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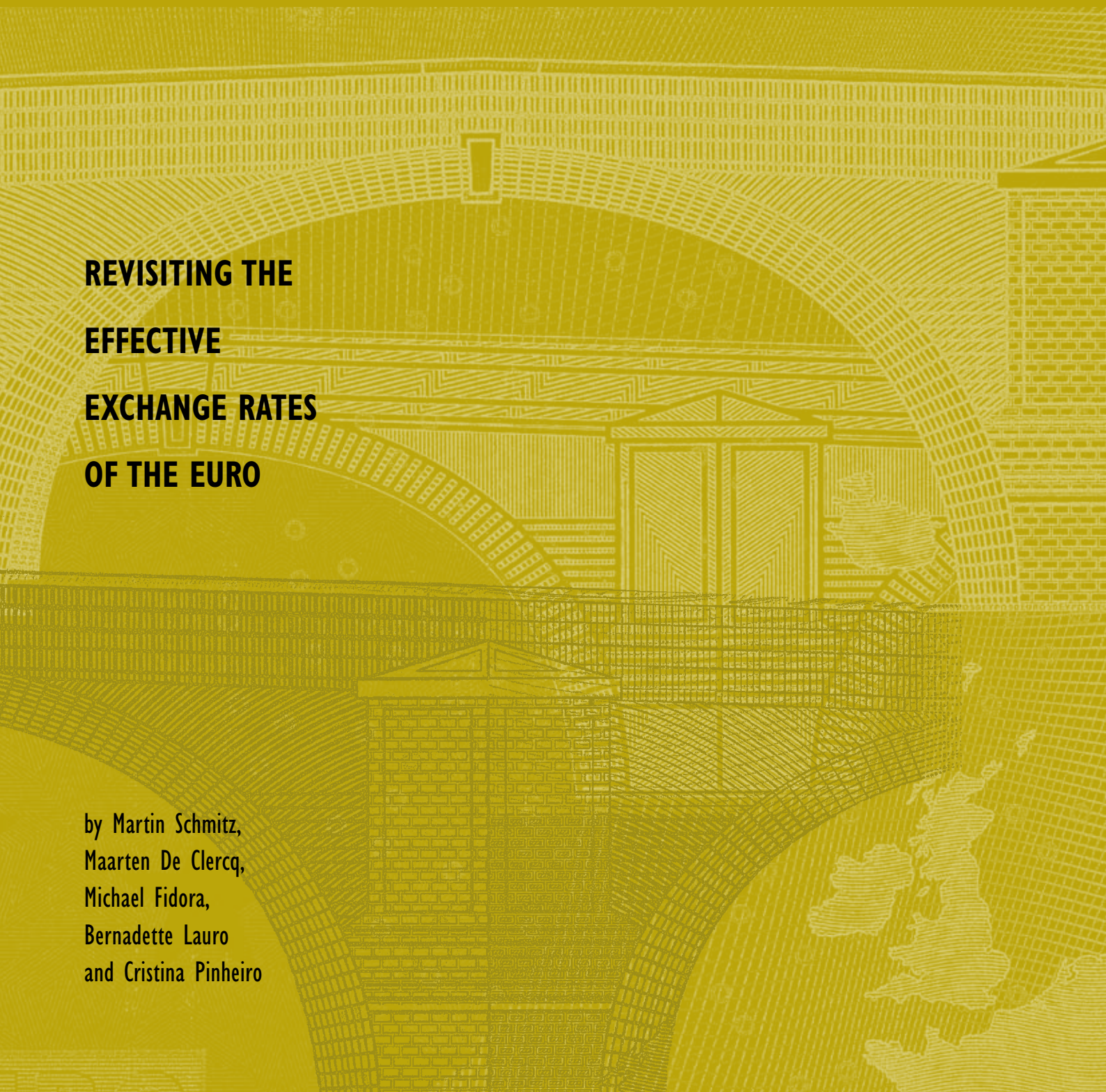

REVISITING THE EFFECTIVE EXCHANGE RATES OF THE EURO

by Martin Schmitz, Maarten De Clercq, Michael Fidora, Bernadette Lauro and Cristina Pinheiro

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ABSTRACT

This paper describes in detail the methodology currently used by the European Central Bank (ECB) to determine the nominal and real effective exchange rate indices of the euro. Building on the work of Buldorini et al. (2002), it shows how the ECB's techniques for calculating effective exchange rates have been updated over time and explains the related theoretical foundations. In particular, the paper discusses the use and development of trade weights based on trade in manufactured goods (taking account of third market effects), the trading partners selected, and the choice of deflators for constructing the real effective exchange rate indices. In addition, it presents evidence on exchange rate and competitiveness developments for both the euro area as a whole and individual Member States. While the growing importance of China is reflected in the updated trade weights of euro effective exchange rates, it appears that the increasing integration of the euro area with other European economies accounts for the largest variation in trade weights. The US dollar, an anchor currency for a number of large emerging markets, continues to play an important role for the effective exchange rate of the euro and euro area competitiveness. Overall, euro area competitiveness has improved slightly since the introduction of the single currency, despite significant heterogeneity within the euro area.

