effect by technological intensity

(as a percentage of total; period averages)

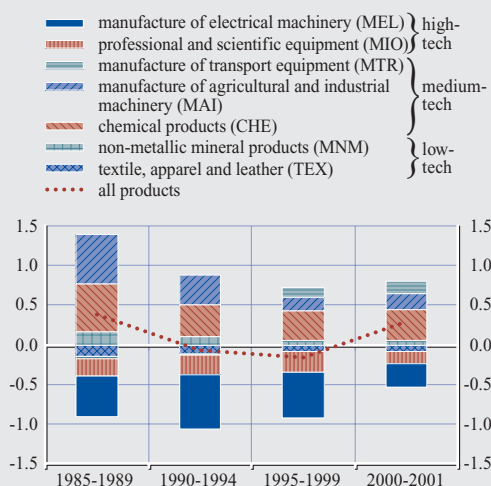
	1985-89	1990-94	1995-99	2000-01	1985-2001
Low-tech	-0.16	0.09	0.05	-0.04	0.00
Medium-tech	1.20	0.77	0.68	0.75	0.85
High-tech	-0.74	-0.94	-0.84	-0.44	-0.79
Other products	0.09	0.01	-0.06	0.01	0.01

Sources: WTA, ECB calculations.

Note: The contribution is calculated as the difference in the sector’s share in euro area and world exports, multiplied by the growth of the sector in world exports. For more details, see Annex II.

Chart 12 Contribution of selected sectors to the product effect

(as a percentage of total; period averages)

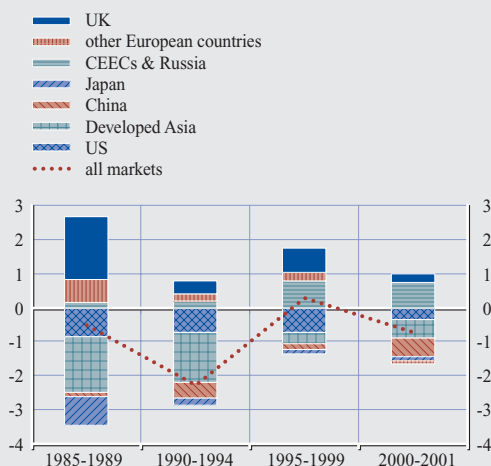


Sources: WTA, ECB calculations.

Note: The contribution is calculated as the difference of the sector's share in euro area and world exports, multiplied by the growth of the sector in world exports. For more details, see Annex II.

Chart 13 Contribution of selected destination markets to the market effect

(as a percentage of total; period averages)



Sources: WTA, ECB calculations.

Note: The contribution is the difference between the market's share in euro area exports and world exports, multiplied by the growth of the market in world exports. For more details, see Annex II.

capitalise fully on the very strong growth in world export demand for these products over the sample period.

Looking more closely at broad export sectors, it appears that the relative specialisation of euro area exports in the medium-tech sectors (chemicals and agricultural and industrial machinery) had a high positive impact on the product effect, given that the world exports of these products grew at a pace close to the world average (Chart 12). Some deterioration over time can be observed in the case of agricultural and industrial machinery, as this sector grew at a relatively slower rate. Finally, although the euro area has become relatively more specialised in transport equipment, this was not a high-growth sector in world export markets. By contrast, the relatively weaker specialisation of euro area exports in electrical machinery and professional and scientific products – i.e. high-tech sectors – accounts for a significant negative contribution to the product effect as these were the most rapidly growing sectors in terms of world exports.

2.3.1.2 Contribution analysis of the market effect

The main negative contribution to the market effect for the euro area appears to arise from the under-specialisation of euro area exports to developed Asian countries, the US and, to a lesser extent, Japan and China (see Chart 13). While in the late 1980s and early 1990s the relatively low penetration of euro area firms in the export markets of developed Asian countries appeared to be the dominant cause of the negative market effect, more recently China seems to be a key market that has been under-exploited by euro area exporters. At the same time, the comparatively low penetration of euro area exports in the US was less important in 2000-01 in line with the slowdown in the growth rate of demand in this market over the same period.

This is partially offset by the rising specialisation of euro area exports in the central and eastern European countries (CEECs) and Russia, while the role of the UK in counterbalancing the negative market

effects has rather sharply decreased over time because of the slower growth of the UK market relative to world markets (Chart 13).

2.3.1.3 Competitiveness effect

The “competitiveness” effect – which is basically the residual of the analysis – is somewhat volatile in the period under consideration, but the overall impact is negative. Although this can be interpreted as representing a loss in export competitiveness for the euro area – i.e. a *de facto* loss in market share after taking out the structure effects – it is not possible to completely disentangle the influence of markets and products, hence its interpretation must be cautious.

Still, the following analysis of the competitiveness effect is informative and adds value to the specialisation issues discussed previously.

First, looking only at the product dimension, the loss in competitiveness appeared mainly in the low-tech sectors (Table 4, top). Conversely, some positive contribution (especially in 2000-01) can be observed in the case of high-tech sectors.

Second, from the geographical market perspective, the euro area’s gains in competitiveness in the CEEC and Russian markets – areas characterised by a high degree of euro area specialisation – lasted until the mid-1990s (Table 4, bottom). In the following period, competitiveness made a negative contribution to euro area exports for many regions of the world, but we can observe some slight improvement in euro area competitiveness in the US and Chinese markets over this period.

2.3.2 ANALYSIS OF THE PRODUCT EFFECT

This section provides more information on the structure effect by looking in more detail at the characteristics of the euro area’s exports relevant for the product effect. This involves an analysis of the relative product specialisation of the euro area, as well as an identification of the sectors which are the most dynamic in world exports.

2.3.2.1 The structure of extra-euro area exports by sector from a world perspective

Technologically, euro area exports are mostly concentrated in the medium-tech sectors (most notably chemicals, agricultural and industrial

Table 4 Contribution of sectors/markets to the competitiveness effect

(as a percentage of total; period averages)

Products	1985-89	1990-94	1995-99	2000-01
Low-tech	-0.095	-0.222	-0.571	-0.638
Medium-tech	-0.019	0.402	-0.180	0.060
High-tech	-0.161	0.073	0.083	0.225
Other products	-0.112	-0.077	-0.060	-0.042
Total	-0.387	0.176	-0.729	-0.395
Markets	1985-89	1990-94	1995-99	2000-01
China	-0.027	0.016	0.008	0.072
Japan	-0.010	-0.043	-0.054	-0.068
UK	0.129	-0.078	-0.072	0.018
US	-0.531	-0.181	0.030	0.044
CEECs & Russia	0.440	0.402	-0.170	-0.224
Developed Asia	-0.136	0.181	-0.175	0.025
Other European countries	0.019	-0.009	0.091	-0.012
Other destinations	-0.271	-0.112	-0.387	-0.250
Total	-0.387	0.176	-0.729	-0.395

Source: WTA, ECB calculations.

Note: The contribution is the difference between the product/market’s growth in euro area and world exports, multiplied by the share of the product/market in euro area exports. For more details, see Annex II.

Table 5 Structure of euro area and world exports by sector

(as a percentage of total; period averages)

	Share of sector in euro area exports			Share of sector in world exports		
	1985-89	2000-01	1985-2001	1985-89	2000-01	1985-2001
Low-tech	38.4	29.7	35.0	41.1	32.8	37.8
Food, beverages and tobacco (FOD)	9.7	7.5	9.1	11.8	8.1	10.4
Textile, apparel and leather (TEX)	9.1	7.3	8.5	10.4	9.5	10.3
Wood and wood products (WOD)	2.2	2.1	2.1	2.7	2.5	2.6
Paper and paper products (PAP)	2.8	2.5	2.7	2.7	2.2	2.5
Non-metallic mineral products (MNM)	4.1	3.6	3.9	3.1	2.7	2.9
Basic metal industries (BMI)	7.5	4.2	5.9	8.2	5.5	6.9
Fabricated metal products (BMA)	3.1	2.5	2.9	2.3	2.3	2.3
Medium-tech	47.6	48.9	48.2	40.4	36.6	38.7
Chemical products (CHE)	15.1	16.1	15.1	11.1	11.3	11.1
Medicines and pharmaceutical products	1.8	4.1	2.7	1.2	2.0	1.5
Manufacture of agricultural and industrial machinery (MAI)	17.4	16.4	17.7	13.3	11.8	13.0
Manufacture of transport equipment (MTR)	15.1	16.4	15.4	16.0	13.5	14.6
High-tech	14.0	21.4	16.7	18.5	30.6	23.5
Professional and scientific equipment (MIO)	6.6	8.6	7.2	7.8	11.5	9.3
Office and data processing machinery	2.9	4.7	3.5	4.0	7.2	5.3
Manufacture of electrical machinery (MEL)	7.5	12.8	9.5	10.7	19.2	14.2

Sources: WTA, ECB calculations.

Note: For the description of the classification of products according to technological intensity, see Annex II.

machinery, and transport equipment; see Table 5). Almost half of all euro area exports are medium-tech and their share has slightly increased over the period. Meanwhile, high-tech exports – such as electrical machinery and professional and scientific products – represented, on average over the 1985-2001 period, about 16% of euro area exports, although their share has been increasing steadily over time reaching 21% in 2001. Conversely, low-tech exports rapidly decreased in importance, dropping from almost 40% of total euro area exports in 1985 to around 30% in 2001.

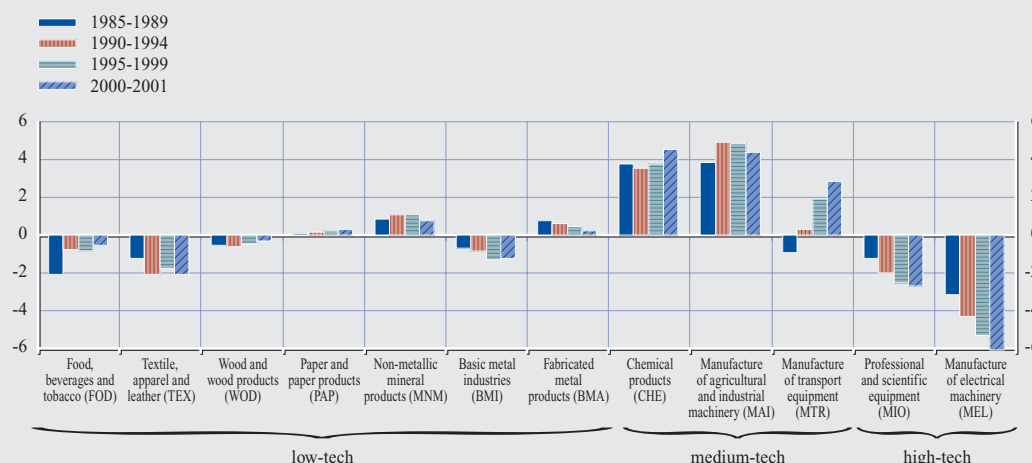
When comparing euro area exports with world exports, two major differences stand out. First, the euro area focuses on medium-tech exports, which accounted for around 48% of euro area exports during the period 1985-2001, versus 39% for world exports. This share was also rather stable through time for the euro area, while it clearly declined for the world. Second, the euro area has a comparatively low export share for high-tech products, combined with a relatively sluggish increase in the importance

of this sector (the share of high-tech exports almost doubled to 29% by 2001 for world exports, while it grew from 13% to only 20% for the euro area; see Table 5).

The above results can be better visualised by calculating an index of relative product specialisation – defined as the difference between the share of individual sectors in euro area exports and its corresponding value for world exports. According to the index, the euro area specialises in chemicals and agricultural and industrial machinery – i.e. medium-tech sectors – as shown by a strongly positive value for the index in Chart 14. Moreover, the relative specialisation has increased also in transport equipment, the other medium-tech sector. One striking result is the remarkable and increasing despecialisation of the euro area in the two high-tech sectors – professional and scientific equipment, and electrical machinery.

Chart 14 Euro area: relative product specialisation

(percentages; period averages)



Sources: WTA, ECB calculations.

Note: This indicator is defined as the difference between the share of the sector in euro area exports and the share of the sector in world exports. A value higher (lower) than zero for a sector indicates that the euro area is relatively specialised (despecialised) in the sector.

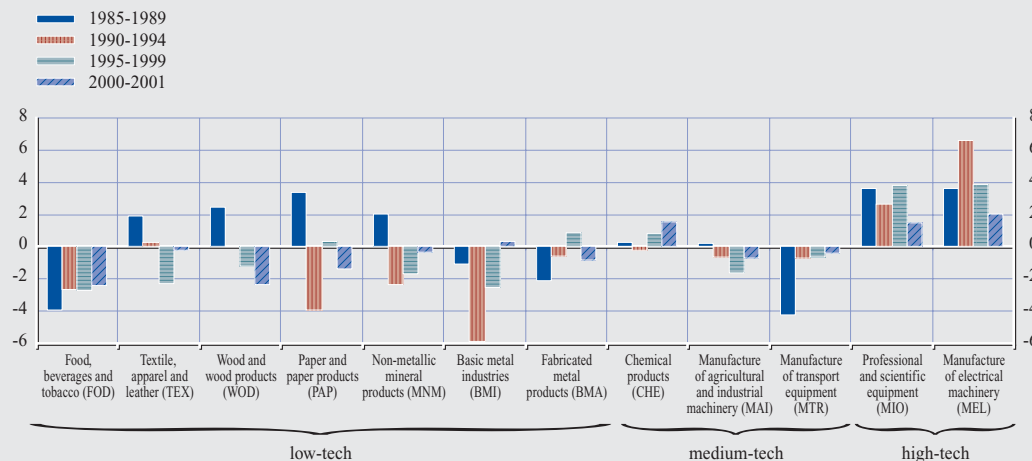
2.3.2.2 Dynamic sectors in world exports

What is relevant however for export performance is not the specialisation *per se*, but how the latter matches world export demand. The question is therefore: did euro area exporters specialise in sectors which had

the most dynamic growth? To answer this question we construct a simple indicator of “dynamic sectors”, defined as the difference between the growth in an export sector worldwide and the average growth of total world exports. A positive value indicates

Chart 15 Dynamic sectors in world exports

(percentages; period averages)



Sources: WTA, ECB calculations.

Note: The indicator is defined as the difference between world export growth of the sector and the average growth of total world exports. A positive value indicates export growth in the sector more dynamic than the average.

export growth more dynamic than the average. Over the period 1985-2001, the high-tech sectors (MIO and MEL) were by far the most dynamic sectors in world exports, with an average annual growth rate of around 12% in nominal terms, i.e. about 4 percentage points higher than world trade (Chart 15). The medium-tech sectors grew in line with total world trade at 8% per annum over the period 1985-2001, while the growth of low-tech

exports was lower than the average (less than 7% per annum over the same period).

An important question in this regard is whether the euro area's specialisation in medium rather than high-tech exports implies some downward pressure on its export prices, caused by competition from new low-labour-cost export competitors (e.g. China). This issue is examined in Box 2 below.

Box 2

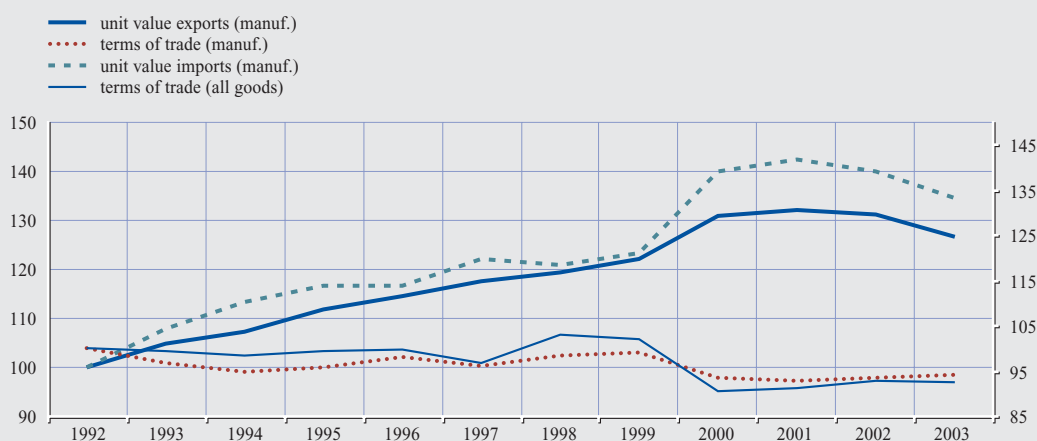
EXPORT PRICES AND TERMS OF TRADE ACROSS SECTORS

This box examines the evolution of export prices and the terms of trade across sectors in order to shed further light on the relative performance of euro area exports. In particular, the hypothesis we want to test is whether the euro area's specialisation in medium rather than high-tech exports implies some downward pressure on its export prices, caused by competition from new low-labour-cost export competitors such as China. If this is the case, while the euro area may have experienced only a marginal loss in export market share in comparison to major competitors, this may have been achieved by focusing on products where profitability is low and decreasing, perhaps resulting in a deterioration in the euro area's overall terms of trade.

Using unit values as a proxy for trade prices, the terms of trade of the euro area were fairly stable until 1999, but then declined in line with the depreciation of the euro and subsequently rose marginally as the euro appreciated (Chart A). Apparently, exchange rate developments – rather than secular trends – appeared to be the trigger for changes in the overall terms of trade.

Chart A Euro area terms of trade

(index: 1992 = 100)

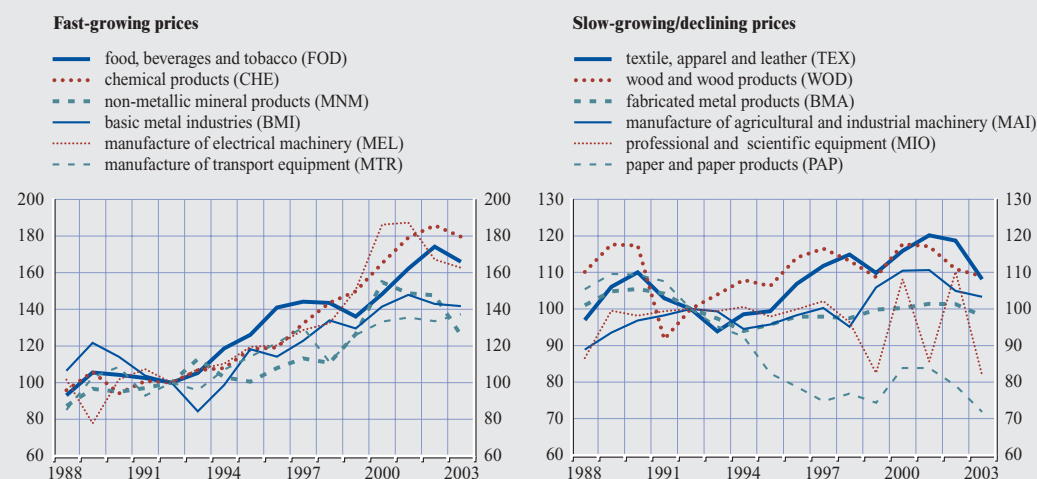


Source: ECB computations based on Eurostat's External Trade Statistics.

Note: The unit values are shown separately for exports and imports of manufactures, while the terms of trade are shown for both manufactures and total goods. The terms of trade are computed as the unit value of exports divided by the unit value of imports. A decrease implies a decline in the terms of trade. Data refer to extra-euro area trade.

Chart B Euro area export prices

(index: 1992=100)



Source: ECB computations based on Eurostat's External Trade Statistics.
Note: Export prices are proxied by unit values for exports. Data refer to extra-euro area exports.

A key question regarding the specialisation of the euro area is whether its exports are more sophisticated, or of higher quality, than the exports of newly emerging competitors such as China. It might be the case that such competitors are involved in the export of relatively simpler manufactures than the euro area. This could mean that they have more of a downward impact on export prices in low-tech sectors, or that they are not directly competing against euro area exports in the medium-tech sectors as they are in a lower quality segment of the export market for these products in comparison to the euro area.

We can get some idea of whether this is the case by looking at euro area trade prices at the sectoral level. Chart B shows this information for sectors where euro export prices are growing relatively rapidly (left chart) and for sectors where prices have grown less dynamically (right chart). Overall, there seems to be no evidence that the export prices of medium-tech sectors have been subdued following increasing competition from low-cost competitors. In fact, the export prices of the medium-tech sectors chemicals and transport equipment, which together account for almost one-third of extra-area exports, grew fairly strongly from the late 1980s onwards. Meanwhile, the high-tech sectors benefited from the strong export price growth in electrical machinery products, but this was offset by falling export prices for professional and scientific equipment, which includes the significant price declines associated with computer equipment. As expected, export prices for many low-tech sectors were quite depressed (e.g. for paper, wood products, textiles and fabricated metal products).

By looking at the terms of trade at the sectoral level, we can make an indirect comparison of the trade prices of euro area products with those of competitors.¹ Looking first at the medium-tech sectors, the terms of trade for chemicals as well as transport equipment improved (see Chart C, left panel). Meanwhile, the terms of trade for agricultural and industrial machinery, another medium-tech sector, experienced a decline. Regarding the high-tech sectors, the terms of trade for professional and scientific equipment also improved.

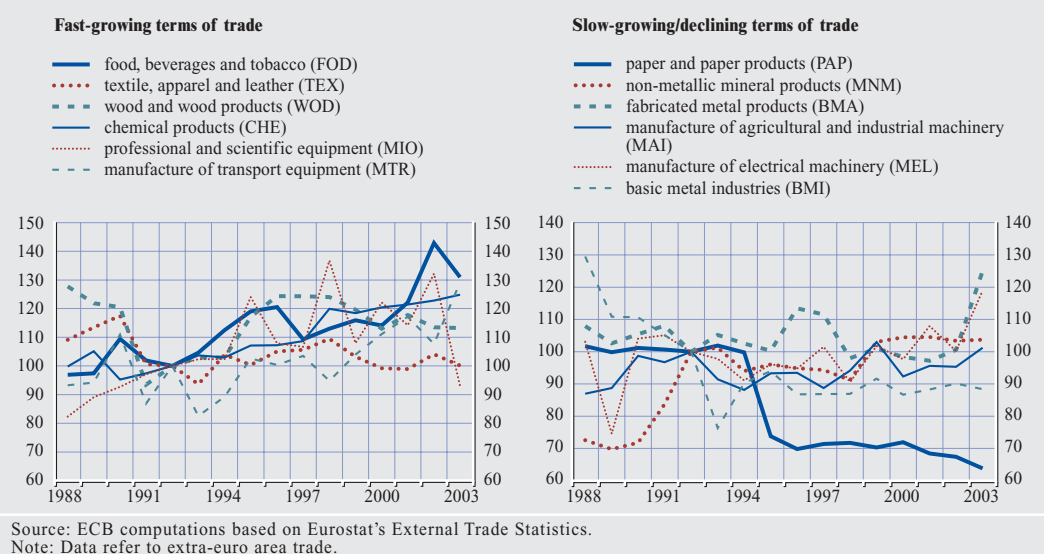
¹ A more direct comparison would be between export prices of the euro area and export prices of competitors to all destinations, but these data are not available at the sectoral level.

By contrast, the significant export price growth for the high-tech sector electrical machinery was accompanied by an increase on the imports side as well, so the terms of trade were less favourable for this sector over most of the sample period. One interpretation of the above results is that the relatively stronger growth of the medium-tech export products of the euro area indicates relatively higher quality products, particularly relative to low-cost producers. However, it could also be the case that the stronger export price growth of medium-tech products represents higher costs and a loss in competitiveness.

