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THE EFFECTIVE EXCHANGE RATES OF THE EURO

BY
LUCA BULDORINI,
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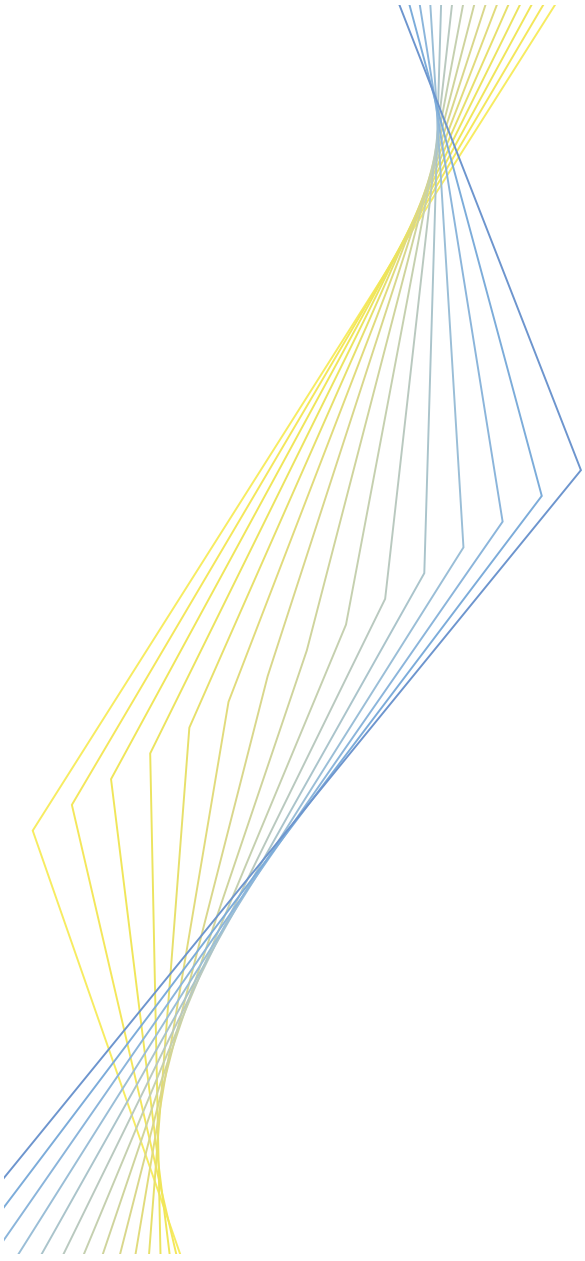

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Contents

Executive summary 5

I Introduction 7

II Methodological features 9

II.1 Trade basis 9

II.2 Trading partners and weights 9

II.3 Weighting method and capturing third-market effects 12

II.4 Deflators 18

II.5 Base period and frequencies 18

II.6 Aggregation of pre-1999 legacy currency data to proxy the euro exchange rate 19

II.7 Adjustment of the euro EER indices as a result of euro area enlargement 20

III Recent developments in euro area competitiveness 23

IV National competitiveness indicators for euro area countries 30

IV.1 Methodological features 30

IV.2 Decomposition of NCIs into intra and extra-euro area components 33

IV.3 Developments in national competitiveness indicators 38

V Conclusions 42

Annex I 43

Aggregating euro area country data to compute the euro EER 43

Bibliography 46

Executive summary

In preparation for the start of Stage Three of Economic and Monetary Union (EMU), the European Central Bank (ECB) and the national central banks of participating countries began their work on the construction of a set of effective exchange rate (EER) indicators for the single currency based on a commonly agreed methodological framework. To this end, a workshop was held in Frankfurt in February 1999, involving representatives of all European Union countries' central banks and the ECB. The outcome of the workshop was the formulation of the general methodological principles upon which the computation of the euro EER indices should be based. The implementation of this commonly agreed framework was undertaken by the ECB. Unlike the condensed description given in the article entitled "The nominal and real effective exchange rates of the euro" in the April 2000 issue of the ECB Monthly Bulletin, this paper's main aim is to provide a more comprehensive account of the methodological framework adopted by the Eurosystem for the calculation of its set of euro EER indices. This more detailed analysis could then serve as a reference guide for researchers and users of the Eurosystem's euro EERs. Accordingly, the paper contains previously unpublished technical information pertaining to the construction of the set of nominal (NEER) and real effective exchange rate (REER) indices for the euro and introduces a set of national competitiveness indicators (NCIs) for the individual euro area countries. This paper has been prepared by Luca Buldorini, Stelios Makrydakis and Christian Thimann.[1]

The methodology underlying the computation of the EERs published by the Bank for International Settlements (BIS) forms the backbone of the Eurosystem's approach to setting up the EERs of the euro. Specifically, the computation of the euro EER indices involves overall trade weights based on extra-euro area manufacturing trade. Following the BIS approach, exports are double-weighted in order to account for competition in third markets. The weighting scheme is fixed, but the weights themselves are subject to revision every five years. Historical data required for the compilation of the set of EER indices are computed through the use of a "theoretical" euro, calculated on the basis of the euro area countries' currencies before 1999.

Two sets of indicators have been developed: (i) one nominal and several real effective exchange rate indices against a narrow reference group of euro area trading partners based on different price and cost deflators; and (ii) a nominal and a real effective exchange rate index against a broad reference group of countries based on consumer prices. As of January 2001, the narrow group consists of 12 industrial and newly industrialised trading partners of the euro area, while the broad group is made up of 38 trading partners including emerging market economies and economies in transition. The narrow and broad groups of trading partners encompass roughly 60% and 90%, respectively, of total euro area manufacturing trade (measured by the average of imports and exports over the 1995-97 period).

Prior to the enlargement of the euro area with the inclusion of Greece in January 2001, the EER indices covered 13 and 39 partner countries in the narrow and broad groups respectively. The adoption of the euro by Greece meant that the EER indices had to be adjusted accordingly. The adjustment involved the ensuing modification of the overall trade weights, as Greece was excluded from the narrow and broad groups of euro area trading partners, and the subsequent chain-linking of the resultant EER indices to the pre-enlargement EER series.

1 *The authors wish to thank all the workshop participants, in particular W. Friedmann and N. Meyer, for their insightful comments and suggestions during the implementation of the EER project. Comments received at various stages of the project from W. Schill, P. Bull, F. Papadia, J.-M. Israël, F. di Mauro, M. Moss, I. Ganoulis, M. Fratzscher, B. Schnatz, D. Schweisguth and two anonymous referees are also gratefully acknowledged. Any remaining errors or omissions are the sole responsibility of the authors. The views expressed in the paper are those of the authors and do not necessarily reflect those of the European Central Bank or the European System of Central Banks.*

The paper also deals with the construction of NCIs using the same methodological framework. The NCIs provide an indication of whether individual euro area countries are gaining or losing in terms of price competitiveness relative not only to non-euro area countries, but also the other countries making up the euro area – for example, as a result of different wage policies or price and cost developments.

As far as the results are concerned, the euro REER indices show a marked increase in the price and cost competitiveness of the euro area since the advent of Monetary Union in January 1999. Indeed, the decline in the euro exchange rate against the currencies of most euro area trading partners has not been significantly offset by movements in most price and cost deflators between the euro area and its main trading partners.

The NCIs show that individual euro area countries have not experienced as large a rise in international price competitiveness as that realised by the euro area as a whole. This finding is a direct consequence of the way NCIs are defined: they measure the price and cost competitiveness of an individual euro area country not only vis-à-vis the euro area's trading partners, but also the other euro area countries. Accordingly, the size of the increase in price competitiveness experienced by each euro area country has been determined essentially by each country's relative exposure to intra and extra-euro area trade, although differing domestic inflation developments could also have played a role. Given these factors, it is evident that the effect of the depreciation of the euro was much smaller on individual countries than on the euro area as a whole.

While movements in the euro EER indices provide important insights at the euro area level, the results stemming from the NCIs are primarily interesting from a national perspective, particularly for fiscal and income policies.

1 Introduction

Effective exchange rates (EERs) are important economic indicators for policy-makers and economic agents alike. The nominal effective exchange rate (NEER) constitutes a summary measure of the external value of a country's (or economic area's) currency vis-à-vis the currencies of its most important trading partners. The real effective exchange rate (REER) – obtained by deflating the nominal rate with appropriate price or cost indices – is the most commonly used indicator of international price and cost competitiveness.

The NEER is particularly useful in gauging exchange rate movements and their potential bearing on import prices and export demand. The REER as an indicator of "international competitiveness" has its greatest relevance over a longer-term horizon. However, even though the use of REER indices as measures of international competitiveness is widespread, they are not free of shortcomings. In particular, the notion of international competitiveness is quite broad and difficult to conceptualise at an economy-wide level, as it is firms rather than economies that compete in international trade. Hence, "international competitiveness indicators" should ideally be developed at a microeconomic or firm level and should try to capture all aspects relevant in international trade, including product quality, innovation and reputation.[2] The REER is therefore to be seen as a rather narrow concept that does not take into account the latter aspects of "international competitiveness". However, the utilisation of REERs can be justified by the fact that firms are heavily influenced in their international trade performance by economy-wide developments. Among these developments, changes in the exchange rate, prices and costs are generally the macroeconomic variables with an important impact on firms engaging in external trade.[3]

Accepting the usefulness and the limitations of REERs as indicators of international price and cost competitiveness, one difficulty remains: the specification of the REER in terms of the choice of appropriate price (or cost) deflators. Here, the aim must be to use the deflator that has the most direct bearing on international price (or cost) competitiveness. The use of export prices would seem the most appropriate from the outset. However, it proves to be a rather narrow concept, as it does not take into account inputs into the firm's production from other sectors, including services. The latter factor, coupled with data quality and availability considerations, renders deflation of EERs by CPI or GDP deflators a good alternative. Furthermore, developments in costs – in particular wages – are relevant for firms, so cost-based REERs, such as those deflated by unit labour costs, can also be computed.[4]

Overall, the question of what is the optimal or the most appropriate indicator to use boils down to an empirical rather than a theoretical matter, in the sense that it is ultimately dependent on how the concept of competitiveness is being measured. In what follows, the term "international competitiveness" will refer to the narrow definition of this concept, that is, how a country's or an economic area's exports fare in terms of prices and costs compared with those of its main competitors.

Even though the concept of EERs is well established, its implementation in the case of the euro area is not straightforward. There are a number of features linked to the euro that deserve special attention and need to be taken into account when constructing NEER and REER indices for the single currency. Specifically:

- The euro has only existed since 1 January 1999; for the period prior to its

2 *For a lengthier discussion on the individual shortcomings of a number of competitiveness indicators, see Marsh and Tokarick (1994).*

3 *In this context, it should be emphasised that EERs are also widely used for macroeconomic surveillance; see Lipschitz and MacDonald (1992) or Zanello and Desruelle (1997) for a presentation of the IMF framework for EERs. The OECD approach is outlined in Durand et al. (1992 and 1998).*

4 *For a detailed discussion on the pros and cons relating to the choice of deflators for constructing REERs, the reader is referred to Lipschitz and MacDonald (1992), Turner and Van't dack (1993) and Clostermann (1998).*

introduction, the national exchange rates of the euro area legacy currencies have to be aggregated.

- The euro is the currency of an area with a composition that changes over time. Two years after its coming into existence, i.e. on 1 January 2001, the euro area grew by one new member, Greece, while further enlargement is likely to take place in the future. Therefore, the concept of euro EERs has to be adapted over time to take into account such changes in the composition of the euro area.

- Even though the euro area is a common currency area, it is composed of sovereign states, which have maintained autonomy over their non-monetary policies. This implies that a number of factors that can influence EERs, such as wage patterns, domestic prices and other policy variables, may differ from country to country. Therefore, it is interesting to look not only at the international competitiveness of the euro area as a whole, but also at that of individual euro area countries. The latter provides an indication of whether each participating country is gaining or losing in terms of price competitiveness relative to the others – for example, as a result of different wage policies or price and cost developments. This information is relevant for national policy-makers and economic agents alike.

The primary aim of this paper is to provide a thorough description of the methodological framework adopted by the European Central Bank (ECB) and the national central banks (NCBs) for calculating euro EERs. This framework draws, to a large extent, on the corresponding methodology used by the Bank for International Settlements (BIS) to compute EERs.[5] The latter, however, has been modified to accommodate the specific needs of the Eurosystem for euro area wide indicators that take the above-mentioned considerations into account. In this context, although the overall trade weights underlying the computation of the Eurosystem's EER indices are derived according to the BIS approach, the euro EER indices produced by the two institutions are not identical. This results principally from differences in: (i) the composition of the reference groups of partner countries; (ii) the sample period for trade data forming the basis for the weight computation; (iii) the aggregation of euro area data prior to January 1999; and (iv) the sources and treatment of data on deflators, particularly for the euro area.

Secondly, the paper intends to serve as a comprehensive reference guide for researchers and users of the Eurosystem's euro EERs. It does so by covering the technical aspects pertaining to the construction of the Eurosystem's set of NEER and REER indices in greater depth. This more detailed account was not possible owing to space constraints when the Eurosystem's framework was presented for the first time in the article entitled "The nominal and real effective exchange rates of the euro" in the April 2000 issue of the ECB Monthly Bulletin. Moreover, a set of national competitiveness indicators (NCIs) – in essence a set of REERs – for the individual euro area countries, which is consistent with the Eurosystem's methodological framework, is also introduced.

The remainder of this paper is structured as follows: Section II presents the general aspects of the methodology to calculate the euro EERs and describes the adjustments to the EER indices required by the recent euro area enlargement; Section III discusses recent developments in the price and cost competitiveness of the euro area as measured by the resultant REER indicators; Section IV presents the derivation of NCIs and discusses developments in the price competitiveness of individual euro area countries on the basis of these indicators; and Section V summarises and concludes the paper.

5 *For a comprehensive account of the BIS methodology, see Turner and Van't dack (1993).*

II Methodological features

In order to construct the set of euro EERs, the ECB and the NCBs of participating countries had to address a number of methodological issues. These related to: (i) the trade basis upon which the weights for the indices had to be computed; (ii) the selection of the currencies of the euro area's trading partners to be included in the EER indices; (iii) the type of weighting scheme and the method for capturing competition in third markets; and (iv) the choice of deflators to derive the real counterparts of the EER indices for measuring the euro area's international price and cost competitiveness.

The way these methodological issues were dealt with is described in detail below, abstracting initially from any questions arising from possible changes in the composition of the euro area as a result of enlargement. Such an enlargement only has weight-adjustment implications and does not affect the general aspects of the methodological framework upon which the set of euro EER indicators is based. The weight adjustments entailed by the inclusion of Greece in the euro area, as of January 2001, are discussed separately at the end of this section.

II.1 Trade basis

In accordance with the general practice followed by a number of international organisations and central banks that construct and publish EERs, the trade basis selected by the Eurosystem for its set of EER indicators is *manufacturing trade*. Based on the 1995-97 average of total euro area trade (the most up-to-date data available in 1999 when the trade weights underlying the Eurosystem's euro EERs were computed), manufacturing goods accounted for almost 80% of this total. Hence, the nominal and real EERs of the euro are computed using manufacturing trade flows as defined in Sections 5 to 8 of the Standard International Trade Classification (SITC 5-8), i.e. excluding agricultural, raw material and energy products.

In principle, it would have been desirable to also include trade in services because its share in international trade, albeit still small by comparison, has risen in recent years. However, data on transactions in services and their prices are relatively scarce and show a low level of comparability across countries. Such data constraints become particularly problematic when the EER indicators are constructed so as to encompass price competitiveness developments against country groupings involving emerging market economies and economies in transition. However, an extension of the trade basis to cover extra-euro area services transactions could become feasible in the future as the availability and quality of data on trade in services have been improving recently.

II.2 Trading partners and weights

The euro area has significant trade relationships with a large number of countries. To cover two-thirds of the euro area's external trade, more than a dozen trading partners have to be considered. This means that euro EER developments and euro area competitiveness developments have to be measured with respect to a relatively large set of currencies and trading partners worldwide, including emerging market economies and economies in transition.[6]

For several of the euro area's trading partners, the full range of desirable price and cost indicators may not be available or may be available only with a long lag and subject to quality caveats. Moreover, in the past,

6 *The significance of emerging market and transition economies – particularly those in Asia – for world trade has been pointed out by a number of international organisations. Both the IMF and the OECD have updated their sets of EERs to take developments in these countries into consideration; see Durand et al. (1998) and Zanello and Desruelle (1997).*

some of these trading partners have experienced high inflation, and large and prolonged nominal depreciation of their currencies, which also largely tends to decouple the nominal and real EERs.[7]

These considerations result in a trade-off between trade coverage and data quality for EERs. In order to deal with this trade-off, two sets of indicators were developed: one set involving a narrow group of industrial and newly industrialised trading partners and one set based on a broader group of trading partners also including other emerging market economies and economies in transition. This dual approach ensures that: (i) the external value of the euro and the price competitiveness of the euro area can be assessed vis-à-vis a number of countries accounting for a sufficiently large proportion of euro area trade and on the basis of a wide range of price and cost indicators; and (ii) euro area competitiveness can be evaluated, albeit only in terms of relative consumer prices, against an extended group of trading partners which encompasses European Union (EU) accession countries and emerging market economies in Asia, Latin America and eastern Europe, as well as relevant trading partners in other parts of the world.

The narrow group comprises 12 industrial and newly industrialised trading partners of the euro area, and the broad group 38 trading partners. The selection criteria for the countries making up each of the two reference groups are different and relate not only to the relative importance of the respective countries as trading partners of the euro area, but also to the properties which the resultant EER indicator is required to exhibit. The narrow group, which covers a significant proportion of around 61% of total euro area manufacturing trade in the 1995-97 period (or carries an overall weight of 69% in the broad index), is made up of those trading partners of the euro area for which: (i) significant trade links with the euro area exist; (ii) exchange rate data are available on a daily basis; and (iii) a sufficiently broad range of price and cost indices exists on a monthly or quarterly basis and in a relatively timely and reliable fashion.