JEL codes: F10, F30, F31, F40

Keywords: competitiveness, effective exchange rate (EER), harmonised competitiveness indicator (HCI), nominal effective exchange rate (NEER), real effective exchange rate (REER), trade weights

NON-TECHNICAL SUMMARY

In preparation for the start of Stage Three of the Economic and Monetary Union (EMU), the European Central Bank and the national central banks (NCBs) of participating countries began work on the construction of a set of effective exchange rate (EER) indicators for the euro based on a commonly agreed methodological framework. The general methodological principles of the euro EER indices were agreed upon in February 1999, with the implementation of this commonly agreed framework being undertaken by the ECB.

The Eurosystem's approach to calculating the EERs of the euro is described by Buldorini et al. (2002) and broadly follows the methodology of the Bank for International Settlements (BIS). The weights assigned to trading partners are derived from their share in international trade in manufactured goods, and combine information on both exports and imports. The import weights are the simple shares of each partner country in total euro area imports. As for the export weights, these are determined in such a way that they capture both the importance of specific euro area export markets and the competition faced by euro area exporters in foreign markets from domestic producers and exporters from third countries.

The nominal EERs of the euro are geometric weighted averages of the bilateral exchange rates of the euro against the currencies of the euro area's main trading partners. Hence, they provide a summary measure of the euro's value vis-à-vis these currencies. The real EERs of the euro – obtained by deflating the nominal EERs by different price or cost indices – are commonly used indicators of international price and cost competitiveness. Depending on data availability, real EERs are calculated on a monthly or quarterly basis. Historical data required for the compilation of the indices for the years before 1999 are computed using "theoretical" euro exchange rates: calculated on the basis of the exchange rates of the legacy currencies of individual euro area countries.

Since 1999, a number of enhancements have been introduced to the methodology for calculating the EERs. When the trade weights were updated for the first time in 2004, the list of countries included in the largest group of trading partners was expanded to encompass all European Union (EU) Member States and accession countries. In addition, a new group of trading partners was created, composed of the 12 countries already in the narrow group of trading partners plus the ten that joined the EU in 2004 and China (given its emergence as one of the euro area's largest trading partners). Production of EERs based on the narrow group was not discontinued, as these time series start earlier than those based on the larger groups. This is due to the fact that, for certain countries, data for earlier periods are not available.

In 2006, a methodological simplification was introduced, whereby the trade weights for the smaller groups of trading partners are obtained by proportionally rescaling the weights of the largest group of trading partners. The trade weights are now revised and updated every three years. The second and third revisions took place in December 2009 and January 2012, respectively. Following an update, the EERs and harmonised competitiveness indicators (HCIs) are recalculated by chain-linking the indices based on the trade weights for consecutive three-year periods (currently 1995-97, 1998-2000, 2001-03, 2004-06 and 2007-09). The trade weights are also recalculated following each enlargement of the euro area.

In 2006, the ECB started publishing HCIs deflated by consumer prices for each individual euro area country. Since 2008, the ECB has also published HCIs based on gross domestic product (GDP) deflators and unit labour costs for the total economy. The HCIs provide meaningful and comparable measures of the price and cost competitiveness of euro area countries that are consistent with the real effective exchange rates of the euro. The HCIs are in fact constructed using the same methodology as that for the real euro EERs.

The main objective of this paper is to provide a comprehensive account of the methodological framework adopted by the Eurosystem to calculate its set of effective exchange rates and harmonised competitiveness indicators.[1] Accordingly, the paper contains previously unpublished technical information on the construction of nominal and real euro EERs as well as the HCIs for euro area countries. It largely builds on the work of Buldorini et al. (2002) and highlights the modifications in methodology that have been introduced over the last decade.

The paper also presents evidence on developments in the effective exchange rates of the euro and the competitiveness of the euro area as a whole as well as of individual Member States. In addition, while the growing importance of China is reflected in the updated trade weights of euro EERs, it appears that the increasing integration of the euro area with other European economies accounts for the largest variation in trade weights. The United States (US) dollar, which serves as an anchor currency for a number of large emerging markets, continues to play an important role for the effective exchange rates of the euro and euro area competitiveness. Overall, since the introduction of the single currency, the competitiveness of the euro area has improved slightly relative to its main trading partners, but there remains a significant degree of heterogeneity across euro area countries. The HCIs are therefore a useful complement to the EERs in the analysis of euro area competitiveness.

1 The effective exchange rates of the euro and the HCIs for euro area countries can be obtained from the ECB's Statistical Data Warehouse (http://sdw.ecb.europa.eu/). Up-to-date information is also available via the following links: http://www.ecb.europa.eu/stats/exchange/effective/html/index.en.html and http://www.ecb.europa.eu/stats/exchange/hci/html/index.en.html.

I INTRODUCTION

In times of global economic integration, countries are increasingly influenced by movements in their exchange rates vis-à-vis the currencies of many partner countries. This is particularly true for the euro area, with this being the most open of the world's largest economies.[2] In order to obtain a useful aggregate measure of exchange rate fluctuations, an effective exchange rate combines various bilateral rates into a single indicator.