In summary, since the late 1980s, euro area export prices in the medium-tech sectors have grown by at least as much as export prices in the high-tech sectors. Accordingly, there is no evidence that the euro area's specialisation in medium-tech products has been associated with lower export price growth or an overall loss in the terms of trade of the euro area. On the contrary, there is some evidence that specialisation in medium-tech products and good export performance in those sectors has been accompanied by a move towards higher-quality products, whose prices rose as shown by improved sectoral terms of trade.

Chart C Euro area terms of trade for product groups

(index: 1992 = 100)



2.3.3 MARKET EFFECT AND GEOGRAPHICAL ANALYSIS

The overall results of the CMSA, presented in Table 2, indicate that a weak presence of euro area exporters in the most rapidly growing export markets had a negative impact on the euro area's export performance. Following a similar computation procedure to that adopted for the product analysis, we now identify in more detail which specific geographical markets were mainly responsible for this negative "market effect" for euro area exports.

2.3.3.1 The structure of extra-euro area exports by destination market from a global perspective

The main destinations of euro area exports of goods are the European countries²⁴ (37.0% on average in the period 1985-2001) along with the US (15.3%), although the share of European destinations declined steadily to 33.2% by the end of the sample period (Table 6). Meanwhile,

²⁴ This group consists of non-euro area European countries (i.e. the UK, Switzerland, other European countries), excluding the CEECs and Russia.

Table 6 Structure of euro area and world exports by destination market

(as a percentage of total, period averages)

	Share of destination in euro area exports			Share of destination in world exports		
	1985-1989	2000-2001	1985-2001	1985-1989	2000-2001	1985-2001
Countries						
Canada	1.9	1.6	1.7	5.9	5.3	5.5
China	1.6	2.6	1.9	3.2	6.1	4.3
Japan	3.4	3.6	3.9	7.3	6.8	7.4
Switzerland	8.3	6.4	7.6	3.1	2.0	2.7
UK	20.8	18.9	19.9	9.9	7.9	8.9
US	16.2	17.9	15.3	25.5	25.9	24.0
Regions						
Africa	9.1	5.6	7.4	4.8	2.9	3.9
CEECs & Russia	10.0	15.2	12.2	7.4	6.4	6.4
Developed Asia	4.9	7.1	7.2	12.2	16.9	16.3
Middle East	6.2	5.1	5.7	5.1	3.6	4.4
Oceania	1.6	1.4	1.5	2.5	1.8	2.2
Other American countries	4.3	5.4	5.1	5.8	8.9	7.5
Other Asian countries	1.6	1.3	1.5	1.9	1.7	1.8
Other European countries	10.1	7.9	9.2	5.4	3.5	4.6

Sources: WTA, ECB calculations.

Note: For the definitions of the destination markets, see Annex II.

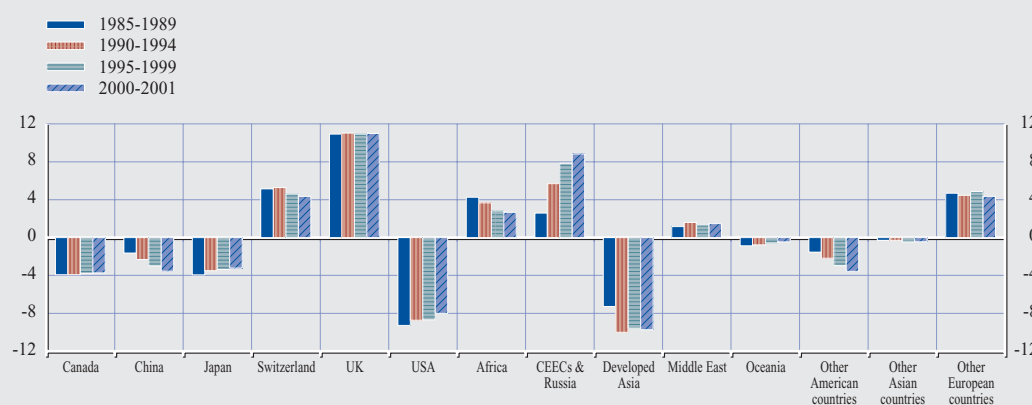
exports to the CEECs and Russia increased their share of euro area exports from 10% in 1985 to 15% in 2001. The share of euro area exports going to Asia – most notably China – and Latin America also increased over time.

In contrast, exports to the US accounted for the largest share of world exports (an average of

24% between 1985 and 2001). In addition Asia, Latin America and Canada all have higher shares in world exports than in euro area exports. By contrast, the world is less specialised in the European market than the euro area, particularly regarding exports to the UK. These differences are obviously related to geographical proximity.

Chart 16 Euro area: relative market specialisation

(percentages; period averages)

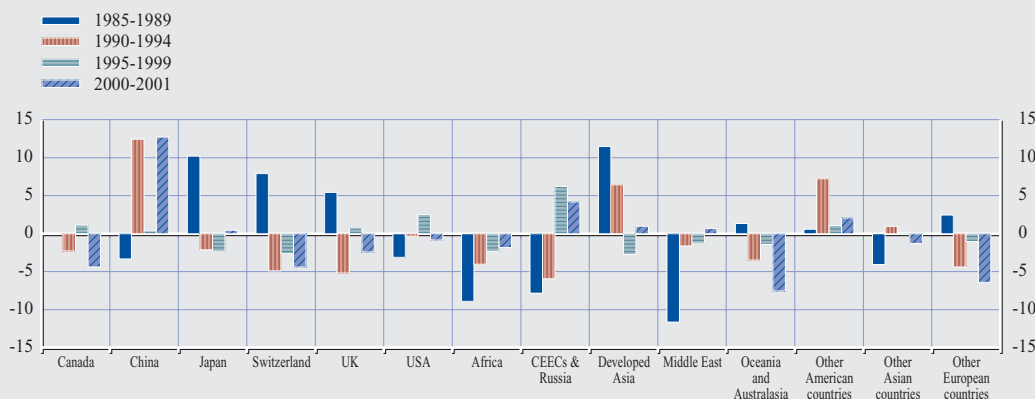


Sources: WTA, ECB calculations.

Note: This indicator is defined as the difference between the share of the destination market in euro area exports and the share of the destination market in world exports. A value higher (lower) than zero for a destination indicates that the exports of the euro area are relatively specialised (despecialised) in that destination.

Chart 17 Dynamic markets in world exports

(percentages; period averages)



Sources: WTA, ECB calculations.

Note: The indicator is defined as the difference between the export growth to a particular destination market and the average growth of total world exports. A positive (negative) value for a destination indicates that export growth to that destination was more (less) dynamic than the average export growth.

Looking at relative market specialisation (measured as the difference between the share of individual destination markets in euro area exports and the corresponding share for world exports), euro area exports appear to be increasingly specialised towards the CEECs and Russia and less so towards Asia, Latin America and Canada (Chart 16).

2.3.3.2 Dynamic markets in world exports

The Asian export markets, most notably China and developed Asia, have shown the most dynamic growth rates in the world since the mid-1980s (Chart 17). The import demand of those markets grew on average by around 13% per annum, although they exhibit a high degree of volatility, e.g. following the Asian crisis and the global downturn in the early 2000s. Exports to Latin America and, to a lesser extent, Japan also recorded faster growth than the world average at the beginning of the period. From the second half of the 1990s onwards, exports to the CEECs and Russia, as well as China, registered growth rates twice the world average.

2.4 UNDERSTANDING THE SPECIALISATION OF EURO AREA EXPORTS IN TERMS OF THE INDIVIDUAL MEMBER COUNTRIES

This section attempts to provide insights into how the CMSA results for the euro area were shaped by the euro area countries by looking at their individual specialisations in terms of export sectors and market destinations.

2.4.1 CONTRIBUTION OF THE COUNTRIES TO EURO AREA EXPORTS

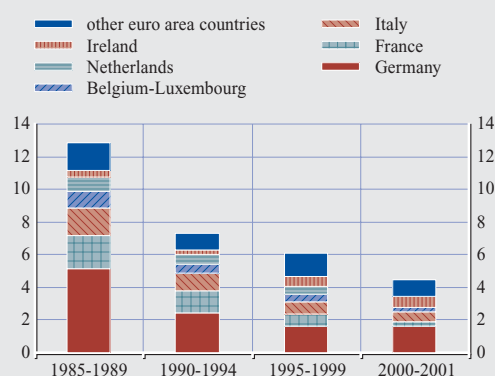
The growth of euro area exports (see Table 2) can be decomposed into the relative contributions of the individual member countries. As Chart 18 shows, German export growth generally accounted for more than one-third of euro area export growth. Meanwhile, French and Italian extra-euro area exports grew less than the euro area average from the mid-1990s onwards, while Ireland increased its contribution over time as its average annual growth of exports (14% in the period 1985-2001) was almost double the euro area average.

2.4.2 EXPORT SECTORS AND THE EURO AREA COUNTRIES

As regards export product composition, most euro area countries re-oriented their exports

Chart 18 Euro area countries' contributions to euro area export growth

(as a percentage of total; period averages)



Sources: WTA, ECB calculations.
Note: The contribution is the export growth of the euro area country, multiplied by its share in euro area exports.

away from low-tech sectors (Table 7) towards medium-tech products (the share of the latter sector decreased only for Finland and the Netherlands), while many countries also increased their shares of high-tech products.²⁵

The euro area's high share of medium-tech products can be explained by the export structure of the largest economies, as more than half of the exports from Germany and France belong to this group. In particular, the exports of transport equipment rapidly increased its

share in the latter part of the sample period. However, the high-tech share of these two countries increased by only around five percentage points reaching 21% in 2000-01, remaining well below the world average (29%). By contrast, smaller countries, such as Ireland and Finland, are highly specialised in high-tech exports.²⁶

Despite a clear downward trend over time, the role of low-tech products remains important as seven of the euro area countries still have more than one-third of their exports in this product segment. For France and Spain, food and beverages play an important role (with shares above 10%), while exports of textiles are much higher for Italy (export share of 18%) compared with the euro area average.

2.4.3 EXPORT DESTINATION MARKETS AND THE EURO AREA COUNTRIES

In terms of market destination, the exports of the euro area countries are strongly influenced by factors such as geographical proximity or language (see Chart 19). Firstly, the euro area countries trade primarily among themselves, as

²⁵ For more details, see Annex II.

²⁶ In the case of the Netherlands, high-tech exports mainly reflect high-tech imports. The specialisation in high-tech exports is related to the growth of re-exports, as the Netherlands is an important logistical centre for ICT exports to other European countries.

Table 7 Shares of technology sectors in euro area countries' exports

(as a percentage of total; period averages)

	Low-tech		Medium-tech		High-tech	
	1985-1989	2000-2001	1985-1989	2000-2001	1985-1989	2000-2001
Belgium-Luxembourg	54	41	37	46	9	12
France	38	28	48	51	14	21
Germany	26	21	58	58	15	21
Greece	88	67	10	21	2	12
Ireland	49	14	22	40	30	46
Italy	47	44	42	44	12	13
Netherlands	42	31	39	34	19	35
Portugal	82	61	13	25	5	14
Spain	57	41	37	47	6	11
Austria	51	37	37	45	12	18
Finland	59	38	32	30	9	32
Euro area average	38	30	48	49	14	21

Source: WTA, ECB calculations.

intra-euro area trade accounts for half of total euro area trade (see Table 4 in Annex II), and with other European countries. In fact, the share of European countries (i.e. the UK, Switzerland and other European countries) is above 30% for each of the five biggest countries, although it declined over the period 1985-2001.

Secondly, the same language or culture also encourages trade. France still maintains its old trade linkages with several African countries, while Spain remains the top euro area exporter to other American countries. Partly as a result of US foreign direct investment, the trade flows between Ireland and the US have increased substantially (see Box 5). Generally, the US remains an important trade partner for Germany, France and Italy, accounting for around 20% of their total extra-area exports.

Thirdly, the break-up of the Soviet Union and the run-up to EU enlargement extended the potential export market to Eastern Europe, which was exploited by several euro area countries (mainly Germany, Italy, Austria and Finland). As an example, the growth in German exports to the CEECs is described in more detail in Chapter 4.

2.5 MAIN COMPETITORS OF THE EURO AREA: PRODUCT AND GEOGRAPHICAL COMPOSITION

This section describes the differences between the euro area and its major competitors in terms of the product and geographical composition of exports, thereby shedding light on the role of competitors in shaping the export share of the euro area.

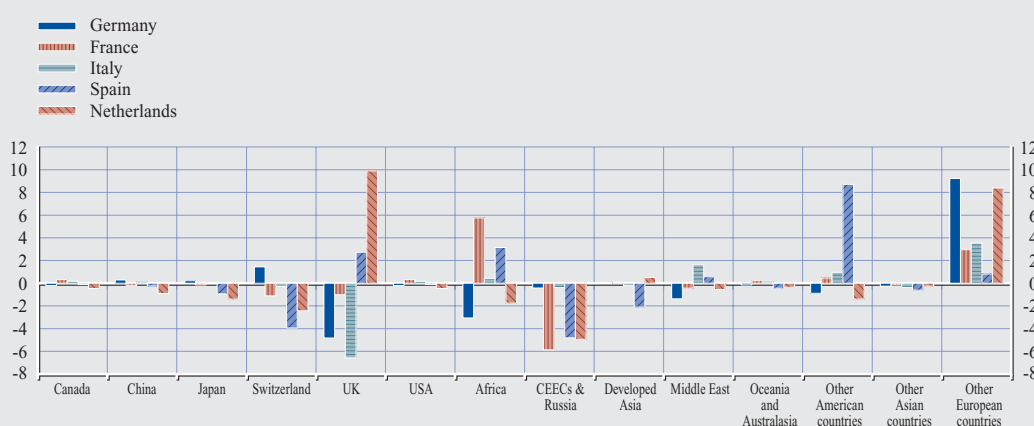
2.5.1 PRODUCT COMPOSITION

The three most important world exporters – the US, Japan and the euro area – have a somewhat different product composition of exports in the sense that, although medium-tech products dominate (see Table 3 in Annex II), the euro area's share in the high-tech sector is considerably smaller – and in low-tech products much higher – in comparison to its main competitors. Note that Japan has the highest share of high-tech products.

Both the United States and Japan entered the 1990s with a relative specialisation in medium-tech sectors (with shares of 48% and 51%, respectively) and in the following period the share remained stable or even decreased. Within this group, the share of agricultural and

Chart 19 Relative market specialisation of selected euro area countries

(as a percentage of total; 1985-2001 average)



Source: WTA, ECB calculations.

Note: This indicator is defined as the difference between the share of the destination in the country's exports and the share of the destination in euro area exports. A value higher than zero for a country/destination indicates a relative specialisation of the country in that destination. Note that the share of CEECs without Russia for Germany is above the euro area average.

industrial machinery increased, but exports of transport equipment became less important. In the case of the euro area, we find exactly the opposite development.

The composition of Chinese exports is considerably different than for the other euro area competitors, with a much higher share accounted for by the low-tech sectors, particularly textiles. Over time, however, there has been a major shift towards high-tech products in China as the share of these products in Chinese exports rose from 5% in the late 1980s to almost 30% in 2002, with particularly strong increases in the share for electrical machinery.

Meanwhile, the United Kingdom has a relative specialisation similar to that of the euro area, i.e. in medium-tech sectors (CHE, MAI and MTR). In contrast to the euro area, the export shares of all of these medium-tech sectors declined over time. In line with other competitors, this was due to a significant change in export structure towards high-tech sectors which seems to have been more successful in the case of the UK than of the euro area.

2.5.2 DESTINATION MARKETS

An analysis of exports in terms of destination markets supports the above-mentioned influence of factors such as geographical

proximity or language. The most important commercial partners of the United States are Canada (around 20% of its exports) and other American countries, while the United Kingdom has strong trade links with the euro area and other European countries (see Table 4 in Annex II). Similarly, Japan trades mainly with developed Asian countries (around 30% of Japanese exports), although the US also has strong export ties with this area (14% of US exports). In fact, the sharp downturn during the Asian crisis had a negative impact mainly on Japan, but Japanese exports to the region gained a new dynamism in the late 1990s due to trade with China. Meanwhile, the exports of the euro area to developed Asia are relatively low.

As for China, the new major player in world trade, in 2001 almost 22% of its exports were directed to the US, 16% to Japan and 13% to the euro area (for more details of China's rising export share in the world market and the possible implications for euro area exports, see Box 3).

In parallel with the higher share for Japan and China in intra-Asian trade, the euro area increased its trade links with Eastern Europe, albeit to a lesser extent due to the more limited dimension of the market. Overall, it is clear that the rapid process of globalisation has been accompanied by substantially higher regional integration across the world.

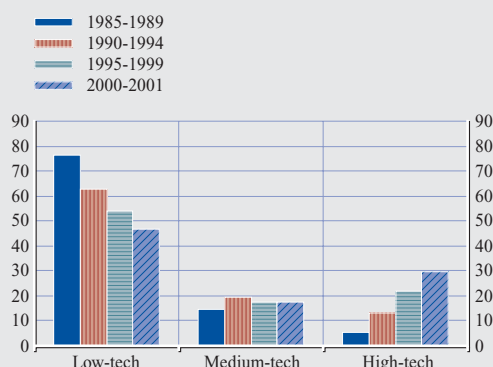
Box 3

CHINA'S RISING EXPORT MARKET SHARE AND ITS IMPLICATIONS FOR THE EURO AREA

This box investigates the recent remarkable export performance of China. China's global export market share rose from 1.7% in 1985 to 7.4% in 2003 (in value terms), and the share of imports from China has increased noticeably in all major markets. It seems that the significant loss in share by Japan was the main counterpart to the gain in global export market share by China. Japan lost market shares in most major markets (especially in the US market), but Japan's losses in other Asian countries were relatively mild and it actually increased its share in China. By contrast, the export share of the euro area does not seem to have been strongly affected by the emergence of China as a major player in world export markets, but competition from China might partly explain the relatively low penetration of the euro area in Asian markets. The latter might, however, reflect the increasing regional integration in the region, largely associated with the internationalisation of production and increased "outward processing" trade flows.

Chart A Structure of Chinese exports by technological content

(as a percentage of total; period averages)



Source: WTA.

Table A Euro area imports from China in selected sectors

(as a percentage of the imports of the euro area by sector)

	1999	2003
Electrical machinery	6.57	14.96
<i>Data machines</i>	6.59	24.55
<i>recorders, televisions, etc.</i>	7.84	22.26
Optical, photographic instruments	4.96	8.07
<i>Photocopiers</i>	12.08	32.17
Furniture, bedding	11.79	16.98
Toys, games and sports requisites	42.12	61.03
Misc. manufactured articles	23.75	31.60
Articles of apparel and clothing accessories	14.17	18.25
Footwear	16.98	21.03

Source: Eurostat

Note: The table shows the percentage of euro area imports in each sector accounted for by China.

More specifically, China and Japan do not compete head-to-head in many product markets – with Japan exporting largely capital-intensive products and China labour-intensive products. Hence, the change in world export market share of these two countries may reflect the outsourcing by Japan of labour-intensive production stages to China, even for overall capital-intensive products. Other Asian countries have also utilised the cheap labour force of China in this way and this trend in the regional division of labour should eventually increase the region's competitiveness.

The share of high-tech products in China's exports increased rapidly over the past two decades, reaching almost 30% of Chinese exports in 2000-01 (see Chart A). This striking increase in its high-tech product share, however, largely reflects the transfer of the final production (and assembly) stage of these goods to China from industrialised economies (mostly Japan, Korea and Taiwan), while the contribution of Chinese value added to this stage of production is still estimated to be low. Subsidiaries of multinational firms accounted for nearly 90% of total Chinese high-tech exports. Accordingly, the direct competition from China vis-à-vis the euro area in terms of higher-value-added products appears to be fairly limited. However, low-tech products (mainly textiles) still represent a significant share of Chinese exports and this may pose some challenges for specific euro area countries.

Over the medium term, China is expected to climb the technology ladder rather quickly, aided partly by the dissemination of technological know-how and management skills via FDI. The enhanced technological capability of Chinese products can already be seen from the product composition of the euro area's imports from China¹. More sophisticated goods, such as office machinery, registered a significant increase in the share of the euro area's imports over the past four years. Traditionally more labour-intensive goods (furniture, toys, apparel and footwear) remain China's main export commodities to the euro area (Table A).

However, the continual FDI-induced upgrade of China's export products, and the catching-up by local firms, is likely to pose increasing competitive pressure on euro area firms in the future.

¹ There has been a gain in market share by Asian exporters in euro area import markets, but this is not as large as the gain in market share of the new EU Member States.

2.6 CONCLUSIONS

During the period 1985-2001, the aggregate export share of the euro area in world markets experienced a decline when measured in value terms after excluding fuels, etc. Accordingly, a constant market share analysis was carried out in order to understand if this outcome might be partly explained by the product and geographical specialisation of euro area exports.

The results of the CMSA suggest that the main reason behind the declining share can be found in the geographical structure of euro area exports, i.e. an under-specialisation in fast-growing markets (such as Asian markets) and a specialisation in European markets, which are growing relatively slowly, apart from the new EU Member States. Somewhat contrary to expectations, the product specialisation of euro area exports in medium-tech sectors helped to support the overall export performance due to the fact that world demand in these sectors grew in line with the average growth of world exports, but this was almost completely offset by the negative impact of the weak presence of euro area exporters in the much faster growing high-tech sectors.

We find that the US and Japan – given their relatively higher specialisation in high-tech products – were better placed than the euro area to take advantage of the strong growth in world demand for high-tech exports during most of the period 1985-2001 (although the later deceleration in demand for these products in the early 2000s may partly explain their losses in export market share towards the end of the sample period). The under-specialisation of the euro area in the high-tech sectors meant that the euro area was unable to capitalise fully on the relatively faster growth of these products in world demand and represents a potential risk for the future as these markets tend to be more dynamic. However, euro area exporters benefited from being less exposed to the volatility of these sectors linked with the technology boom and bust of the second half of

the 1990s and early 2000s. Nevertheless, if world demand for high-tech products had continued to grow as rapidly as in the mid-to-late 1990s, the export share of the euro area may have declined more rapidly in recent years. Accordingly, looking forward, the product composition of euro area exports could be a future source of weakness, particularly as new world players such as China seem to be catching-up with the euro area in terms of product sophistication and may pose a serious threat to market share in the coming years.

Somewhat surprisingly, the emergence of China as a major player in world export markets did not seem to have a strong impact on the euro area's export market share over the past, although it might partly explain the relatively low penetration of the euro area in the Asian and US markets. Even so, the euro area was able to capture another fast-growing market (CEECs and Russia) and compensate to some extent for the missed opportunities in Asia.

Although there are significant differences in export characteristics across the euro area countries, the largest countries – Germany and France in particular – appear to be shaping the pattern of euro area exports. The strong orientation towards medium-tech products and strong linkages with other European countries were the main characteristics of German exports over the last fifteen years, while new export links have been created with the more dynamic markets of the new EU Member States. Meanwhile, the exports of France and Italy grew less than the euro area average, accompanied by relative specialisations in low and medium-tech sectors concentrated in less dynamic geographical markets. Although some smaller countries – like Ireland, and more recently, Finland – managed to change the orientation of their exports towards high-export-growth products (high-tech) and markets (the United States), their impact on the geographical and product structure of the euro area remains limited in view of the size of these countries.