The broad group of partner countries covers 89% of euro area external trade in manufacturing goods in the 1995-97 period. In addition to the countries in the narrow group, it includes other countries, which possess one or more of the following features: (i) an individual share of total euro area manufacturing trade larger than 1%; (ii) EU accession country status; and (iii) significant trade links with individual euro area countries, although the share relative to overall euro area manufacturing trade may be small. In conjunction with these selection criteria, the composition of the broad group was also determined on the basis of timely and reliable availability of the consumer price index (CPI) on a monthly basis.

Table II.1 shows that, in terms of simple trade shares, the euro area's two main trading partners are the United Kingdom and the United States with shares in total euro area trade of around 30% and 24% in the narrow group and 21% and 16% in the broad group respectively. The weights of the next three most important trading partners – Switzerland, Japan and Sweden – in the narrow group are 11%, 10% and 7%, while in the broad group they amount to 8%, 7% and 5% respectively. All the other trading partners have a share of less than 5% in both groups, reflecting the wide dispersion of euro area external trade. In terms of regional groupings, the European industrial economies outside the euro area clearly constitute the most important regional group for the euro area's external trade, carrying a weight of around 38% in the broad index. The second largest region is Asia (including Japan), with some 23%, followed by North America, with around 18%. The transition economies in central and eastern Europe (including Russia) account for around 12% and Latin America for around 3%. The remainder mainly includes countries in Africa, the Middle East and

7 *A relatively broad set of competitiveness indicators for emerging market economies and economies in transition can be found in Turner and Golub (1997).*

Table II.1

Weights in the ECB's narrow and broad EER indices

(percentages)

Partner countries	Simple share in the euro area's manufacturing trade [1]	Overall weight in the narrow EER index [2]	Simple share in the euro area's manufacturing trade [1]	Overall weight in the broad EER index [2]
Broad group [3]			**100**	**100**
Narrow group [3]	**100**	**100**	**68.89**	**69.31**
Australia	1.29	1.13	0.89	0.80
Canada	1.88	1.96	1.29	1.46
Denmark	3.99	3.50	2.75	2.58
Hong Kong SAR [4]	2.72	3.90	1.87	2.06
Japan	10.23	15.01	7.05	10.10
Norway	2.13	1.70	1.47	1.33
Singapore	2.39	3.50	1.65	2.06
South Korea	3.03	4.91	2.08	2.82
Sweden	7.21	6.23	4.97	4.35
Switzerland	11.41	8.84	7.86	6.51
United Kingdom	30.04	24.26	20.70	18.03
United States	23.68	25.05	16.31	17.21
Additional countries in the broad group			**31.11**	**30.69**
Algeria			0.38	0.32
Argentina			0.59	0.53
Brazil			1.44	1.44
China			3.75	4.05
Croatia			0.51	0.50
Cyprus			0.17	0.12
Czech Republic			2.11	1.85
Estonia			0.17	0.16
Hungary			1.79	1.54
India			1.33	1.47
Indonesia			0.96	0.92
Israel			1.28	1.10
Malaysia			1.19	1.31
Mexico			0.69	0.83
Morocco			0.72	0.63
New Zealand			0.14	0.20
Philippines			0.44	0.42
Poland			2.63	2.31
Romania			0.75	0.69
Russia			2.17	2.38
Slovakia			0.70	0.76
Slovenia			0.95	0.82
South Africa			0.90	0.90
Taiwan			1.97	2.15
Thailand			1.11	1.22
Turkey			2.24	2.07

Sources: Eurostat – Comext; and ECB calculations.

1) *Simple import and export shares in total euro area manufacturing trade excluding "third-market" effects.*
2) *Overall weights are a weighted average of simple import shares and double-export weights, i.e. taking into account "third-market effects".*
3) *The narrow and broad groups account for 61.2% and 88.8% of total euro area manufacturing trade respectively.*
4) *Special Administration Region.*

Oceania. Although the trading partners not included in the broad group account for approximately 11% of total euro area manufacturing trade, they exhibit small individual trade shares with the euro area and weak trade relationships with individual euro area countries.

II.3 Weighting method and capturing third-market effects

The euro NEERs are constructed by applying *overall trade weights* (following the geometric weighting principle)[8] to the bilateral exchange rates of the euro against the currencies of the trading partners in each reference group.[9] The weighting scheme is fixed in the sense that the same weights are applied uniformly to the whole period over which the EER indices are calculated. Because overall country weights tend to change only very gradually over time, it is envisaged that the weights will be updated at a *five-year* interval in order to take shifts in international trade flows into account.

In formal terms, the NEER of the euro is defined as follows:

$$NEER = \prod_{i=1}^{N} \left(e_{i,euro}\right)^{w_i} \qquad \text{(II.1)}$$

where N stands for the number of competitor countries in the reference group against which the external value of the euro is measured, $e_{i,euro}$ is an index of the exchange rate of the currency of partner country i vis-à-vis the euro, and w_i is the overall trade weight assigned to the currency of the trading partner i.

The *overall weights* incorporate information on both exports and imports, excluding trade within the euro area. The import weights are the simple shares of each partner country in total euro area imports from the partner countries. Exports are double-weighted in order to account for "third-market effects", i.e. to capture the competition faced by euro area exporters in foreign markets from both domestic producers and exporters from third countries.

The double-weighting of exports is performed in accordance with the BIS methodology presented in Turner and Van't dack (1993). Following the BIS approach, we assume that euro area exports are destined for H foreign markets. These markets are not only the domestic markets of the N competitor countries comprising the reference group against which the external value of the euro is measured, but also the domestic markets of other countries, termed henceforth "rest of the world" (ROW) for convenience (where $H>N$). It is further assumed that the N competitor countries are the only suppliers in the H foreign markets and that exports of manufactured goods, as well as the domestic output of the manufacturing sector of the countries not included in the reference group (i.e. the ROW countries), do not compete with goods produced by the competitor countries in the reference group. If, therefore, x_j^a denotes the gross export flows in the reference period from the euro area to market j, then the shares of each market in total exports are:

$$x_j = x_j^a \Big/ \sum_{j=1}^{H} x_j^a \,,\ j=1,2,\ldots,H \qquad \text{(II.2)}$$

The subsequent adjustment of these export shares to capture third-market effects yields the double-export weights of each partner country, that is:

$$w_i^x = \sum_{j=1}^{H} \left(s_{i,j} x_j\right),\ i=1,2\ldots N \qquad \text{(II.3)}$$

8 *On the question of arithmetic versus geometric EERs, see Brodsky (1982).*

9 *In line with conventional standards, all exchange rates are expressed in terms of national currency per euro so that an increase in the resulting index implies a nominal effective appreciation of the euro.*

$S_{i,j}$ is the share of country *i* 's supply in market *j*, which is obtained as:

$$S_{i,j} = S^a_{i,j} / \sum_{i=1}^{N} S^a_{i,j} \qquad \text{(II.4)}$$

where $S^a_{i,j}$ (for $i \neq j$, i=1,2,…,N, and j=1,2,..,H) denotes the gross export flows from country *i* to market *j* and $S^a_{i,i}$ (for i=1,2,…,N) represents the gross domestic production destined for the domestic market of country *i*.

The import weight of competitor country *i* is not subject to any adjustment and, consequently, coincides with its simple import share (m_i) in total euro area imports from the *N* partner countries in the reference group, that is:

$$w^m_i = m_i = m^a_i / \sum_{i=1}^{N} m^a_i, \; i=1,2,\ldots,N \qquad \text{(II.5)}$$

where m^a_i denotes the gross import flows in the reference period to the euro area from country *i*.

The overall trade weights of each partner country are then obtained as the weighted average of the doubled-weighted export weights and the simple import weights, that is:

$$w_i = \left(\frac{x^a}{x^a + m^a}\right) w^x_i + \left(\frac{m^a}{x^a + m^a}\right) w^m_i \;, \; i=1,2,\ldots N \qquad \text{(II.6)}$$

where $x^a = \sum_{j=1}^{H} x^a_j$ denotes the exports of the euro area to the *H* foreign markets and

$m^a = \sum_{i=1}^{N} m^a_i$ denotes the imports of the euro area from the *N* partner countries.

In order to illustrate how the double-export weights are derived, all the elements required for their computation appear in Tables II.2 and II.3 for the narrow and broad groups respectively. Consider, for instance, the case of the narrow group of competitor countries; Panel 2.1 in Table II.2 reports the simple percentage share of euro area exports destined for each of the 12 partner countries comprising the narrow group and each of the ROW countries (x_j).[10] It can be seen that 1.20% of euro area exports go to Australia, 1.23% to Canada, 2.56% to Denmark, etc. The supply structure matrix of the competitor countries in the narrow group is presented in the second panel of Table II.2. Each element in this panel ($S_{i,j}$) – excluding those on the main diagonal – represents the percentage of manufacturing goods produced in a competitor country (that is, one of the reference group of countries *N* appearing in the rows of Panel 2.2) and exported to one of the foreign markets (i.e. another competitor or ROW country among the *H* appearing in the columns of Panel 2.2). The elements on the main diagonal of the supply structure matrix ($S_{i,i}$) stand for the percentage of manufactured goods produced domestically in each of the competitor countries in the reference group. Taking the first column of Panel 2.2 as an example, it can be seen that in Australia 74.52% of manufactured goods come from domestic production, while 0.52% is imported from Canada, 0.16% from Denmark, and so on – where 74.52% + 0.52% + 0.16% +…+ 9.11% = 100%. To obtain the double-export weights – shown in the third panel of Table II.2 – each row of the supply structure matrix (Panel 2.2) is multiplied by the simple euro area export shares (Panel 2.1), as defined in equation (II.3). For instance, the double-export weight of 1.51% assigned to Australia in the narrow euro NEER index is obtained as (1.20% x 74.52%) + (1.23% x 0.08%) + ... + (14.32% x 1.21%). It measures the competition which euro area exporters face from Australian producers both in the Australian market as well as in each of the remaining *H-1* markets considered. Out of the 1.51%, only 0.89% (1.20% x 74.52%) originates from the competition faced in the

10 In the case of the narrow group, the ROW includes 26 countries, namely Algeria, Argentina, Brazil, China, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Morocco, New Zealand, the Philippines, Poland, Romania, Russia, Slovakia, Slovenia, South Africa, Taiwan, Thailand and Turkey and a residual group termed "all other countries" (see Table II.2). In the case of the broad group, the ROW comprises solely "all other countries" (see Table II.3).

Table II.2

EER weights' calculation - Narrow group

(percentages)

	Australia	Canada	Denmark	Hong Kong	Japan	Norway	Singapore	South Korea	Sweden	Switzerland	United Kingdom	United States	ROW: Algeria	Argentina	Brazil	China	Croatia	Cyprus	Czech Rep.	Estonia
2.1 Euro area exports																				
Euro area exports	1.20	1.23	2.56	2.03	3.94	1.45	1.42	1.76	3.94	6.72	17.53	13.57	0.55	0.81	1.66	2.06	0.55	0.22	1.91	0.19
2.2 Supply structure matrix																				
Australia	74.52	0.08	0.10	1.68	0.19	0.02	1.73	0.74	0.22	0.14	0.30	0.11	0.00	0.50	0.30	0.34	0.36	0.45	0.21	0.08
Canada	0.52	47.74	0.12	0.68	0.20	0.38	0.51	0.65	0.32	0.31	0.58	6.64	1.26	2.21	2.82	0.79	1.57	0.69	1.43	0.85
Denmark	0.16	0.06	71.77	0.24	0.05	4.95	0.25	0.16	8.93	1.17	0.95	0.08	1.12	0.91	0.57	0.19	6.95	2.05	5.24	11.72
Hong Kong SAR	0.65	0.38	0.49	18.45	0.23	0.41	7.48	0.64	0.76	1.07	0.88	0.58	1.14	6.10	5.63	54.39	1.97	3.29	4.58	1.49
Japan	7.07	1.73	2.07	31.85	91.42	2.55	31.14	19.05	3.61	4.11	5.00	6.70	17.64	8.22	12.81	19.41	2.10	17.52	6.97	2.07
Norway	0.05	0.05	2.41	0.15	0.05	67.52	0.42	0.14	4.90	0.31	0.63	0.07	0.31	0.58	0.32	0.11	3.68	3.12	1.52	4.56
Singapore	1.36	0.37	0.14	13.32	0.59	0.64	23.19	1.37	0.31	0.32	1.18	1.12	2.07	2.28	2.17	2.94	0.95	10.21	0.69	0.00
South Korea	1.64	0.65	0.80	11.69	1.38	0.96	7.40	62.30	0.85	0.60	1.24	1.21	2.36	6.51	7.72	10.01	3.98	12.45	2.19	1.16
Sweden	0.93	0.35	9.62	0.98	0.25	11.96	0.90	0.38	53.43	2.68	2.36	0.36	2.05	3.82	2.85	1.07	18.84	3.03	11.40	50.56
Switzerland	0.90	0.20	1.76	2.82	0.28	1.38	1.65	0.55	6.83	71.53	1.76	0.43	5.85	3.17	3.16	0.54	13.29	2.89	14.40	1.98
United Kingdom	3.09	1.06	7.46	5.20	0.65	6.49	4.40	1.08	13.64	8.93	75.70	1.51	8.66	7.11	5.74	1.07	25.93	27.67	37.07	10.37
United States	9.11	47.32	3.25	12.92	4.71	2.75	20.92	12.94	6.19	8.83	9.41	81.20	57.55	58.59	55.91	9.14	20.37	16.64	14.30	15.15
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
2.3 Double-export weights																				
Export weights	1.51	2.16	3.54	4.94	15.44	1.72	4.09	5.87	5.56	7.76	21.72	25.70								
2.4 Import weights																				
Import weights	0.36	1.56	3.44	1.77	14.15	1.66	2.30	2.97	7.60	11.04	29.44	23.71								
2.5 Overall weights																				
Overall weights	1.13	1.96	3.50	3.90	15.01	1.70	3.50	4.91	6.23	8.84	24.26	25.05								

ROW: Hungary	India	Indonesia	Israel	Malaysia	Mexico	Morocco	New Zealand	Philippines	Poland	Romania	Russia	Slovakia	Slovenia	South Africa	Taiwan	Thailand	Turkey	Other countries	Total	
																				2.1 Euro area exports
1.56	1.16	0.88	1.38	0.94	0.78	0.65	0.18	0.42	2.55	0.60	2.28	0.57	0.79	1.03	1.33	1.00	2.26	14.32	100	*Euro area exports*
																				2.2 Supply structure matrix
0.14	1.39	4.40	0.24	1.42	0.03	0.06	39.80	1.67	0.31	0.19	0.13	0.22	0.21	2.77	1.82	1.82	0.38	1.21		*Australia*
1.45	1.37	1.11	1.23	0.65	0.82	1.22	1.27	0.56	1.10	3.45	1.49	2.92	0.81	1.35	1.35	0.58	1.26	0.61		*Canada*
3.77	1.53	0.54	0.99	0.13	0.07	1.48	0.47	0.21	10.11	3.45	2.06	6.66	4.17	0.84	0.21	0.38	1.28	1.83		*Denmark*
4.50	5.75	4.94	4.37	3.00	0.72	3.62	3.89	9.88	4.97	4.05	4.41	2.22	3.91	7.73	2.83	4.66	5.06	12.44		*Hong Kong SAR*
18.90	18.47	48.84	10.50	28.52	6.58	10.92	18.35	37.91	4.01	6.80	11.39	5.45	7.93	21.46	46.01	46.85	14.10	22.76		*Japan*
0.60	0.53	0.09	0.31	0.07	0.04	0.39	0.36	0.18	1.94	0.78	0.96	1.88	1.13	0.17	0.07	0.12	0.86	0.75		*Norway*
2.34	15.59	0.00	2.06	39.86	0.61	2.54	4.46	10.94	1.53	1.24	8.75	0.00	2.03	3.99	4.47	17.06	1.74	11.05		*Singapore*
2.73	8.76	15.96	3.51	7.02	2.11	1.84	2.56	9.29	14.01	9.79	17.71	1.73	5.08	4.91	7.13	6.44	9.03	11.21		*South Korea*
12.66	2.53	1.72	2.06	0.90	0.35	5.97	1.64	0.98	15.05	7.95	6.84	13.08	11.32	3.38	1.09	1.48	5.97	3.56		*Sweden*
13.02	3.44	1.46	8.19	0.77	0.59	6.27	2.17	0.85	8.22	12.37	3.36	21.87	20.74	4.60	1.32	1.65	9.09	2.02		*Switzerland*
25.18	18.47	4.17	16.80	3.15	0.84	33.47	7.44	2.60	24.32	27.85	13.80	32.51	27.00	23.85	2.44	3.20	22.33	13.48		*United Kingdom*
14.72	22.18	16.77	49.73	14.52	87.24	32.23	17.59	24.92	14.43	22.08	29.11	11.45	15.67	24.95	31.25	15.75	28.91	19.08		*United States*
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		*Total*
																				2.3 Double-export weights
																				Export weights
																				2.4 Import weights
																				Import weights
																				2.5 Overall weights
																				Overall weights

Sources: Eurostat - Comext; and ECB calculations.

Australian market. The rest comes from the competition in other markets and its level depends on the amount of euro area exports to, as well as the relative importance of Australian exports in, each of these markets.

In concluding the presentation of the double-export weighting scheme, some technical aspects underlying the trade weight computations deserve some additional clarification. As regards the composition of the supply of manufactured goods to the ROW markets, this has been explicitly introduced in the supply structure matrix to encompass competition faced by euro area exporters in the domestic markets of countries other than those included in the reference group of trading partners. The inclusion of the ROW markets has the advantage of bringing informational gains into the computation of the double-export weights as it accounts more comprehensively for export competition over a wider area, that is, an area which is not confined to the competitor countries making up the reference group. For the computation of the double-export weights to be performed, however, the supply of manufacturing goods by domestic producers of the ROW countries has to be disregarded[11] because these countries do not form part of the reference group against which the euro's external value is measured. This yields a supply structure matrix with the dimensions *NxH* and the number of markets (*H*) exceeding the number of suppliers (*N*).

The exclusion of the own-production effect for the ROW countries is not without shortcomings, as it could, under certain circumstances, introduce some bias in the computation of the double-export weights.[12] Overall, however, the gains in computational accuracy achieved through the application of the BIS approach outweigh the costs incurred by adopting a simpler procedure, i.e. one completely disregarding the competition faced in markets outside those of the reference group countries.