There are two distinct indicators to measure these fluctuations: the nominal effective exchange rate (NEER) and the real effective exchange rate (REER). While the euro NEER is the weighted average of bilateral nominal exchange rates against the currencies of selected trading partners, the REER indices are derived by adjusting the nominal indices for relative price and cost developments between a given economy and its trading partners. To construct these indices in a meaningful way, one needs to decide on the composition of the index and the relative weights of the various partner currencies.

The weighting method for euro EERs reflects the importance of different countries in euro area trade in manufactured goods, hence accounting for trade integration with these countries. The trade weights combine information on both exports and imports. While import weights are each trading partner's simple share of total euro area imports, export weights are double-weighted to account for "third market" effects. Specifically, they capture the effect of competition faced by euro area exporters in foreign markets from both domestic producers and exporters from third countries.

The NEER of the euro is a summary measure of the euro's value vis-à-vis the currencies of the euro area's most important trading partners. Meanwhile, the REER usually serves as a measure of international price and cost competitiveness: it captures broad macroeconomic developments in the exchange rate and prices or costs. While it neither includes any firm-level data nor explicitly reveals factors relating to non-price competitiveness (such as product quality and reputation), it does, nevertheless, provide a comprehensive assessment of the international pressures on domestic firms over the medium term in respect of costs or prices. The high relevance of the real effective exchange rate as a measure of competitiveness is also reflected by its inclusion in the scoreboard of the EU Macroeconomic Imbalance Procedure that was adopted in December 2011 (see European Commission, 2012).

This paper largely builds on the work of Buldorini et al. (2002), which provides a detailed description of the framework for calculating effective exchange rates adopted by the ECB and NCBs after the foundation of the euro area. Buldorini et al. note that the ECB's methodology for constructing EERs combines the framework used by the Bank for International Settlements (as per Turner and Van't dack, 1993), with euro area-specific components. We present an updated version of this methodology. In particular, we highlight the modifications that have been introduced since the publication of the paper by Buldorini et al. (2002), i.e. as regards the partner countries included in the EER indices, the approach used to calculate trade weights and the choice of deflators for the REERs. Hence, similar to Buldorini et al., this paper aims at providing a comprehensive reference guide for researchers and users of the ECB's euro EERs. Moreover, it presents an overview of existing state-of-the-art methodologies for calculating effective exchange rates. To this end, we explain the methodological choices made by the Eurosystem, highlight the positive and negative aspects of these choices, present potential avenues for future enhancement of the indices and provide a comparison with the methodologies of other international institutions (see Table A in the Appendix).

2 This is conventionally measured, for example, by the ratio of combined exports and imports to GDP.

There are two main peculiarities with regard to the calculation of EERs for the euro area: first, in order to obtain a long time series, the national exchange rates of the original 11 euro area legacy currencies need to be aggregated for the period before 1 January 1999, the date on which the single currency was introduced as an accounting currency. Second, as the composition of the euro area changes over time, with the entry of each new Member State, the EERs need to be flexible to take these changes into account.[3]

The methodology for constructing the euro REERs is also used to calculate harmonised competitiveness indicators for individual euro area Member States. While intra-euro area trade flows are not considered in the calculation of trade weights for euro EERs, they are used for the HCIs, which are constructed from the perspective of individual Member States. Hence, all other euro area countries are considered as trading partners. The HCIs are highly relevant, as they show competitiveness developments for each individual euro area Member State. Hence, the HCIs illustrate how domestic factors, notably price and wage developments, affect the international competitiveness of euro area countries, also vis-à-vis fellow Member States.

The remainder of the paper is organised as follows. Section 2 explains in detail the methodology for calculating the euro EERs: first, it presents the trade basis of the necessary weighting scheme, trading partners, theories and formulae, regular updates and patterns of trade weights over time. Second, it describes the theory and deflators for the REERs and then explains the aggregation of the euro's legacy currencies for the period before 1999 as well as the adjustments of the EERs following euro area enlargements. Section 3 discusses the evolution of the EERs of the euro since its introduction and presents evidence on developments in the competitiveness of the euro area as a whole and of individual Member States based on REER indices and HCIs respectively. Lastly, Section 4 provides some conclusions.

3 Greece joined the euro area in 2001, Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009 and Estonia in 2011.

2 METHODOLOGY FOR CALCULATING THE EFFECTIVE EXCHANGE RATES OF THE EURO

This section describes the methodology behind the effective exchange rates of the euro. Taking economic theory and data constraints into account, it presents the options available for constructing the nominal and real effective exchange rates of the euro and the choices eventually made. In particular, it discusses the weighting method (based on the theoretical foundations outlined by Armington, 1969) and set of deflators used to compile the REERs. Harmonised competitiveness indicators for individual euro area Member States are also constructed using the same methodology.

2.1 TRADE BASIS

It is common practice to use bilateral trade as the basis for determining the weight of the different bilateral exchange rates included in the calculation of an effective exchange rate; the idea being to assign a greater weight to those countries accounting for a higher proportion of an economy's foreign trade.