In terms of market destination, the share of the slower-growing European export markets (i.e. the UK, Switzerland and other European countries) is above 30% for each of the five biggest euro area countries, although this share declined during the period 1985-2001. Generally, the US remains an important trade partner for Germany, France and Italy, accounting for around 20% of their total extra-area exports, but this is still significantly lower than the share of the US market in world exports. However, partly as a result of US foreign direct investment, the trade flows between Ireland and the US have increased substantially. Meanwhile, the dynamic export markets of Eastern Europe have been mostly penetrated by Germany, Italy, Austria and Finland.

3 TECHNOLOGICAL AND STRUCTURAL COMPETITIVENESS²⁷

3.1 INTRODUCTION

As shown in Chapter 1, foreign demand and price competitiveness seem to explain only part of export behaviour for some euro area countries. This may not be surprising as export flows are increasingly affected by the globalisation of production as well as rapid technological advances, while on the demand side consumers are becoming increasingly more discerning with regard to quality. Against this background, the aim of this chapter is to discuss and evaluate how other factors, which we broadly define as non-price competitiveness, may help to explain export performance. In this chapter, we focus on two components of non-price competitiveness, namely “technological” and “structural” competitiveness. Following a brief overview of the literature on the relationship between innovation and product quality, we assess the evolution over time of various proxies for technological competitiveness – such as patenting activity and R&D expenditure – for the euro area and major competitors as well as their possible relationship with developments in export performance. We then look at some structural indicators of competitiveness such as educational attainment and survey data on the business environment. The latter provide measures of factors that may ultimately feed into export performance such as labour market regulations and tax regimes. In this context, Chapter 4 is also partly related to non-price competitiveness issues as it looks at how FDI activities also affect competitiveness and export performance.

3.2 INNOVATION, PRODUCT QUALITY AND EXPORT PERFORMANCE

3.2.1 THEORETICAL AND EMPIRICAL LITERATURE

In the simplest empirical model of trade, the volume of exports is modelled as a function of demand and relative prices. In the new trade

and endogenous growth theories expounded by Krugman (1983, 1989) and Grossman and Helpman (1991, 1995), the importance of technological competitiveness in explaining the growth of both GDP and trade flows is highlighted. Krugman claims that high-growth countries face higher income elasticities for their exports, which reflect the greater *variety* of goods they produce.²⁸ Grossman and Helpman acknowledge the role of *innovation* in the development of new *varieties* of a horizontally differentiated product, but they also stress the importance of innovation in developing new products that are of higher *quality* than similar goods available on the market. Spending more on innovation-enhancing activities, such as R&D, enables firms to improve the products and thereby move up the quality ladder relative to competitors. Consequently, in a framework of monopolistic competition, it is possible that a country can shift its export demand curve outwards by innovating which, in turn, increases the quality of the goods it produces.

However, one important aspect to consider is that technological improvements can lead to either *process* or *product* innovations: a *process* innovation will result in a product being manufactured more efficiently, thereby reducing its costs of production, whereas a *product* innovation results in a new commodity or a higher quality product. Therefore, process innovations will affect export volumes indirectly via their impact on export prices and price competitiveness rather than directly influencing export demand.

Recently, economists have sought to include these non-price-competitiveness factors in empirical models of trade. At the industry level, numerous econometric studies have found evidence of a positive impact of innovation – proxied by factors such as patenting activity and R&D expenditure – on

27 By Robert Anderton, Wim Melyn, Sonia Pokutova and Javier Torres.

28 In support of Krugman’s theory, see for example Gagnon (2004).

trade performance (see, for example, Fagerberg, 1988; Oliveira-Martins, 1993; Greenhalgh et al, 1994; Magnier and Toujas-Bernate, 1994; Ioannidis and Schreyer, 1997; Anderton, 1999). Oliveira-Martins (1993) and Ioannidis and Schreyer (1997) find that R&D expenditure and patenting activity are far more important factors in the demand curves for trade in the medium and higher-technology-intensity sectors than for the low-tech sectors. In the low-tech industries, R&D expenditure and innovation seem to be associated with declines in export prices, thereby affecting export demand via changes in price competitiveness (see Greenhalgh et al, 1994). Finally, case-study evidence suggests that the generally good export performance of Germany is largely based on high product quality, and less so on price competitiveness.²⁹ In particular, Anderton (1998) shows that German manufacturers of medical equipment have continually climbed up the quality ladder (i.e. occupying a higher quality segment of the export market), thereby escaping competition from the range of products offered by emerging economies. However, as we will see in Chapter 4, in the context of stronger international competition the importance of cost advantages (through lower wages) cannot be disregarded as it seems to be an important motivation behind Germany's vertical FDI in new EU Member States.

3.3 DEVELOPMENTS IN TECHNOLOGICAL COMPETITIVENESS

As identified in Chapter 2, the specialisation of the euro area in medium-tech sectors and its under-specialisation in high-tech sectors have been significant in shaping euro area exports. In the following analysis, we focus on R&D expenditure and patenting activity (see Box 4) in order to proxy “technological” competitiveness. We begin by looking at the evolution over time of R&D intensity and patenting activity and compare trends for the euro area with those of major competitors. We find some evidence that weak technological competitiveness may have negatively influenced euro area export performance, particularly in the high-tech sectors. In particular, the level of R&D intensity in total manufacturing in Japan and the US is around 50% higher than in the euro area. Meanwhile, within the euro area, there are significant differences in R&D intensities across euro area countries.

29 See, for example, the various National Institute of Economic and Social Research case studies documenting the relatively higher quality of German production (see Jarvis and Prais, 1997; Jarvis et al, 2002) and Anderton (1999), who suggests that lower relative price elasticities for German trade relative to the UK indicate that Germany is far less responsive to competition based on price due to the higher quality composition of German products.

Box 4

PATENT AND R&D DATA

The patent data used in this chapter relate to patents registered in the US. The major advantage of using such data is that they are the most comprehensive and reliable in terms of length of sample period as well as country and product coverage (the source is the United States Patent and Trademark Office, USPTO). Given that the patents are registered in the US, there is a bias towards US companies (called “home advantage”), which causes an underestimation of non-US patents. As a result, the number of patents of US companies is generally much higher than foreign companies according to this data source and their structure is slightly different (while the share of European companies in patents registered at the European Patent Office is relatively higher). Nevertheless, particularly because of the importance of the US market and the increasingly prominent role of multinationals, the US patent data still provide essential information regarding the evolution of technological competitiveness over time, while

allowing meaningful comparisons across countries (see also Annex III, which shows that the general trends in the USPTO data are similar to those of the European Patent Office database).

Data used in the R&D expenditure analysis come from two different, but consistent, datasets (the OECD STAN and ANBERD databases). Data are also available by sector, but the country coverage is more limited in comparison to the patent data. In particular, no data are available for most of the Asian economies and three euro area countries – namely Austria, Portugal and Greece, which represent approximately 5% of total euro area value added – which may marginally distort overall measures of technological competitiveness. For example, approximating the R&D expenditure of the euro area as a weighted average of the remaining euro area countries for which data are available creates a marginal upward bias in this measure. For more details, see Annex III.

3.3.1 TRENDS IN PATENTING ACTIVITY AND R&D EXPENDITURE

Both patenting activity and R&D intensity have grown strongly for many exporting economies since the early 1980s, possibly suggesting that technological competitiveness is becoming more important over time. Relative to competitors, however, the euro area's position has worsened over the same period, particularly due to new competitors such as the Asian economies.

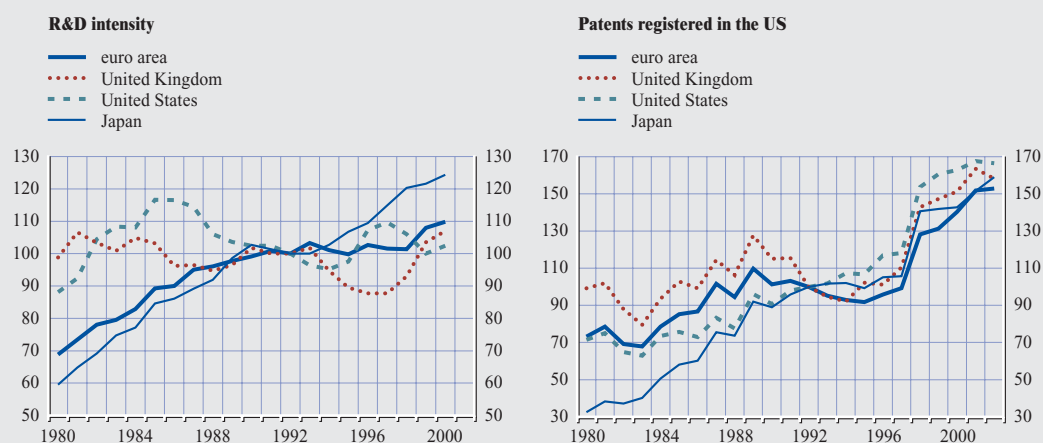
As Chart 20 (left panel) shows, R&D intensity – i.e. R&D expenditure as a proportion of value

added in the manufacturing sector – increased rather sharply in many developed countries over the past twenty years, more than doubling in Japan but rising by around 60% for the euro area. Meanwhile, in the US and the UK the rise in R&D intensity was much less marked. A key fact regarding technological competitiveness is that the *level* of R&D intensity in Japan and the US, at around 9% in 2000, was approximately 50% higher than the euro area and the UK.³⁰ Within the euro area,

³⁰ By contrast, the study by Schibany and Streicher (2005) concludes that the differences in manufacturing R&D intensity between the EU15 and the US are not significant.

Chart 20 Trends in technological innovation in manufacturing

(index: 1992 = 100)



Sources: USPTO, OECD STAN database.
Note: R&D intensity = R&D expenditure divided by value added in manufacturing.

there are significant differences in R&D intensities across euro area countries. In particular, while Italy, Spain and Ireland³¹ have low R&D intensities of around 2%, Germany and France have levels only slightly below those of the US and Japan (see Table 3 in Annex III for country details). In terms of evolution over time, the results for R&D are broadly consistent with patent data (Chart 20, right panel), although developments in patenting activity are somewhat more dynamic.

In order to capture more precisely the position of the euro area with respect to other competitors, we constructed a simple *relative patenting indicator* (see Annex III for further details). As Chart 21 shows, the deterioration in the euro area's relative patenting performance in most of the 1980s corresponded with a rapid improvement in the performance of Japan; later it was negatively affected by the strong patenting activity of some other Asian countries (for example, South Korea and Singapore). However, from 2000 onwards the deterioration in the euro area's relative patenting performance came to a halt, along

with a slowdown in US patenting activity after the technology boom came to an end.

Although the strong performance of the Asian economies also influenced the US and UK relative patenting performance, these latter two countries were more successful than the euro area in the 1990s in maintaining their relative position. Despite the high growth rate of Japanese patents, Japan's relative patenting indicator shows a substantial deterioration during the 1990s due to the dynamic patent growth of the other Asian economies, particularly as the latter account for almost one-quarter of Japan's major competitors.

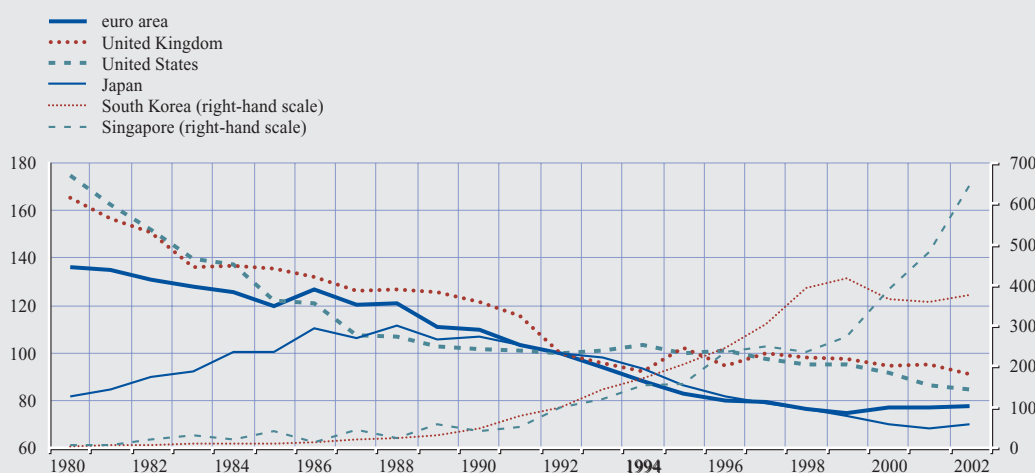
3.3.2 THE STRUCTURE OF EURO AREA PATENTS AND R&D BY SECTOR

A sectoral analysis of technological competitiveness can reveal important determinants of possible shifts in a country's export demand curve. It confirms that countries which invest more in medium and high-tech

31 As we see in Box 5 (Chapter 4), multinational firms established in the Irish economy still tend to undertake most of their R&D activities in the home country.

Chart 21 Relative patenting performance

(index: 1992=100)



Source: USPTO.

Note: A relative patenting indicator is derived as an index of the number of patents registered by a given country divided by patents registered by a weighted average of 12 major competitors. Weights for the euro area correspond to those used to construct the Eurosystem National Competitiveness Indicators (see Buldorini, Makrydakis and Thimann, 2002) – Annex III also provides full details of the weights used. A decline in the index indicates a deterioration in relative patenting performance.

Table 8 Technological structure

(as a percentage of total; period averages)

	Number of patents				R&D expenditure			
	Euro area	UK	US	Japan	Euro area	UK	US	Japan
1980-1984								
Low	11.9	13.6	14.7	9.4	6.2	7.6	5.4	15.1
Medium	57.6	55.9	49.3	42.6	61.0	54.5	56.3	47.6
High	30.5	30.6	35.9	48.0	32.8	37.9	38.3	37.3
1985-1989								
Low	12.0	12.8	14.3	8.8	6.5	6.9	5.4	14.9
Medium	55.2	49.2	45.2	37.7	58.9	60.8	58.1	44.1
High	32.8	38.0	40.5	53.4	34.6	32.3	36.5	41.0
1990-1994								
Low	11.0	11.5	13.3	7.7	7.1	6.7	5.9	13.5
Medium	57.2	50.8	43.6	34.3	60.1	69.0	56.6	44.9
High	31.8	37.8	43.1	58.0	32.8	24.3	37.5	41.6
1995-1999								
Low	9.9	9.4	10.5	6.3	7.4	6.2	6.1	11.5
Medium	54.3	47.8	38.4	28.1	63.2	72.8	51.6	44.1
High	35.8	42.8	51.1	65.6	29.4	21.0	42.3	44.4
2000-2002								
Low	10.0	8.8	9.3	6.3	7.3	5.3	6.5	9.6
Medium	51.3	46.2	34.8	27.2	64.3	72.5	47.5	43.6
High	38.7	45.0	55.9	66.5	28.4	22.2	46.0	46.8

Sources: US Patent and Trademark Office (USPTO), OECD STAN database.

Note: For each economy, the number of patents (R&D expenditure) for individual sectors are expressed as a proportion of the economy's total patents (total R&D expenditure).

R&D, and/or register more medium and high-tech patents, are usually the ones specialised in the production and export of medium and high-tech products (see Table 3 in Annex II).

Starting with the euro area, half of all patents registered by euro area countries in the US are now in medium-tech sectors (see Table 8). This share, however, is declining (from 58% in the early 1980s), while at the same time the high-tech share is increasing (from 31% to 39%) and the low-tech share is falling, though slowly, to below 10%. Data for both the US and Japan show a much stronger move in patent activity towards the high-tech sectors: in the 1980s a large proportion of US and Japanese patents were medium-tech, but now the high-tech patents are dominant, at 56% and 67% respectively. Despite some differences in the evolution over time, the R&D results are qualitatively consistent with the patent data, confirming that the euro area has a relatively lower high-tech share than the US and Japan.³²

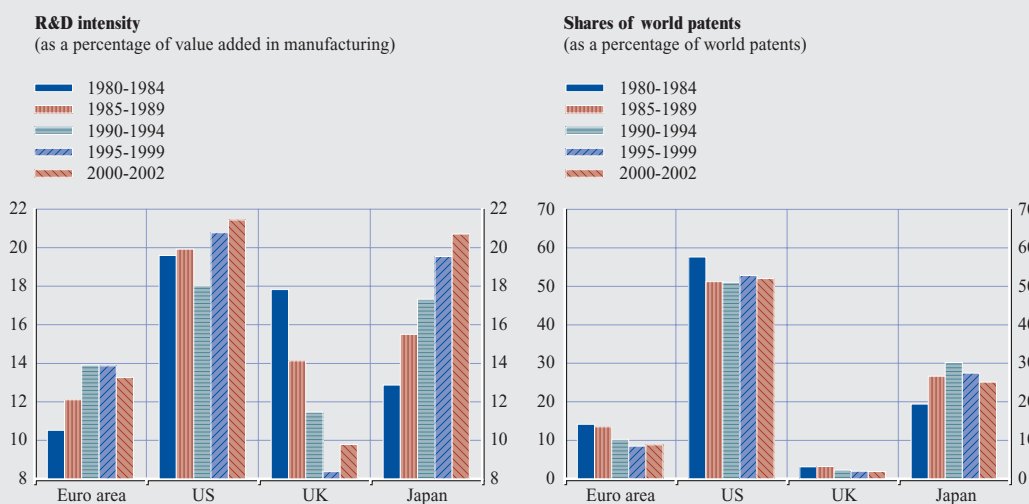
At the euro area country level, Germany, France and Italy tend to shape the euro area's concentration in medium-tech patents. The share of R&D in high-tech sectors in Germany and Spain is clearly below the euro area average. The Netherlands, Finland and Ireland have particularly large shares in the high-tech sectors both for patents and R&D (see Tables 1 and 2 in Annex III).

The euro area's relative weakness in the high-tech sectors is confirmed by looking again at its performance vis-à-vis the US and Japan. While R&D intensity for these competitors is high

³² However, in the last few years, euro area R&D developments in the high-tech sectors have differed somewhat from the evolution of patents in the same sectors, as the share of the latter rose in the second half of the 1990s. One factor that may partly explain this apparent contradiction is an increase in the propensity to patent in some high-technology sectors due to changes in the strategic behaviour of firms as well as the increasing proliferation of computer software patents. In addition, differences in the evolution of R&D and patents are specially pronounced in the case of Germany, suggesting that the high "global involvement" of German firms could help to partly explain this difference.

Chart 22 Technological competitiveness in the high-tech sector

(period averages)



Sources: USPTO, OECD STAN database.

Note: Data refer to levels in percentages, while Charts 20 and 21 refer to indices.

and has been increasing, particularly for Japan, it remains low for the euro area and has recently fallen (see Chart 22, left panel). The technological boom certainly improved the US high-tech R&D intensity from the mid-1990s onwards, but we cannot see a similar pattern for the euro area. As a result, the differences in R&D allocated to high-tech sectors for the euro area relative to the US and Japan became even more acute over this period. In fact, in the high-tech sectors, the R&D intensity of the euro area was around two-thirds that of the US and Japan in 2000-2002. In the case of Japan, there was a strong upward trend in the high-tech sectors during the whole period, with Japan eventually catching up with the US in the late 1990s. Similarly, and even more strikingly, the patent results show a decline in the euro area's share of high-tech patents registered by all countries in the US (see Chart 22, right panel). While euro area medium-tech patents accounted for around 18% of all medium-tech patents registered in the US in 2002, the share for high-tech patents declined to 9%. This is substantially lower than the Japanese high-tech share of world patents of around 25%. The US has managed to maintain a stable share of world

patents in high-tech products since the mid-1980s (at a level much higher than other countries due to the "home advantage" effect).

3.4 TECHNOLOGICAL COMPETITIVENESS AND EXPORT PERFORMANCE

Following the analysis of the previous section, we look at the relationship between one indicator of technological competitiveness – R&D intensity – and the export performance of the euro area countries and major competitors.³³ We separate the industries according to their technological intensities as theory tells us that the links between technological competitiveness and exports differ across sectors. In particular, technological innovation is expected to play an important role in boosting export demand mainly in the medium and high-tech sectors.

Our earlier analysis showed that countries which have higher shares in medium and high-

³³ We only carry out the analysis for R&D intensity as it is not appropriate to "normalise" the patent data by dividing by value added. Also, simply using the growth rate of patents would not be a useful alternative.

tech R&D and patents are the ones specialised in the production and export of medium and high-tech products. However, although technological competitiveness can partly explain the relative export shares of different countries for specific export products, this is to some extent an automatic result as countries naturally tend to devote a greater amount of R&D and patents to sectors in which they specialise. Against this background, this section examines the evidence of a more direct relationship between movements in technological competitiveness and export performance. To do so, Chart 23 plots the percentage change in the world export market shares (in value terms) of the US, the UK and the individual euro area countries against the percentage change in R&D intensity. Data

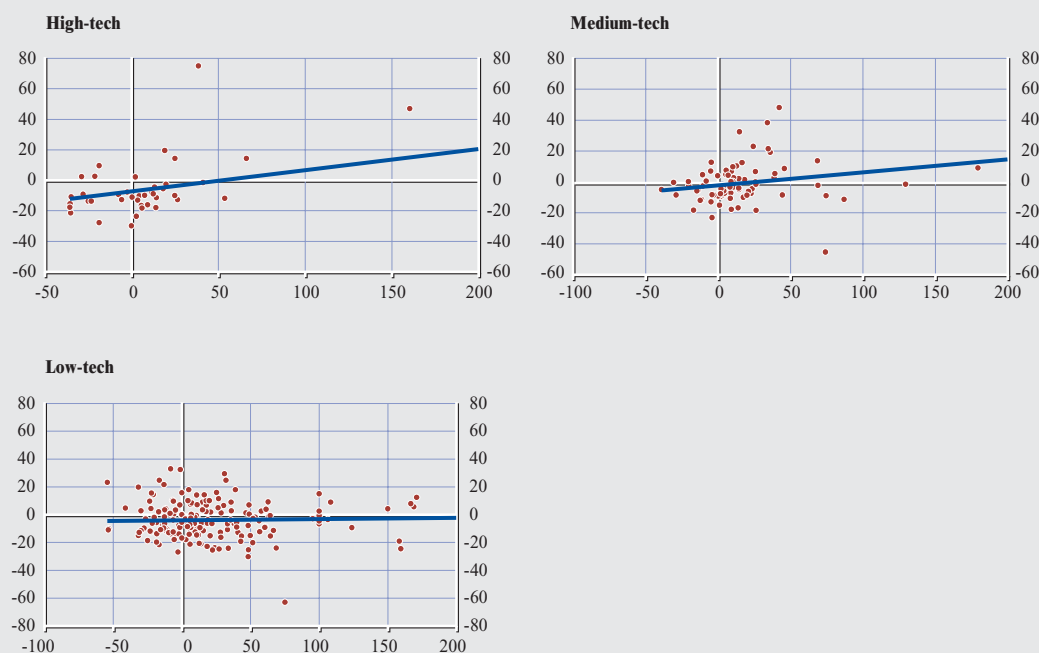
cover the twelve broad sectors for four sub-periods (1985-89; 1990-94; 1994-99; and 2000-02).³⁴ The lagged value of the percentage change in R&D intensity is used in order to capture the probable time lag between an increase in R&D expenditure and its possible impact on export performance.³⁵ As expected, a positive relationship between changes in R&D intensity and export performance is generally observed for the medium and high-tech sectors (Chart 23, upper panel), while this relationship

34 We exclude Japan from the analysis as it is clear that Japan's export market share has declined due to the significant impact of the outsourcing of production to China, as well as the use of China as an export platform by Japan. Note that the analysis is only carried out for eight euro area countries as R&D data are not available for all euro area countries.