A second and final issue relates to the internally produced supply of manufactured goods destined for the domestic market in each partner country, i.e. the data on the main diagonal of the supply structure matrix (see the second panel of Tables II.2 and II.3). These figures had to be estimated.[13] Specifically, data on the gross domestic product (GDP) of the manufacturing sector for the OECD countries have been collected from the Organisation for Economic Co-operation and Development ("National Accounts – Detailed Tables"). For non-OECD countries and Switzerland, the sectoral breakdown of GDP was not available and the manufacturing sector was taken to account for a fixed percentage (15%) of total GDP. As these data represent value added, they need to be adjusted to be comparable with the gross value-based trade data. In order to obtain a proxy for the gross value of the production of manufactured goods, total imports of manufactured goods[14] (including imports of manufacturing goods from euro area countries) were added to the manufacturing sector GDP of each country. Total imports of the non-OECD countries were estimated.[15]

Subsequently, exports of manufactured goods (including exports of manufacturing goods to euro area countries) for each country were subtracted from the computed gross value of the production of manufactured goods in order to identify production for domestic use. The sources and the methods used to obtain the export data were the same as those used for the import data above.

11 See Turner and Van't dack (1993), p. 18.

12 The sort of bias that could be introduced in the double-export weights through the exclusion of the own-production effect of ROW countries relates to cases where a competitor country in the reference group has its main trading partners in the ROW. In such an event, the double-export weight of this country could be expanded relative to that of another competitor country whose trading partners are mainly among the countries forming the reference group.

13 For a more detailed discussion on domestic output sold in local markets, see Turner and Van't dack (1993), Appendix 1.

14 Although the use of imports of manufacturing goods is not the ideal method for dealing with missing data on inputs into manufacturing coming from abroad or produced domestically by non-manufacturing firms, its deployment has been dictated by data availability problems. This method, however, has the advantage of circumventing the derivation of negative or very small figures on domestic production for small open economies in the supply structure matrix (see Turner and Van't dack (1993), Appendix 1).

15 Sources: OECD, "Foreign trade by commodities"; COMEXT database for EU countries; and IMF, Direction of Trade Statistics.

Table II.3

EER weights' calculation - Broad group

(percentages)

	Australia	*Canada*	*Denmark*	*Hong Kong*	*Japan*	*Norway*	*Singapore*	*South Korea*	*Sweden*	*Switzerland*	*United Kingdom*	*United States*	*Algeria*	*Argentina*	*Brazil*	*China*	*Croatia*	*Cyprus*	*Czech Rep.*	*Estonia*
3.1 Euro area exports																				
Euro area exports	1.20	1.23	2.56	2.03	3.94	1.45	1.42	1.76	3.94	6.72	17.53	13.57	0.55	0.81	1.66	2.06	0.55	0.22	1.91	0.19
3.2 Supply structure matrix																				
Australia	69.73	0.08	0.09	0.89	0.17	0.02	1.16	0.67	0.20	0.12	0.28	0.10	0.00	0.05	0.03	0.16	0.02	0.13	0.02	0.01
Canada	0.49	46.22	0.12	0.36	0.18	0.37	0.34	0.59	0.30	0.28	0.54	6.11	0.09	0.20	0.25	0.38	0.10	0.19	0.16	0.16
Denmark	0.15	0.06	67.87	0.13	0.05	4.80	0.17	0.15	8.33	1.06	0.88	0.08	0.08	0.08	0.05	0.09	0.46	0.58	0.58	2.16
Hong Kong SAR	0.61	0.37	0.46	9.78	0.21	0.40	5.00	0.57	0.71	0.98	0.81	0.53	0.08	0.57	0.50	26.21	0.13	0.93	0.51	0.27
Japan	6.61	1.68	1.96	16.89	84.48	2.47	20.82	17.09	3.36	3.74	4.64	6.17	1.22	0.76	1.13	9.35	0.14	4.92	0.77	0.38
Norway	0.05	0.05	2.28	0.08	0.04	65.48	0.28	0.12	4.57	0.28	0.58	0.06	0.02	0.05	0.03	0.05	0.25	0.88	0.17	0.84
Singapore	1.27	0.36	0.13	7.06	0.54	0.62	15.51	1.23	0.29	0.29	1.10	1.03	0.14	0.21	0.19	1.42	0.06	2.87	0.08	0.00
South Korea	1.54	0.63	0.76	6.20	1.28	0.93	4.95	55.91	0.79	0.55	1.15	1.11	0.16	0.60	0.68	4.82	0.27	3.50	0.24	0.21
Sweden	0.87	0.34	9.10	0.52	0.23	11.59	0.60	0.34	49.83	2.44	2.19	0.33	0.14	0.35	0.25	0.52	1.26	0.85	1.26	9.31
Switzerland	0.84	0.19	1.67	1.50	0.26	1.33	1.10	0.49	6.37	65.08	1.63	0.40	0.40	0.29	0.28	0.26	0.89	0.81	1.59	0.36
United Kingdom	2.89	1.02	7.06	2.76	0.60	6.29	2.94	0.97	12.72	8.12	70.16	1.39	0.60	0.66	0.51	0.51	1.73	7.78	4.10	1.91
United States	8.52	45.81	3.07	6.85	4.35	2.67	13.99	11.61	5.77	8.03	8.72	74.79	3.98	5.43	4.94	4.41	1.36	4.68	1.58	2.79
Algeria	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	88.52	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Argentina	0.01	0.01	0.06	0.03	0.01	0.01	0.01	0.02	0.01	0.03	0.02	0.02	0.07	86.18	0.49	0.04	0.01	0.02	0.00	0.02
Brazil	0.08	0.08	0.18	0.10	0.11	0.07	0.10	0.18	0.13	0.25	0.16	0.18	0.49	2.62	89.22	0.17	0.07	0.27	0.05	0.08
China	1.44	0.67	0.72	23.80	2.97	0.77	3.71	4.58	0.91	0.90	1.07	1.41	0.48	0.45	0.36	44.47	0.09	0.99	0.73	0.28
Croatia	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.03	0.07	0.02	0.00	0.03	0.00	0.00	0.01	76.32	0.46	0.14	0.00
Cyprus	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.01	55.28	0.01	0.01
Czech Rep.	0.03	0.02	0.27	0.04	0.01	0.16	0.06	0.02	0.34	0.43	0.16	0.02	0.06	0.02	0.01	0.08	1.48	0.15	70.24	0.47
Estonia	0.00	0.00	0.10	0.00	0.00	0.06	0.00	0.00	0.40	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	72.00
Hungary	0.02	0.01	0.12	0.01	0.01	0.05	0.01	0.01	0.25	0.32	0.14	0.02	0.11	0.01	0.01	0.00	2.06	0.34	0.96	0.47
India	0.26	0.12	0.28	1.02	0.17	0.12	0.74	0.24	0.26	0.46	0.56	0.26	0.05	0.06	0.04	0.17	0.06	0.39	0.09	0.07
Indonesia	0.70	0.11	0.20	0.75	0.88	0.05	3.15	1.36	0.14	0.09	0.28	0.24	0.21	0.06	0.06	0.60	0.01	0.23	0.03	0.03
Israel	0.16	0.05	0.11	0.60	0.10	0.07	0.18	0.19	0.19	0.54	0.38	0.28	0.00	0.11	0.07	0.03	0.11	1.48	0.14	0.15
Malaysia	0.90	0.21	0.28	2.47	0.87	0.07	13.63	1.23	0.32	0.18	0.82	0.67	0.07	0.09	0.15	0.69	0.02	0.32	0.05	0.04
Mexico	0.04	0.58	0.03	0.18	0.08	0.03	0.18	0.05	0.05	0.54	0.13	2.79	0.02	0.38	0.23	0.01	0.00	0.00	0.00	0.00
Morocco	0.01	0.01	0.01	0.00	0.02	0.04	0.00	0.00	0.03	0.04	0.07	0.01	0.20	0.01	0.01	0.01	0.12	0.05	0.01	0.00
New Zealand	0.44	0.02	0.01	0.05	0.04	0.00	0.04	0.08	0.01	0.02	0.06	0.01	0.05	0.01	0.00	0.03	0.00	0.02	0.00	0.00
Philippines	0.13	0.10	0.04	0.50	0.30	0.02	1.08	0.24	0.04	0.06	0.27	0.32	0.00	0.01	0.01	0.09	0.00	0.02	0.01	0.00
Poland	0.01	0.03	1.15	0.02	0.00	0.36	0.06	0.05	1.03	0.28	0.28	0.03	0.10	0.04	0.02	0.01	0.36	1.01	2.30	1.06
Romania	0.00	0.01	0.03	0.01	0.00	0.06	0.06	0.03	0.09	0.09	0.08	0.01	0.45	0.03	0.02	0.04	0.16	0.66	0.07	0.01
Russia	0.00	0.02	0.25	0.06	0.11	0.20	0.15	0.16	0.67	2.54	0.37	0.10	0.24	0.01	0.02	0.60	0.65	3.53	2.74	6.16
Slovakia	0.00	0.01	0.06	0.00	0.00	0.02	0.00	0.00	0.09	0.14	0.04	0.01	0.07	0.01	0.00	0.01	0.84	0.12	10.31	0.20
Slovenia	0.01	0.01	0.11	0.01	0.00	0.03	0.01	0.01	0.12	0.13	0.06	0.01	0.06	0.01	0.01	0.00	10.47	0.06	0.58	0.05
South Africa	0.10	0.03	0.12	0.13	0.06	0.11	0.11	0.15	0.03	0.32	0.38	0.03	0.02	0.05	0.05	0.04	0.01	0.08	0.01	0.00
Taiwan	1.49	0.86	0.67	15.35	1.09	0.50	3.98	1.18	1.13	0.47	1.01	0.94	0.14	0.51	0.32	4.10	0.23	2.97	0.21	0.18
Thailand	0.57	0.20	0.36	1.68	0.74	0.10	5.61	0.46	0.27	0.72	0.50	0.44	0.09	0.06	0.06	0.59	0.00	0.48	0.00	0.19
Turkey	0.03	0.04	0.28	0.14	0.01	0.11	0.26	0.04	0.21	0.37	0.38	0.07	1.53	0.01	0.01	0.01	0.25	2.91	0.24	0.12
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
3.3 Double-export weights																				
Export weights	1.17	1.70	2.66	2.61	10.11	1.44	2.35	3.30	3.61	5.56	15.99	17.42	0.50	0.80	1.88	3.09	0.59	0.15	1.76	0.18
3.4 Import weights																				
Import weights	0.26	1.11	2.45	1.26	10.09	1.19	1.64	2.12	5.42	7.87	21.00	16.91	0.06	0.14	0.81	5.44	0.35	0.07	1.97	0.11
3.5 Overall weights																				
Overall weights	0.80	1.46	2.58	2.06	10.10	1.33	2.06	2.82	4.35	6.51	18.03	17.21	0.32	0.53	1.44	4.05	0.50	0.12	1.85	0.16

Sources: Eurostat - Comext; and ECB calculations.

																		ROW		
Hungary	*India*	*Indonesia*	*Israel*	*Malaysia*	*Mexico*	*Morocco*	*New Zealand*	*Philippines*	*Poland*	*Romania*	*Russia*	*Slovakia*	*Slovenia*	*South Africa*	*Taiwan*	*Thailand*	*Turkey*	*Other countries*	*Total*	
																				3.1 Euro area exports
1.56	1.16	0.88	1.38	0.94	0.78	0.65	0.18	0.42	2.55	0.60	2.28	0.57	0.79	1.03	1.33	1.00	2.26	14.32	100	*Euro area exports*
																				3.2 Supply structure matrix
0.02	0.22	1.38	0.07	0.81	0.01	0.01	13.44	0.69	0.05	0.02	0.01	0.01	0.03	0.59	0.86	0.75	0.06	0.83		*Australia*
0.18	0.22	0.35	0.34	0.37	0.35	0.14	0.43	0.23	0.16	0.39	0.16	0.07	0.11	0.29	0.64	0.24	0.19	0.42		*Canada*
0.46	0.24	0.17	0.27	0.07	0.03	0.17	0.16	0.09	1.48	0.39	0.22	0.17	0.54	0.18	0.10	0.16	0.19	1.25		*Denmark*
0.55	0.91	1.55	1.21	1.72	0.31	0.42	1.31	4.06	0.73	0.45	0.47	0.06	0.51	1.65	1.34	1.91	0.74	8.51		*Hongkong SAR*
2.32	2.94	15.35	2.90	16.31	2.82	1.28	6.19	15.57	0.59	0.76	1.21	0.14	1.03	4.59	21.79	19.24	2.07	15.57		*Japan*
0.07	0.08	0.03	0.09	0.04	0.02	0.05	0.12	0.07	0.28	0.09	0.10	0.05	0.15	0.04	0.03	0.05	0.13	0.51		*Norway*
0.29	2.48	0.00	0.57	22.80	0.26	0.30	1.51	4.49	0.22	0.14	0.93	0.00	0.26	0.85	2.12	7.01	0.26	7.56		*Singapore*
0.34	1.39	5.02	0.97	4.01	0.90	0.22	0.87	3.82	2.05	1.09	1.88	0.04	0.66	1.05	3.38	2.64	1.33	7.67		*South Korea*
1.56	0.40	0.54	0.57	0.51	0.15	0.70	0.55	0.40	2.21	0.89	0.72	0.34	1.47	0.72	0.52	0.61	0.88	2.44		*Sweden*
1.60	0.55	0.46	2.26	0.44	0.25	0.73	0.73	0.35	1.20	1.38	0.36	0.56	2.69	0.98	0.63	0.68	1.34	1.38		*Switzerland*
3.10	2.94	1.31	4.64	1.80	0.36	3.92	2.51	1.07	3.56	3.11	1.46	0.84	3.50	5.10	1.16	1.32	3.28	9.22		*United Kingdom*
1.81	3.53	5.27	13.72	8.31	37.34	3.77	5.94	10.23	2.11	2.47	3.08	0.29	2.03	5.33	14.80	6.47	4.25	13.05		*United States*
0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.04	0.04		*Algeria*
0.00	0.04	0.05	0.03	0.05	0.03	0.14	0.01	0.01	0.02	0.07	0.03	0.00	0.05	0.11	0.02	0.02	0.05	0.51		*Argentina*
0.19	0.10	0.19	0.05	0.10	0.18	0.58	0.05	0.19	0.15	0.35	0.24	0.01	0.47	0.23	0.52	0.15	0.14	1.62		*Brazil*
1.53	0.92	2.33	0.55	1.51	0.20	0.90	0.89	2.05	1.39	1.72	1.92	0.14	0.32	1.41	5.84	1.55	0.75	4.00		*China*
0.28	0.01	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.11	0.08	0.14	0.10	9.71	0.00	0.00	0.00	0.01	0.48		*Croatia*
0.01	0.00	0.00	0.06	0.00	0.00	0.05	0.00	0.00	0.01	0.29	0.18	0.01	0.05	0.00	0.00	0.00	0.00	0.10		*Cyprus*
1.95	0.08	0.01	0.08	0.01	0.01	0.08	0.01	0.01	2.55	0.71	0.66	13.31	3.90	0.10	0.03	0.04	0.11	0.66		*Czech. Rep.*
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.02	0.10		*Estonia*
73.09	0.02	0.02	0.11	0.01	0.00	0.07	0.01	0.01	0.89	3.01	0.81	1.07	4.30	0.03	0.01	0.01	0.09	0.33		*Hungary*
0.13	78.39	0.72	0.51	0.38	0.04	0.19	0.21	0.29	0.16	0.21	0.81	0.02	0.10	0.57	0.30	0.39	0.25	2.57		*India*
0.11	0.44	59.30	0.01	0.85	0.06	0.10	0.29	0.89	0.17	0.15	0.01	0.01	0.09	0.15	1.47	0.59	0.14	0.97		*Indonesia*
0.24	0.32	0.01	67.63	0.04	0.03	0.01	0.09	0.26	0.16	1.16	0.24	0.06	0.75	0.34	0.24	0.26	0.29	0.61		*Israel*
0.21	1.12	1.54	0.00	34.69	0.18	0.14	0.72	1.52	0.13	0.06	0.10	0.00	0.09	0.55	2.84	2.78	0.34	1.87		*Malaysia*
0.12	0.02	0.02	0.03	0.02	55.49	0.04	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.01	1.49		*Mexico*
0.01	0.29	0.01	0.00	0.00	0.03	84.06	0.09	0.00	0.06	0.08	0.02	0.00	0.01	0.01	0.00	0.00	0.07	0.20		*Morocco*
0.00	0.02	0.06	0.00	0.06	0.01	0.05	62.64	0.06	0.00	0.00	0.03	0.00	0.00	0.02	0.10	0.04	0.03	1.11		*New Zealand*
0.04	0.07	0.09	0.02	0.50	0.06	0.00	0.08	49.02	0.03	0.02	0.00	0.00	0.01	0.03	0.92	0.60	0.01	0.44		*Philippines*
1.41	0.08	0.04	0.04	0.05	0.00	0.45	0.02	0.06	74.07	0.46	1.07	0.92	0.56	0.02	0.13	0.11	0.08	1.54		*Poland*
0.94	0.12	0.05	0.30	0.02	0.00	0.38	0.00	0.05	0.15	71.10	0.20	0.10	0.35	0.06	0.03	0.04	0.56	0.68		*Romania*
3.52	0.38	0.03	0.52	0.10	0.01	0.16	0.01	0.09	1.86	2.80	79.04	2.91	0.86	0.02	0.21	0.10	1.01	4.09		*Russia*
2.05	0.06	0.02	0.02	0.01	0.00	0.04	0.00	0.00	1.00	0.57	0.31	78.36	1.70	0.01	0.01	0.02	0.04	0.11		*Slovakia*
0.64	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.00	0.33	0.25	0.34	0.28	62.86	0.01	0.01	0.01	0.04	0.50		*Slovenia*
0.01	0.10	0.11	0.39	0.08	0.01	0.07	0.06	0.04	0.04	0.08	0.02	0.01	0.00	73.93	0.19	0.07	0.07	1.88		*South Africa*
0.29	1.18	2.68	0.82	2.53	0.77	0.18	0.74	3.45	0.78	0.93	1.59	0.04	0.56	0.89	38.36	2.23	0.68	1.57		*Taiwan*
0.24	0.26	1.25	0.51	1.65	0.05	0.06	0.30	0.88	0.62	1.95	0.00	0.00	0.00	0.00	1.29	49.80	0.13	2.52		*Thailand*
0.70	0.04	0.03	0.68	0.12	0.01	0.44	0.02	0.06	0.62	2.77	1.43	0.09	0.24	0.13	0.06	0.08	80.35	1.59		*Turkey*
100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		*Total*
																				3.3 Double-export weights
1.39	1.58	0.96	1.25	1.32	1.12	0.61	0.30	0.44	2.38	0.61	2.95	0.77	0.70	1.16	1.92	1.35	2.29			*Export weights*
																				3.4 Import weights
1.75	1.31	0.86	0.87	1.31	0.42	0.68	0.05	0.39	2.20	0.81	1.55	0.74	0.99	0.51	2.48	1.03	1.76			*Import weights*
																				3.5 Overall weights
1.54	1.47	0.92	1.10	1.31	0.83	0.63	0.20	0.42	2.31	0.69	2.38	0.76	0.82	0.90	2.15	1.22	2.07			*Overall weights*

In conclusion, combining the double-export weights (see third panel of Tables II.2 and II.3) with the simple import shares (see panel four in the aforementioned tables) as described in equation (II.6) yields the overall trade weights (see panel five in these tables). The overall trade weights are also presented in Table II.1 for both groups of trading partners, along with the simple shares of the partner countries in total euro area manufacturing trade (i.e. imports plus exports). A simple comparison between the two sets of weights for each grouping reveals the practical implications of accounting for third-market effects. Those trading partners, which are important global suppliers of manufactured goods and compete strongly with euro area exporters in third markets, in particular Japan, Hong Kong, South Korea and the United States, tend to have larger overall trade weights than their corresponding simple shares in total euro area manufacturing trade would imply.