Trade flows can be broadly classified into three main categories: manufactured goods, commodities and services. As outlined by Buldorini et al. (2002), the EERs of the euro are based on manufactured goods trade weights, with such trade being defined as per Sections 5 to 8 of the Standard International Trade Classification (SITC).[4] Choosing manufactured goods trade to calculate the weights is consistent with the practice of many international organisations and central banks, most notably the BIS.[5] This type of trade accounted for about 61% of total euro area exports and 49% of total euro area imports of goods and services in 2009, and is generally deemed most responsive to developments in competitiveness. In addition, high quality data are available for a broad set of countries.[6] Thus, the ECB's weighting scheme does not reflect patterns of trade in agricultural products, raw materials, energy products or services. Commodities are not included, as these are considered to be homogeneous goods whose prices are determined in global markets without being influenced by the competitiveness of individual countries. Indeed, including trade in agricultural or mining products may distort the competitiveness analysis, as such goods are often heavily regulated or subsidised.

From a conceptual point of view, it would be desirable to include services trade in the weighting scheme, as many different types of services are subject to competition in global markets. This would be particularly important if patterns in services trade flows were to differ significantly from those observed for manufactured goods. However, despite improvements in the coverage of bilateral services trade flows over the last decade, there are still considerable data gaps compared with data on trade in manufactured goods. Nevertheless, services trade weights are used by a number of institutions (again, see Table A in the Appendix). For example, the Bank of England uses bilateral services trade data from the Office for National Statistics of the United Kingdom (UK; Lynch and Whitaker, 2004) and the International Monetary Fund (IMF) includes trade in services by using the same weights as for manufactured goods, while tourism flows are used for those countries where these are sizeable (Bayoumi et al., 2005); the Hong Kong Monetary Authority calculates a REER based solely on services trade vis-à-vis a small group of partner countries (Ha and Fan, 2003). As regards the euro, Di Mauro et al. (2008) have constructed an experimental effective exchange rate based on bilateral services trade with regard to 24 partner countries. They conclude that simple services trade weights (i.e. ones without third market effects) are typically higher than manufacturing-related weights for trade between the euro area and advanced countries such as the United Kingdom and the United States,

4 These categories comprise chemicals and related products, manufactured goods, machinery and transport equipment, and miscellaneous manufactured articles.

5 See Table A in the Appendix for a detailed comparison of the methods used by different organisations to calculate effective exchange rates.

6 The data sources for bilateral trade in manufactured goods are Eurostat, the OECD, and the United Nations.

while relatively smaller for trade between the euro area and emerging economies. Given the increasing availability of data for both bilateral trade in services and related price indices, an extension of the trade basis to include services may become feasible in the future.

2.2 TRADING PARTNERS

The EERs of the euro are currently calculated against two main groups of trading partners, i.e. the EER-20 group and the broad EER-40 group:[7]

- EER-20: this group is composed of the non-euro area EU Member States (Bulgaria, Czech Republic, Denmark, Latvia, Lithuania, Hungary, Poland, Romania, Sweden and the United Kingdom), plus Australia, Canada, China, Hong Kong, Japan, Norway, Singapore, South Korea, Switzerland and the United States.

- EER-40: in addition to the trading partners in the EER-20, the EER-40 includes Algeria, Argentina, Brazil, Chile, Croatia, Iceland, India, Indonesia, Israel, Malaysia, Mexico, Morocco, New Zealand, the Philippines, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela.[8]

The selection of countries is based on their importance as trading partners of the euro area and on data availability, particularly in respect of the high quality data on price and cost indicators required for calculating the REER.[9]

2.3 CALCULATING THE NOMINAL EFFECTIVE EXCHANGE RATES OF THE EURO

THEORY AND FORMULAE

The nominal effective exchange rate (NEER) of the euro is calculated as the geometric weighted average of a basket of bilateral nominal exchange rates:

$$NEER^t = \prod_{i=1}^{N} \left(e^t_{i,euro}\right)^{w_i} \quad (1)$$

where N stands for the number of competitor countries in the reference group of trading partners, $e^t_{i,euro}$ is an index of the average exchange rate of the currency of partner country i vis-à-vis the euro in period t (expressed in terms of foreign currency per euro), and w_i is the trade weight assigned to the currency of trading partner i.

It is common practice to use geometric averages rather than arithmetic averages for calculating effective exchange rates. Exchange rate indices based on geometric averaging have the convenient feature that the logarithm of the index is equal to the arithmetic average of the logarithms of the underlying bilateral rates. As Brodsky (1982) notes, a percentage change in the geometrically averaged effective exchange rate between two periods is independent of the base period. However, when an arithmetic average is applied, it is affected by all movements since the base period. Moreover, for geometrically averaged EERs, proportionally equivalent currency appreciations and depreciations have the same effect (with opposing signs) on the overall index, whereas there is an upward bias in arithmetically averaged indices.[10]

7 In addition, the ECB publishes indices vis-à-vis a narrow group of 12 partner countries (the EER-12, comprising Australia, Canada, Denmark, Hong Kong, Japan, Norway, Singapore, South Korea, Sweden, Switzerland, the United Kingdom and the United States). This is because, for some of the countries included in the EER-20 (and thus the EER-40), the historical data do not allow for the production of an EER over a long period, starting from the 1980s.