35 In terms of the empirical results, the lagged variable also performed better than the non-lagged R&D term.

Chart 23 R&D intensity and export performance for selected countries

(percentage changes)



Sources: OECD STAN database, NCB calculations.

Note: Vertical axis – percentage change in export market share in value terms; horizontal axis – lagged percentage change in R&D intensity. Data used in the calculation cover 10 countries (8 euro area countries, the UK and the US), 5 sub-periods (1980-84, 1985-89, 1990-94, 1994-99, 2000-01) and the 12 broad sectors grouped according to their high, medium and low-tech classification. For more details, see Annex III.

does not seem to hold for the low-tech sectors (Chart 23, lower panel).³⁶

A regression analysis of the above variables using panel estimation techniques, pooling the data across the various time periods, countries and sectors, points to similar conclusions. The estimated parameters (and t-statistics) for the R&D terms were as follows: low-tech sectors 0.01 (0.07); medium-tech sectors 0.09 (2.3); high-tech sectors 0.14 (2.9). The results were very similar regardless of whether country and sector dummies were included. Overall, the results relating technological competitiveness to export performance should be interpreted with caution as the explanatory power of the regression equations is quite low, while the evidence reported in Chart 23 needs to be further investigated using more sophisticated analysis. Another factor that is not taken into account in the analysis is the possible differences in the effectiveness of R&D expenditure across countries.³⁷

From a broader perspective, the trends in technological competitiveness identified in this chapter help us to interpret the results regarding export performance in the previous chapters. For example, Chapter 1 highlighted how the US export market share remained remarkably stable during the period 1995-99 despite the significant loss in US price competitiveness over this period. These developments seem to be linked to the technology boom of the second half of the 1990s, which saw rapid growth in world demand for high-tech products, accompanied by a strong performance from the US in terms of technological competitiveness in these sectors. Another example is the CMSA in Chapter 2. There we found that the product composition had a roughly neutral impact on the euro area's export performance, resulting from a positive impact from the medium-tech sectors, offset by a negative impact from the high-tech sectors. This result is fully supported by the analysis in this chapter which reveals that, in terms of technological competitiveness, the euro area has a strong

presence in medium-tech products but is somewhat weak in high-tech products. Moreover, the analysis helps us to understand the diversity of export performances across the individual euro area countries as described in Chapter 1. For example, the loss in the export shares of Italy seems to partly correspond with its weak technological competitiveness performance across most sectors, while at the same time technology seems to be increasingly important in determining export performance in world markets. However, we should be cautious in our interpretation. For example, in contrast to Italy, Spain managed to increase its export share until the late 1990s and to maintain it after that, despite its low level of technological competitiveness (although, as mentioned earlier, other factors seem to explain Spain's relatively stronger export performance).

3.5 STRUCTURAL COMPETITIVENESS

The "structural" competitiveness of an economy can be defined as a set of characteristics of an economy which can determine its export performance. These characteristics include amongst others human capital, infrastructure, product market regulations, the legal and institutional framework, and taxes. The analysis in this section gives only a brief overview of structural competitiveness based on human capital and some business environment indicators from the Institute for Management Development (IMD) survey.³⁸ The overall analysis of these indicators suggests that on both counts the euro area fares less favourably than its main competitors. In particular, structural rigidities seem to make the business

36 Ideally, R&D stocks are a more appropriate indicator for this analysis but, for the sample period and country coverage, data are only available for R&D flows. One methodology to create data for R&D stocks is the perpetual inventory method as used in Mayes and Soteri (1994).

37 See Pottelsberghe (1998) for an analysis of these issues. Related issues concerning the quality of national innovation systems are discussed in OECD (2002).

38 Measures of structural competitiveness are also compiled by other organisations such as the World Economic Forum (WEF).

environment in the euro area less conducive to improving the performance of firms, which may inhibit technological innovation and hurt price competitiveness. This notwithstanding, on a positive note, some structural reforms seem to be taking place in various euro area countries.

However, some important caveats, which are described in more detail below, have to be noted regarding the use of survey data. In addition, one should be careful in arriving at strong conclusions regarding structural competitiveness and its impact on export performance based on the structural indicators in this report as more theoretical and empirical research is needed in this respect.

3.5.1 HUMAN CAPITAL

According to the theoretical literature, human capital plays an important role in determining a country's economic growth and competitiveness, but empirical studies have not always found convincing evidence for this.³⁹ This failure is usually the result of problems with the quality of the data and the difficulty to quantify the interaction between human capital and economic growth. However, recent research by de la Fuente and Domenech (2000) and Bassanini and Scarpetta (2001) found a positive and significant impact of human capital accumulation on output per capita growth. In another study, Cohen and Soto (2003) calculated the educational attainment (average years of schooling of the population aged 15-64) for a large set of countries over the period 1960-2010 and used it as a proxy for the human capital stock. They were able to demonstrate the positive effects of human capital on growth and on private and social returns.

Using the data of Cohen and Soto, we compare the evolution of the average years of schooling of the euro area with that of its main competitors and find a relatively stronger increase for the euro area over the period 1980-2000 (Table 9). The absolute level of schooling however remains lower in the euro area with an

Table 9 Educational attainment

	1980	1990	2000
Euro area			
Average years of schooling	9.8	10.7	11.2
Index 1980 = 100	100	108	114
Complete higher education (% of population aged 15 or older)	8.9	11.2	14.9
Index 1980 = 100	100	125	166
Main competitors			
Average years of schooling	11.2	11.8	12.3
Index 1980 = 100	100	106	110
Complete higher education (% of population aged 15 or older)	15.8	20.0	22.7
Index 1980 = 100	100	127	144

Source: Cohen and Soto (2003).

Note: Individual country results were aggregated in order to derive a measure for the euro area, using GDP weights for 2003, and a measure for the main competitors, using weights based on the EER-12 index of the euro area.

average of 11.2 years of schooling in 2000, compared with 12.3 years for the main competitors. This is also reflected in the detailed figures on the share of the population aged 15 or older with a complete higher education. This share amounts to 22% for the main competitors and almost 15% for the euro area. On the basis of these figures, it seems that the euro area still has a disadvantage regarding the human capital stock relative to its main competitors.

These indicators, however, give no indication of the quality of the schooling system or the extent to which it meets the needs of a competitive economy. This aspect is not easy to measure. However, one of the questions of the IMD survey, which is referred to below, tries to capture this aspect.

3.5.2 THE BUSINESS ENVIRONMENT

A second indicator of structural competitiveness relates to measures of the business environment in which firms operate. Many of these measures are based on survey

39 See European Commission (2002), "European Competitiveness Report", Chapter II.

data which have particular limitations and should therefore be interpreted with caution.⁴⁰

Different sources (IMD, WEF, EC, OECD) are available in this respect, with a variety of different indicators. In this report, the IMD World Competitiveness Yearbook (WCY) was chosen as it contains a broad selection of indicators measuring the competitiveness of a large set of countries/regions. In addition, the focus of the IMD WCY is also highly relevant for this report as it “analyses and ranks the ability of nations to create and maintain an environment that sustains the competitiveness of enterprises”, using some 300 different criteria. However, it should be made clear that the results obtained by the IMD WCY can differ from other sources, as will be shown later in this section in a comparison with some results of the WEF survey.

Table 10 shows four major indicators of the business environment based on survey data (legal and institutional framework; image of the country; tax system; and production infrastructure). These indicators were chosen because they appear to be crucial in shaping the business environment in which firms operate and their results are available for the past ten years.⁴¹

On average, over the period 1994-2004, the IMD surveys suggest that the business environment was less favourable for the euro area than for its major competitors. In particular, the main weaknesses of the euro area seem to be related to the legal and institutional framework and the tax system (see Table 10). Looking at the more detailed individual criteria (see Table 4 in Annex III), the euro area was assessed rather negatively vis-à-vis major competitors with regard to labour regulations, as well as personal taxes and corporate taxes. Overall, the euro area only performed better in 3 out of the 12 detailed criteria (cross-border transactions, foreign investors, education). Interestingly, the education system is not viewed as a structural weakness of the euro area.

⁴⁰ In particular: (1) the ranking of countries in the survey depends on the criteria used and on the personal opinions of business leaders; (2) different countries use different ways to promote competitiveness, which is not taken into account in business environment surveys; and (3) there is no consensus in the theoretical literature regarding the most important factors shaping the competitive position of a country.

⁴¹ See Annex III for a detailed description of the questions. There were some changes in the formulation of the questions underlying the different criteria, but the results by indicator remained relatively stable over the whole period.

Table 10 Business environment

(averages for 1994-2004)

Relevance in countries	Legal and institutional framework	Image of the country	Tax system	Production infrastructure	Total
Belgium	3.6	7.9	2.8	6.7	5.3
Germany	3.4	7.9	3.2	6.7	5.3
Greece	3.5	7.4	4.4	4.5	4.9
Spain	4.6	7.3	4.7	5.4	5.5
France	3.4	6.9	3.4	6.1	4.9
Ireland	5.8	8.4	5.7	6.4	6.6
Italy	2.7	7.0	3.3	4.3	4.2
Luxembourg	5.3	8.1	5.5	6.6	6.4
Netherlands	5.2	8.1	4.9	6.7	6.2
Austria	4.7	8.1	5.2	7.4	6.3
Portugal	3.9	7.2	4.2	4.8	5.0
Finland	5.9	8.5	4.3	7.6	6.7
Euro area	3.7	7.5	3.7	6.0	5.2
Main competitors	5.2	7.7	5.7	6.3	6.2

Source: IMD World Competitiveness Yearbook, various issues.

Note: The ranking is on a 1-10 scale, with 1 indicating a negative perception and 10 the most positive perception.

From the perspective of the individual euro area countries, Finland, Ireland and Luxembourg recorded the best overall scores, while France, Greece and Italy registered the worst scores, especially regarding the legal and institutional framework and the tax system. On average, the smaller euro area countries seem to perform better than the larger ones.⁴²

Apart from the indicators mentioned above, other indicators are available in the IMD survey but unfortunately only for the most recent years. One of these indicators captures whether the creation of firms in a country is supported by legislation. Another criterion relates to the attractiveness of investment incentives for foreign investors. For both criteria the score of the euro area is somewhat below that of its main competitors.

The results for 4 out of the 12 selected indicators of the IMD survey were compared with the results for similar indicators in the WEF survey⁴³ to see whether they lead to the same conclusions. One has, however, to be careful in comparing the results of both surveys as the indicators they analyse do not match perfectly because the questions on which they are based differ. In line with the IMD survey, the WEF survey results for the questions on labour regulations, the distribution infrastructure and taxes were better for the main competitors than for the euro area. The result on bureaucracy, however, was different in the WEF survey. This shows that the results can be different depending on the source used. One should therefore be cautious in their interpretation.

Summarising our findings, it seems that business environment surveys by the IMD indicate that the euro area is in a worse position than its main competitors and that this has been the case since the mid-1990s. This is most pronounced in areas like the legal and institutional framework and the tax system.

3.6 CONCLUSIONS

Theory tells us that technological competitiveness may improve export performance by shifting outwards the export demand curve, particularly in the medium and higher-technology sectors (product innovations), while process innovations are likely to dominate in low-technology sectors, thereby improving price competitiveness in those sectors. By and large, our empirical analysis supports this hypothesis.

Regarding our analysis of the euro area's technological competitiveness, both the patent and R&D data show that most of the euro area's innovation occurs in medium-technology-intensive sectors (e.g. these sectors account for half of all patents registered by the euro area in the US in 2002), while euro area innovation in the high-tech sectors is substantially below that of major competitors such as the US and Japan. The euro area experienced a decline in its share of world patents in high-tech sectors from the mid-1980s to the early 2000s, while the US managed to keep its share stable. Meanwhile, the R&D gap between the euro area and the US and Japan has widened recently for the high-tech sectors. In 2000, R&D intensity in total manufacturing in the US and Japan was about 50% higher than in the euro area, with Italy and Spain having particularly low R&D intensities.

Our earlier analysis showed that countries which have higher shares of medium and high-tech R&D and patents are usually the ones specialised in the production and export of medium and high-tech products. However, although technological competitiveness can partly explain the relative export shares of different countries for specific export products, this is to some extent an automatic result as countries naturally tend to devote a greater

⁴² We can arrange the euro area countries in the following clusters according to whether they got a low, medium or high score in the IMD survey: low (Italy, Greece and France); medium (Belgium, Germany, Spain and Portugal); and high (Ireland, Luxembourg, the Netherlands, Austria and Finland).

⁴³ These indicators are those that match most closely in both surveys.

amount of R&D and patents to sectors in which they specialise. We therefore examined the evidence for a more direct positive relationship between technological competitiveness and export performance. We found that changes in R&D intensity and export performance seem to be positively correlated for the medium and high-tech sectors, while this does not seem to hold for low-tech sectors. However, this is not a sophisticated analysis and the results should be interpreted with caution, with further research being needed on this issue.

From a broader perspective, the trends in technological competitiveness identified in this chapter help us to interpret the results regarding export performance in the previous chapters. In particular, developments in US export market share seem linked to the technology boom and bust of the second half of the 1990s. Moreover, the analysis reinforces the message of the constant market share calculations as both analyses indicate that the euro area is weak in high-tech sectors but strong in medium-tech products. Developments in technological competitiveness also help us to understand the diversity of export performances across the individual euro area countries.

Finally, our brief analysis of structural indicators of competitiveness using educational attainment and IMD survey data on the business environment shows that the euro area is on average in a less favourable position than its main competitors. In terms of individual criteria, the euro area compared relatively poorly as regards labour regulations as well as personal and corporate taxes. Overall, structural rigidities seem to make the business environment in the euro area less conducive to improving firms' competitiveness, which may inhibit technological innovation and hurt price competitiveness. More research is however needed on structural competitiveness in order to be able to firmly establish its link with export performance and to confirm the results for the euro area relative to its major competitors.

4 FDI AND TRADE⁴⁴

4.1 INTRODUCTION

Over the past 20 years world cross-border FDI activity has grown at a rapid pace driven by the growing role of multinationals in shaping global economic developments. Such trends obviously have implications for world trade and the objective of this chapter is to shed light on how these developments may have affected euro area competitiveness and export performance.

The starting point for the analysis is the large body of academic literature on why multinationals exist and the interactions of their FDI activities with trade. According to the OLI framework proposed by Dunning (1977, 1981), three conditions are needed for a firm to engage in FDI activities, thereby becoming multinational.⁴⁵ First, a firm must have an *Ownership* advantage for a product or production process to which other firms do not have access (i.e. a patent, blueprint or trade secret).⁴⁶ Second, the foreign country must offer a *Location* advantage so that goods can be produced or supplied more cheaply. Third, the multinational firm must have an *Internalisation* advantage, i.e. a strategic reason to exploit its ownership advantage internally rather than licensing or selling it to a foreign firm.

In order to investigate the link between FDI activities and trade, the OLI framework has been used to develop the so-called “knowledge-capital” models of multinational enterprises, which distinguish between two broad categories of multinationals, i.e. those carrying out “vertical” FDI and those involved in “horizontal” FDI activities.⁴⁷ Vertical firms divide the production process along the value-added chain across several geographical locations, while horizontal multinationals aim at replicating a firm’s core activities in foreign markets to satisfy demand in the host country.

The different categories of FDI will have rather distinct impacts on trade and competitiveness.

Horizontal FDI is likely to have a negative impact on trade. Such a kind of FDI occurs among countries which have similar GDP per capita and where trade costs are relatively high (i.e. the “tariff/trade cost-jumping argument”). In particular, trade barriers and transport costs cause a substitution effect away from trade and towards foreign direct investment.⁴⁸ More recently, since trade costs have also been falling, FDI among developed countries has been explained by the competitive advantage of firms in acquiring new technologies abroad.⁴⁹ The technology boom in the United States and the desire of euro area firms to acquire the new technologies developed by US companies seem to have been a factor behind the large euro area FDI outflows to the United States,⁵⁰ particularly in the second half of the 1990s through M&As.

Vertical FDI instead tends to increase trade and competitiveness, as multinational firms seek to locate in more than one country different parts of their production processes to maximise efficiency and reduce costs by taking advantage of international factor-price differences. Generally, the production process is carried out in the low-cost, unskilled-labour-abundant country, while headquarter services (such as R&D, engineering, patents, blueprints, design and advertising) are conducted in the high-cost, skilled-labour-abundant country. A typical example of vertical FDI activity is foreign outsourcing,⁵¹ which has been playing an increasing role worldwide. These operations are characterised by cross-border trade in intermediate goods

44 By Tobias Blattner, Roberto De Santis, Axel Jochem and Karin Wagner, with Box 5 supplied by Mark Cassidy and Box 6 by Laurent Maurin.

45 OLI stands for *Ownership*, *Location* and *Internalisation* advantage.

46 For example, Barrell and Pain (1997) concentrate on the role of firm-specific assets in the form of technology.

47 For an overview, see Markusen (2002).

48 See Horstmann and Markusen (1992), Brainard (1997), Markusen and Venables (1998), Carr, Markusen and Maskus (2001) and De Santis and Stähler (2004).

49 See Kogut and Chang (1991), Neven and Siotis (1996), Fosfuri and Motta (1999), De Santis, Anderton and Hijzen (2004).

50 See De Santis, Anderton and Hijzen (2004).

51 See Helpman (1984) and Freenstra and Hanson (1996).

within the multinational firm. The latter repatriates most of the output for sale back home or abroad. These activities increase intra-firm trade and are intrinsically of a complementary nature vis-à-vis trade. The euro area has also exploited this form of investment to compete on a global scale by outsourcing important manufacturing production facilities to the new EU Member States.

This chapter begins by providing basic information on overall FDI activity of the euro area, both within the area and with respect to the rest of the world, using data compiled by the ECB and UNCTAD. Since such data, however, are too aggregated to provide value added in terms of measuring the impact of FDI activities on euro area competitiveness and export performance and given the large restrictions in terms of more detailed data, the chapter focuses on a number of “case studies”. The first looks at the importance of inward FDI in the case of Ireland’s exports (Box 5).⁵² The second analyses how M&A activity and the related acquisition of technology may have bridged part of the competitive gap – such as the existing gap in research and development previously examined in Chapter 3 – affecting the euro area (Section 4.2.1). The third looks at euro area vertical FDI activities in Eastern

Europe and their relative importance for euro area countries (Section 4.2.2), particularly the impact of outsourcing and the internationalisation of euro area production and how exports have become more reliant on imported inputs, which could imply a lower value added per export unit in comparison to the past (Box 6). Finally, the fourth case study relates – through an econometric analysis – FDI activity and trade for Germany, using a detailed regional and sectoral dataset (see Box 7). The information collected through the case studies supports the view that FDI activities have an essential bearing on competitiveness and trade developments, particularly because they reflect substantial changes in international production patterns.

4.2 EURO AREA FDI ACTIVITY: AN AGGREGATE VIEW

Euro area FDI activity is rather substantial – both within and outside the area – amounting to around 30% of euro area GDP, which is very similar in size to other developed countries (see Table 11). Looking first at outward FDI activity outside the euro area, Luxembourg, the Netherlands, Finland, Ireland and Belgium are

⁵² For a study on FDI as an export platform to reach other markets, see Ekholm, Forslid and Markusen (2003).

Table 11 Euro area foreign direct investment

(as a percentage of GDP; stocks at end-2003)

	Extra-euro area		Intra-euro area	
	In	Out	In	Out
Austria	7	15	14	6
Belgium	34	22	71	74
Finland	20	29	5	13
France	12	21	14	16
Germany	9	16	16	11
Greece	4	5	8	1
Ireland	62	24	65	14
Italy	5	6	6	9
Luxembourg	2,001	1,130	540	1,294
Netherlands	157	173	57	125
Portugal	12	10	20	12
Spain	16	19	18	11
Total euro area	28	29	21	25
Memo item: World	23	23		

Source: ECB, UNCTAD.

the most active euro area countries,⁵³ while Luxembourg, the Netherlands, Ireland and Belgium are the largest recipients of FDI inflows in terms of their GDP. Conversely, Greece and Italy are characterised by relatively low levels of both inward and outward FDI.

Turning to recent intra-euro area FDI activities, it seems that their impact on competitiveness and trade may not be that relevant since a substantial share of such FDI took the form of M&As in the financial services sector (about 83.2% of total M&As during the period 1995-2001).⁵⁴ As a result, the transfer of technology usually associated with M&A deals may have been rather limited with respect to FDI between the euro area countries. With regard to overall FDI activities within the euro area, Belgium, Luxembourg and the Netherlands recorded the largest FDI stock in terms of their GDP. Note that German FDI towards other euro area countries was a smaller proportion of German GDP (11%) than the FDI

of other euro area countries in Germany (16%). This probably resulted from previous substantial investments by German companies in euro area countries such as Spain and Portugal in the 1980s and early 1990s being replaced in later years by German FDI towards the new EU Member States (see Section 4.2.2). Meanwhile, Italy and Greece did not build up significant FDI stocks, thereby possibly reducing the potential positive impact on their competitiveness and export performance.

53 The FDI outflows from Luxembourg and the Netherlands partly reflect their role as channels for investments, directed to and originating from outside the euro area, since a number of foreign multinationals channel FDI through special purpose entities (SPEs) in these two countries. This is due, among other reasons, to favourable financial and tax environments in these countries. The transactions through SPEs tend to inflate the inward and outward investments of those countries. For example, a US investment in Germany via a Dutch SPE appears as an outward investment from the Netherlands to Germany.

54 In the boom period 1995-2001, intra-euro area M&A activities accounted for approximately 60% of total extra plus intra-euro area M&As. At the beginning of the 1990s and after the bursting of the global “dot com” equity bubble in 2001, the intra-euro area share amounted to around 80%.