II.4 Deflators

The euro REERs measure the competitiveness of euro area suppliers in terms of prices or costs relative to their trading partners. These indicators are defined as the relative prices between the euro area and its partner countries expressed in a common currency and are constructed by deflating the NEER index using appropriate price or cost indices. The general expression for the REER is therefore:

$$REER = \prod_{i=1}^{N} \left(\frac{d_{euro} e_{i,euro}}{d_i} \right)^{w_i} \qquad \text{(II.7)}$$

where d_i and d_{euro} are the deflators for partner country i and the euro area respectively.

In the case of the narrow group of partner countries, the competitive position of the euro area is measured in terms of several deflators, namely consumer prices (CPI), producer (or wholesale) prices (PPI) and unit labour costs in manufacturing (ULCM). REER indicators based on GDP deflators, export unit value indices and unit labour costs in the total economy (ULCE) are planned to complement the set of euro EER indices in the near future.[16] For the broad group, only consumer prices are being used, owing to a lack of timely and comparable data on other measures of prices and costs. The deflators used for the euro area are the corresponding aggregated indicators as compiled by Eurostat or the ECB (i.e. the euro area Harmonised Index of Consumer Prices (HICP) and the euro area PPI published by Eurostat, and the ULCM index compiled by the ECB).

II.5 Base period and frequencies

The base period for all euro EER indicators is the first quarter of 1999 (1999 Q1 = 100). The base period was selected simply on institutional grounds, as it coincides with the start of Stage Three of Economic and Monetary Union (EMU). The base period chosen does not relate to any notion of an "equilibrium" value of the euro.

With regard to the data frequency of the series, the NEER index is available daily, as it constitutes a summary measure of short-term foreign exchange market developments. The REER indices are available monthly with the exception of the index based on unit labour costs, which is published at a quarterly frequency.

16 *The use of several price deflators to compute the euro REER indices stems from the fact that no single deflator exists that could be considered as an ideal basis for measuring international price and cost competitiveness (see also footnote 4).*

II.6 Aggregation of pre-1999 legacy currency data to proxy the euro exchange rate

As euro exchange rates have only been available since the start of Stage Three of EMU, earlier EER data are based on a basket of the currencies of those countries that founded Monetary Union in January 1999. The weights for the pre-1999 "theoretical" euro exchange rates are based on the share of each euro area country in total manufacturing trade (given by the 1995-97 average) of the euro area vis-à-vis non-euro area countries. In order to ensure consistency with the weighting method used to compute the overall trade weights for the euro EERs, total manufacturing trade is defined as the sum of total euro area exports and euro area imports from the partner countries. This entails two sets of weights for the "theoretical" euro, depending on whether the narrow or broad group of trading partners is used.[17]

Formally, for the purpose of calculating the exchange rate of the euro up to 31 December 1998, the exchange rates of the national currencies of the 11 countries that adopted the euro in January 1999 are aggregated in order to obtain a "theoretical" euro exchange rate (that is, a proxy for this exchange rate) according to the following formula:

$$e_{i,euro} = \prod_{k=1}^{n} \left(e_{i,k}\right)^{w_k^e}, \; i = 1,2, \ldots, N \qquad \text{(II.8)}$$

where n stands for the number of EMU legacy currencies, $e_{i,euro}$ is the proxy for the exchange rate of the currency of partner country i against the euro, and $e_{i,k}$ is the exchange rate of the currency of partner country i against euro area country k's currency.

The weights applied are the shares of each euro area country in the total manufacturing trade of the euro area and are obtained as follows. Let t_k^a denote the total gross trade flow of euro area country k, where the total gross trade flow is defined as total euro area exports to the H foreign markets plus total euro area imports from the N partner countries. These data are consistent with the data on exports and imports used for deriving the overall trade weights for the euro EER in the sense that $\sum_{k=1}^{n} t_k^a = \sum_{j=1}^{H} x_j^a + \sum_{i=1}^{N} m_i^a$. The weights for the calculation of the "theoretical" euro exchange rate are then given by:

$$w_k^e = t_k^a / \sum_{k=1}^{n} t_k^a, \; k=1,2,\ldots,n \qquad \text{(II.9)}$$

The resulting "theoretical" euro composite indicator summarises the exchange rate developments of the countries which formed the euro area in January 1999, thereby providing a synthesis of the external value of euro area currencies in the 1990s.[18]

As regards aggregation prior to 1999 of the euro area deflators used to compute the euro REERs, no composite euro area deflator involving the trade weights derived in

17 *The use of two sets of weights for the "theoretical" euro is a consequence of the weighting method employed in computing the double-export weights for the EER indices. According to this procedure, the exports of manufactured goods, as well as the domestic output of the manufacturing sector of the countries not included in the narrow (broad) group, i.e. the ROW countries, are assumed not to compete with goods produced by the competitor countries (see the discussion in Section II.3). Thus the definition of total euro area trade underlying the computation of the weights for the "theoretical" euro does not include imports from the ROW countries.*

18 *It should be noted that only one weight is given to each participating currency, assuming implicitly that the importance of a given participating country's trade in euro area trade is the same with respect to all individual competitor countries (i.e. the German share in euro area trade with the United States is the same as in the trade with the United Kingdom, Japan and the other partner countries). As the trade importance of each participating country may vary across the competitor countries, a case to assign a different set of weights to each competitor country currency could be made. However, such an approach would have been complicated and possibly opaque (given that the transitivity property of exchange rates would not hold; see Annex I on this point). Against this background and considering that there are no quantitative differences in the results obtained for the euro NEER index by applying the two competing approaches, the single euro area currency weights approach was eventually adopted (see Annex I for a demonstration of this point).*

Table II.4

Weights for constructing the "theoretical" euro 11

(percentages)

EMU legacy currencies	Theoretical euro weights in the narrow index	Theoretical euro weights in the broad index
Deutsche mark	34.66	35.52
French franc	17.83	17.38
Italian lira	14.34	14.20
Dutch guilder	9.19	9.32
Belgian and Luxembourg franc	8.01	8.04
Spanish peseta	4.95	4.94
Irish pound	3.75	3.47
Finnish markka	3.27	3.07
Austrian schilling	2.91	3.02
Portuguese escudo	1.08	1.05

Sources: Eurostat – Comext; and ECB calculations.

equation (II.9) and national data on participating countries' deflators have been constructed. As mentioned in Section II.4, the approach adopted involved utilisation of the euro area HICP and PPI indices compiled by Eurostat and the ULCM index compiled by the ECB. These euro area deflators cover the period from 1990 to date and their aggregation involves different weighting schemes. The HICP and PPI use *consumption spending* and *domestic turnover of the manufacturing sector* weights respectively, while the ULCM index employs *value added in industry* weights. Although at first glance this differing aggregation treatment between the "theoretical" euro and euro area deflators could appear inconsistent, it is aimed at avoiding confusion generated by the construction of a new set of aggregated euro area deflators. At the same time, this approach ensures that the most appropriate and already established aggregation methodology for computing each of these deflators for the euro area is followed.

II.7 Adjustment of the euro EER indices as a result of euro area enlargement

The trade weights underlying the euro EER indices as reported in Table II.1 as well as all the intermediate computational steps described in Tables II.2 and II.3 take into account the recent enlargement of the euro area. Following the adoption of the euro by Greece on 1 January 2001, the composition of the euro area changed and, in effect, the euro EER indices had to be adjusted to reflect this.

Specifically, before 1 January 2001, the reference groups of trading partners were composed of 13 and 39 countries respectively, including Greece. Following the euro area's enlargement, Greece was excluded from both the narrow and the broad group of euro area trading partners. This called for a recalculation of the overall trade weights of the euro EER indices following the same methodological procedure described earlier. Following this weight adjustment, the coverage by the reference groups of total euro area manufacturing trade remained effectively unchanged, amounting to 61.2% after (61.6% before) for the narrow group and 88.8% after (88.9% before) for the broad group. The changes made to the overall trade weights underpinning the computation of the EER indices as a result of the inclusion of Greece in the euro area were also very small, as can be easily inferred from Table II.5. As a final step, the nominal and real EER indicators based on the new overall weights, which reflect the enlarged composition of the euro area, were re-scaled in order to link them to the old EER series. The latter operation, which neutralised the effects of the weight changes on the evolution of the indices, was performed choosing as a starting point for the new EER indices the last value of the EER series prior to enlargement (i.e. the last value in 2000).

For analytical purposes, "historical" nominal and real EER series – treating Greece as a euro area country prior to January 2001 – have also been constructed. In this case, rather than chain-linking, the new overall trade weights are applied for the whole of

Table II.5

Weights in the ECB's narrow and broad EER indices

(percentages)

Partner countries	Overall weights in the narrow EER index		Overall weights in the broad EER index	
	up to 2000	as from 2001	up to 2000	as from 2001
Broad group			**100**	**100**
Narrow group	**100**	**100**	**69.69**	**69.31**
Australia	1.12	1.13	0.79	0.80
Canada	1.93	1.96	1.45	1.46
Denmark	3.45	3.50	2.55	2.58
Greece	1.47	-	1.10	-
Hong Kong SAR [1]	3.83	3.90	2.03	2.06
Japan	14.78	15.01	9.98	10.10
Norway	1.68	1.70	1.32	1.33
Singapore	3.44	3.50	2.04	2.06
South Korea	4.80	4.91	2.76	2.82
Sweden	6.14	6.23	4.31	4.35
Switzerland	8.71	8.84	6.44	6.51
United Kingdom	23.92	24.26	17.85	18.03
United States	24.72	25.05	17.07	17.21
Additional countries in the broad group			**30.31**	**30.69**
Algeria			0.32	0.32
Argentina			0.53	0.53
Brazil			1.43	1.44
China			3.99	4.05
Croatia			0.49	0.50
Cyprus			0.10	0.12
Czech Republic			1.83	1.85
Estonia			0.15	0.16
Hungary			1.52	1.54
India			1.46	1.47
Indonesia			0.91	0.92
Israel			1.08	1.10
Malaysia			1.30	1.31
Mexico			0.82	0.83
Morocco			0.63	0.63
New Zealand			0.20	0.20
Philippines			0.42	0.42
Poland			2.29	2.31
Romania			0.68	0.69
Russia			2.33	2.38
Slovakia			0.76	0.76
Slovenia			0.81	0.82
South Africa			0.89	0.90
Taiwan			2.13	2.15
Thailand			1.20	1.22
Turkey			2.04	2.07

Sources: Eurostat – Comext; and ECB calculations.

1) Special Administration Region.

Table II.6

Weights for constructing the "theoretical" euro 12

(percentages)

EMU legacy currencies	"Theoretical" euro weights in the narrow index	"Theoretical" euro weights in the broad index
Deutsche mark	34.49	35.31
French franc	17.75	17.27
Italian lira	13.99	13.87
Dutch guilder	9.16	9.28
Belgian and Luxembourg franc	7.98	8.00
Spanish peseta	4.90	4.88
Irish pound	3.76	3.47
Finnish markka	3.27	3.06
Austrian schilling	2.89	3.00
Portuguese escudo	1.07	1.04
Greek drachma	0.74	0.82

Sources: Eurostat – Comext; and ECB calculations.

the period over which the euro EER indices are calculated. Moreover, a "theoretical" euro exchange rate also had to be computed treating the Greek drachma as an EMU legacy currency, in order to track its actual evolution against the euro within ERM II in the two-year period preceding Greece's entry to the euro area. The relevant weights used for the construction of this "theoretical" euro series appear in Table II.6. Euro area-wide deflators used for this purpose include Greek cost or price developments, again prior to Greece's adoption of the single currency.

III Recent developments in euro area competitiveness

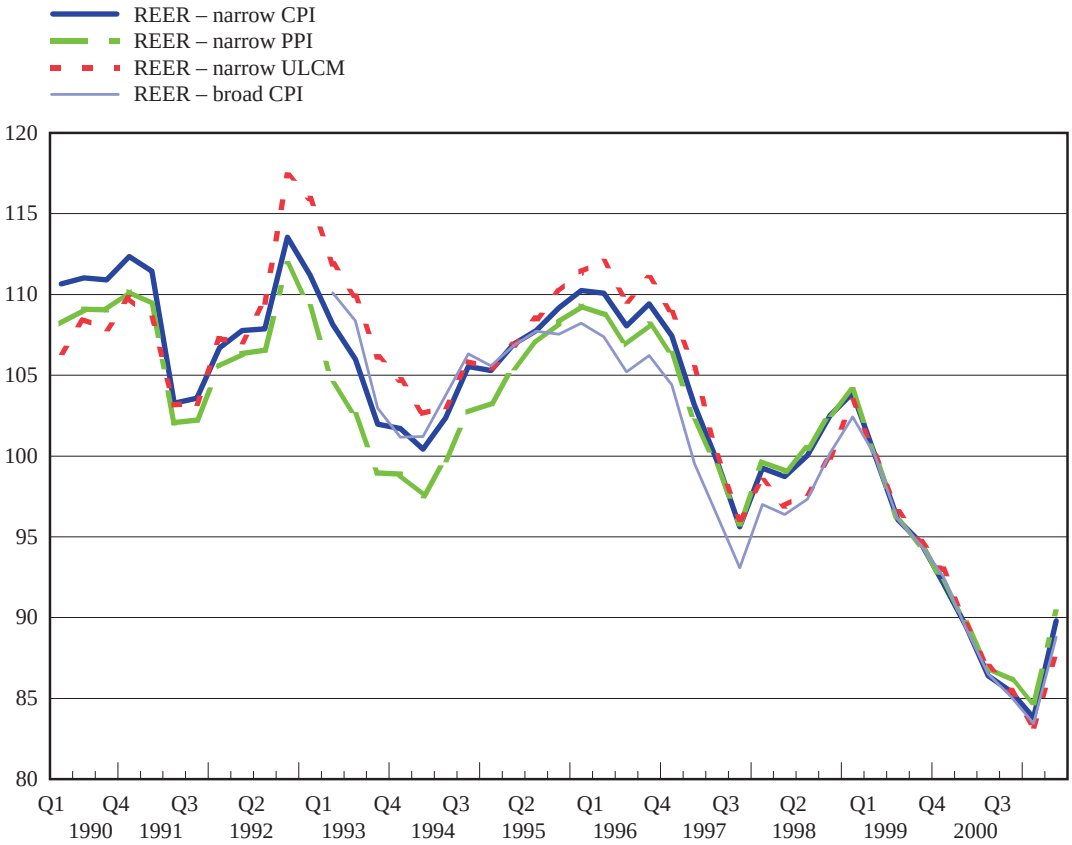
The international price and cost competitiveness of the euro area showed an overall increase in the period spanning from early 1990 to early 2001. This is reflected in a gradual depreciation of all the REER indicators developed in this paper. According to the CPI, PPI and ULCM-deflated EER indices vis-à-vis the narrow group of competitor countries, the overall increase in the euro area's competitiveness between the first quarter of 1990 (the start of the calculation period) and the first quarter of 2001 (the cut-off date), which is our reference period, amounted to roughly 17-19%. About half of this increase in competitiveness took place during the 1990s and the other half materialised after the launch of the euro (see Chart III.1). A broadly comparable picture emerges when looking at the CPI-based REER index against the broad group of partner countries. As Chart III.1 shows, this broader index tracks the other three REER indices rather closely – especially its CPI-deflated counterpart for the narrow group – from its start in the first quarter of 1993.

Looking at the evolution of the REER for the narrow group over time, the CPI, PPI and ULCM-based indices move very closely together throughout the reference period. This is in line with the fact that variations among price deflators as well as between price and unit labour cost indices tend, overall, to be relatively small for this group of countries and the euro area. Between the first quarter of 1990 and the fourth quarter of 1998, the change in euro area competitiveness as measured by the ULCM, the PPI and the CPI-based REER indicators against the narrow group of partner countries amounted to about 3%, 4% and 6% respectively.

Chart III.1

Narrow and broad REERs of the euro

(quarterly averages; 1999 Q1=100)



Source: ECB.