8 The composition of the two groups changes in the case of an enlargement of the euro area, as the joining Member States are removed from the group of trading partners.

9 For the sake of brevity, all trading partners are hereafter referred to as "countries" irrespective of their legal status as a territorial entity. To be included in the narrow group of countries, Buldorini et al. (2002) mention the following selection criteria: (i) significant trade links with the euro area; (ii) the availability of exchange rate data on a daily basis; and (iii) the availability of data related to a sufficiently broad range of price and cost indices on a monthly or quarterly basis – with all data to be relatively timely and reliable. For inclusion in the broad group, one or more of the following features are necessary: (i) an individual share of total euro area manufacturing trade larger than 1%; (ii) EU "accession country" status; (iii) significant trade links with individual euro area countries; and (iv) timely and reliable availability of monthly CPI data.

10 For example, under a geometric EER, a ceteris paribus appreciation of 5% ($x_1=x_0*1.05$) in the currency of a trading partner would produce a symmetric effect of a depreciation of 4.76% ($x_1=x_0/1.05$).

WEIGHTING METHOD

The approach used for calculating the effective exchange rates of the euro follows the BIS methodology presented in Turner and Van't dack (1993). Under this method, import weights are each trading partner's simple share of total euro area imports. Export weights, on the other hand, are double-weighted to account for third market effects. Consequently, they capture the effect of competition faced by euro area exporters in foreign markets from both domestic producers and exporters from third countries.

The overall weight of each partner country i in the broad group of trading partners is obtained as the weighted average of the export and import weights, that is:

$$w_i = \left(\frac{m^a}{x^a+m^a}\right)w_i^m + \left(\frac{x^a}{x^a+m^a}\right)w_i^x, \text{i}=1,2,...,N \qquad (2)$$

where w_i^m and w_i^x are partner country i's import and export weights, respectively, and m^a and x^a are total imports and total exports by the euro area, respectively.

The import weight of competitor country i is calculated as its simple share of total euro area imports:

$$w_i^m = m_i^a / \sum_{i=1}^{N} m_i^a, \text{i}=1,2,...,N \qquad (3)$$

where m_i^a denotes gross import flows into the euro area from country i during the reference period. Hence, this measure captures the relative importance of each of the partner countries in total euro area imports. It also implies that, the higher the share of country i in total euro area imports, the greater the weight of its exchange rate in the basket of currencies included in the EER of the euro.

In order to capture the effect of competition faced by euro area exporters from domestic producers in the economies of the trading partners, the domestic supply of manufactured goods in these countries is included in the calculation of export weights. The export weights also take into account each trading partner's bilateral exports to different foreign markets. In this way, the trade weights also reflect the competition faced by euro area exporters in each given foreign market from exporters of the countries included in the group of trading partners. For this purpose, a distinction is made between N, the trading partners, and, R, the group of countries referred to as the "rest of the world" (whereby $H = N + R$, with H being the total number of export markets). It is assumed that the euro area and the N competitor countries are the only suppliers of manufactured goods in the R countries. Hence, the calculations neither include exports from the rest of the world to the N trading partners, nor the rest of the world's domestic manufacturing output.

The share of each market in total euro area exports is calculated as

$$x_j = x_j^a / \sum_{j=1}^{H} x_j^a, \text{j}=1,2,...,H \qquad (4)$$

where x_j^a denotes the gross export flows in the reference period from the euro area to market j. The subsequent adjustment of export shares to capture third market effects yields the double export weights of each partner country i, i.e.

$$w_i^x = \sum_{j=1}^{H} (S_{i,j} x_j), \text{i}=1,2,...,N \qquad (5)$$

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

$$S_{i,j} = S_{i,j}^a / \sum_{i=1}^{N} S_{i,j}^a \qquad (6)$$

where $S_{i,j}^a$ (for i≠j, i=1, 2,…, N, and j=1, 2, ..., H) denotes the gross export flows from country i to market j, and $S_{i,i}^a$ (for i=1,2,…, N) represents the gross manufacturing output of country i that is sold in its domestic market. $S_{i,i}$ serves as a proxy for the gross value of the domestically produced supply of manufactured goods. For each country, it is obtained by adding manufactured goods imports to the value added of the manufacturing sector and then subtracting manufactured goods exports. Imports of manufactured goods are used as a proxy for both domestic non-manufactured inputs and imported inputs. According to Turner and Van't dack (1993), this method can be used to obtain an estimate of the

gross value of the manufactured goods produced and sold domestically which is comparable with international trade data that are also expressed in similar (gross value) terms.[11]