Box 5

FDI TO THE EURO AREA: THE IRISH EXPERIENCE IN THE 1990s

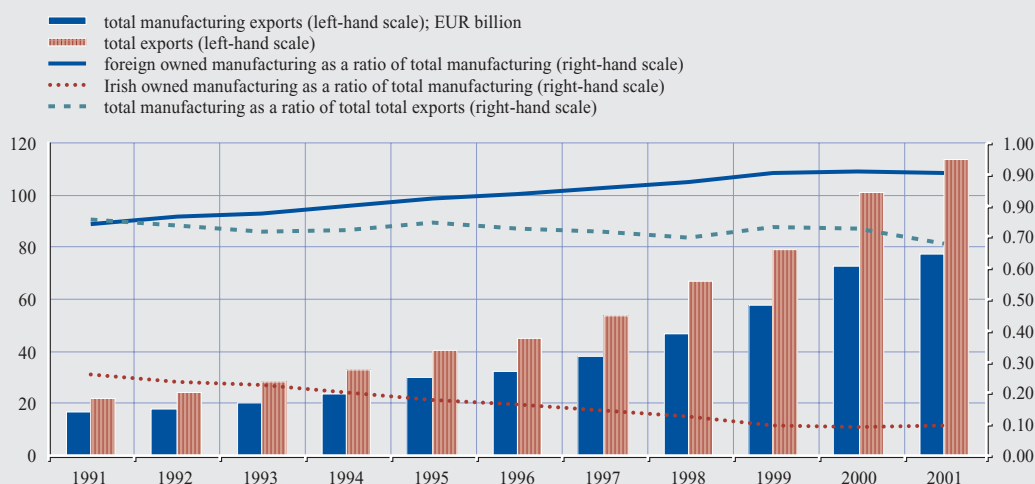
The Irish economy provides a useful case study of the potential benefits for the host country of inward FDI, as it experienced a combination of high inward FDI flows and strong export-led economic growth during the 1990s.¹

The inward FDI stock as a percentage of Irish GDP rose from 72% in 1990 to 130% in 2003, a much higher ratio than in the European Union as a whole. This has primarily involved “greenfield” investments and expansion of existing plants rather than M&As. The majority of the FDI inflows into Ireland have been from US multinational firms in high-technology manufacturing sectors, including electrical and electronic equipment, medical instruments and higher-tech chemicals and pharmaceuticals. More recently, the economy has also managed to attract new foreign investment in internationally traded services, including computer software and financial services.

There is no doubt that inward FDI has improved competitiveness in Ireland, both directly through the effect on exports and the sectoral composition of the economy and indirectly through spillover effects on domestic firms. Real GDP growth in Ireland averaged over 7% per annum during the 1990s with a corresponding rate of growth in real exports of over 14%. This

1 For a more complete analysis of FDI in Ireland see, for example, Barry and Bradley (1997).

Chart A Developments in Irish exports



Source: Irish Census of Industrial Production, national accounts.

export-led growth was driven by the foreign sector of the economy. In fact, while the share of Irish-owned manufacturing exports in total manufacturing exports declined over the 1990s, the foreign-owned manufacturing exports rose sharply (see Chart A).

Data on the value of exports show that foreign-owned firms in Irish manufacturing accounted for around 95% of the total increase in Irish manufacturing exports and around 63% of the increase in total-economy exports over the same period. Foreign firms in the services sectors also contributed to the aggregate increase in exports, although the data are not available to measure this contribution.

Foreign multinationals in Ireland are generally characterised by an extremely high export orientation and productivity levels and tend to be located in high-technology sectors.² As a result, the Irish economy now has the highest degree of specialisation in high-technology sectors in the European Union (ESCB, 2004). As these sectors are generally associated with higher productivity growth rates, the increased specialisation has had a positive impact on the competitiveness position of the Irish economy.

In addition to the direct contribution of FDI to productivity and export competitiveness, it seems evident that the Irish economy has also benefited from spillover effects. A number of channels for the transfer of knowledge from multinationals to the host country have been identified in the economic literature. These include imitation effects, backward and forward linkages, labour market channels and the effects of increased competition. In Ireland, the rate of growth of R&D expenditures of both foreign and domestic firms since 1990, combined with an expansion of the domestically owned information technology sector, suggest that foreign

2 In 2001, the latest year for which data are available, foreign-owned firms in the Irish manufacturing sector exported around 93% of their output, compared with a corresponding figure of 37% for Irish-owned firms. Labour productivity levels, measured as gross value added per worker, were around five times higher in the foreign sector than in the indigenous sector of manufacturing.

firms are locating more of their high-value-added processes in Ireland and also that Irish companies are benefiting from knowledge spillovers.³

There is also empirical evidence that multinationals have had a positive effect on the development of indigenous enterprises through the creation of linkages with domestic producers, including a substantial increase in the proportion of raw materials used by foreign firms which are sourced in Ireland.⁴ Agglomeration economies, meanwhile, have provided momentum for the establishment of increasing numbers of knowledge-intensive multinationals. Finally, the presence of foreign multinationals has also had a positive impact on the value of human capital in Ireland by creating a demand for high-skilled graduates which was not present before the 1990s and also through employee training and technological and managerial advances.

3 Despite the increase during the 1990s, the R&D intensity of foreign firms in Ireland remains low, particularly in the high-technology sectors, which indicates that multinational firms still tend to undertake most of their R&D activity in the home country at headquarters.

4 See for example Görg and Strobl (2002).

4.2.1 EURO AREA HORIZONTAL FDI: M&A ACTIVITY

Since the mid-1990s, extra-euro area M&As formed a substantial part of total euro area FDI abroad. They accounted on average for 62.8% of the total euro area FDI abroad in the period from 1999 to 2001,⁵⁵ declining to 41.5% on average over the period from January 2002 to August 2004 (see Chart 24). They reached a peak of EUR 361.8 billion (5.5% of GDP) in 2000.

Among the motivations for firms to merge with or acquire an existing company, the quest for strategic assets appears to be very relevant. This includes acquiring R&D or technical know-how, patents, brand names, local permits and licences, and supplier or distribution networks, which are not available elsewhere in the market and take time to develop. As they imply acquisition of knowledge capital, M&As can therefore improve euro area competitiveness and hence export performance. Indeed, changes in trade patterns also reflect structural shifts in production caused by the use of new technologies and new ways of organising and locating production.⁵⁶

Moreover, the links between domestic and foreign affiliates can spill over to suppliers and other domestic firms, favouring the diffusion of expertise and technologies. Overall, strategic M&As are possibly carried out to acquire both skills and technologies and may directly or indirectly have an impact on the competitiveness of euro area exports.

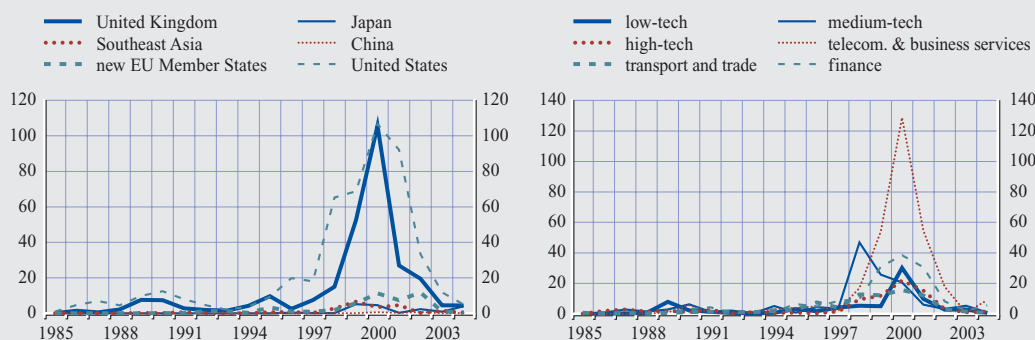
The United States is the major single destination of extra-euro area M&A activity, attracting on average 39% of total M&As from the euro area over the last ten years (EUR 43.0 billion on an annual average basis; see

55 Deal values from the Thomson One Banker database are not strictly comparable with the balance of payments' concept of FDI. Data on euro area FDI outflows are usually provided on a net basis (capital transactions' credits less debits between euro area investors abroad and their foreign affiliates), while M&A activities are reported at their gross transaction values.

56 The technology boom in the United States and the desire of euro area firms to acquire the new technologies of US companies seem to have been a key factor behind FDI flows to the United States, particularly in the second half of the 1990s. In fact, De Santis et al (2004) show that US patents in high-tech sectors and US expenditure in manufacturing R&D, together with the investment climate in the euro area, are statistically significant variables in explaining euro area FDI in the United States.

Chart 24 Developments in extra-euro area M&As and euro area M&As by sector

(EUR billions)



Source: Thomson One Banker.

Note: See footnote 58 in the text for a detailed breakdown of industries.

Chart 24, left panel). Over the same time span, the United Kingdom was the second largest host country, accounting on average for 23% of total euro area M&A activity abroad. However, the share for the United Kingdom has an upward bias given the role of the City of London as an important financial centre for euro area-owned monetary financial institutions (MFIs).⁵⁷ More surprisingly, other major industrialised countries like Japan or emerging economies in South-East Asia, and more recently China, did not attract any substantial part of euro area M&A activity, despite their prominent role as hosts to global FDI. As to the new EU Member States, during the 1990s euro area multinationals invested in manufacturing and in services from banking to retailing, often through privatisations.

More recently, over the period 2002-04, the new EU Member States were the third largest host economy, accounting on average for 6.5% of total euro area M&A activity abroad. The sectoral breakdown of euro area M&A activity abroad indicates that euro area companies invested worldwide largely in telecommunication and business services (which include many computer software-related activities), medium-tech manufacturing and finance (see Chart 24, right panel).⁵⁸ The high-tech manufacturing industries showed similar but more subdued trends.

Overall, euro area companies are less engaged in M&As in both low-tech industries and low-cost countries. Investment in finance, telecommunication and many computer software-related business services, as well as high-tech and medium-tech manufacturing, represents around 80% of euro area M&As abroad over the period 1985-2004.

4.2.2 EURO AREA VERTICAL FDI: OUTWARD FDI IN THE CENTRAL AND EASTERN EUROPEAN COUNTRIES

The increased internationalisation of production over the past years has led to a marked increase in vertical FDI, whereby multinational firms seek to locate different parts of their production processes in lower-

⁵⁷ Investments were highly concentrated in both geographical terms and, to a lesser extent, in terms of the number of deals. For example, EUR 17.3 billion or 77% of euro area M&A activity in the telecommunication sector from 1995 to 2000 were accounted for by approximately 15 transactions only in the United Kingdom, stressing the role of the City of London as a financial centre.

⁵⁸ High-tech manufacturing includes the following industries: aerospace and aircraft, computer and communication equipment, medical, photo equipment and clocks and electrical products and electrical equipment. Medium-tech manufacturing comprises the following industries: manufacturing of chemicals and chemical products, rubber and plastic products, machinery and transport equipment. Low-tech manufacturing covers the following industries: the manufacturing of food, beverages and tobacco, metal and metal products, textiles, apparel and leather, wood and wood products and paper and paper products.

wage countries in order to maximise efficiency and reduce costs. This type of FDI, by enhancing the technological capabilities of an economy and the sectoral structure of exports, is likely to have a positive impact on productivity and competitiveness in the host country, as well as important effects on the trade and competitiveness of the home country.

Most of the euro area's vertical FDI is in the CEECs, fuelled in the 1990s by privatisation, economic liberalisation, deregulation and the prospect of EU enlargement. The relatively low wage costs (along with good education levels) and the establishment of strategic positions in these relatively new markets are the two main pull factors behind euro area FDI in the CEECs. As shown in Table 12, euro area FDI in this region is focused on a few countries: around 70-80% of the total FDI inflows into the Czech Republic, Hungary, Poland and Slovakia were from the euro area (mostly from Germany, the Netherlands and Austria).

Greenfield foreign investment in manufacturing in the CEECs plays an important role as 35-40% of FDI activities are

in the traditional manufacturing sectors. In particular, the automotive industry is on a growth path. New projects were carried out in 2003 in Slovakia (Hyundai and Peugeot-Citroen) and Romania (Renault), coupled with the expansion of already existing projects (Audi and Suzuki in Hungary). In recent years, a shift towards higher-value-added industries and service industries (e.g. banking, insurance) has also taken place. In some countries (e.g. the Czech Republic), large-scale privatisation projects particularly in the financial sector have been the main driving force of FDI. Bulgaria and Romania instead saw a great number of investment projects in real estate and the retail sector.

The increase in the CEECs' share of euro area trade – particularly the new EU Member States – was to some extent accompanied by declining intra-euro area trade, which affected mostly the larger euro area countries. Over the period 1985-2001, there was a significant decline in the share of the total (i.e. intra plus extra) imports of the euro area supplied by France, Germany, the Netherlands and Italy, while the share of the new EU Member States increased

Table 12 Inward FDI stocks in selected CEEC-economies by investing country

(as a percentage of total)

	Czech Rep. ¹⁾	Hungary ¹⁾	Poland ¹⁾	Slovakia ²⁾	CEEC-8 ^{1), 2)}
Austria	11.4	10.9	3.6	14.1	8.5
Belgium	4.9	2.1	3.1	1.1	..
Denmark	0.5	0.4	2.9	0.7	2.1
France	6	5.3	13.8	7	8
Germany	22.1	32.5	18	23.3	21.5
Italy	0.8	2	4.1	8.2	2.8
Japan	1.1	1.7	0.1	0.2	0.7
Netherlands	34.1	14.8	24.6	16.8	22.3
Russia	0.1	0.2	2.9	0	1.3
Sweden	1.2	1.6	3.5	0.2	4.2
Switzerland	3.5	1.3	1.7	0.8	2.3
United Kingdom	2.7	1.1	3.2	7.3	2.8
US	4.9	8.3	10	3.9	7.4
Other countries	10.5	16.8	7.9	14.1	14
Euro area	81.7	71.4	72.2	79.5	71.2
EU 15 countries	86.1	74.5	82.8	88.9	80.3

Source: WIIW database.

1) 2002.

2) 2003.

from just over 1% to almost 5% (Table 13). However, the trade diversion effect is only partially confirmed by Fidrmuc and Djablik (2004), who claim that these developments are also partly due to a stagnation of intra-industry trade in the larger euro area countries since the mid-1990s. Meanwhile, in terms of purely extra-euro area imports, the share of the new EU Member States had increased to 10.4% by 2003.

The biggest transformation has occurred in trade between the new EU Member States and Germany. As Table 13 shows, the share of the new EU Member States in total (intra plus extra) German imports increased from around 2% in 1985 to around 10% in 2001, with the key trade partners being the Czech Republic, Hungary and Poland. Over the same period, the share of euro area countries in German imports decreased from around 50% to just below 45%, with virtually all the decline occurring from the mid-1990s onwards. The major euro area countries accounting for this decline are France, Italy and the Netherlands. It is especially pronounced in sectors such as textiles, wood and wood products, fabricated metals, electrical machinery and transport equipment. To a large extent, this trade shift is due to the rising importance of new EU Member States' affiliates in German firms' production processes, which has entailed a rise

in intra-industry trade of a vertical nature. However, some of the loss in market share by euro area countries in Germany was also due to increasing import penetration by Asian economies, particularly China.

Outsourcing and the internationalisation of euro area production suggest that exports have become more reliant on imported inputs, which could imply a lower value added per export unit in comparison to the past. Therefore, although this report focuses almost exclusively on export performance, it is important to also examine its relationship with import developments since net trade is the key variable that actually affects GDP growth. Quantitative evidence of this phenomenon is provided by Box 6 which shows that – in part due to increasing outsourcing – the dependence of exports on imports is high and rising for the euro area. This notwithstanding, the value added per export unit remains high while the internationalisation of production has other wider effects on participants, which overall are expected to be beneficial.

Given the importance of vertical FDI in the CEECs for German manufacturing, Table 14 compares the growth of German FDI stocks in the eight central and eastern European EU Member States with the growth of German bilateral trade at the sectoral level for the

Box 6

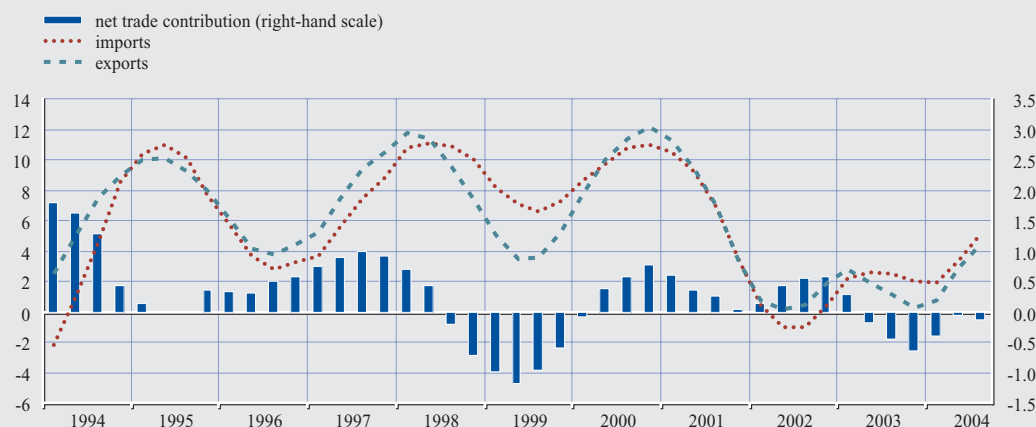
THE IMPORT CONTENT OF EXPORTS AND THE INTERNATIONALISATION OF PRODUCTION

In addition to export performance, it is important to remember that import developments also matter, since changes in the import intensity of exports affect the impact of export growth on GDP. An understanding of how imports and exports interact in the euro area has critical policy implications and is dealt with below.

Over the last ten years, the share of both exports and imports in the GDP of the euro area countries has increased rather steadily. Although the rise in intra-industry trade may have played a role, a major explanatory factor appears to be the rapidly increasing importance of the internationalisation of euro area production, whereby the process of manufacturing a product is broken down into a number of discrete parts and stages involving vertical chains of production,

Chart A Euro area trade volumes

(annual growth in percentages; net trade contribution in percentage points)



Source: ECB computations based on Eurostat national accounts data.
Note: Exports and imports cover goods and services and include intra-euro area trade.

spread over numerous countries both inside and outside the euro area. One outcome of this process is that the import content of exports has risen over time as exports become increasingly reliant on imported inputs, implying a lower “value added” per export unit in comparison to the past. As a result, strong export growth is no guarantee of strong GDP growth. Chart A indicates that euro area exports and imports tend to move closely together over the medium term. Moreover, it shows that, on several occasions, the net trade contribution to GDP growth has been negative even during periods of strong export growth (e.g. at the end of 1999 and start of 2000, as well as in the first half of 2004). Interestingly, it also shows that the magnitude of the euro area’s net trade contribution has fallen over the past ten years, which again is consistent with exports and imports moving more closely together.

In order to shed some light on this issue, we use input-output tables to directly compute the import content of exports (we define the latter as the share of imports embodied in one unit of exports, which can also be interpreted as the long-run elasticity of imports with respect to exports). The import content of exports is computed for two separate years (1995 and 2000) for Germany, France, Italy, the Netherlands, Austria and Finland (Table A).

Input-output tables for the euro area do not exist, but results that roughly approximate the euro area can be derived from the input-output tables for five countries that together account for around 60% of euro area GDP (Germany, Italy, the Netherlands, Austria and Finland). Moreover, for Germany, the Netherlands, Austria and Finland, the import content can be broken down into its intra and extra-EU components. For all the countries, the results show an increase in the import content of exports between 1995 and 2000, with Germany showing the strongest increase (of 8.1 percentage points), and Italy the lowest (3.8 percentage points).¹ Comparing the results across countries, the import content of exports in 2000 was highest in the Netherlands (58.7%) and lowest in Italy (35.4%).²

1 For Germany, the results are confirmed by a recent study by DESTATIS, the Federal Statistical Office (see the press release of 17 August 2004).
2 The high import intensity of exports for the Netherlands is partly due to “transit trade”.

Table A Import content of exports for the euro area and euro area countries

(percentages)

	1995			2000		
	Total	Intra-EU	Extra-EU	Total	Intra-EU	Extra-EU
Euro area	37.6	23.3	14.4	44.2	23.9	20.3
Germany	34.7	20.3	14.1	42.8	22.4	20.4
France	34			40.6		
Italy	31.6			35.4		
Netherlands	52.3	34.2	18.1	58.7	30.2	28.4
Austria	46.7	33.9	12.7	51	34.5	16.5
Finland	37.5	22.5	15	42	23	19.1

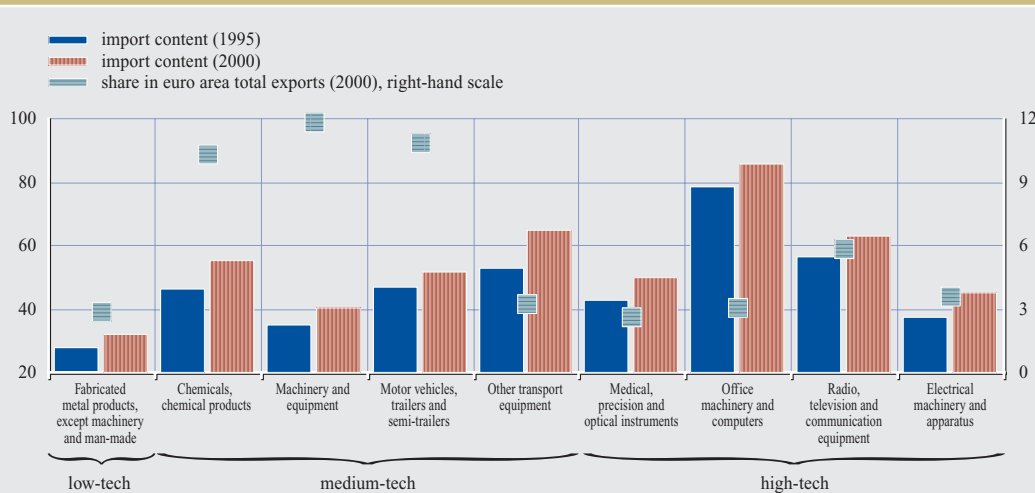
Source: ECB calculations using Eurostat and OECD data.

Note: 1) Computations based on Eurostat input-output tables for 1995 and 2000. 2) The euro area is approximated by a weighted average of Germany, Italy, the Netherlands, Austria and Finland. 3) The computation for France is based on OECD input-output tables based on a different product classification.

Moreover, weighting together the five countries as an approximation of the euro area shows that the import content of exports for the euro area increased from 37.6% to 44.2%. In addition, among the components of final demand, exports have by far the highest import content (compared with 44.2% for exports in 2000, the import content of total investment was 29.0%, while the import content of private consumption and government consumption was 19.7% and 7.8% respectively).

Given that the import content of exports increased in the euro area from 37.6% in 1995 to 44.2% in 2000, this implies that the value added in euro area exports has declined from 62% to 56% over the same period. However, the internationalisation of production that partly explains the rise in the import content of exports has boosted trade as well. For the euro area, the share of (intra plus extra) exports in GDP rose from 29% in 1995 to 38% in 2000. As a result, the net impact of a 1% increase in exports on GDP growth may have remained constant in the euro area,

Chart B Import content of exports across major manufacturing sectors for the euro area



Source: ECB calculations using Eurostat and OECD data.

1) Computations based on Eurostat input-output tables for 1995 and 2000.

2) The euro area is approximated by a weighted average of Germany, Italy, the Netherlands, Austria and Finland.

with the decline in the value added of exports being counterbalanced by the increasing share of exports in GDP.

Looking at the geographical breakdown of imports for the intra-EU15 and extra-EU15, it appears that, although the intra-EU import content generally increased from 1995 to 2000, it increased much less than the extra-EU import content. In the case of the Netherlands, it has even decreased. The greater increase in the extra-EU import content may be partly related to the rapid increase in outsourcing between the euro area and the new EU Member States.

Meanwhile, Chart B shows that the import content of exports for the euro area as a whole varies widely across sectors, with exports of office machinery and computers showing the highest import intensity and fabricated metal products the lowest. Moreover, there was an increase in the import content of exports in all of the sectors shown between 1995 and 2000, with increases ranging from 3.9 to 12.1 percentage points.