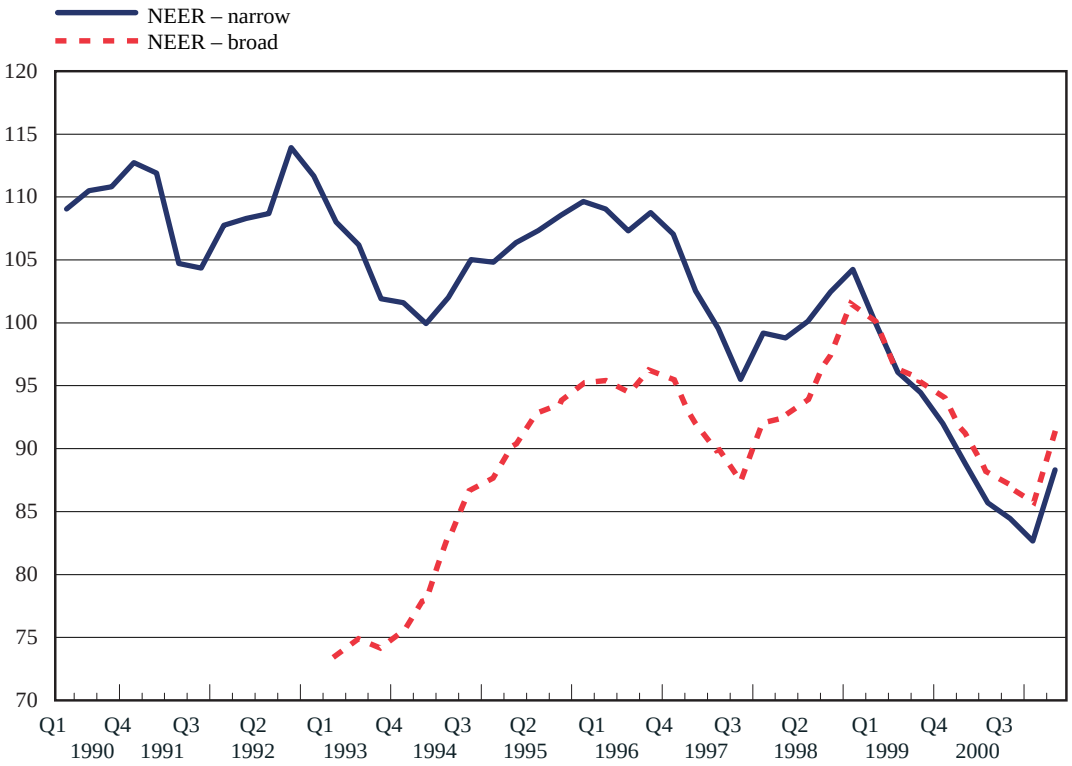
Since the launch of the single currency, the cumulative real effective depreciation of the euro in terms of the ULCM and PPI-deflated EER indices has been in the region of 10%, which is effectively equal to that shown by the corresponding CPI-deflated REER indicator over the same period. Especially in the first two years after the advent of EMU, movements in price and cost deflators hardly played a role. This resulted from the fact that this period was characterised by broadly stable and similar price and cost developments in the euro area and most of its trading partners, reflecting also that cyclical positions moved, by and large, in similar directions for many countries over this period.

As relative price and cost developments evolved in a broadly similar manner for the euro area and its competitors in the narrow group, it follows that the principal factor accounting for the observed increase in the euro area's international price and cost competitiveness, both before and after the launch of the euro, has been the change in the nominal external value of the euro or its predecessor currencies. Over the 12-year period considered here, the first significant movement in the NEER occurred in 1992-93, as a result of the crisis in the ERM. During this episode, the currencies of several countries that later formed the euro area depreciated against the currencies of major trading partners, causing the narrow NEER of the "theoretical" euro to depreciate by around 12% between the third quarter of 1992 and the first quarter of 1994 (see Chart III.2). This depreciation only began to be reversed when in 1994-95 euro area legacy currencies strengthened, while the external value of the US dollar fell significantly against major currencies in 1995. By 1997, and mainly driven by the strengthening of the US dollar and the British pound, the NEER and REER indices of the euro area declined again and

Chart III.2

Narrow and broad REERs of the euro

(quarterly averages; 1999 Q1=100)

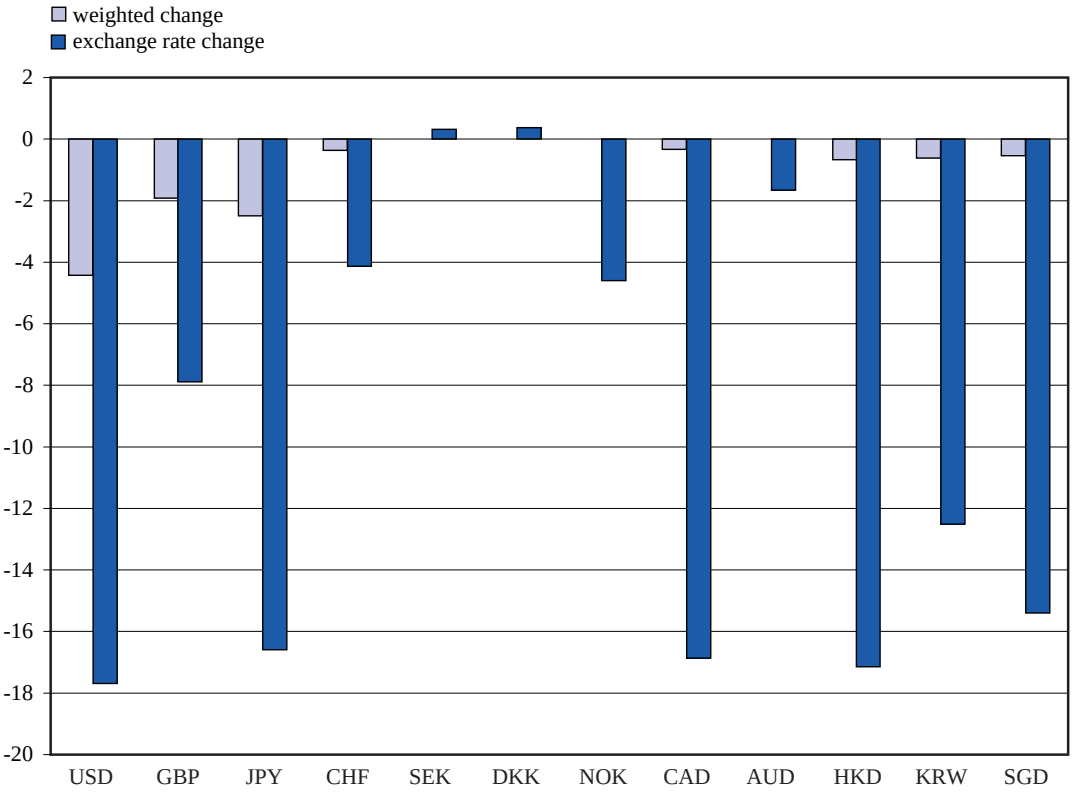


Source: ECB.

Chart III.3

Contributions to NEER changes between 1999 Q1-2001 Q1 (narrow group) [1) 2)]

(percentage changes)



Source: ECB.

1) Weighted changes are calculated using trade weights against the partner countries in the narrow group.

2) A negative (positive) number signifies a depreciation (appreciation) of the euro against a partner currency.

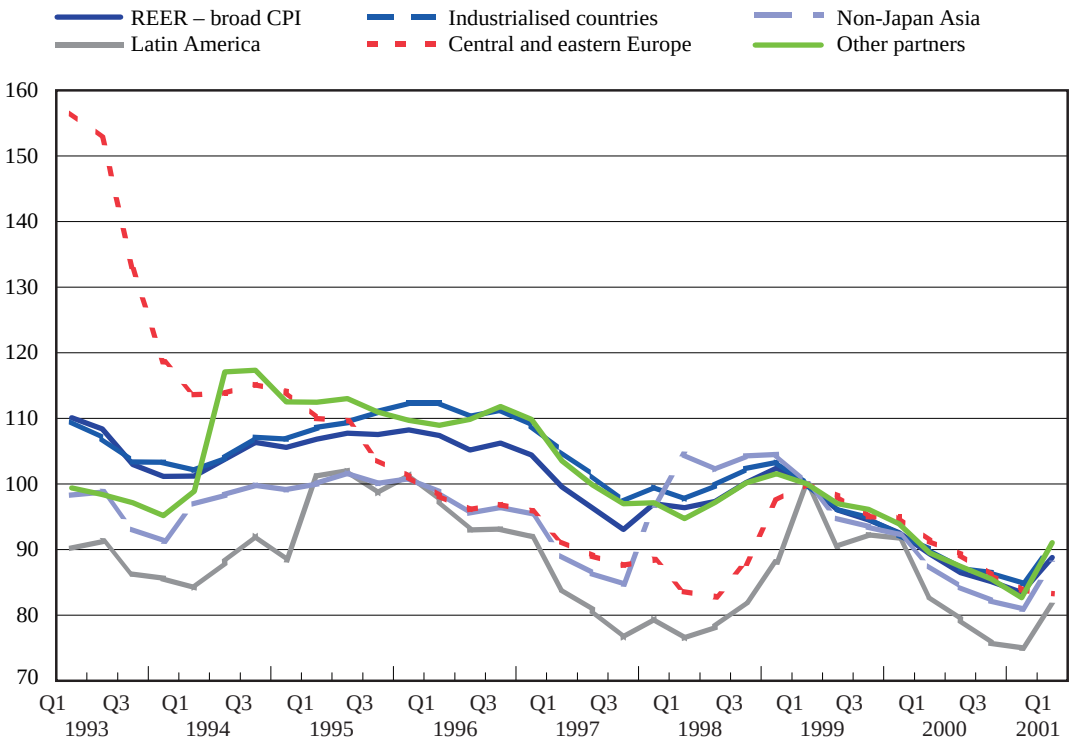
actually fell below the trough reached in the aftermath of the ERM crisis. The financial crisis in Asia, which started in the third quarter of 1997, reversed this trend as it implied an effective appreciation of the euro area currencies. Although the individual overall trade weights of the countries in Asia (included in the narrow index) that were affected by the crisis are not very large (the largest is that of South Korea with a weight of 4.9% in the narrow index), the fact that some of the Asian currencies temporarily depreciated by 30-40% had a significant upward impact on the NEER of the euro. After the launch of the single currency in 1999, the depreciation of the euro vis-à-vis major currencies triggered a renewed decline of the euro NEER causing the index to fall to its lowest level during the reference period. The trough of this development was reached in the last quarter of 2000, when the euro recorded a low against the US dollar and several other currencies. Between the first quarter of 1999 and the fourth quarter of 2000, the nominal effective depreciation of the euro amounted to slightly more than 17% against the currencies of the trading partners in the narrow group. As Chart III.3 shows, the bulk of this effective depreciation was caused by the euro's movements against the US dollar, the Japanese yen and the pound sterling. The recovery of the euro between the fourth quarter of 2000 and the first quarter of 2001 reduced the extent of the nominal effective depreciation of the single currency since its introduction to slightly above 11.5% vis-à-vis the narrow group of partner countries.

Turning to competitiveness developments against the broad group of competitor countries, the associated CPI-based REER

Chart III.4

Regional REERs of the euro

(quarterly averages; 1999 Q1=100)



Source: ECB.

euro area indicator depreciated by just over 19% between early 1993 (the starting point for the broad index) and early 2001. This increase in euro area competitiveness is broadly comparable with the development observed for the corresponding narrow CPI-based REER index since early 1990. An analysis of the developments in the euro area's competitiveness vis-à-vis country groups or regions could facilitate a better understanding of the observed co-movement of the broad and narrow REERs. To this end, the broad REER index was broken down into five sub-indices covering: industrialised countries, Asia excluding Japan, Latin America, central and eastern Europe, and a residual group of other trading partners (see Box on next page). This breakdown of the broad CPI-based REER shows that the regional dispersion of competitiveness developments is significant (see Chart III.4). First, it can be gauged that an important factor behind the similar development of the broad and narrow CPI-based indices is the fact that the bulk of the euro area's external trade takes place with industrialised economies. In fact, industrialised countries – defined as the G7 countries outside the euro area (i.e. the United States, the United Kingdom, Japan and Canada), other western European countries, and Australia and New Zealand – tend to dominate the broad index where they account for nearly 63% of the total. As the same countries also dominate the narrow group (with the exception of New Zealand which is not included in this group), it is not surprising that the overall change in the euro area's competitiveness over the last 12 years has been mainly determined by the changes in competitiveness vis-à-vis industrialised countries. As CPI inflation differentials between the euro area and these trading partners are, on average, rather narrow, nominal exchange rate movements tend to drive REER developments in that sub-group. Overall, the euro REER index against the

Box

The decomposition of the effective exchange rate of the euro into regional sub-indices

To analyse further exchange rate movements and euro area competitiveness against groups of trading partners, the broad REER index is decomposed into sub-indices relating to industrialised countries, Asia excluding Japan, Latin American countries, central and eastern European countries (CEECs), and a residual group of other trading partners.

In methodological terms, the decomposition of the broad index into the above-mentioned sub-indices has been performed through a simple renormalisation of the weights of the partner countries in the broad group. Specifically, the weights of the trading partners selected to be clustered together into a sub-group are obtained by dividing the weight of each of these countries in the broad index by the weight of the associated sub-group in the broad index. This approach ensures that the broad euro EER index can be obtained as a geometric weighted average of the EER sub-indices, where the weights reflect the share of each sub-index in the broad index. The composition of each regional sub-group and the corresponsing weights appear in the table below.[1]

Geographical decomposition of the broad EER index of the euro

(percentages)

	Share in the broad index	*Share in the sub-group*		*Share in the broad index*	*Share in the sub-group*
Industrialised countries	**62.6**		**Latin America**	**2.8**	
United Kingdom	18.0	28.8	*Brazil*	1.4	51.4
United States	17.2	27.5	*Mexico*	0.8	29.7
Japan	10.1	16.1	*Argentina*	0.5	18.9
Switzerland	6.5	10.4			
Sweden	4.4	7.0	**Central and eastern Europe**	**11.0**	
Denmark	2.6	4.1	*Russia*	2.4	21.7
Canada	1.5	2.3	*Poland*	2.3	21.0
Norway	1.3	2.1	*Czech Republic*	1.8	16.8
Australia	0.8	1.3	*Hungary*	1.5	14.0
New Zealand	0.2	0.3	*Slovenia*	0.8	7.4
			Slovakia	0.8	6.9
Non-Japan Asia	**18.5**		*Romania*	0.7	6.3
China	4.0	21.9	*Croatia*	0.5	4.5
South Korea	2.8	15.2	*Estonia*	0.2	1.4
Taiwan	2.2	11.6			
Singapore	2.1	11.1	**Other trading partners**	**5.1**	
Hong Kong SAR	2.1	11.1	*Turkey*	2.1	40.3
India	1.5	8.0	*Israel*	1.1	21.4
Malaysia	1.3	7.1	*South Africa*	0.9	17.4
Thailand	1.2	6.6	*Morocco*	0.6	12.3
Indonesia	0.9	5.0	*Algeria*	0.3	6.2
Philippines	0.4	2.3	*Cyprus*	0.1	2.3

Sources: Eurostat – Comext; and ECB calculations.

1 *As explained in Section II.7, the overall trade weights have been revised to reflect Greece's entry to the euro area. Therefore, Greece is considered as a trading partner of the euro area for the period up to December 2000 and as a member of the euro area thereafter. The table presents the weights of the regional sub-groups within the broad group of partner countries following euro area enlargement. All regional EER indices are chain-linked.*

currencies of the industrialised countries' group has declined by almost 5% between 1993 and 1998 and by 9.5% since the introduction of the single currency. In both periods, this is less than the overall decrease in the broad index, implying a greater drop in the REER indices against the four smaller regional sub-groups taken together.

Competitiveness changes vis-à-vis central and eastern Europe, which carries a weight of 11% in the index, are the most striking in the regional picture, especially the seemingly strong increase in the euro area's competitiveness in the mid-1990s. This movement is, however, almost entirely explained by developments in Russia, both as far as the nominal and the real indices are concerned. From early 1993 to early 1995, the rouble was devalued by about 85%, causing surges in inflation in Russia, which added to the inflationary impact of the liberalisation process after the collapse of the Soviet Union. This resulted in a rise in the price level over this period, which was four times larger than the exchange rate devaluation and, thereby, led to a significant loss in Russia's external competitiveness. Accordingly, as Russia carries the largest weight in the sub-index for central and eastern Europe, the euro area gained competitiveness against this group of countries by almost 50% within a period of one to two years. This movement of the index should, therefore, be seen in the special context of the regime shift in Russia and the adjustment of its price structure to that in market economies. Russia again affected regional competitiveness developments in 1998 significantly during the financial crisis in this country, when the external value of the rouble tumbled again. Developments in exchange rates and prices in other countries in central and eastern Europe were much more subdued relative to the wide swings experienced in Russia. However, on the whole, the relative competitiveness between the euro area and this region shifted somewhat in favour of the euro area, as depreciating nominal exchange rates in the region were offset by higher inflation rates. It cannot be ruled out that part of these higher inflation rates may, however, be due to a Balassa-Samuelson effect, according to which inflation is partially driven by higher productivity in the tradable sector and is thus not harmful to competitiveness. As the countries in this sub-group are engaged in a catching-up process, some real effective appreciation of their exchange rates would rather be an equilibrium phenomenon. By the same token, the euro area's regional indicator for central and eastern Europe may overstate an increase in the euro area's competitiveness. So far, however, Balassa-Samuelson effects have been found to be rather small for many of the countries in central and eastern Europe, indicating that this effect has played only a negligible role in real exchange rate movements in these countries.