In an alternative, but equivalent way to equation (5), one can decompose the double export weights (as per Turner and Van't dack, 1993) to disentangle direct export competition and third market competition:

$$w_i^x = \left(\frac{x_i^a}{\sum_{j=1}^{H} x_j^a}\right)\left(\frac{S_{i,i}^a}{S_{i,i}^a + \sum_{j=1, j\neq i}^{N}(S_{j,i}^a)}\right) + \sum_{k=1,\,k\neq i}^{H-1}\left(\frac{x_k^a}{\sum_{j=1}^{H} x_j^a}\right)\left(\frac{S_{i,k}^a}{S_{k,k}^a + \sum_{i=1,\,i\neq k}^{N}(S_{i,k}^a)}\right), \mathrm{i} = 1,2,\ldots,N \quad (7)$$

where x_i^a denotes the euro area's exports to market i, $\sum_{j=1}^{H} x_j^a$ is the sum of euro area exports to all markets H. $S_{i,i}^a$ represents the domestic production of country i, while $\sum_{j=1,j\neq i}^{N}(S_{j,i}^a)$ denotes gross export flows from all N competitor countries to market i.

The first term of equation (7) measures the direct competition faced by the euro area in economy i from domestic manufacturers. Hence, the weight is greater if i is an important export market for the euro area and if i's share of domestically produced and sold goods in total domestic supply is large (i.e. i is relatively less open to foreign manufactured goods).

The second term of equation (7) shows the third market effect, i.e. the competition faced by euro area exporters in all H foreign markets (excluding i's domestic market) from exporters of economy i: one considers the share of euro area exports $x_k^a / \sum_{j=1}^{H} x_j^a$ to each market k, and the exports $S_{i,k}^a$ of economy i to market k, divided by $S_{k,k}^a + \sum_{i=1,i\neq k}^{N}(S_{i,k}^a)$ which includes the domestic supply in economy k (except for rest of the world countries, whose domestic supply is not taken into account) and the exports $\sum_{i=1,i\neq k}^{N}(S_{i,k}^a)$ of all N competitor economies to market k. Hence, the weight of i's currency in the euro area's EER is greater if i is an important exporter to a foreign market which is a key destination for euro area exports.

The trade weights for the narrower reference groups (i.e. the EER-12 and EER-20) are calculated by rescaling the overall trade weights obtained under equation (2) for the EER-40 group, as per equation (8) below. This represents a change in methodology compared with that outlined in Buldorini et al. (2002), where a set of weights is calculated separately for each trading partner group according to slightly different formulae. Using the new method implies that the trade weights of the smaller trading partner groups can be obtained by proportionally rescaling the corresponding country trade weights in such a way that they add up to 100. For example, in the case of N, a broad group of 40 partner countries and, M, a narrow group of 20 countries (i.e. $M < N$), the overall trade weight of country i in the narrow group ($w_{i(narrow)}$) is calculated from the weights of the broad group ($w_{i(broad)}$) using the following formula:

$$w_{i(narrow)} = \frac{w_{i(broad)}}{\sum_{i=1}^{M} w_{i(broad)}} \quad (8)$$

Effective exchange rates calculated in this way have the useful feature that various combinations of sub-indices are consistent with the overall EER index for the broadest group of countries. Using the rescaling approach enables all available information on trade and domestic supply conditions in the largest group of countries to be taken into account, and thus limits the potential for bias to just the rest of

11 The data on the gross value added of the manufacturing sector are retrieved from various sources (mainly from the United Nations National Accounts database).

the world countries. In fact, by employing the former method of calculating separate weights for each smaller group of trading partners, one excludes information on a sizeable number of countries, thereby introducing (potentially significant) distortions in the calculations.[12]

DOUBLE EXPORT WEIGHTS IN PRACTICE

How are double export weights obtained in practice? All of the elements involved in the related calculations for the EER-40 group can be observed in Table 1.

Panel 1.1 of Table 1 reports the simple percentage share of euro area manufactured goods exports destined for each of the 40 partner countries plus the aggregate for the rest of the world. For example, 1.28% of such euro area exports go to Australia, 1.17% to Canada, 2.11% to Denmark, etc.

The supply structure matrix of the competitor countries in the broad group is presented in the second panel of Table 1. Each element in this panel ($S_{i,j}$) – excluding those on the main diagonal – represents the percentage of manufactured goods produced in one of the N competitor countries (across the rows) that is exported abroad to one of the H foreign markets (across the columns). The elements on the main diagonal of the supply structure matrix ($S_{i,i}$) stand for the percentage of total manufactured goods that is accounted for by domestic production in each of the competitor countries. Taking the first column of Panel 1.2 as an example, it can be seen that, in Australia, 68.57% of the total supply of manufactured goods is due to domestic production, while 0.41% is accounted for by imports from Canada, 0.18% by imports from Denmark, and so forth, with all these percentages totalling to 100%.

To obtain the double export weights – shown in the third panel of Table 1 – each row of the supply structure matrix (Panel 1.2) is multiplied by the simple euro area export shares (Panel 1.1), as defined in equation (5). For example, the double export weight of 1.48% assigned to Australia in the broad EER index of the euro is obtained as follows: (1.28% × 68.57%) + (1.17% × 0.08%) + ... + (14.34% × 0.76%). The double export weight assigned to Australia measures the competition faced by euro area exporters from Australian producers in both the Australian market as well as in all of the other markets. Only 0.88 percentage points (1.28% × 68.57%) of Australia's double export weight (1.48%) is due to competition encountered by euro area exporters in the Australian market, while the remainder stems from third market competition.