To conclude, the evidence suggests that the extent to which exports depend on imports is high and increasing for the euro area. Nevertheless, the value added per export unit remains high. On a sectoral basis, it would appear that the high-tech sector “office machinery and computers” recorded the highest import intensity and therefore a lower net trade contribution to GDP than some medium-tech sectors. This bodes well for the euro area (at least for now) given the specialisation of euro area exports in medium-tech products.

period 1997-2002. It is important to emphasise that FDI and trade activities in the traditional sectors, such as food, textiles and wood, are not as dynamic as in other sectors characterised by higher value added. The sectors where the shift away from intra-euro area imports to imports from new EU Member States has been most pronounced are characterised by strong dynamics in German FDI and a reversal in the bilateral trade balance from a surplus to a deficit. Transport equipment exhibits the highest value of German FDI. In the high-tech sector professional and scientific goods, the level of FDI is lower, but also increased substantially over time and simultaneously entailed a jump in German imports.⁵⁹ All in all, firms specialised in manufacturing electrical machinery, scientific and optical goods, and transport equipment have shifted some production abroad in order to import intermediate manufacturing goods, implying that German firms have benefited from increasing efficiency by a restructuring of production and outsourcing abroad (see Box 7).

4.3 CONCLUSIONS

Trade patterns have been changing significantly, partly reflecting structural shifts in production caused by new technologies, new demand patterns, new trade policies and new ways of organising and locating production. In particular, the share of parts and components in total trade and intra-firm trade has been rising. Therefore, the activities carried out by multinational enterprises have become important in understanding competitiveness, trade dynamics and export performance. A genuine improvement in international competitiveness can result from FDI via the upgrading of human resources or the use of

⁵⁹ A recent survey of the German Chamber of Commerce also indicates that German FDI in the new Member States is primarily motivated by cost advantages arising from lower wages. According to this study, especially small and medium-sized firms in electrical engineering, the textile industry and the chemical sector are going to play an increasing role. In the first years of transition, German FDI in central and eastern Europe was dominated by large enterprises (DIHK, 2004).

Table 13 Euro area imports: the increasing role of new EU Member States

(as a percentage of German and euro area imports by country of origin)

	1985		2001		Difference 2001-1985	
	Germany	Euro area	Germany	Euro area	Germany	Euro area
Germany		18.1		14.7		-3.3
France	12.0	9.9	9.3	8.7	-2.7	-1.3
Italy	10.7	7.6	8.1	6.8	-2.6	-0.8
Belgium-Luxembourg	7.3	6.8	7.5	7.3	0.1	0.5
Greece	0.8	0.5	0.3	0.2	-0.5	-0.2
Ireland	0.9	0.8	2.3	1.9	1.5	1.1
Netherlands	10.5	7.4	7.3	5.8	-3.2	-1.5
Portugal	0.7	0.6	1.1	1.0	0.4	0.4
Spain	2.0	2.3	3.2	4.4	1.2	2.1
Austria	4.1	2.0	4.4	2.0	0.3	0.1
Finland	1.0	0.7	1.3	0.9	0.3	0.2
Euro area countries	49.9	56.7	44.7	53.8	-5.1	-2.9
Denmark	2.1	1.3	2.1	1.2	-0.1	-0.1
United Kingdom	7.7	8.1	7.0	8.1	-0.7	0.0
Sweden	2.8	2.6	1.7	1.8	-1.1	-0.8
EU 15 countries	62.5	68.7	55.4	64.9	-7.0	-3.8
Czech Republic	-	-	3.1	1.3	-	-
Slovakia	-	-	0.9	0.4	-	-
Hungary	0.5	0.3	2.5	1.3	2.0	0.9
Poland	0.6	0.4	2.8	1.3	2.1	0.9
New EU Member States	1.8	1.1	10.1	4.9	8.3	3.8
Switzerland	4.4	3.0	4.3	2.7	-0.1	-0.3
United States	8.0	8.1	7.7	7.1	-0.3	-1.0
Japan	5.7	3.9	4.1	3.2	-1.6	-0.7
China	0.6	0.4	2.8	2.4	2.3	2.0

Source: World Trade Analyzer.

Note: Imports by country/region of origin are expressed as a percentage of total (intra+extra) imports. Data for some new EU Member States are not available for 1985.

Table 14 Structure of German FDI and trade in the CEEC-8

(EUR millions, unless otherwise specified)

	FDI stock		Exports		Imports	
	2002	2002/1997 (% growth)	2002	2002/1997 (% growth)	2002	2002/1997 (% growth)
Low-tech						
Food, beverages and tobacco (FOD)	393	45.6	1,581	34.9	1,527	50.6
Textiles, apparel and leather (TEX)	267	44.3	3,381	10.0	3,381	-14.2
Wood and wood products (WOD)	65	66.7	435	74.7	1,285	7.0
Paper and paper products (PAP)	248	56.0	1,945	72.7	1,284	196.5
Non-metallic mineral products (MNM)	998	209.9	1,036	81.8	1,001	19.2
Basic metal industries (BMI)	90	143.2	2,367	81.4	2,616	40.3
Fabricated metal products (BMA)	404	160.6	2,793	92.4	2,703	80.7
Medium-tech						
Chemical products (CHE)	1,394	212.6	8,926	71.5	3,978	72.0
Manufacture of agricultural/indust. machinery (MAI)	802	51.3	7,509	49.8	5,239	136.4
Manufacture of transport equipment (MTR)	3,723	129.5	9,022	124.9	12,301	234.9
High-tech						
Professional and scientific equipment (MIO)	106	265.5	2,552	55.7	3,134	337.1
Manufacture of electrical machinery (MEL)	870	49.0	6,615	89.7	7,180	140.5

Source: Deutsche Bundesbank, German Federal Statistical Office.

Note: Data refer to manufacturing FDI.

Box 7

GERMANY: THE IMPACT OF FDI ON TRADE FLOWS

This box investigates the impact of the outward and inward FDI stock on trade and competitiveness in Germany employing a cross-section gravity model with 21 sectors and 34 countries, 18 “developed” and 16 “transition” economies.¹ Sectors have been pooled in two groups: low and medium-tech (15 industries) and high-tech (6 industries).

We test whether outward and inward FDI stocks affect German imports and exports vis-à-vis developed and transition economies, controlling for a set of standard variables used widely in the literature. The causal direction from FDI stocks to trade in the current period is justified by the fact that existing FDI stocks have been cumulated over the past. The results for the year 2002 are reported in Table A.²

Among the explanatory variables, distance and GDP are generally significant and have the expected sign (ie, *GDP* has a positive sign as the larger a country’s GDP, the greater the amount of trade that will take place; *distance* has a negative sign as the greater the distance between countries, the smaller the amount of trade that will take place). The EU dummy relates to the EU acceding countries (including or excluding Bulgaria and Romania) was not significant. Meanwhile, *German FDI to the transition economies has a significant positive impact on*

Table A Impact of German inward and outward manufacturing FDI on bilateral trade

(year 2002)

	Transition economies				Developed economies			
	low-med tech exports	low-med tech imports	high-tech exports	high-tech imports	low-med tech exports	low-med tech imports	high-tech exports	high-tech imports
GDP	0.338 [3.45]**	0.22 [1.74]	0.447 [3.57]**	0.279 [2.62]*	0.269 [3.57]**	0.318 [3.50]**	0.547 [5.08]**	0.711 [4.06]**
Distance	-0.392 [1.65]	-1.036 [3.46]**	-0.259 [1.07]	-1.572 [4.61]**	-0.372 [3.84]**	-0.401 [2.93]**	-0.541 [4.07]**	-0.377 [2.10]*
FDI (out): low-med tech	0.213 [2.02]*	0.285 [3.89]**			0.307 [8.14]**	0.232 [4.35]**		
FDI (inward): low-med tech					0.139 [3.89]**	0.236 [4.42]**		
FDI (out): high-tech			0.372 [6.21]**	0.667 [7.80]**			0.337 [5.97]**	0.153 [1.98]
FDI (inward): high-tech							-0.009 [0.16]	0.163 [2.29]*
EU dummy					0.295 [1.72]	0.406 [1.65]	0.466 [2.01]*	0.565 [1.64]
Constant	3.583 [1.97]	8.57 [3.28]**	1.387 [0.95]	10.4 [3.68]**	2.464 [2.58]*	0.611 [0.55]	1.762 [1.64]	-3.334 [1.88]
Observ.	106	106	42	42	151	151	60	60
R ² – adj.	0.32	0.31	0.68	0.77	0.58	0.47	0.67	0.53
F-test	13.25	18.24	31.49	73.98	50.43	43.32	27.3	19.4
Prob>F	0	0	0	0	0	0	0	0

Note: Robust t-statistics in brackets; * significant at 5%; ** significant at 1%.

- 1 The developed countries are the euro area countries (excluding Greece and Portugal), Canada, Denmark, Japan, Norway, Sweden, Switzerland, the United Kingdom and the United States. The “transition economies” are the ten new EU Member States, Bulgaria, Croatia, Romania, Russia, Turkey and Ukraine.
- 2 FDI stocks of the reforming countries in Germany are negligible and were therefore excluded.

German exports as well as imports for the low, medium and high-tech sectors. In particular, the t-statistics and the estimated parameters indicate that trade in the high-tech sectors is strongly linked with German outward FDI stocks. Moreover, the elasticity of German imports is higher than the elasticity of German exports in both low-medium and high-tech sectors, with the highest value displayed for high-tech imports. This is in accordance with Table 14, where it is clearly indicated that firms specialising in manufacturing electrical machinery, professional and scientific equipment or transport equipment have shifted production abroad in order to import intermediate manufacturing goods (i.e. vertical FDI).

With regard to the impact of outward and inward FDI stocks on German trade vis-à-vis other advanced economies, the results suggest that the German outward FDI stock has a larger positive impact on German exports than on imports, while FDI activity in Germany tends to promote German imports rather than its exports. In particular, there is no evidence of a statistically significant relationship between outward FDI stocks and German imports as well as between the inward FDI stock and German exports in the high-tech sectors. This supports the hypothesis that the relocation of production processes to reduce costs does not play a major role for FDI in and from advanced economies in the high-tech sectors (i.e. horizontal FDI).

Data sources: Deutsche Bundesbank for FDI micro database, German Federal Statistical Office for the external trade statistics, the Newcronos database of Eurostat and a web-based distance calculator.

Estimation method: Cross-section OLS for the year 2002. Variances are estimated by the Huber-White sandwich procedure and are robust against heteroscedasticity.

improved technologies, which is what we have called “horizontal” FDI. In addition, FDI can also be used to gain export market share by utilising resources in labour-intensive and low-labour-cost countries, i.e. “vertical” FDI.

Euro area FDI activities with developed economies outside the euro area were largely in the form of M&As. In particular, investment in finance, telecommunication and business services (including computer software-related services), and high-tech and medium-tech manufacturing represents around 80% of extra-euro area outward M&As over the last twenty years. The desire of euro area firms to absorb and acquire new technologies available worldwide, and particularly in the United States, is a possible explanation for these developments. Therefore, strategic M&As might have provided the required missing elements for greater technological competitiveness of euro area exports, although the evidence is mixed regarding the direct

impact of this type of FDI on trade. Hence, further research is required on this issue before reaching firm conclusions.

The international intra-firm division of labour is also intensifying. In this context, evidence was presented on the high and increasing activity of euro area multinationals in new EU Member States. Econometric analysis for Germany tends to support the expectation that this type of FDI (“vertical”, i.e. aimed at exploiting low labour costs through the internationalisation of production) has a positive impact on both exports and imports. The overall outcome seems to be that exports have become more reliant on imported inputs, which could imply a lower value added per export unit in comparison to the past. Quantitative evidence of this phenomenon shows that – in part due to increasing outsourcing – the dependence of exports on imports is high and rising for the euro area. This notwithstanding, the value added per

export unit remains high while the internationalisation of production has other wider effects on participants, which overall are expected to be beneficial.

The counterpart to the higher share of new EU Member States in euro area trade was the decline in intra-euro area trade among some of the larger euro area countries. In particular, German firms specialising in manufacturing electrical machinery, scientific and optical goods and transport equipment have shifted some production to the new EU Member States and now import intermediate manufacturing goods from these countries, implying that German firms have benefited from increasing efficiency by restructuring and outsourcing abroad, at a cost, however, of crowding out some euro area producers.

Besides horizontal or vertical activities, FDI is also sometimes used as an export platform to reach other markets. The experience of inward FDI in Ireland is very informative as affiliates' output produced in Ireland is largely sold in third markets. Multinational firms provide Ireland with competitive assets for export-oriented production of technology-intensive and dynamic products in world trade. Skills development and knowledge transfer also provide spillovers for domestic firms. Therefore, the export competitiveness of Ireland improved. By contrast, Italy stands out as a large euro area country which has relatively small inward and outward stocks/flows of FDI, and has therefore benefited very little from the potentially large improvements in price and non-price competitiveness resulting from FDI.

5 AN ASSESSMENT OF EURO AREA EXPORT PERFORMANCE⁶⁰

5.1 INTRODUCTION

The aim of this final chapter is to take a look at the main findings of the report and to critically evaluate their importance and implications. From a policy perspective, the links between export performance and monetary policy may at first seem somewhat indirect. However, despite being large and relatively closed in comparison to the individual euro area economies, the economy of the euro area remains strongly influenced by external trade developments. Accordingly, the findings of this report provide policy-makers with a detailed review and explanation of the euro area's export performance, thereby improving our understanding of past, and perhaps future, developments in euro area economic activity. In particular, against the background of rapid changes in the structure of both euro area exports and world trade, various aspects of export developments need to be closely monitored within the economic analysis underlying the ECB's assessment of price stability over the medium term. In this context, the findings of the report provide policy-makers with critical inputs regarding: (i) issues related to the product and geographical specialisation of euro area exports; (ii) divergences in export performance across the euro area countries due to differences in price as well as technological and structural competitiveness; and (iii) changes in the relationships between exports, imports and domestic activity resulting from outsourcing and the internationalisation of production.

One important aspect identified in this report is that euro area exporters utilise their profit margins in order to mitigate the impact of exchange rate shocks on price competitiveness which, in turn, reduces the impact on export volumes. Moreover, our findings regarding the product and geographical specialisation of euro area exports are also highly relevant for the understanding of export developments,

possibly providing useful background information for trade projections. In particular, the product composition of world demand growth – and particularly how it compares with the medium-tech product specialisation of euro area exports – has an impact on export growth, thereby shedding light on why the relationship between changes in exchange rates and export volumes sometimes differ from their usual pattern. The medium-tech specialisation of euro area exports is also consistent with measures of technological competitiveness – proxied by patenting activity and R&D expenditure – as most of the euro area's innovation is concentrated in the medium-technology-intensive sectors, while euro area innovation in the high-tech sectors is substantially below that of major competitors such as the US and Japan. However, regarding the role of price competitiveness and foreign demand over the whole sample period, it appears that these can largely explain export developments at the euro area level, but this is not always the case for individual euro area countries.

Although specialisation in medium-tech sectors resulted in a satisfactory outcome, as world demand for these products grew at the same pace as total world exports, the under-specialisation of the euro area in the faster-growing high-tech export sectors represents a missed opportunity. In addition, if the world demand for high-tech products had continued to grow as rapidly as in the mid-to-late 1990s, the export share of the euro area may have declined more rapidly in recent years. Accordingly, looking forward, the product composition of euro area exports could be a future source of weakness, particularly as new world players such as China seem to be catching-up with the euro area in terms of product sophistication and are likely to pose increasing competitive pressure on euro area firms in the future. In this context, given the rapidly changing product composition of world exports, the report suggests the need for

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structural reforms which would enhance innovation and create the flexibility necessary for the euro area to move rapidly towards sectors which are expanding in terms of both exports and innovation in the future. This may also help to reduce the significant differences in export performance across the euro area countries. Finally, although this report focuses almost exclusively on export performance, we also examined its relationship with import developments since net trade is the key variable that actually affects GDP growth. We found that FDI and globalisation, particularly the growing relevance of the internationalisation of production, tend to raise the import content of exports as the latter have become increasingly more reliant on imported intermediate inputs, although the value added per export unit remains high. As a result, this has affected the relationships between exports, imports and domestic activity, thereby highlighting one aspect of the changing economic environment in which monetary policy operates.

5.2 EXPORT MARKET SHARES AND PRICE COMPETITIVENESS

Chapter 1 showed that since the early 1990s the euro area experienced a smaller fall in its export market share in comparison to the more marked declines experienced by major competitors such as the United States and particularly Japan. The relative resilience of euro area exports over this particular sample period should not be a cause for complacency, particularly as more recently the euro area has experienced losses in export market share due to the euro appreciation which started in 2002 combined with divergences in export performance across the euro area countries. In particular, the recent strong export growth of Germany has been offset by a rather weak export performance by some of the other euro area countries. Furthermore, the smaller decline in the euro area's export share in comparison to major competitors should be seen against the background of a number of issues and caveats.

First, a loss of export market shares by developed economies as emerging economies are catching up is to be expected as it constitutes an adjustment to a new equilibrium. In this context, the United States and Japan are relatively more exposed than the euro area to export competition from the Asian economies.⁶¹ This partly explains the somewhat weaker export market shares of the United States and Japan given the strong export performance of the other Asian countries. In particular, as explained in Chapter 2, the emergence of China as a major player in world export markets has had a significant negative impact on Japan's export share, while the euro area does not seem to have been especially affected.

Second, the euro area's relatively stable export market share over part of the sample period was achieved against the background of a loss in the terms of trade connected to the depreciation of the effective exchange rate of the euro until 2000. The loss in terms of trade may reduce growth in the other components of GDP by, for example, lowering real incomes and consumer expenditure. However, despite the loss in the overall terms of trade, the products in which the euro area specialises – i.e. medium-tech products – actually experienced increases in the terms of trade.

Third, the 30% depreciation of the effective exchange rate of the euro from the early 1990s to 2001 was associated with only limited changes in price competitiveness as strong growth in euro area export prices offset a significant part of the beneficial impacts of the depreciation on the price competitiveness of the euro area. However, looking at the dynamics of unit labour costs, the rise in euro area export prices appears not to be connected to rising costs, but rather to increases in exporters' profit margins, confirming that euro area exporters are able to mitigate the impact of exchange rate shocks on price competitiveness

⁶¹ This can be seen from the higher export weights – when including third-market effects – attributed to the Asian economies for the US and Japan in comparison to the euro area (see Annex III).

and export volumes by varying their profit margins, raising them during times of depreciation and lowering them when appreciations occur.

It should also be noted that, when looking at the major euro area countries, Spain and Italy recorded rapid export price growth, while export prices of other large euro area countries grew only marginally. Meanwhile, the changing nature of the product structure of Italy and Spain's exports might also suggest that compositional changes resulting from improvements in quality may partly explain the rising export prices in these two countries. This would also be consistent with the improvements in the terms of trade for specific euro area sectors mentioned earlier, but this is not analysed in detail in this report and remains an issue for possible future research.

On the negative side, Italy experienced a substantial decline in export market share from the second half of the 1990s onwards, partly due to the poor price competitiveness resulting from rapid increases in export prices. Italy's exports also suffered from fierce and direct competition from both the new EU Member States and Asia, combined with weak technological competitiveness. But this was not the case for Spain, which managed to substantially increase its export market share – despite rapidly rising export prices – partly thanks to the protracted trade benefits of its accession to the European Union in 1986. In addition, relatively low levels of labour costs and export prices in comparison to major competitors, combined with the ongoing process of convergence – which may imply a continued movement towards a higher ratio of exports to GDP in line with other euro area countries – may also help to explain Spain's ability to maintain its higher export share in recent years. While the export performances of Spain and Italy were clearly different, Germany, France and the Netherlands were somewhat similar to each other partly as a result of similar movements in price competitiveness. The major difference among these countries was that Germany, after an initial poor export

performance in the post-reunification period, increased its world export market share. Meanwhile, France and the Netherlands experienced fairly stable market shares over most of the sample period, showing weak responses to the gains in competitiveness due to the depreciation of the euro during the period 1999-2000, followed by some losses in market share due to the euro appreciation from 2002 onwards. The sometimes weak response of market shares to price competitiveness, and particularly the very good export performance of Germany, call for alternative explanations. Among those, the report gives a special importance to the impact that the internationalisation of production – particularly strong for Germany – has on export performance.

Fourth, and connected with the point above, a simple analysis of market shares is not sufficient to capture the complex interactions between the changing production patterns and trade. In particular, the report underlines how for Japan and Germany the outsourcing of labour-intensive stages of production to neighbouring regions – South-East Asia and the new EU Member States respectively – yielded quite different outcomes: trade diversion for Japan and trade creation for Germany. The different outcomes are possibly related to the relative maturity of the outsourcing process. South-East Asia is clearly an export platform to the rest of the world for Japanese companies. In this context, Japan may be losing market share, but its companies have reduced costs through outsourcing, while amassing considerable wealth in terms of reinvested profits in ongoing FDI operations abroad. In addition, the considerable advances in technological competitiveness by Japan imply that outsourcing to South-East Asia has allowed Japan to devote more domestic resources to the higher-value-added stages of production – including the creation and application of new technologies – where it has a comparative advantage. On the other hand, the outsourcing process for the euro area, most notably German outsourcing to the new EU

Member States, may be at an earlier stage in comparison to Asia. This is a fact which may represent a potential source of weakness for euro area trade going forward, as larger shares of manufacturing production may eventually be transferred abroad and directly exported from those locations, the more so if structural reforms do not take place, in particular the need for more liberalisation to facilitate movements of workers (in particular unskilled workers) between sectors, namely into services.

5.3 MARKETS, SECTORS AND TECHNOLOGICAL AND STRUCTURAL COMPETITIVENESS

The constant market share analysis in Chapter 2 shows that some of the loss in the euro area's market share was due to an under-specialisation in rapidly growing markets such as Asia. However, as described in Box 3 in Chapter 2, this does not necessarily imply an inability of euro area exporters to penetrate such markets, but rather that much of the trade in Asia has been intra-regional and associated with outsourcing to China. Accordingly, much of this Asian trade is based on geographical proximity and under these circumstances there may be some barriers to the euro area significantly increasing its export share in this region. However, given the growth potential of the Chinese market, this is clearly a drawback for the euro area. Finally, although the euro area's export performance was held back somewhat by its high exposure to some slow-growing European markets, its growing specialisation in the more dynamic markets of the new EU Member States made a significant positive contribution to the euro area's export performance. Even so, the potential size of this market is not comparable to the Asian one.