Asia excluding Japan accounts for nearly 19% of the broad REER index and is, thereby, the most important trading region for the euro area within the emerging market sphere. Overall, the euro area's competitiveness vis-à-vis Asia in the period spanning from 1993 to 1998 was characterised by significant swings. In the first half of the 1990s, these swings were partially attributable to movements of the euro against the US dollar, to which most of Asia's emerging market currencies were pegged during this time. Relative price movements occurred mostly in favour of the euro area, although the differences were rather small, as inflation rates in some of the current euro area countries were not much lower than those in Asia at that time. In the second half of the 1990s, the most relevant change for external competitiveness was obviously the Asian financial crisis of 1997-98, which led to a significant nominal depreciation of many of the region's currencies. Given sluggishness in inflation changes, this implied a rapid and significant increase in the region's competitiveness vis-à-vis the euro area. Two to three quarters after the crisis had set in, the euro area's regional competitiveness index had declined by around 15%. However, this development began to evaporate only

one year after the crisis, with higher import prices in Asia being partially passed through to domestic prices. About two years after the peak of the crisis, Asia's gain in competitiveness measured by CPI-deflated exchange rate movements had practically vanished. This experience is broadly in line with that of other emerging market economies, such as Russia, which have undergone a financial crisis where competitiveness gains resulting from exchange rate depreciation lasted for about two years before being offset by higher inflation.

Compared with developments in central and eastern Europe, competitiveness changes vis-à-vis Latin America were much more subdued over the 1993-2001 period and also had a significantly smaller impact on the euro area, as the region – which, for our purposes, comprises Argentina, Brazil and Mexico – accounts for only 3% of the broad index. As in Asia and central and eastern Europe, however, the largest movements in the euro area's sub-index vis-à-vis Latin America were due to nominal exchange rate movements resulting from emerging market crises. In the case of Latin America, the main movements occurred in the context of the crisis in Mexico in late 1994, which led to a large depreciation of the peso, and that in Brazil in 1999, which resulted in the floating and subsequent strong depreciation of the real. However, owing to the rapid pass-through to domestic inflation, the competitiveness gains recorded by these countries were relatively short-lived.

Following the introduction of the euro, the regional REER sub-indices against Latin American and Asian countries excluding Japan show substantial declines (just over 18.5% and 12% respectively in the period between the first quarter of 1999 and the first quarter of 2001). This marked downward movement in these sub-indices seems to be related to the traditionally strong links of the currencies of major Latin American and Asian countries (excluding Japan) with the US dollar, together with the euro's significant overall depreciation vis-à-vis the US currency since the first quarter of 1999.

IV National competitiveness indicators for euro area countries

Although the introduction of the euro has created a single currency area, price competitiveness developments in individual euro area countries could differ from those for the euro area in its entirety, owing to a number of factors:

(a) different trade flow patterns of individual euro area countries vis-à-vis the rest of the world;

(b) different degrees of openness to extra-euro area trade; and

(c) different developments in production cost and price developments across euro area countries.

In the light of the points raised above, it is interesting to examine the extent to which the international price competitiveness of each euro area national economy may have, indeed, evolved differently from that of the euro area (taken as a whole) since the advent of the euro. To this end, a set of REERs for the individual countries participating in Stage Three of EMU has been constructed. These indices are called *national competitiveness indicators* (NCIs) in order to differentiate them from the set of euro EERs. The NCIs have been designed to measure each euro area country's international competitiveness against not only the main trading partners outside the euro area, but also the other euro area countries. In this context, the group of competitor countries against which the NCIs are computed differs from that underlying the computation of the euro REER indices and includes, as of 1999, the countries with exchange rates fixed irrevocably within the framework of EMU.

The set of NCIs constructed for the euro area countries using CPI indices as deflators is presented below. Each of these indicators is also decomposed into an intra and an extra-euro area trade component. Developments since the launch of the euro are then analysed and compared with those in the euro area-wide CPI-deflated EER indicator.

IV.1 Methodological features

The construction of NCIs for the individual euro area countries precisely follows the methodology which underlies the setting-up of the euro REER indices described in detail in Section II. Specifically, the same trade basis (manufacturing trade, SITC Sections 5-8, average for 1995-97) and the same procedure to account for third-market effects on the export side are employed in deriving the overall trade weights needed for the compilation of the NCIs.

In terms of notation, the NCI for the euro area country *c* is defined as:

$$NCI_c = \prod_{i=1}^{k} \left(\frac{d_c e_{i,c}}{d_i} \right)^{v_i} \quad , c=1,2,\ldots n \qquad \text{(IV.1)}$$

where d_c is the price deflator for euro area country c, d_i is the price deflator of partner country i, $e_{i,c}$ stands for the exchange rate of the currency of partner country *i* against the legacy currency of euro area country *c*, $k=N+(n-1)$ is the number of partner countries, n represents the number of euro area countries, *N* is the number of euro area trading partners against which the narrow euro EER indices are computed and, finally, v_i stands for the overall trade weights. Starting in January 1999, i.e. following the introduction of the single currency, the irrevocably fixed exchange rates between the euro area legacy currencies and the euro are employed in order to calculate $e_{i,c}$ making use of the transitivity property of bilateral exchange rates.

Equation (IV.1) implies that the fundamental difference between the NCIs and the euro REER indices lies in the composition of the group of partner countries against which price competitiveness is assessed, while another important difference, after January 1999, is the irrevocable fixing of exchange rates

among the legacy currencies (as reflected in $e_{i,c}$). Each NCI is computed against a group of 23 partner countries, i.e. the 12 main euro area trading partners comprising the narrow group and the euro area countries excluding the one for which the indicator is computed. Consequently, the calculation of the overall trade weights v_i is based on both intra and extra-euro area manufacturing trade. The computed overall trade weights for the NCIs of the 12 euro area countries appear in Table IV.1. The base for all NCIs is the first quarter of 1999 (1999 Q1 = 100), as for the set of euro EER indices. The NCIs have been based on the HICP indices in the case of the euro area countries, Denmark, Sweden, Norway and the United Kingdom, and on CPIs in the case of the other trading partners of the euro area.

Each set of weights, i.e. each column of Table IV.1, reflects the particular trade structure of each euro area country. It becomes apparent that the overall trade weights for the NCIs are significantly different from those underlying the euro area REER indices. This is mainly because other euro area countries are among the group of competitors, while the fact that the geographical distribution of trade is not identical for all euro area countries is an additional explanatory factor. The importance of the former factor is reflected in the significance of intra-euro area trade. Indeed, the share of intra-euro area trade in total manufacturing trade (after accounting for third-market effects) is sizeable. It ranges from a minimum of 38.8% in the case of Ireland to a maximum of nearly 78% in the case of Luxembourg, while it exceeds 50% for the vast majority of euro area countries. As to the differences in the geographical dispersion of trade, their importance is most clearly underscored by the existence of high trade weights between countries with strong traditional trade links. For instance, the United Kingdom carries a

Table IV.1

NCI overall trade weights[1)]

(percentages)

	Germany	*France*	*Italy*	*Netherlands*	*Belgium*	*Spain*	*Ireland*	*Finland*	*Austria*	*Portugal*	*Greece*	*Luxembourg*
Germany		23.00	23.72	25.60	22.20	19.94	13.50	19.14	44.24	20.76	21.44	26.35
France	13.76		14.78	10.53	15.15	19.60	7.97	6.76	7.26	13.35	9.55	15.47
Italy	10.86	11.50		6.68	7.12	11.65	4.58	5.90	9.94	9.30	21.10	5.31
Netherlands	7.73	5.91	5.17		11.19	4.96	4.88	5.33	4.84	5.28	4.84	5.92
Belgium	6.32	7.21	4.81	8.40		4.48	3.01	3.38	3.32	4.07	3.96	19.68
Spain	4.20	7.26	5.32	3.10	3.08		2.26	2.24	2.17	17.60	4.23	1.93
Ireland	1.19	1.25	1.06	1.29	1.42	0.98		0.95	0.61	0.84	0.84	0.65
Finland	1.41	0.91	0.96	1.22	0.97	0.94	0.87		0.93	0.84	1.04	0.52
Austria	5.48	1.60	2.84	1.74	1.43	1.52	0.91	1.65		1.31	1.75	1.53
Portugal	1.21	1.31	1.02	0.90	0.80	4.15	0.53	0.70	0.56		0.56	0.43
Greece	0.55	0.43	1.10	0.34	0.33	0.49	0.20	0.41	0.35	0.24		0.17
Luxembourg	0.47	0.49	0.26	0.31	0.72	0.19	0.13	0.16	0.22	0.16	0.32	
Euro area	**53.16**	**60.86**	**61.04**	**60.09**	**64.41**	**68.89**	**38.83**	**46.62**	**74.44**	**73.76**	**69.63**	**77.96**
United States	12.11	10.98	10.70	10.03	9.63	7.93	16.22	10.82	6.07	5.23	5.56	7.22
United Kingdom	9.73	9.96	8.67	11.18	10.67	9.13	25.60	9.55	4.97	8.81	8.27	5.49
Japan	7.98	5.67	6.27	6.05	5.06	4.70	7.46	7.44	3.70	3.57	5.21	3.34
Switzerland	4.83	3.31	3.56	2.08	2.13	2.00	1.68	2.16	4.16	2.08	2.70	1.96
Sweden	2.61	1.86	1.88	2.90	2.67	1.70	1.76	10.38	1.77	1.85	2.01	1.06
South Korea	2.25	1.68	2.04	1.30	1.10	1.59	1.52	2.03	1.02	1.27	2.91	0.58
Hong Kong SAR	1.64	1.34	1.50	1.62	0.95	1.03	0.82	1.60	0.84	0.46	0.83	0.71
Denmark	1.83	1.03	0.94	1.52	0.99	0.80	1.11	3.75	1.04	1.13	1.04	0.63
Singapore	1.43	1.54	1.33	1.26	0.91	0.96	2.65	1.32	0.59	0.51	0.72	0.42
Canada	1.00	0.88	0.98	0.64	0.64	0.54	1.09	0.93	0.71	0.46	0.51	0.27
Norway	0.84	0.47	0.51	1.05	0.46	0.45	0.83	2.54	0.40	0.67	0.41	0.23
Australia	0.57	0.41	0.57	0.29	0.38	0.29	0.42	0.85	0.28	0.20	0.20	0.14
	100	100	100	100	100	100	100	100	100	100	100	100

Sources: Eurostat – Comext; and ECB calculations.

1) The table should be read in columns, e.g. in Germany's NCI, France carries a weight of 13.76%, Italy 10.86% and so on.

weight of 25.6% in the NCI of Ireland, while Germany has a 44.3% weight in the NCI of Austria.

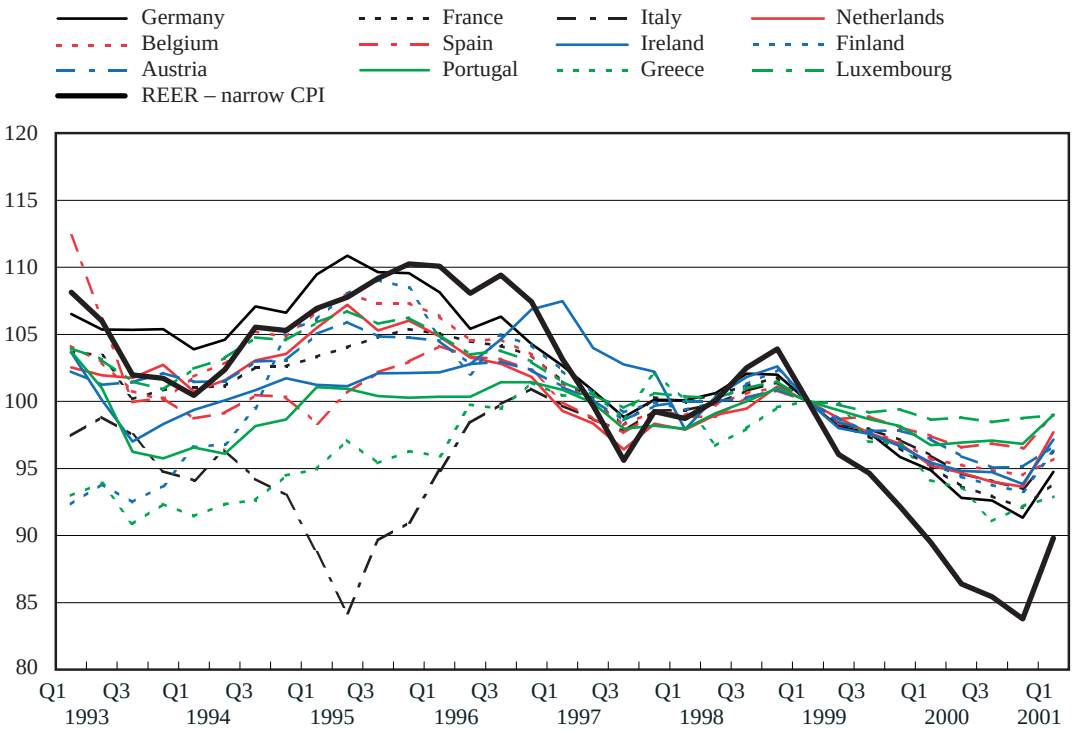
Charts IV.1 and IV.2 show that the NCIs exhibit both a closer co-movement and decreasing volatility in the two-year period leading up to the start of Stage Three of EMU.[20] Evidently, this is a consequence of the process of nominal convergence as euro area countries had over this period geared their macroeconomic policies towards fulfilling the Maastricht Treaty criteria for EMU entry. This led to the stabilisation of intra-euro area price relations as well as to gradually diminishing exchange rate fluctuations of the legacy currencies until these exchange rates were irrevocably fixed on 31 December 1998. Following the introduction of the euro, the NCIs have evolved, as one would have expected, in line with the euro REER index. The same holds true for the case of the Greek drachma prior to the adoption of the euro by Greece in January 2001, as the drachma was tied to the euro in the context of its ERM and ERM II participation in the almost two and a half years preceding Greece's accession to the euro area. However, price competitiveness of individual euro area countries in the period since January 1999 increased less than the rise registered for the euro area as a whole (see Chart IV.1). This result is directly linked to the way the NCIs are defined. Unlike the CPI-based REER index vis-à-vis the narrow group of euro area trading partners, which measures solely extra-euro area price and cost competitiveness, NCIs also take into consideration intra-euro area developments which, since the launch of the single currency, have no longer been subject to exchange rate volatility. As, by definition, extra-euro area trade carries a smaller weight in the NCIs, it is not surprising that these indicators point

20 *The historical volatility of the NCIs has been computed as the annualised standard deviation of month-on-month changes in the underlying NCI within a 12-month moving window over the period for which the NCIs are calculated.*

Chart IV.1

NCIs

(quarterly averages; 1999 Q1=100)

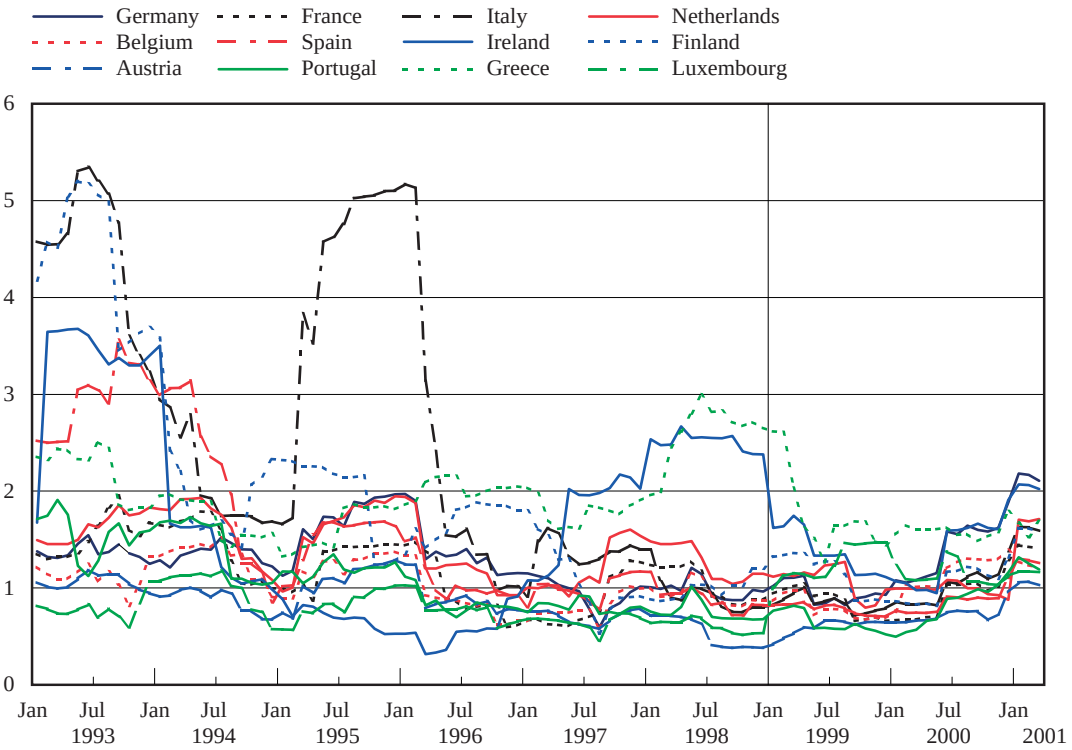


Source: ECB.

Chart IV.2

Historical volatility of NCIs[1)]

(percentages)



Source: ECB.

1) Historical volatility is computed as the annualised standard deviation of month-on-month changes in the underlying index within a 12-month rolling window over the period for which the index is available.

to a lower increase in price competitiveness. It should be pointed out, however, that the magnitude of any increase in competitiveness recorded by the NCI of a euro area country relative to that recorded by the NCIs of the other euro area countries is very much dependent on the combination of factors mentioned at the beginning of this section; namely, the differing trade patterns of individual euro area countries vis-à-vis the rest of the world, the varying exposure of each euro area country to fluctuations in the euro as measured by the country's degree of openness to extra-euro area trade and, lastly, the impact of relative inflation developments among euro area countries.

IV.2 Decomposition of NCIs into intra and extra-euro area components

A better understanding of the arguments presented above and, thereby, of competitiveness developments in individual euro area countries can be achieved through the decomposition of each NCI into an extra and an intra-euro area trade sub-index. The decomposition simply entails the computation of two sub-NCIs for each euro area country, one involving solely euro area countries as competitors (the so-called intra-euro area trade NCI) and one involving as competitors the 12 major trading partners of the euro area in the narrow group (the so-called extra-euro area trade NCI).