UPDATING OF TRADE WEIGHTS

The trade weights for the effective exchange rates of the euro are time-varying as they are calculated over non-overlapping three-year periods. An advantage of using three-year averages, as opposed to trade weights that are updated more frequently, is the smoothing out of potentially large short-term fluctuations in trade flows. Moreover, more frequent updating also entails additional data revisions, which could complicate the analysis of competitiveness developments. Using time-varying weights has the advantage of giving an accurate picture of both current trade patterns, as well as those for past periods. As noted by Klau and Fung (2006), this ensures that the EERs accurately reflect medium to long-term exchange rate movements by taking account of the varying importance of different trading partners at different points in time.[13]

In 1999, the first set of trade weights employed to calculate the euro EERs was based on trade data for the three-year period 1995-97. These were kept constant until 2004, when the weights for the period 1995-97 were recalculated on the basis of data revisions for that period, and new trade weights were determined for the three years from 1999 to 2001.

12 Buldorini et al. (2002) describe this problem in footnote 12.

13 Using moving averages of trade weights (e.g. over a three-year period) is another approach that would smooth out short-term fluctuations. This method, however, would be subject to annual updates and revisions.

Table 1 Trade weight calculations for the EER-40 group

(percentages)

	Australia	Canada	Denmark	Hong Kong	Japan	Norway	Singapore	South Korea	Sweden
1.1 Euro area exports									
Euro area exports	1.28	1.17	2.11	1.10	2.19	1.34	1.15	1.44	3.51
1.2 Supply structure matrix									
Australia	68.57	0.08	0.07	0.37	0.24	0.04	0.83	0.71	0.10
Canada	0.41	47.83	0.37	0.24	0.21	0.36	0.48	0.36	0.34
Denmark	0.18	0.12	57.63	0.06	0.07	4.50	0.33	0.17	7.95
Hong Kong	1.56	0.66	1.05	2.98	1.56	0.34	4.35	2.12	1.04
Japan	4.28	1.94	0.75	9.01	72.42	1.12	11.86	16.45	1.69
Norway	0.06	0.03	2.30	0.04	0.09	63.85	0.74	0.54	3.87
Singapore	1.62	0.43	0.12	6.73	1.24	0.07	1.28	3.75	0.13
South Korea	1.33	0.73	0.59	4.78	2.12	1.39	7.53	39.20	0.85
Sweden	0.58	0.26	11.45	0.14	0.16	12.81	0.62	0.30	52.56
Switzerland	0.58	0.46	1.45	1.44	0.64	0.72	1.31	0.58	1.59
United Kingdom	1.47	0.88	4.39	1.46	0.62	3.88	2.93	0.99	7.70
United States	5.75	39.60	2.80	5.04	4.31	2.46	15.11	8.14	4.24
Bulgaria	0.00	0.01	0.05	0.01	0.00	0.03	0.00	0.01	0.09
Czech Republic	0.08	0.03	1.27	0.09	0.05	0.58	0.10	0.08	2.27
Hungary	0.06	0.04	0.85	0.05	0.04	0.23	0.14	0.08	1.02
Latvia	0.00	0.00	0.30	0.00	0.00	0.17	0.00	0.00	0.30
Lithuania	0.00	0.00	0.75	0.00	0.00	0.38	0.00	0.00	0.59
Poland	0.07	0.11	2.83	0.04	0.03	2.39	0.09	0.09	4.27
Romania	0.01	0.01	0.12	0.01	0.00	0.47	0.05	0.03	0.32
China	6.55	3.87	6.12	49.91	9.74	2.41	19.86	18.81	4.83
Algeria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Argentina	0.03	0.04	0.01	0.03	0.02	0.01	0.01	0.02	0.01
Brazil	0.18	0.19	0.17	0.10	0.16	0.09	0.50	0.34	0.29
Chile	0.10	0.16	0.03	0.03	0.05	0.02	0.05	0.66	0.07
Croatia	0.00	0.00	0.04	0.00	0.00	0.02	0.05	0.00	0.09
Iceland	0.00	0.00	0.04	0.00	0.01	0.05	0.00	0.00	0.02
India	0.36	0.22	0.67	1.78	0.15	0.25	2.36	0.43	0.52
Indonesia	0.45	0.08	0.15	0.29	0.65	0.05	5.04	0.54	0.11
Israel	0.17	0.14	0.15	0.95	0.06	0.05	0.30	0.20	0.13
Malaysia	1.16	0.16	0.18	1.96	0.90	0.10	11.81	0.87	0.26
Mexico	0.16	1.17	0.11	0.07	0.10	0.03	0.20	0.12	0.07
Morocco	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.01
New Zealand	0.99	0.02	0.04	0.04	0.09	0.03	0.11	0.05	0.01
Philippines	0.09	0.04	0.02	1.24	0.64	0.01	1.58	0.59	0.02
Russia	0.02	0.02	0.84	0.04	0.22	0.36	0.08	0.33	0.48
South Africa	0.35	0.07	0.04	0.11	0.55	0.05	0.18	0.25	0.28
Taiwan	0.88	0.34	0.60	8.68	1.45	0.21	5.39	2.48	0.63
Thailand	1.82	0.17	0.59	2.24	1.38	0.11	4.48	0.68	0.44
Turkey	0.07	0.07	1.07	0.05	0.01	0.35	0.14	0.04	0.79
Venezuela	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.3 Double export weights									
Export weights	1.48	1.67	2.09	1.74	5.74	1.26	1.22	3.30	3.24
1.4 Import weights									
Import weights	0.28	0.86	2.10	0.67	5.78	0.81	1.11	2.94	4.44
1.5 Overall weights									
Overall weights	0.94	1.33	2.10	1.29	5.76	1.07	1.17	3.14	3.75