Although the constant market share analysis showed that product specialisation did not have a strong bearing on the overall export share of the euro area, this was the outcome of an under-specialisation in high-tech sectors – where export demand grew rapidly particularly between the mid-1990s and the early 2000s – which was offset by a high degree of

specialisation in medium-tech products. These results are consistent with those of Chapter 3 which show that, in terms of technological competitiveness as proxied by patenting activity and R&D expenditure, most of the euro area's innovation is concentrated in the medium-technology-intensive sectors, while innovation of the euro area in the high-tech sectors is substantially below that of major competitors such as the United States and Japan. These trends in technological competitiveness and specialisation, particularly the strong differences between the euro area and major competitors in terms of medium and high-tech specialisation, help to explain export performance. In particular, developments in US export market share seem to be strongly linked to the technology boom and bust of the second half of the 1990s and of the early 2000s. Finally, although the euro area has a relatively smaller presence in high-tech export markets than its major competitors, the constant market share analysis shows that in high-tech sectors where the euro area has a presence, its export performance was actually quite good. However, caveats regarding the classification of sectors into high, medium and low-technology-intensity categories should be mentioned: first, the allocation of sectors according to technological intensity in this report is only a rough approximation and is somewhat less sophisticated than classifications based on 3 or 4-digit-level data; and second, specific products might have a technological content which is somewhat different from what the classification suggests.⁶²

Apart from its impact on market share, what are the other possible consequences of the euro area's specialisation in medium-tech sectors? One possibility is that, relative to high-tech sectors, the export prices of medium-tech products are more exposed to downward

⁶² For example, although in this report Germany is generally defined as specialising in the export of medium-tech products, more detailed information sometimes suggests otherwise. Case studies comparing ostensibly the same products across countries find that German products usually embody a relatively higher degree of quality (Jarvis and Prais, 1997; Anderton and Schultz, 1998; Jarvis et al, 2002).

pressure from new low-labour-cost export competitors such as China. However, Box 2 in Chapter 2 addresses this question and finds little evidence that the euro area's specialisation in medium-tech products has been associated with downward pressure on export prices.

However, the more fundamental question for the longer term is not whether the sectors in which the euro area currently specialises are doing well, but rather the extent to which the euro area can move rapidly and flexibly towards expanding sectors in terms of both exports and innovation in the future. Although there are several important caveats to bear in mind and other indicators may give a somewhat different picture, our analysis of structural competitiveness – using educational attainment and survey data – shows that national business environments are overall less favourable for the competitiveness of the euro area when compared with its main competitors. In terms of individual criteria, the euro area compared relatively poorly in terms of labour regulations as well as personal and corporate taxes. Overall, structural rigidities seem to make the business environment in the euro area less conducive to improving firms' competitiveness, which may inhibit technological innovation and hurt price competitiveness. One has, however, to be careful in arriving at far-reaching conclusions in this respect as these results are partly based on survey data and more research is needed on structural competitiveness and its link with export performance.

5.4 FDI, COMPETITIVENESS AND THE INTERNATIONALISATION OF PRODUCTION

As described in Chapter 4, one motive behind euro area outward FDI in developed economies (horizontal FDI) seems to have been the acquisition of technology via M&A activity. During the last decade, a significant proportion of euro area M&A activity took place in the high-tech sectors such as telecommunications and business services (including ICT companies), mostly located in the United

States. For example, the technology boom in the United States and the desire of euro area firms to acquire the new technologies of US companies seem to have been one factor behind the large euro area FDI outflows to the United States, particularly in the second half of the 1990s through M&As. Therefore, strategic M&As might have provided the required missing elements for greater technological competitiveness of euro area exports, although the evidence is mixed regarding the direct impact of this type of FDI on trade. Hence, further research is required on this issue before reaching firm conclusions.

Meanwhile, the increased internationalisation of production over the past years has also led to a marked increase in vertical FDI, whereby multinational firms seek to locate different parts of their production processes in different countries – particularly emerging markets – in order to maximise efficiency and reduce costs. This type of FDI, by enhancing the technological capabilities of an economy and the sectoral structure of exports, is likely to generate high productivity in the host country, while having important spillovers on euro area trade. Most of the euro area's vertical FDI is being carried out by German, Dutch and Austrian firms and is largely directed towards the new EU Member States. The resulting rise in trade with the new EU Member States, the share of which has tripled over the past decade, was associated with a decline in intra-euro area trade shares, particularly regarding German imports from France, Italy and the Netherlands.

Finally, this report focuses almost exclusively on export performance, but it is important to also examine its relationship with import developments since net trade is the key variable that actually affects GDP growth. Quantitative evidence of this phenomenon is provided by Box 6 in Chapter 4, which shows that – in part due to increasing outsourcing – the dependence of exports on imports is high and rising for the euro area. This notwithstanding, the value added per export unit remains high, while the internationalisation of production has other

wider effects which overall are expected to be beneficial. For example, particularly for Germany, outsourcing to the new EU Member States reduces costs and increases profitability which, in turn, should have a separate positive influence on GDP.

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ANNEX I

ADDITIONAL INFORMATION TO CHAPTER I

I EURO AREA EXPORTS: ADDITIONAL INFORMATION

Table 1 Euro area foreign demand

(percentage shares by destination country)

	Germany	France	Italy	Spain	Netherlands	Euro area
Euro area	44	50.3	47.4	61.1	64.8	
Extra-Euro area	56	49.7	52.6	38.9	35.2	
<i>of which:</i>						
Denmark	3.2	1.8	1.5	1.8	4.5	2.6
Sweden	4.3	2.8	1.9	2.3	6.3	3.9
United Kingdom	14.5	18.9	12.5	21.1	27.3	17.6
Switzerland	8.9	7.4	6.8	2.8	4.5	6.9
Japan	4.5	3.6	4.2	3.1	2.8	3.9
United States	14.3	12.3	14.3	11.1	10.5	12.6
Norway	1.6	1.0	1.0	1.3	2.3	1.4
Canada	1.1	1.4	1.5	1.3	0.9	1.2
Former economies in transition	16.8	6.4	14.3	12.9	9.9	12.9
Latin America	4.6	6.2	7.4	15.4	4.0	5.4
Non-Japan Asia	14.1	14.3	14.1	10.0	12.5	13.0
Other countries	12.1	23.7	20.2	22.1	14.8	18.6

Source: ECB, IMF.

Note: Average export weights over the period 1995-97.

Table 2 Competitor export prices

(percentage shares by country)

	Germany	France	Italy	Spain	Netherlands
Euro area	38.9	42.7	42.8	47.3	46.4
Extra-euro area	61.1	57.3	57.2	52.7	53.6
<i>of which:</i>					
Denmark	1.5	1.3	1.3	1.2	1.5
Sweden	2.8	2.3	2.1	2.0	2.6
United Kingdom	7.8	7.0	6.7	7.0	7.4
Switzerland	2.8	2.9	2.7	2.9	3.2
Japan	8.4	8.0	8.3	6.2	6.4
United States	13.2	12.5	12.8	12.5	10.4
Norway	1.6	1.5	1.5	1.5	1.8
Canada	3.0	2.5	2.8	2.0	1.8
Former economies in transition	4.6	5.2	4.5	4.6	5.9
Latin America	4.0	3.7	3.7	3.1	3.0
Non-Japan Asia	11.5	10.4	10.8	9.7	9.6

Source: ECB, IMF.

Note: Average export weights over the period 1995-97.

Table 3 Annual changes in real market shares

(percentages)

	Germany	France	Italy	Spain	Netherlands	Euro area	UK	US	Japan
1993	-6.9	-0.7	7.3	8.1	2.2	-1.2	6.4	0.2	-7
1994	-0.9	-1.1	1.5	7.1	-1.7	4.1	0.3	0.1	-3.2
1995	-2.4	-0.1	3.2	1.5	-0.4	-1.4	1.7	7.7	0.3
1996	0.7	-2.1	-5.9	5.6	-0.4	-3.1	3.4	-0.2	-0.3
1997	1.3	1.9	-2.4	4.4	0.1	1.6	-1.1	1.3	1.9
1998	0.1	1.2	-3.1	-0.2	-0.5	0.1	-4.4	-0.2	-1.5
1999	-0.8	-2.8	-6.2	0.1	-1.5	-3.2	-3	-3.9	-9
2000	2.3	2.2	-2.3	0.4	0	0.6	-2.3	-4.1	-4
2001	3.7	0.2	-0.4	2.1	-0.1	3.3	2.8	-3.5	-2.4
2002	1	0.6	-4.9	-1	-0.3	-0.5	-1.4	-4.8	1.9
2003	-2	-6.2	-7.8	1.8	-3.2	-5.0	-3.2	-2.6	2.9
Cumulated change (1992-2003)	2.9	-6.3	-25.4	23.7	-7.8	-4.9	-7.3	-10.3	-13.1

Source: ECB computations based on national accounts, Eurostat and IMF data.

Note: For the countries belonging to the euro area, the market share refers to the total of goods and services.

2 STANDARD DETERMINANTS OF EXPORTS ACCORDING TO NCB AND ECB MODELS

2.1 A CONTRIBUTION ANALYSIS USING THE MULTI-COUNTRY MODEL (MCM)

We carried out a contribution analysis using the export volume specifications estimated by the ECB and NCBs in the context of the Multi-Country Model (MCM) and the Area-Wide Model (AWM). The MCM provides export volume equations for the five largest euro area countries which have been estimated in a consistent fashion using similar specifications for each of the countries. All of the equations restrict the foreign demand parameter to be equal to unity and include a relative export price term. In some cases trend terms prove to be significant. Meanwhile, the AWM provides export volume equation parameters for the aggregate euro area. In both the MCM and AWM, export volumes are based on national accounts data and hence refer to total (intra plus extra) real exports of goods and services.

In order to assess the relative importance of factors included in the models, a “contribution analysis” was carried out which calculates the relative contributions of the individual explanatory variables and the residuals to

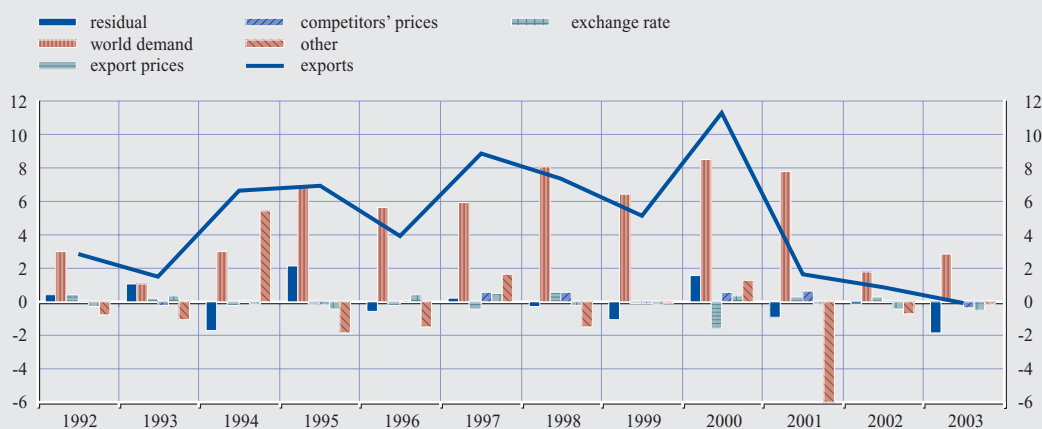
export growth. The results for the euro area and its five largest countries are shown in the following charts, while the interpretation of these results is described at the end of the main text of Chapter 1.

Chart I Contribution analysis for the Multi-Country Models

Germany



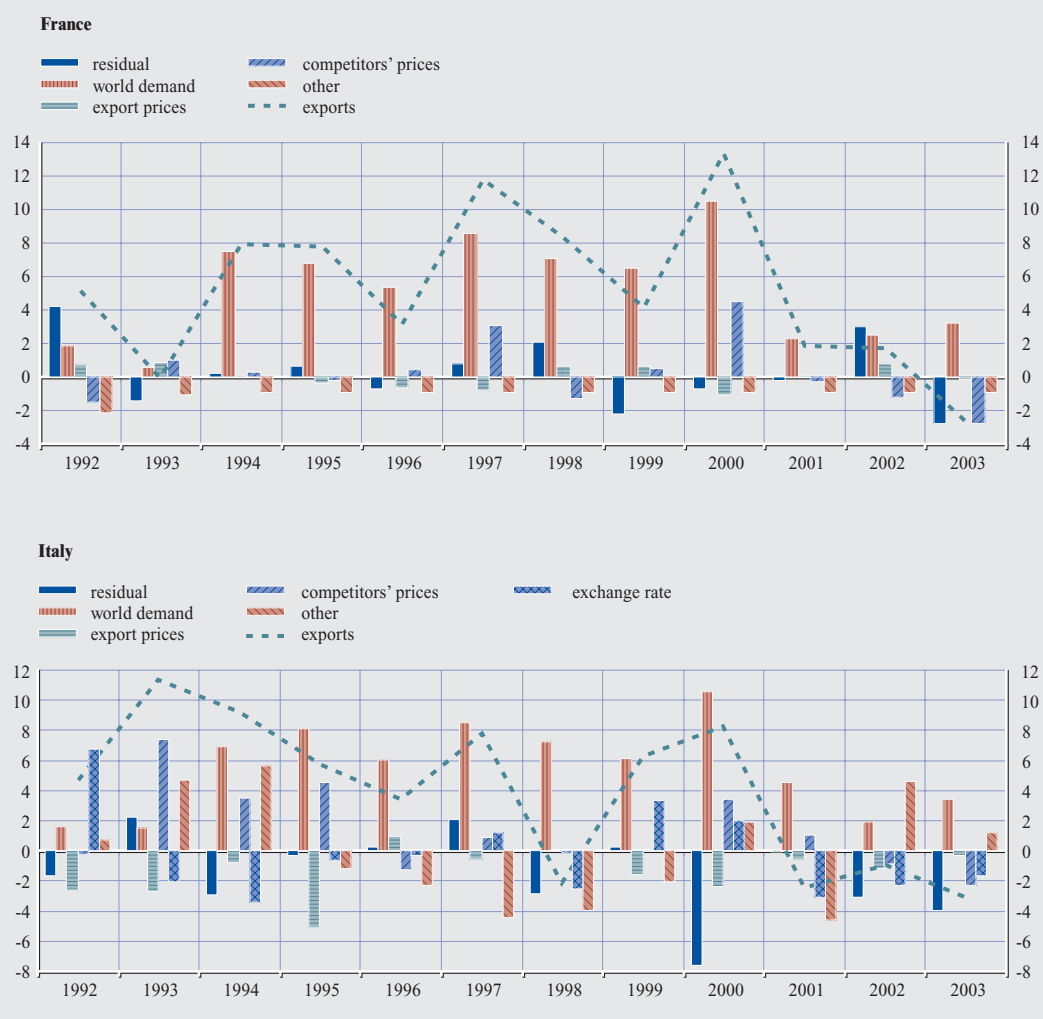
The Netherlands



Spain



Chart I Contribution analysis for the Multi-Country Models (cont'd)



ANNEX II

ADDITIONAL INFORMATION TO CHAPTER 2

The CMSA formulation applied in this work decomposes the variation in the aggregate export market share of the euro area between any two periods (called the *total effect*) in the following way:

$$g - g^* = \left[\sum_i \sum_j (\theta_{ij} - \theta_{ij}^*) g_{ij}^* \right] + \left[\sum_i \sum_j \theta_{ij} (g_{ij} - g_{ij}^*) \right] \quad (1)$$

where:

$$g = \frac{X_t - X_{t-1}}{X_{t-1}} \quad \left(g^* = \frac{X_t^* - X_{t-1}^*}{X_{t-1}^*} \right)$$

- percentage change in euro area (world) exports, in period t

$$\theta_{ij} = \frac{X_{ijt-1}}{X_{t-1}} \quad \left(\theta_{ij}^* = \frac{X_{ijt-1}^*}{X_{t-1}^*} \right)$$

- share of product i to destination market j in total euro area (world) exports, in period t-1

$$g = \sum_i \sum_j \theta_{ij} g_{ij} \quad \left(g^* = \sum_i \sum_j \theta_{ij}^* g_{ij}^* \right)$$

- being g_{ij} (g_{ij}^*) the percentage change in euro area (world) exports of product i to destination market j, in period t

The first term in square brackets in equation (1) is the *structure effect*. It will be positive if the euro area's export structure is more concentrated on high-growth products/markets than the world structure. This effect can be decomposed into three terms:

- *product effect* = $\sum_i (\theta_i - \theta_i^*) g_i^*$
- *market effect* = $\sum_j (\theta_j - \theta_j^*) g_j^*$
- *mixed structure effect* = residual = $\sum_i \sum_j \left[(\theta_{ij} - \theta_{ij}^*) - (\theta_i - \theta_i^*) \frac{\theta_{ij}^*}{\theta_i^*} - (\theta_j - \theta_j^*) \frac{\theta_{ij}^*}{\theta_j^*} \right] g_{ij}^*$

where:

$$\theta_i = \sum_j \theta_{ij} \quad \left(\theta_i^* = \sum_j \theta_{ij}^* \right)$$

- share of product i in total euro area (world) exports, in period t-1

$$\theta_j = \sum_i \theta_{ij} \quad \left(\theta_j^* = \sum_i \theta_{ij}^* \right)$$

- share of market j in total euro area (world) exports, in period t-1

$$g_i^* = \frac{\sum_j \theta_{ij}^* g_{ij}^*}{\theta_i^*} \quad \left(g_j^* = \frac{\sum_i \theta_{ij}^* g_{ij}^*}{\theta_j^*} \right)$$

- growth of world exports of product i (market j), in period t

The *mixed structure effect* is a residual and its interpretation is not completely straightforward. Given that it is not possible to completely dissociate product and geographical structures, the residual will comprise the interaction effects between them. The fact that the two structures are not independently distributed, i.e. for a specific product (market) the geographical (sectoral) distribution of exports differs from the geographical (sectoral) distribution of total exports (e.g. $\theta_{ij}^* \neq \theta_i^* \theta_j^*$), is one of the factors affecting the magnitude of this effect.

The second term in square brackets in equation (1) is the *competitiveness or "pure" market share effect*. It gives the aggregated impact of changes in market shares of each product/destination market⁶³.

The CMSA has several limitations that have been pointed out in the literature⁶⁴, mainly related to its empirical implementation. Although some aspects of the technique have

63 The competitiveness effect for a specific product i (market j) can be taken as the sum over j (i) of this effect.

64 An influential contribution about the shortcomings of the traditional formulation of the CMSA is J. Richardson (1971a), "Constant market share analysis of export growth", *Journal of International Economics* 1, pp. 227-239 and (1971b) "Some sensitivity tests for a constant market share analysis of export growth", *Review of Economics and Statistics* 53(3), pp. 301-304.

been refined⁶⁵, important limitations remain, namely the fact that results can vary substantially depending on some of the empirical choices that have to be made.

The CMSA formulation used in this work takes in some of these refinements and, therefore, differs slightly from the traditional formulation used in the literature in the following ways:

i) the CMSA decomposition is applied over discrete time periods even though the export structure of any country changes continuously. However, different aggregation weights can be chosen to translate the continuous-time into a discrete-time decomposition formula⁶⁶ (i.e. the index problem number). Traditionally, studies have used the structure of the initial year in the calculation of the structural effect and therefore the competitiveness effect is affected by changes in structure that occurred between the initial and the final year under analysis. This is also the case in the formulation used here but calculations are performed annually in order to restrain this problem, as the structure is less likely to change appreciably over such short time spans;

ii) in the traditional CMSA formulation the product and the market effects are calculated in an asymmetric way⁶⁷. Depending on the calculation sequence of these two effects either the product or the market effect will include the interaction effect that we called the mixed structure effect⁶⁸. The solution adopted here is to calculate and present this interaction effect explicitly.

DATABASE USED

The database used for the CMSA is the World Trade Analyzer (WTA), which is a merchandise trade flows database compiled by Statistics Canada from data reported by member countries to the United Nations Statistical Office. The WTA database provides annual data, in value terms (expressed in USD), for more than 180 countries and more than 800 products at the Standard International Trade Classification (SITC Rev. 2) 4-digit level. Data

is available for the period 1985-2001. Statistics Canada adjusts for the discrepancies in the reporting of each transaction (i.e. between reported exports and imports) in order to have a single-valued array.

PRODUCT DISAGGREGATION

The CMSA computations are performed using the SITC at the 3-digit level, excluding “Mineral fuels, lubricants and related materials” (SITC 3) and “Commodities and transactions n.e.s.” (SITC 9). This corresponds to around 280 products and approximately 95% of total euro area exports. For analytical purposes, this product disaggregation is mapped into 12 broad sectors, using a correspondence between the SITC and the International Standard Industrial Classification (ISIC). These are then classified into three sectors according to their technological intensity (high, medium and low), as shown in Table 1.

65 See, for instance, J. Fagerberg and G. Sollie (1987), “The method of constant market share analysis reconsidered”, *Applied Economics* 19, pp. 1571-1583, and D. Simonis (2000), “Belgium’s export performance: a constant market share analysis”, Federal Planning Bureau WP2-00. For a review of the alternative formulations used in regional economics, see S. Loveridge and A. Selting (1998), “A review and comparison of shift-share identities”, *International Regional Science Review* 21(1), pp. 37-58.

66 See J. Richardson (1971a).

67 See J. Richardson (1971b).

68 Using the traditional formulation in the literature, equation (1) would become:

$$g - g^* = \left[\sum_i \theta_i g_i^* - g^* \right] + \left[\sum_i \sum_j \theta_{ij} g_{ij}^* - \sum_i \theta_i g_i^* \right] + \left[\sum_i \sum_j \theta_{ij} (g_{ij} - g_{ij}^*) \right]$$

(product effect computed in the first place)

or

$$g - g^* = \left[\sum_j \theta_j g_j^* - g^* \right] + \left[\sum_i \sum_j \theta_{ij} g_{ij}^* - \sum_j \theta_j g_j^* \right] + \left[\sum_i \sum_j \theta_{ij} (g_{ij} - g_{ij}^*) \right]$$

(market effect computed in the first place)

Table 1 Export classification by product

Broad sectors		Technological intensity
FOD	Food, beverages and tobacco	Low-tech / resource based
TEX	Textile, leather apparel and leather industries	Low-tech / resource based
WOD	Wood and wood products, including furniture	Low-tech / resource based
PAP	Paper and paper products, printing and publishing	Low-tech
MNM	Non-metallic mineral products, etc.	Low-tech
BMI	Basic metal industries	Low-tech
BMA	Fabricated metal products, except machinery and transport equipment	Low-tech
CHE	Chemical products, rubber and plastic products	Medium-tech
MAI	Manufacture of agricultural and industrial machinery, except electrical machinery	Medium-tech
MTR	Manufacture of transport equipment	Medium-tech
MIO	Professional, scientific, measuring and controlling equipment n.e.c., photographic and optical goods, office and data processing machines	High-tech
MEL	Manufacture of electrical machinery, apparatus, appliances and supplies	High-tech

Source: Anderton (1999).

Note: Exports include both manufactured and non-manufactured products. These categories are based on the following 2-digit SITC codes: FOD (00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 11, 12), TEX (61, 65, 83, 84, 85), WOD (63, 82), PAP (64), MNM (66), BMI (67, 68), BMA (69), MAI (71, 72, 73, 74), MTR (78, 79), MIO (75, 87, 88), MEL (76, 77).