The overall trade weights required for decomposing the NCIs into an intra and an extra-euro area trade component have

been computed according to the same methodology described earlier and they appear in Tables IV.2 and IV.3 respectively. The sub-NCIs are then calculated as follows:

The intra-euro area trade NCI for euro area country c is given by:

$$NCI_{c,\,intra} = \prod_{i=1}^{n-1}\left(\frac{d_c e_{i,c}}{d_i}\right)^{v_{i,\,intra}}, \quad c = 1,2,\ldots n \quad \text{(IV.2)}$$

while the extra-euro area trade NCI for euro area country c is given by:

$$NCI_{c,\,extra} = \prod_{i=1}^{N}\left(\frac{d_c e_{i,c}}{d_i}\right)^{v_{i,\,extra}}, \quad c = 1,2,\ldots n \quad \text{(IV.3)}$$

where $v_{i,\,intra}$ and $v_{i,\,extra}$ are the overall trade weights derived using intra and extra-euro area trade respectively. The set of intra-euro area trade NCIs is depicted in Chart IV.3 and the set of extra-euro area NCIs is plotted against the narrow CPI-based REER in Chart IV.5. The historical volatility of the intra and extra-euro area trade NCIs is shown in Charts IV.4 and IV.6 respectively.

Table IV.2

NCI intra-euro area component trade weights[1)]

(percentages)

	Germany	*France*	*Italy*	*Netherlands*	*Belgium*	*Spain*	*Ireland*	*Finland*	*Austria*	*Portugal*	*Greece*	*Luxembourg*
Germany		37.37	37.60	42.83	34.05	28.48	34.34	40.58	60.52	28.20	30.99	33.82
France	25.98		24.78	17.67	23.73	28.83	20.61	14.17	9.31	18.17	13.15	20.19
Italy	18.52	18.32		10.56	10.33	16.60	11.01	11.35	12.50	12.27	30.83	6.62
Netherlands	16.17	10.29	8.88		18.57	7.32	14.09	12.86	6.84	7.32	7.07	7.96
Belgium	12.23	12.16	7.85	14.34		6.43	7.79	7.34	4.44	5.46	5.62	24.87
Spain	8.06	12.24	9.14	5.10	4.70		5.85	5.15	2.90	24.18	6.03	2.46
Ireland	2.23	2.08	1.77	2.19	2.17	1.42		2.13	0.81	1.07	1.20	0.79
Finland	2.24	1.28	1.27	1.86	1.33	1.21	1.91		1.09	1.03	1.36	0.60
Austria	10.11	2.44	4.34	2.81	2.10	2.09	2.22	3.42		1.75	2.47	1.91
Portugal	2.42	2.26	1.85	1.51	1.26	6.61	1.32	1.64	0.79		0.81	0.57
Greece	1.05	0.70	2.05	0.56	0.51	0.72	0.52	0.97	0.48	0.32		0.21
Luxembourg	1.00	0.88	0.46	0.56	1.26	0.28	0.34	0.38	0.32	0.23	0.48	
	100	100	100	100	100	100	100	100	100	100	100	100

Sources: Eurostat – Comext; and ECB calculations.

1) The table should be read in columns, e.g. in Germany's trade with the euro area, 25.98% is with France, 18.52% with Italy, etc.

Table IV.3

NCI extra-euro area component trade weights[1)]

(percentages)

	Germany	*France*	*Italy*	*Netherlands*	*Belgium*	*Spain*	*Ireland*	*Finland*	*Austria*	*Portugal*	*Greece*	*Luxembourg*
United States	24.43	27.19	26.40	23.94	26.32	25.33	25.29	19.43	21.76	18.58	18.35	32.17
United Kingdom	20.55	24.89	21.72	28.19	30.11	28.34	43.06	18.25	19.87	34.64	26.33	25.02
Japan	16.37	14.20	15.40	14.69	13.71	15.15	11.61	13.14	13.13	12.72	16.83	14.52
Switzerland	11.12	8.83	9.67	4.86	5.84	5.68	2.94	4.15	17.27	7.55	8.75	8.54
Sweden	5.92	4.71	5.11	7.43	7.54	5.35	2.97	19.50	7.87	7.31	6.50	4.67
South Korea	5.29	4.81	5.88	3.71	3.60	5.75	2.61	4.51	4.50	5.02	9.84	3.21
Hong Kong SAR	3.91	4.05	4.49	4.58	3.09	4.26	1.45	3.33	3.94	2.10	3.43	4.10
Denmark	4.22	2.65	2.54	4.10	2.83	2.50	1.94	7.16	4.07	4.78	3.32	2.92
Singapore	3.22	4.33	3.74	3.48	2.87	3.65	4.30	2.81	2.54	2.12	3.05	2.21
Canada	2.00	2.10	2.32	1.51	1.71	1.62	1.71	1.60	2.49	1.65	1.56	1.02
Norway	1.77	1.17	1.29	2.73	1.21	1.40	1.39	4.64	1.52	2.70	1.33	0.95
Australia	1.20	1.06	1.43	0.77	1.16	0.97	0.72	1.49	1.02	0.84	0.70	0.68
	100	100	100	100	100	100	100	100	100	100	100	100

Sources: Eurostat – Comext; and ECB calculations.

1) The table should be read in columns, e.g. of Germany's trade with non-euro area countries, 24.43% is with the United States, 20.55% with the United Kingdom, etc.

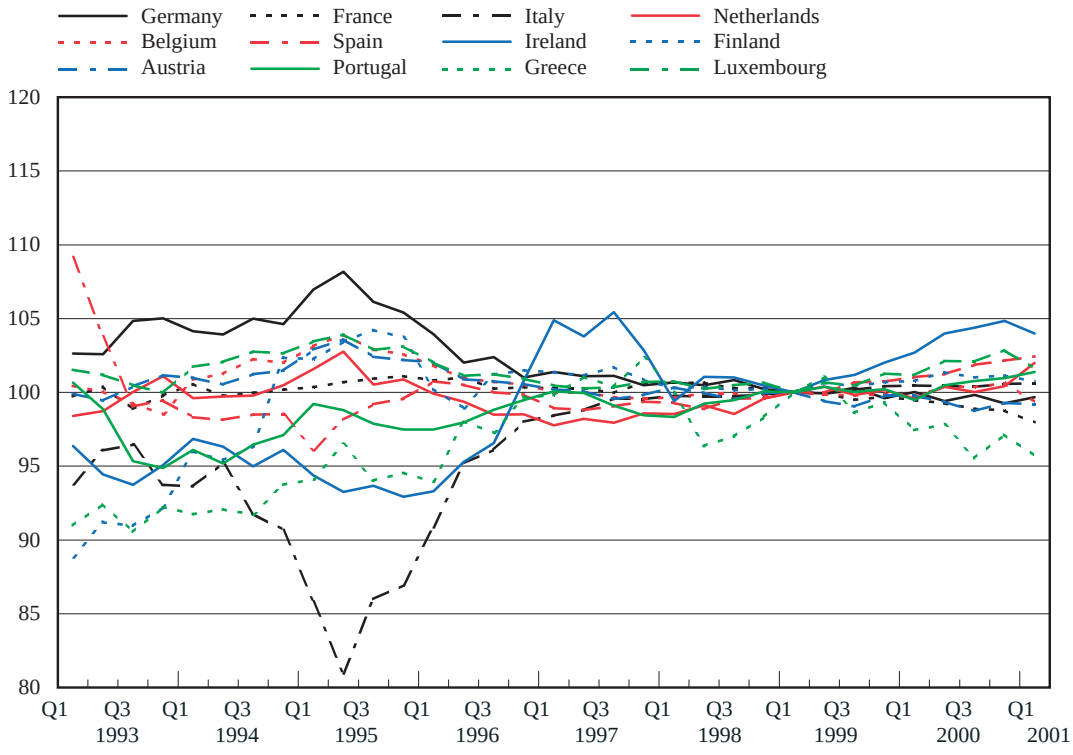
An examination of Charts IV.4 and IV.6 reveals that the decline in the variability of NCIs observed in the years leading up to EMU as well as in the subsequent period is mainly due to the intra-euro area NCI component, as the impact of exchange rate variation broadly diminished and was eventually eliminated with the introduction of the euro. Indeed, the historical volatility of almost all intra-euro area NCI sub-indices decreased significantly from 1997 onwards (Chart IV.4). On the other hand, the volatility of the extra-euro area trade NCI sub-indices remained high even after the start of EMU. Turning to competitiveness developments, overall, the majority of extra-euro area trade NCIs point to increases in competitiveness of a broadly similar magnitude to that indicated by the narrow euro REER index (see Chart IV.5), as the impact of exchange rate variation affects all euro area countries in a similar way.[21]

21 It is important to clarify that the euro area CPI-based REER index could also, at least in principle, be derived as the geometric trade-weighted average of the extra EMU component of NCIs, given the way the latter indicators are defined. As, however, the euro area-wide deflators are not aggregated using trade weights (see Section II.4), the trade-weighted average of the extra-euro area trade NCIs would be similar but not identical to the official CPI-based REER index for the euro.

Chart IV.3

Intra-euro area trade NCIs

(quarterly averages; 1999 Q1=100)

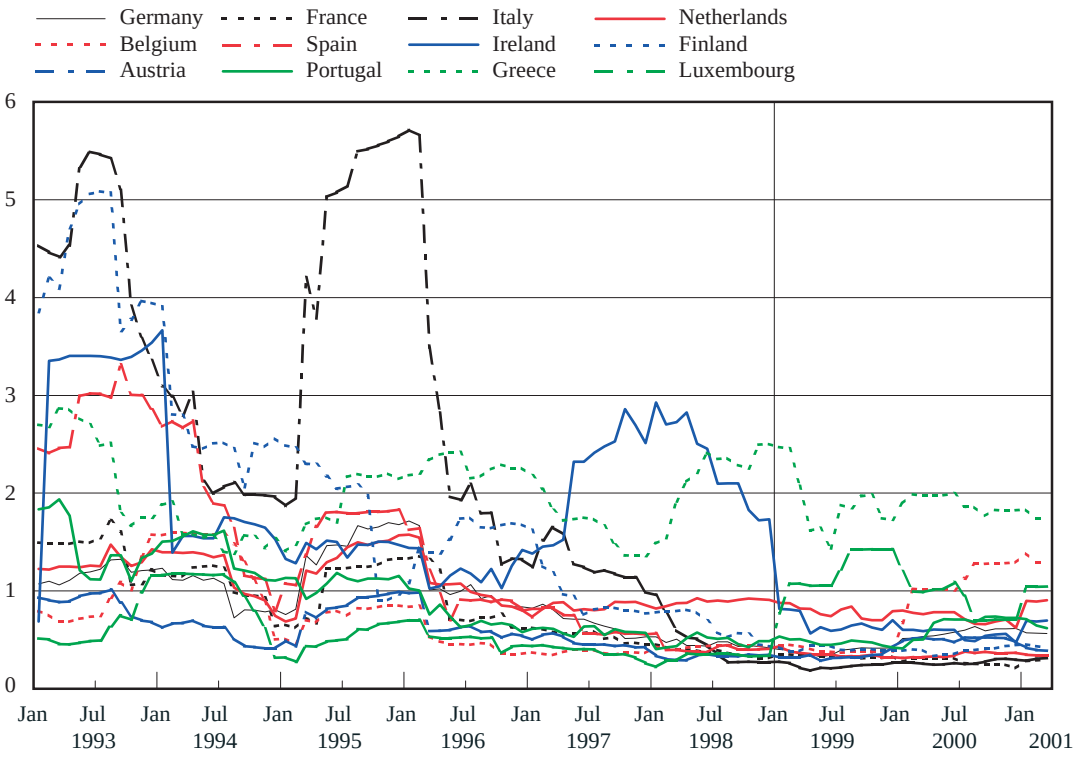


Source: ECB.

Chart IV.4

Historical volatility of intra-euro area trade NCIs[1)]

(percentages)



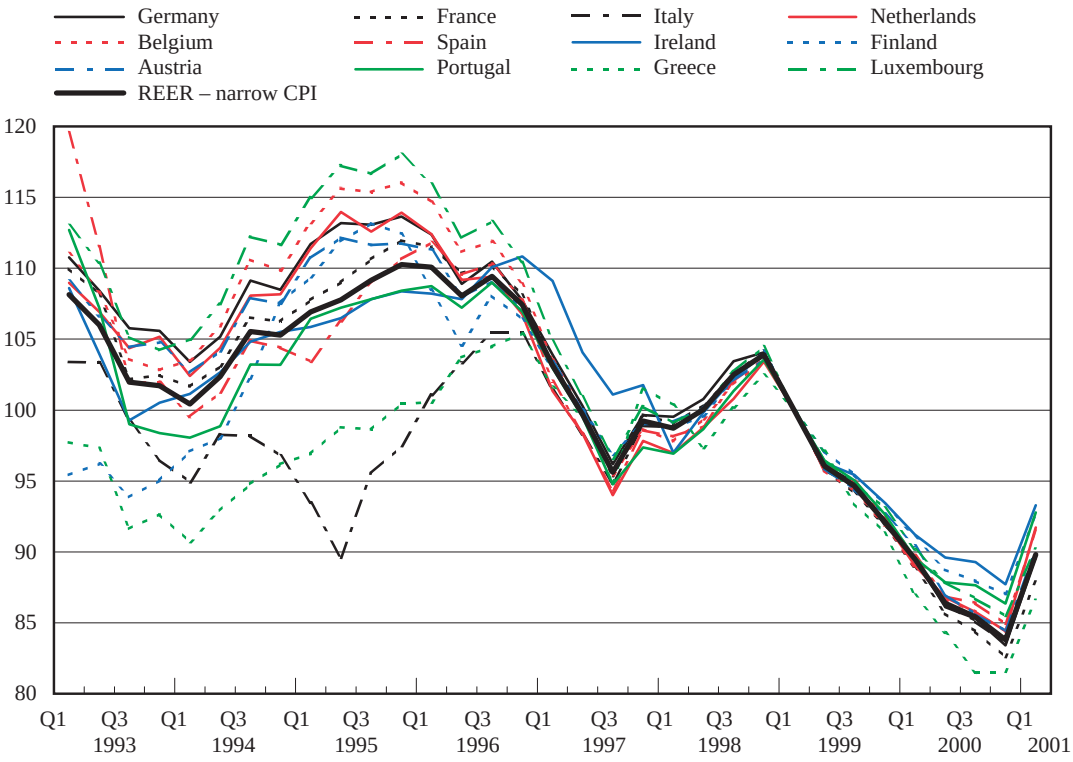
Source: ECB.

1) See note to Chart IV.2

Chart IV.5

Extra-euro area trade NCIs

(quarterly averages; 1999 Q1=100)

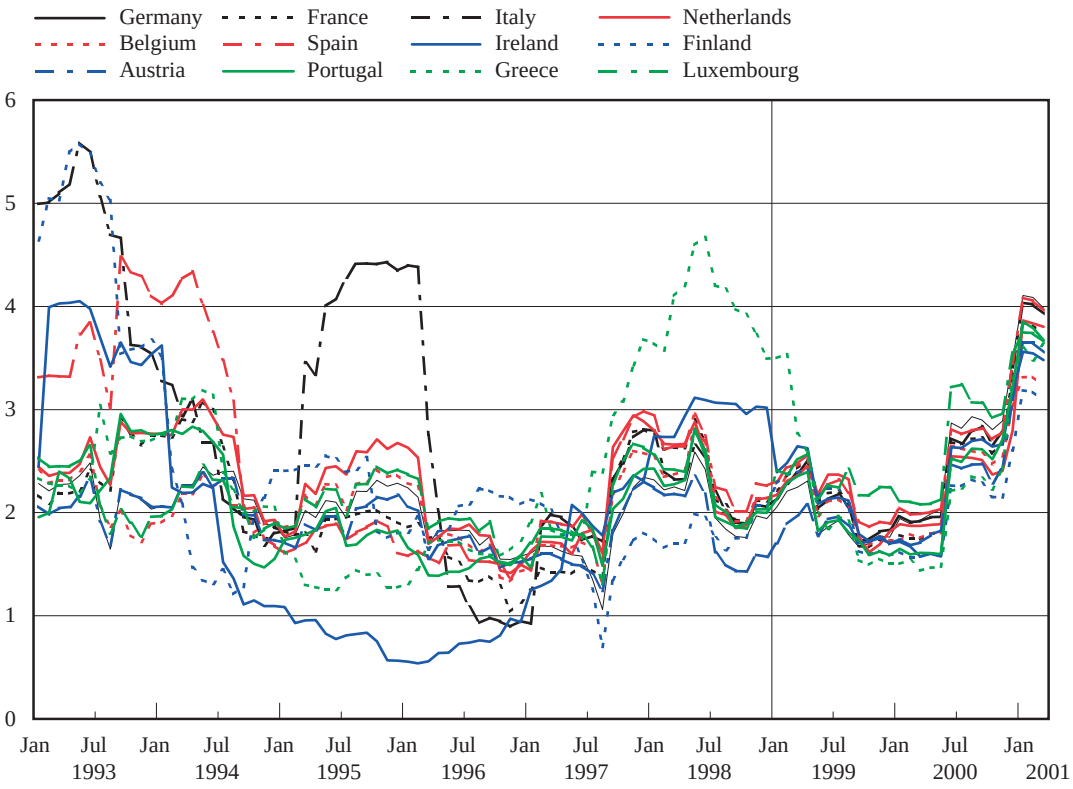


Source: ECB.

Chart IV.6

Historical volatility of extra-euro area trade NCIs[1)]

(percentages)



Source: ECB.

1) See note to Chart IV.2

IV.3 Developments in national competitiveness indicators

As discussed above, the depreciation of the euro vis-à-vis the currencies of many of the euro area's trading partners has, so far, increased the international price competitiveness of the euro area. On the basis of the CPI-deflated EER index, the euro area as a whole has registered an increase in price competitiveness of just over 10% during the 1999 Q1-2001 Q1 period, mainly owing to the nominal depreciation of the euro against all major currencies since its introduction (Table IV.4). The euro's depreciation has also increased the price competitiveness of the individual euro area countries as reflected in a depreciation of their NCIs. As pointed out earlier, however, the magnitude of the increase in competitiveness of individual euro area countries has been significantly smaller than for the euro area as a whole. This is due to the fact that the euro's depreciation plays a much smaller role in the NCIs, as the bulk of external trade of most individual euro area countries takes place with the other euro area countries and is therefore not influenced by exchange rate variations. The decomposition of the NCIs into extra and intra-euro area trade clearly illustrates this phenomenon.