Table 2 Export classification by destination market

Countries Canada, China, Japan, Switzerland, United Kingdom, United States									
Regions:									
Africa		CEEC& Russia	Developed Asia	Middle East	Oceania	Other American countries		Other Asian countries	Other European countries
Algeria	Madagascar	Albania	Hong Kong	Afghanistan	Australia	Argentina	Mexico	Bangladesh	Denmark
Angola	Malawi	Bulgaria	Indonesia	Bahrain	Fiji	Bahamas	Neth Antilles	Bhutan	Gibraltar
Benin	Mali	Cyprus	Korea Rp	Fm Dem Yemen	Kiribati	Barbados	Nicaragua	Brunei	Iceland
Br Ind Oc Tr	Mauritania	Czech	Malaysia Republic	Fm Yemen	New	Belize Caledonia	Panama	Cambodia	Malta
Burkina Faso	Mauritius	Slovakia	Philippines	Iran	New Zealand	Bermuda	Paraguay	India	Norway
Burundi	Morocco	Russian federation	Singapore	Iraq	Papua N Guinea	Bolivia	Peru	Korea D P Rp	Sweden
Cameroon	Mozambique	Fm Yugoslavia/ successors	Taiwan	Israel	Solomon Islds	Brazil	St Kitts Nev	Laos P Dem R	
Central Afr Rep	Niger		Thailand	Jordan		Cayman Islds	St Pierre Miqu	Maldives	
Chad	Nigeria	Hungary		Kuwait		Chile	Suriname	Mongolia	
Comoros	Reunion	Poland		Lebanon		Colombia	Trinidad Tbg	Myanmar	
Congo	Rwanda	Romania		Oman		Costa Rica	Turks Caicos Isl	Nepal	
Congo Dem Rep	Senegal	Turkey		Qatar		Cuba	Uruguay	Pakistan	
Côte D'Ivoire	Seychelles			Saudi Arabia		Dominican Rp	Venezuela	Sri Lanka	
Djibouti	Sierra Leone			Syrn Arab Rp		Ecuador		Vietnam	
Egypt	Somalia			Untd Arab Em		El Salvador			
Eq Guinea	South Africa			Yemen		Falkland Isl			
Ethiopia	St Helena					French Guiana			
Fr So Ant Tr	Sudan					Greenland			
Gabon	Tanzania					Guadeloupe			
Gambia	Togo					Guatemala			
Ghana	Tunisia					Guyana			
Guinea	Uganda					Haiti			
Guinea-Bissau	Western Sahara					Honduras			
Kenya	Zambia					Jamaica			
Liberia	Zimbabwe								
Libya									

Source: ECB classification.

GEOGRAPHICAL DISAGGREGATION

The CMSA calculations consider 14 destination markets comprising the above

6 individual countries and 8 geographical areas (covering around 160 countries) that represent approximately 95% of total euro area exports.

Table 3 Technological content of exports

(as a percentage of total, average of period 2000-01)

	World	Euro area	US	Japan	China	UK
Low-tech	31.1	28.3	22.5	11.6	46.6	21.6
Medium-tech	34.8	46.5	43.7	50.8	17.5	46.9
High-tech	29.1	20.4	31.3	36.6	29.7	25.9

Sources: WTA, ECB calculations.

Note: Exports to selected 14 destinations, excluding SITC 3 and 9. For the definition of technological content, see Table 1 of Annex II.

Table 4 Direction of trade

(as a percentage of total, average of period 2000-01)

<i>Exporting countries</i> <i>Importing countries</i>	World	Euro area	US	Japan	China	UK
Euro area	29	50	15	12	13	53
China	4	1	2	8	0	1
Japan	5	2	8	0	16	2
UK	5	10	5	3	2	0
USA	19	9	0	30	22	15
Developed Asia	12	4	14	31	30	5
Other	26	25	55	16	15	24

Sources: WTA, ECB calculations.

Note: Exports to selected 14 destinations and euro area, excluding SITC 3 and 9. For the description of the classification by destination market, see Table 2 of Annex II.

ANNEX III

ADDITIONAL INFORMATION TO CHAPTER 3

PART I

Table I Patents according to technological intensity

(expressed as a share of the individual economy's total patents)

	Belgium	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg
1980-1984								
Low	12.7	10.5	24.2	19.6	12.6	11.4	9.6	35.0
Medium	57.7	56.9	57.6	53.3	49.6	43.8	60.0	50.4
High	23.5	28.0	9.1	14.4	32.5	36.2	23.9	13.7
1985-1989								
Low	12.0	10.6	9.1	13.7	11.9	14.0	8.7	19.9
Medium	56.2	53.1	63.6	53.2	42.4	36.7	52.8	67.9
High	26.0	27.9	18.2	16.3	34.3	35.8	24.3	9.0
1990-1994								
Low	10.3	9.8	11.5	12.9	10.2	6.5	8.4	21.8
Medium	55.9	55.1	34.4	50.0	44.1	36.6	55.8	66.1
High	26.0	26.4	32.8	19.1	32.9	37.9	22.8	11.3
1995-1999								
Low	7.4	8.8	8.6	10.7	8.8	8.0	7.7	21.2
Medium	51.0	52.6	36.6	47.8	40.9	23.2	50.5	64.6
High	33.6	28.6	34.4	20.5	34.3	46.0	27.5	8.8
2000-2002								
Low	8.3	9.2	11.7	10.8	8.3	6.1	8.1	16.4
Medium	52.3	48.7	36.4	39.8	41.3	21.8	45.5	62.9
High	32.5	32.1	22.1	27.7	34.5	50.3	32.7	12.1

Source: ECB computations based on USPTO data.

Table I Patents according to technological intensity (cont')

(expressed as a share of the individual economy's total patents)

	Netherlands	Austria	Portugal	Finland	Euro area	UK	US	Japan	All
1980-1984									
Low	12.7	11.7	11.8	14.6	11.3	12.7	13.4	8.9	12.5
Medium	43.2	53.2	70.6	53.8	54.6	52.5	44.8	40.7	46.5
High	39.7	21.3	5.9	20.6	28.9	28.7	32.6	45.8	33.2
1985-1989									
Low	9.1	13.9	14.8	12.4	10.8	12.1	12.9	8.5	11.8
Medium	37.1	50.1	70.4	51.4	49.7	46.3	40.7	36.0	42.2
High	44.9	21.4	7.4	22.7	29.6	35.8	36.5	51.1	37.9
1990-1994									
Low	8.5	12.4	31.0	12.6	9.8	10.8	11.9	7.4	10.8
Medium	40.0	46.9	55.2	45.6	51.1	47.9	39.2	32.9	40.3
High	41.7	24.0	13.8	28.7	28.3	35.6	38.7	55.7	40.7
1995-1999									
Low	7.1	13.9	12.5	8.1	8.6	8.9	9.5	6.1	8.8
Medium	32.8	46.6	31.3	37.1	47.4	44.9	34.6	27.1	35.3
High	46.2	22.3	40.6	41.2	31.2	40.2	46.1	63.1	47.9
2000-2002									
Low	7.4	12.4	11.1	6.1	8.7	8.3	8.5	6.1	8.2
Medium	33.6	45.0	44.4	29.8	44.8	43.3	31.8	26.3	32.8
High	43.3	27.8	38.9	49.9	33.8	42.2	51.0	64.3	51.9

Source: ECB computations based on USPTO data.

Table 2 R&D expenditure according to technological intensity

(expressed as a share of the individual economy's total R&D)

	Belgium	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg
1980-1984								
Low		5.4		12.9	6.8	28.7	5.0	
Medium		63.0		64.7	60.2	37.0	64.6	
High		31.6		22.4	33.0	34.3	30.4	
1985-1989								
Low	12.2	5.4		12.9	6.7	27.3	5.3	
Medium	54.0	60.9		57.8	59.6	26.8	61.9	
High	33.8	33.7		29.3	33.7	45.9	32.7	
1990-1994								
Low	14.0	5.5		11.5	7.5	21.3	5.3	
Medium	57.5	61.8		57.9	60.6	32.8	61.0	
High	25.4	32.7		30.6	32.0	45.9	33.7	
1995-1999								
Low	14.5	5.4		14.4	7.9	16.8	5.1	
Medium	61.0	69.6		61.0	61.2	29.1	60.4	
High	24.5	24.9		24.6	30.9	54.1	34.6	
2000-2002								
Low	14.8	5.3		16.4	7.8		5.4	
Medium	59.1	72.2		61.3	61.8		61.1	
High	26.1	22.5		22.3	30.4		33.5	

Source: OECD ANBERD database.

Table 2 R&D expenditure according to technological intensity (cont')

(expressed as a share of the individual economy's total R&D)

	Netherlands	Austria	Portugal	Finland	Euro area	UK	US	Japan
1980-1984								
Low	8.3			17.4	6.2	7.6	5.4	15.1
Medium	46.7			46.6	61.0	54.5	56.4	47.6
High	45.0			36.0	32.8	37.9	38.3	37.3
1985-1989								
Low	9.0			16.4	6.5	6.9	5.4	14.9
Medium	42.9			48.3	58.9	60.8	58.1	44.1
High	48.1			35.3	34.6	32.3	36.5	41.0
1990-1994								
Low	12.0			17.6	7.1	6.7	5.9	13.5
Medium	50.4			42.4	60.1	69.0	56.6	44.9
High	37.6			40.0	32.8	24.3	37.5	41.6
1995-1999								
Low	12.9			13.6	7.4	6.2	6.1	11.5
Medium	46.2			28.2	63.2	72.8	51.6	44.1
High	41.0			58.2	29.4	21.0	42.3	44.4
2000-2002								
Low	12.5			10.0	7.3	5.3	6.5	9.6
Medium	44.9			23.5	64.3	72.5	47.5	43.6
High	42.6			66.5	28.4	22.2	46.0	46.8

Source: OECD ANBERD database.

Table 3 R&D intensity according to technological intensity

(percentages)								
	Belgium	Germany	Greece	Spain	France	Ireland	Italy	Luxembourg
1980-1984								
Low		1.2		0.2	0.7		0.2	
Medium		8.3		1.5	8.4		3.4	
High		10.1		1.7	16.6		4.7	
<i>Total</i>		5.4		0.7	5.1		1.6	
1985-1989								
Low	0.8	1.1		0.3	0.9	0.5	0.3	
Medium	4.3	9.5		2.2	10.5		4.7	
High	1.0	11.4		4.9	17.3		7.4	
<i>Total</i>	5.1	6.4		1.2	6.1	1.7	2.3	
1990-1994								
Low	1.4	1.0		0.4	1.1	1.1	0.3	
Medium	7.8	10.1		3.2	13.0	2.7	5.3	
High	10.5	12.0		7.1	20.1	12.4	9.2	
<i>Total</i>	5.3	6.5		1.8	7.3	2.5	2.7	
1995-1999								
Low	1.8	1.0		0.5	1.2	1.5	0.2	
Medium	8.8	10.9		3.4	11.7	2.9	4.0	
High	17.0	12.6		6.3	18.4	12.4	8.1	
<i>Total</i>	5.9	7.0		1.9	7.1	2.7	2.2	
2000-2001								
Low	1.9	0.8		0.6	1.0		0.2	
Medium	9.5	12.6		3.0	11.0		4.2	
High	20.2	11.1		6.6	17.5		10.4	
<i>Total</i>	7.3	7.7		1.8	6.9		2.3	

Source: OECD STAN and ANBERD databases.

Table 3 R&D intensity according to technological intensity (cont')

(percentages)								
	Netherlands	Austria	Portugal	Finland	Euro area	UK	US	Japan
1980-1984								
Low	0.9			1.2	0.7	0.8	1.2	1.8
Medium	8.0			4.1	6.9	8.5	13.0	6.8
High	2.8			12.2	10.5	17.8	19.6	12.9
<i>Total</i>	5.0			2.8	4.0	5.9	8.3	5.1
1985-1989								
Low	1.1			1.5	0.8	0.8	1.2	2.4
Medium	8.2			6.5	8.2	9.3	14.8	8.6
High	11.2			14.8	12.1	14.1	19.9	15.5
<i>Total</i>	6.2			4.2	4.9	5.6	9.3	6.7
1990-1994								
Low	1.2			2.2	0.8	0.8	1.2	2.4
Medium	8.3			7.1	9.2	10.7	12.6	9.8
High	18.3			19.3	13.9	11.5	18.0	17.3
<i>Total</i>	5.2			5.3	5.3	5.7	8.2	7.5
1995-1999								
Low	1.4			1.8	0.9	0.7	1.3	2.5
Medium	7.5			7.4	9.1	10.6	11.7	10.6
High	23.1			23.7	13.9	8.4	20.8	19.5
<i>Total</i>	5.3			7.1	5.4	5.3	8.6	8.5
2000-2001								
Low	1.2			1.7	0.7	0.7	1.3	1.7
Medium	7.7			8.4	9.9	12.4	10.6	11.3
High	24.2			22.9	13.3	9.8	21.4	20.7
<i>Total</i>	5.7			9.1	5.8	6.4	8.5	9.6

Source: OECD STAN and ANBERD databases.

Table 4 Business environment

(averages for 1994-2004)

	Belgium	Germany	Greece	Spain	France	Ireland	Italy
1) Legal and institutional framework	3.6	3.4	3.5	4.6	3.4	5.8	2.7
Adaptability of government policy	4.3	3.6	4.2	5.6	4.0	6.3	3.6
Bureaucracy	3.1	3.1	1.8	3.6	2.8	4.9	1.7
Labor regulations	3.2	2.7	4.1	3.5	2.8	5.9	2.8
Political parties	3.9	4.3	4.0	5.7	3.9	6.0	2.6
2) Image of the country	7.9	7.9	7.4	7.3	6.9	8.4	7.0
Cross-border transactions	8.5	8.9	8.1	8.0	7.6	9.0	7.5
Foreign investors	8.8	8.8	8.8	8.4	7.7	9.1	8.1
Values of the society	6.5	5.9	5.3	5.5	5.2	7.1	5.3
3) Tax system	2.8	3.2	4.4	4.7	3.4	5.7	3.3
Real personal taxes	2.0	2.7	4.4	4.4	3.0	4.6	3.5
Real corporate taxes	3.6	3.7	4.4	4.9	3.7	6.8	3.2
4) Production infrastructure	6.7	6.7	4.5	5.4	6.1	6.4	4.3
Distribution infrastructure	7.5	8.6	5.1	6.4	8.2	5.4	4.2
Educational system	6.5	5.2	3.6	5.0	5.1	7.5	3.7
Worker motivation	6.2	6.2	4.7	4.9	5.1	6.4	4.9
Total	5.3	5.3	4.9	5.5	4.9	6.6	4.2

Sources: IMD World Competitiveness Yearbook, various issues.

Note: The ranking is on a 1-10 scale, with 1 indicating a negative perception and 10 the most positive perception. The total is obtained as the simple average of the individual factors. See Table 6 below which gives full details of the WCY survey questions.

Table 4 Business environment (cont')

(averages for 1994-2004)

	Luxembourg	Netherlands	Austria	Portugal	Finland	Euro area	Main competitors
1) Legal and institutional framework	5.3	5.2	4.7	3.9	5.9	3.7	5.2
Adaptability of government policy	6.4	5.9	5.5	4.8	6.2	4.3	5.1
Bureaucracy	4.8	4.7	3.5	2.3	6.4	3.0	4.3
Labor regulations	4.0	4.3	4.4	3.6	4.7	3.2	6.4
Political parties	6.2	5.9	5.3	5.0	6.4	4.3	4.9
2) Image of the country	8.1	8.1	8.1	7.2	8.5	7.5	7.7
Cross-border transactions	8.9	8.8	9.1	8.2	9.0	8.3	8.0
Foreign investors	8.9	8.8	8.8	7.9	8.9	8.4	8.0
Values of the society	6.5	6.7	6.5	5.6	7.6	5.7	7.0
3) Tax system	5.5	4.9	5.2	4.2	4.3	3.7	5.7
Real personal taxes	5.2	4.0	4.4	4.3	2.5	3.3	5.5
Real corporate taxes	5.7	5.8	5.9	4.2	6.2	4.1	5.9
4) Production infrastructure	6.6	6.7	7.4	4.8	7.6	6.0	6.3
Distribution infrastructure	7.8	7.5	8.2	5.9	8.6	7.2	7.4
Educational system	5.4	6.1	6.9	3.7	7.5	5.1	4.9
Worker motivation	6.5	6.6	7.2	4.9	6.8	5.6	6.4
Total	6.4	6.2	6.3	5.0	6.7	5.2	6.2

Sources: IMD World Competitiveness Yearbook, various issues.

Note: The ranking is on a 1-10 scale, with 1 indicating a negative perception and 10 the most positive perception. The total is obtained as the simple average of the individual factors. See Table 6 below which gives full details of the WCY survey questions.

PART 2

PATENT AND R&D DATA

PATENT DATA

The patent data cover US utility patents (i.e. patents for inventions) granted in the United States during the period from 1963 to 2002 (plant and design patents are not included), which are collected by the US Patent and Trademark Office (USPTO). Although a strong “home country advantage” effect is present in the data – i.e. the number of patents registered by US companies is generally much higher than that by foreign companies – the overall trends depicted by the data are comparable to other datasets. According to the European Patent Office (EPO), which collects data on patents registered in Europe, the euro area has the highest share of patents registered at the EPO (see REIST-3), but the United States has increased its presence over the past decade in terms of the percentage of patent applications filed at the EPO. In 2001, the euro area was responsible for 33.9% of patents applied for at the EPO, while the United States accounted for 32.4% and Japan for 14.6%. Over the period from 1992 to 2001, the United States managed to increase its share by 4.2 percentage points, while the euro area’s share fell by 2.1 percentage points and Japan’s by 4.9 percentage points. These are similar trends to those described by the USPTO dataset.

R&D DATA

The R&D data are from the OECD STAN Indicators database, which includes annual data on R&D intensity, measured as the share of R&D expenditure in value added. This indicator has been computed using the value-added data from the OECD STAN database for Industrial Analysis and R&D expenditure from the Analytical Business Enterprise R&D (ANBERD) Database. The industrial breakdown is based on the International Standard Industrial Classification (ISIC) Revision 3 and the data are available for eight euro area countries: Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands and Spain. The data for these countries are weighted together to approximate R&D measures for the euro area (using the weight of each country in euro area value added). Moreover, this source also provides data for Sweden, Denmark, Norway, Australia, Canada, Japan, the United Kingdom and the United States. These data are available for the period 1987-2001. For previous periods (1980-86), the OECD Main Industrial Indicators database was used, adjusted using the correspondence between ISIC Rev. 2 and ISIC Rev. 3 classifications. This earlier dataset includes information for the same set of countries, except for Belgium and Ireland.

Table 5 Weights for the relative patenting indicator

	EA	US	UK	Japan	South Korea	Singapore
EA		28,6	58,0	26,5	22,9	21,7
US	25,1		16,7	36,3	25,6	24,4
UK	24,3	6,6		5,7	4,2	5,4
Japan	15,0	23,7	8,5		29,9	27,7
Switzerland	8,8	1,8	3,1	1,7	1,3	1,5
Sweden	6,2	1,5	2,9	1,5	1,1	1,2
South Korea	4,9	5,6	2,1	10,0		
Hong Kong	3,9	3,0	1,7	5,9	6,0	6,8
Denmark	3,5	0,5	1,4	0,5	0,5	0,4
Singapore	3,5	4,0	2,0	6,7	4,6	0,0
Canada	2,0	23,1	1,5	2,6	1,9	1,5
Norway	1,7	0,3	1,2	0,4	0,4	0,4
Australia	1,1	1,4	1,0	2,3	1,7	2,0

Source: ECB.

Note: Table should be read in columns, i.e. for RPI_{EA} , the US carries a weight of 25.1% etc.; EA is the euro area.

RELATIVE PATENTING INDICATOR (RPI)

Based on the computations used in calculating National Competitiveness Indicators (NCI), a similar indicator was derived for the relative patenting activity of the euro area as a whole, which is defined as:

$$RPI_{EA} = \prod_{i=1}^n \left(\frac{PAT_{EA}}{PAT_i} \right)^{w_i}$$

where PAT_{EA} stands for the number of patents of the euro area, and PAT_i for the number of patents of competitor i , both registered in the United States. As for the NCI, the “narrow group” of competitors was used, namely the United States, the United Kingdom, Japan, Switzerland, Sweden, South Korea, Hong Kong, Denmark, Singapore, Canada, Norway and Australia (i.e. $n=12$). The weights are the same as those used in the NCI computation, appropriately adjusted for the euro area (see Table 5). The RPI was then computed for each member of the narrow group.

NATIONAL BUSINESS ENVIRONMENTS AND COMPETITIVENESS

The detailed survey questions used in the World Competitiveness Report shown in Table 10 in Chapter 3 are shown below:

Table 6 Survey questions used in the World Competitiveness Yearbook

Area	Criterion	Applicable for the survey of the year...	Question
1. Government policy	Adaptability of government	2004	Adaptability of government policy to changes in the economy is high
	Government economic policy	2002, 2003	Government economic policies adapt quickly to changes in the economy
	Government economic policy	1999, 2000, 2001	Gov. economic policies adapt its policies to changes in the economic environment
	Government economic policy	1994, 1995, 1996, 1997, 1998	The government adapts its policies to new economic realities effectively
2. Bureaucracy	Bureaucracy	1999, 2002, 2003, 2004	Bureaucracy does not hinder business activity
	Bureaucracy	1994, 1995, 1996, 1997, 1998, 2000, 2001	Bureaucracy does not hinder business development
3. Labor	Labor regulations	1999, 2004	Labor regulations do not hinder business activities
	Labor regulations	1997, 1998, 2000, 2001, 2002, 2003	Labor regulations are flexible enough
	Hiring and firing practices	1994, 1995, 1996	Hiring and firing practices are flexible enough
4. Politics	Political parties	2002, 2003, 2004	Political parties do understand today's economic challenges
	Political system	1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001	Political system is well adapted to today's economic challenges
5. Cross-border operations	Cross-border transactions	2004	Cross-border transactions can be freely negotiated with foreign partners
	Cross border ventures	2002, 2003	Cross border ventures can be freely negotiated with foreign partners
	Cross-border transactions	1999, 2000, 2001	Cross-border ventures can be negotiated with foreign partners without government intervention
	Cross border ventures	1998	Cross-border ventures can be negotiated with foreign partners without government imposed restraint
	Cross border ventures	1994, 1995, 1996, 1997	Cross border ventures can be negotiated freely
6. Foreign investors		1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004	Foreign investors are free to acquire control in domestic companies
7. Values of the society	Values of the society	1998, 2002, 2003, 2004	Values of the society support competitiveness
	Values of the society	1999, 2000, 2001	Values of the society (hard work, innovation) support competitiveness
	Values of the society	1994, 1995, 1996, 1997	Values of the society support competitiveness (such as hard work,...)
8. Personal taxes	Real personal taxes	2002, 2003, 2004	Real personal taxes do not discourage people from working or seeking advancement
	Real personal taxes	2000, 2001	Real personal taxes do not discourage people from working
	Real personal taxes	1998, 1999	Real personal taxes encourage individual work initiative
	Personal taxes	1994, 1995, 1996, 1997	Personal taxes encourage individual work initiative
9. Corporate taxes	Real corporate taxes	2000, 2001, 2002, 2003, 2004	Real corporate taxes do not discourage entrepreneurial activity
	Real corporate taxes	1998, 1999	Real corporate taxes encourage entrepreneurial activity
	Corporate taxes	1997	Corporate taxes encourage entrepreneurial activity
	Fiscal policy	1994, 1995, 1996	Fiscal policy encourages entrepreneurial activity
10. Distribution	Distribution infrastructure	1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004	The distribution infrastructure of goods and services is generally efficient
	Distribution systems	1994, 1995	Distribution systems are generally efficient
11. Educational system	Educational system	1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003	Educational system meets the needs of a competitive economy
12. Worker motivation	Worker motivation	2002, 2003, 2004	Worker motivation is high in your country
	Worker motivation	1999, 2000, 2001	Employees do identify with company objectives
	Worker motivation	1994, 1995, 1996, 1997, 1998	Employees truly identify with company objectives

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