Consequently, any comparison between the various NCIs has to take into consideration the different behaviour of the two constituent components of each NCI and the weights with which they are combined in the total NCI. *Ceteris paribus,* the more open a euro

Table IV.4

Changes in competitiveness as measured by NCIs and the narrow euro REER between 1999 Q1 and 2001 Q1[1) 2)]

(percentages)

		NCI for											
	Euro REER[3)]	*Germany*	*France*	*Italy*	*Netherlands*	*Belgium*	*Spain*	*Ireland*	*Finland*	*Austria*	*Portugal*	*Greece*	*Luxembourg*
Intra-euro area component	-	-0.32	-2.03	0.59	1.99	-0.63	2.43	3.99	0.75	-0.82	1.39	-4.29	1.62
Extra-euro area component	-10.2	-10.33	-12.07	-10.29	-8.27	-10.58	-8.51	-6.71	-7.42	-9.94	-7.23	-13.38	-9.77
Total	*-10.2*	*-5.26*	*-6.11*	*-3.86*	*-2.3*	*-4.31*	*-1.06*	*-2.84*	*-3.74*	*-3.35*	*-1.01*	*-7.11*	*-1.02*
Memo item													
Share of intra-euro area trade in the index[4)]		*53.16*	*60.86*	*61.04*	*60.09*	*64.41*	*68.89*	*38.83*	*46.62*	*74.44*	*73.76*	*69.63*	*77.96*

Source: ECB calculations.

1) *The table should be read in columns, e.g. German price competitiveness increased by 0.32% vis-à-vis the rest of the euro area and by 10.33% vis-à-vis the rest of the world. In terms of total external trade, Germany's price competitiveness increased by 5.26%.*
2) *A negative (positive) number signifies an increase (decrease) in price competitiveness.*
3) *The CPI deflated REER of the euro for the narrow group is used.*
4) *Shares are measured in overall trade terms, that is including third-market effects. See Table IV.1.*

area country is to extra-euro area trade, the more it is affected by variations in the euro exchange rate. In contrast, the higher the level of intra-euro area trade, the greater the impact of relative inflation developments in different euro area countries on their price competitiveness vis-à-vis other euro area countries (which could potentially offset the competitiveness changes arising from the variations in the euro's EER).

On the basis of the changes in overall price competitiveness as recorded by the NCIs between the advent of EMU and the first quarter of 2001, euro area countries can be divided into three groups. The first group comprises the countries experiencing a significant overall increase in price competitiveness, namely France (6.1%), Germany (5.3%) and Greece (7.1%). The second group includes countries that have registered about average competitiveness increases: Austria (3.4%), Belgium (4.3%), Finland (3.7%), Ireland (2.8%), Italy (3.9%) and the Netherlands (2.3%). Finally, there is a third group of countries whose competitiveness has increased only to a negligible extent: this group consists of Luxembourg (1.0%), Portugal (1.0%) and Spain (1.1%).

France and Germany recorded a significant increase in overall price competitiveness in the period from 1999 Q1 to 2001 Q1 because of their greater openness to extra-euro area trade, in particular with the United States and the United Kingdom. These two countries also benefited from their inflation rates being significantly below the euro area average over most of this period. Hence, their price competitiveness has increased both vis-à-vis the outside trading world as well as within Monetary Union. Greece is a special case in that it has benefited substantially from the convergence process in the run-up to EMU participation between the first quarter of 1999 and the fourth quarter of 2000. During this period, HICP inflation declined rapidly toward the euro area average, while the Greek drachma experienced only a small nominal depreciation toward its ERM II central parity and the conversion rate to the euro. Hence, Greece benefited from its improved inflation performance, which translated favourably into an increase in overall and extra-euro area competitiveness.

The fact that Luxembourg, Spain and Portugal hardly gained in competitiveness despite the significant depreciation of the euro is due to different factors. For Luxembourg, it is the result of the fact that trade is predominantly taking place with other countries in the euro area so that the euro's depreciation played only a negligible role. For Spain and Portugal, by contrast, the euro's depreciation had a noticeable effect on competitiveness, but this was offset by relatively higher inflation rates in these countries and, hence, competitiveness declines vis-à-vis other euro area countries.

Turning to the intra-euro area trade NCIs, the only EMU countries that have seen their price competitiveness improve since the introduction of the single currency are Austria, Belgium, France, Germany and Greece. By contrast, the two countries experiencing the highest inflation rates, i.e. Ireland and Spain, suffered the largest declines in competitiveness vis-à-vis other euro area countries (see Table IV.5). Luxembourg and Portugal, and more recently, the Netherlands also experienced sizeable losses in price competitiveness owing to relatively high inflation over the period under consideration. Finland and Italy witnessed slightly above average inflation rates and have seen their price competitiveness deteriorate only marginally. Caution should be exercised, however, when drawing inferences about competitiveness developments from NCIs for catching-up economies, such as Ireland, Portugal and Spain. Here, the positive inflation differential may be partially due to a Balassa-Samuelson effect in these countries. This argument, nonetheless, does not apply to the cases of Luxembourg or the Netherlands, where higher inflation rates in the reference period were partially attributable to taxation changes.

A consideration of the impact of external openness on price competitiveness reveals how the external gains in competitiveness resulting from the depreciation of the euro and the intra-euro area losses (gains) coming from above (below) average inflation combine to form the overall NCI. The extra-euro area NCI figures are dominated by the effect of the euro depreciation, and show significant improvements in price competitiveness for all countries in EMU. However, it is, in general, only for countries with a high degree of external openness (i.e. a large trade exposure to non-euro area countries) that these large gains translate into an increase in overall competitiveness.

This point is illustrated by the relative positions of Ireland and Luxembourg, which are the most externally open and the most externally closed of the euro area economies, with extra-euro area trade shares of around 60% and 20% respectively. In terms of the intra-euro area trade NCIs, Ireland recorded a larger deterioration in competitiveness with respect to its euro area partners than Luxembourg, in view of Ireland's higher HICP inflation during the period in question. In terms of the overall NCI, however, Luxembourg has seen its price competitiveness improve by only 1%, while Ireland gained nearly 3%. To put it differently, the higher Irish inflation rates – although reflected in the intra and extra-euro area trade components (i.e. a decrease in intra competitiveness of almost 4% and an increase in extra competitiveness of about 7%) – do not show up as strongly in the overall Irish NCI. The latter points to a gain in overall competitiveness of about 3%, which is comparable with that realised by other euro area countries that experienced significantly lower inflation rates (for instance Austria) and clearly exceeds the 1% overall competitiveness increase recorded by Luxembourg's NCI. The different degrees of openness of Ireland and Luxembourg to extra-euro area trade are thus the principal factor explaining the observed differences in overall competitiveness. The decline of the euro has overcompensated for the higher inflation in Ireland, while it merely offset the impact of rising prices in Luxembourg. The same conclusion can also be easily reached when comparing, for example, Ireland with Spain or Finland with Portugal.

To sum up, the NCIs may provide a useful tool to study changes in the competitiveness of individual member countries. Here, the geographical distribution of trade and, in particular, the relative weights of intra and extra-euro area trade are important, in addition to national inflation developments. For the latter, however, catching-up effects need to be considered, as part of inflation differentials may be productivity driven, thus not affecting national competitiveness. The reference period of only slightly more than two years is obviously too short to draw inferences about relevant competitiveness changes, but experience has already shown that movements may somewhat diverge between individual euro area countries, making such a comparative analysis particularly useful.

V Conclusions

This paper has focused on providing an in depth description of the methodological framework underlying the calculation of the effective exchange rate (EERs) indices for the euro. This framework delivers EER indices that summarise exchange rate movements and measure changes in the euro area's price and cost competitiveness vis-à-vis both a narrow and a broad group of trading partners. In line with the established practice, the euro real effective exchange rates (REERs) obtained through the implementation of this framework use a wide range of deflators in order to capture various facets of the euro area's price and cost competitiveness in a sufficiently comprehensive manner. Moreover, the paper has addressed a number of methodological issues specific to the case of the euro area, such as the aggregation of national exchange rates before the launch of the euro and adjustments resulting from euro area enlargement. Finally, the paper has introduced a set of national competitiveness indicators (NCIs) based on the same methodological principles as the euro EER indices. The NCIs permit international price competitiveness developments for individual euro area countries to be assessed in parallel with those for the euro area as a whole.

As far as the results are concerned, the computed indices show a marked increase in the price and cost competitiveness of the euro area between the first quarter of 1999 (the base period for the computed EER indices) and the first quarter of 2001 (the cut-off date for data underlying this paper). This development is found to be primarily attributable to the decline in the euro nominal exchange rate against the currencies of most of the euro area's trading partners. This picture holds true for most REERs, as differing movements in most price and cost deflators between the euro area and its main trading partners have been rather small compared with the nominal depreciation of the euro.

As for the NCIs, they show that euro area countries have not experienced, taken individually, as large an increase in international price competitiveness as that realised by the euro area in its entirety. This is due to the fact that most euro area countries conduct the bulk of their trade with other countries within the euro area where exchange rate movements no longer play a role. Competitiveness developments, nevertheless, vary somewhat among the different euro area countries. This results from the combination of varying national inflation and wage developments and differing degrees of trade openness to other euro area countries and the outside world.

Overall, this paper has provided important insights into the methodological details underlying the computation of the Eurosystem's set of nominal and real EER indices, which could prove helpful in enhancing the understanding about these indices both at the user as well as the researcher level. Furthermore, the movements in the computed euro EER indices provide useful information for the ECB's monetary policy under the second pillar of its monetary policy strategy, while the results for the NCIs are mainly relevant at the national level, especially for the euro area countries' fiscal and income policies.

Annex 1

Aggregating euro area country data to compute the euro EER

The calculation of the EER for the euro presents some difficulties compared with the traditional calculation of EER indices. In calculating an EER for a given country/currency, the necessary country data (exchange rates and deflators) are normally available and only weighting at the competitor country level is required. Hence, a traditional formula for the REER of a country *C* can be expressed as:

$$REER_C = \prod_{i=1}^{N} \left(\frac{d_C}{d_i} e_{i,C}\right)^{w_i} \qquad (1)$$

where d_C and d_i are the deflators of country *C* and competitor country *i* respectively, $e_{i,C}$ is the exchange rate against competitor country *i*, *N* gives the number of competitor countries, and w_i is the trade weight assigned to the competitor country *i* ($\sum_{i=1}^{N} w_i = 1$).

In the case of the euro area, equation (1) cannot always be applied directly. In fact, there are instances in which data on euro area aggregates do not exist and have to be constructed by aggregating the associated data on individual euro area countries. For example, before the introduction of the euro in January 1999, the exchange rate of the euro is not available and has to be synthesised using the exchange rates of the legacy currencies of the countries that participated initially in Stage Three of EMU. Therefore, in addition to aggregating information on the competitor countries, the calculation of the euro area EER indices involves the further complication of aggregating the data of euro area countries.

Taking the above-mentioned complications into consideration, the euro area EER index could be set up, in principle, as follows:

$$REER_{euro} = \prod_{i=1}^{N} \prod_{k=1}^{n} \left(\frac{d_k}{d_i} e_{i,k}\right)^{w_{i,k}} \qquad (2)$$

where *n* is the number of euro area countries, $w_{i,k}$ is the trade weight assigned to the relative prices of competitor country *i* and euro area country *k*, while the weights respect the standard constraint, i.e. $\sum_{i=1}^{N} \sum_{k=1}^{n} w_{i,k} = 1$.

It can be shown that expressions (1) and (2) are effectively equivalent. Let us derive from the trade weights used in expression (2) a set of weights for the *N* competitors as $w_i = \sum_{k=1}^{n} w_{i,k}$, which respect the constraint $\sum_{i=1}^{N} w_i = 1$. Introducing these weights into (2) yields:

$$REER_{euro} = \prod_{i=1}^{N} \left[\prod_{k=1}^{n} \left(\frac{d_k}{d_i} e_{i,k}\right)^{\frac{w_{i,k}}{w_i}} \right]^{w_i} \qquad (3)$$

Expanding (3) and rearranging gives:

$$REER_{euro} = \prod_{i=1}^{N} \left[\prod_{k=1}^{n} \left(\frac{d_k}{d_i} e_{i,k}\right)^{\frac{w_{i,k}}{w_i}} \right]^{w_i} = \prod_{i=1}^{N} \left[\frac{\prod_{k=1}^{n} (d_k)^{\frac{w_{i,k}}{w_i}}}{d_i} \prod_{k=1}^{n} (e_{i,k})^{\frac{w_{i,k}}{w_i}} \right]^{w_i} = \prod_{i=1}^{N} \left(\frac{d_{euro}}{d_i} e_{i,euro}\right)^{w_i}$$

which amounts to equation (1) applied to the euro area with the euro deflator defined as:

$$d_{euro} = \prod_{k=1}^{n} (d_k)^{\frac{w_{i,k}}{w_i}} \quad (4)$$

and the "theoretical" exchange rate of the euro obtained as:

$$e_{i,euro} = \prod_{k=1}^{n} (e_{i,k})^{\frac{w_{i,k}}{w_i}} \quad (5)$$

However, as a general rule, the calculation of the euro EER, as published by the ECB, does not require the utilisation of either (4) or (5). In the case of the deflators, as explained at length in Section II.4, euro area-wide official indicators as complied by Eurostat and the ECB were used for the whole of the computation period. As to the euro exchange rate, actual quotations of the single currency allow the utilisation of the traditional formulation (1) as of January 1999. Prior to this date, however, the euro exchange rate was calculated by aggregating the legacy currency exchange rates using trade-based weights (see Section II.6). The formula applied to calculate the "theoretical" euro exchange rate was:

$$e_{i,euro} = \prod_{k=1}^{n} (e_{i,k})^{w_k} \quad (6)$$

This is slightly different from formulation (5) as far as the weights employed are concerned. The reason for that is the existence of certain advantages of expression (6) over expression (5). These are: (i) it is simpler, as it requires only a single set of weights for all the partner country currencies; (ii) it preserves the transitivity property of exchange rates; and (iii) it is equivalent to (5) in the sense that there is no quantitative difference in the resultant euro NEER.

As regards point (ii), i.e. the transitivity property of exchange rates, any currency *k* should fulfil the following relation:

$$\frac{e_{USD,k}}{e_{JPY,k}} = e_{USD,JPY}$$

It can then be demonstrated that the transitivity property holds also for the "theoretical" euro exchange rate, provided that expression (6) is used for its computation. Indeed:

$$\frac{e_{USD,euro}}{e_{JPY,euro}} = \prod_{k=1}^{n} (e_{USD,k})^{w_k} \Big/ \prod_{k=1}^{n} (e_{JPY,k})^{w_k} = \prod_{k=1}^{n} (e_{USD,k}/e_{JPY,k})^{w_k} = \prod_{k=1}^{n} (e_{USD,JPY})^{w_k} = e_{USD,JPY}$$

where w_k represents the share of each euro area country in the total manufacturing trade of the euro area. This is not the case for expression (5) as the set of weights applied is not common across currencies. Under formulation (5), taking the case of the US dollar as an example, the weights applied reflect the share of each euro area country in the euro area's trade with the United States. These weights would, of course, be different for the Japanese yen or the British pound, thereby leading to a violation of the transitivity property for the resultant "theoretical" euro exchange rate.

In order to demonstrate point (iii), let us start from expression (2), now excluding the deflators so as to concentrate on the euro NEER indicator. It has been shown earlier that in this expression the "theoretical" euro is identified as specified in equation (5). Consider now that, owing to the transitivity property of exchange rates, the exchange rate $e_{i,k}$ in (2) can be equivalently expressed as $e_{i,0}e_{0,k}$, where 0 represents a numeraire currency (for instance the ECU). Then the NEER becomes:

$$NEER_{euro} = \prod_{i=1}^{N}\prod_{k=1}^{n}(e_{i,0}e_{0,k})^{w_{i,k}} =$$

(changing the order of the factors in the following way)

$$= \prod_{i=1}^{N}\prod_{k=1}^{n}(e_{i,0})^{w_{i,k}}\prod_{i=1}^{N}\prod_{k=1}^{n}(e_{0,k})^{w_{i,k}} =$$

(summing the common factors in the exponential)

$$= \prod_{i=1}^{N}(e_{i,0})^{\sum_{k=1}^{n}w_{i,k}}\prod_{k=1}^{n}(e_{0,k})^{\sum_{i=1}^{N}w_{i,k}} =$$

(as $w_i = \sum_{k=1}^{n} w_{i,k}$ *and* $w_k = \sum_{i=1}^{N} w_{i,k}$*)*

$$= \prod_{i=1}^{N}(e_{i,0})^{w_i}\prod_{k=1}^{n}(e_{0,k})^{w_k} =$$

(as $\sum_{k=1}^{n} w_k = 1$ *and* $\sum_{i=1}^{N} w_i = 1$*)*

$$= \prod_{i=1}^{N}(e_{i,0})^{(\sum_{k=1}^{n}w_k)w_i}\prod_{k=1}^{n}(e_{0,k})^{w_k(\sum_{i=1}^{N}w_i)} =$$

(distributing the sums in the exponential as factors)

$$= \prod_{i=1}^{N}\prod_{k=1}^{n}(e_{i,0})^{w_k w_i}\prod_{i=1}^{N}\prod_{k=1}^{n}(e_{0,k})^{w_k w_i} =$$

(changing the order of the factors)

$$= \prod_{i=1}^{N}\prod_{k=1}^{n}(e_{i,0}e_{0,k})^{w_k w_i} =$$

$$= \prod_{i=1}^{N}(\prod_{k=1}^{n}(e_{i,k})^{w_k})^{w_i} = \prod_{i=1}^{N}(e_{i,euro})^{w_i} .$$

In the last expression, the "theoretical" exchange rate of the euro against the currency of partner country *i* can this time be isolated as:

$$e_{i,euro} = \prod_{k=1}^{n}(e_{i,k})^{w_k}$$

which is identical to expression (6), thereby showing that computationally the use of either approach for deriving a "theoretical" euro exchange rate has no quantitative implications for the euro NEER index.

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