	Switzerland	United Kingdom	United States	Bulgaria	Czech Republic	Hungary	Latvia	Lithuania	Poland	Romania	China	Algeria
	5.49	13.58	12.54	0.58	3.77	2.54	0.26	0.38	5.25	1.73	4.77	0.82
	0.12	0.24	0.13	0.07	0.02	0.02	0.04	0.02	0.01	0.01	0.13	0.01
	0.65	0.99	5.28	0.14	0.28	0.43	0.25	0.19	0.16	0.09	0.23	0.43
	0.64	0.79	0.14	0.61	0.91	1.04	2.09	1.85	1.21	0.25	0.08	0.12
	1.94	1.62	1.32	0.27	1.07	2.22	0.65	0.31	0.48	0.30	9.31	0.07
	2.07	2.26	3.63	0.56	3.93	4.51	0.45	0.42	1.26	0.40	5.68	1.98
	0.26	0.45	0.08	0.08	0.22	0.15	0.45	0.57	0.52	0.17	0.08	0.03
	0.56	0.79	0.67	0.03	0.69	1.51	0.05	0.05	0.19	0.04	1.36	0.08
	0.35	0.96	1.22	0.68	1.46	3.55	0.83	0.52	2.99	0.88	4.45	2.08
	1.25	1.37	0.28	0.74	1.64	1.19	3.48	3.11	2.20	0.47	0.19	0.44
	59.77	1.55	0.52	1.28	2.54	2.05	1.53	0.67	1.41	0.94	0.29	1.00
	5.64	67.62	1.32	1.61	4.19	3.01	1.48	2.30	3.15	1.53	0.35	0.87
	9.79	6.59	68.68	1.18	1.76	2.51	2.05	2.75	1.94	0.72	2.51	1.90
	0.10	0.06	0.01	65.42	0.20	0.31	0.14	0.14	0.19	1.12	0.01	0.13
	1.78	1.08	0.07	2.63	50.40	6.56	1.64	2.03	4.88	2.02	0.04	0.22
	0.80	0.78	0.06	3.72	5.32	41.42	1.33	1.09	2.51	4.71	0.06	0.11
	0.03	0.03	0.00	0.04	0.07	0.04	55.30	5.13	0.19	0.03	0.00	0.15
	0.05	0.08	0.01	0.09	0.21	0.13	8.46	58.04	0.52	0.05	0.00	0.00
	0.99	1.38	0.06	2.09	10.65	7.19	6.63	9.14	65.83	2.24	0.06	0.23
	0.23	0.26	0.02	3.69	1.05	3.78	0.15	0.18	0.67	75.23	0.01	0.31
	3.28	5.79	6.99	3.98	8.28	11.37	5.28	4.44	5.68	3.17	69.16	7.85
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	75.25
	0.05	0.03	0.05	0.01	0.04	0.01	0.07	0.02	0.01	0.04	0.02	0.19
	0.59	0.26	0.44	0.03	0.06	0.16	0.04	0.18	0.14	0.07	0.13	0.19
	0.07	0.01	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00
	0.09	0.04	0.01	0.19	0.17	0.31	0.04	0.06	0.07	0.08	0.00	0.03
	0.04	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
	0.57	0.95	0.56	0.27	0.28	0.62	0.31	0.25	0.30	0.42	0.17	1.10
	0.15	0.22	0.25	0.04	0.18	0.07	0.06	0.05	0.13	0.02	0.14	0.15
	1.01	0.26	0.53	0.25	0.22	0.24	0.19	0.11	0.14	0.23	0.05	0.00
	0.16	0.40	0.63	0.11	0.29	0.75	0.18	0.08	0.22	0.06	0.63	0.18
	0.13	0.14	4.94	0.05	0.12	0.28	0.00	0.09	0.06	0.04	0.06	0.11
	0.16	0.10	0.01	0.06	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.19
	0.01	0.05	0.04	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00
	0.03	0.06	0.21	0.02	0.10	0.16	0.00	0.00	0.02	0.01	0.24	0.00
	3.55	0.22	0.15	1.87	0.84	1.14	5.26	4.11	0.87	0.36	0.25	0.55
	1.52	0.57	0.19	0.02	0.12	0.08	0.03	0.02	0.20	0.06	0.08	0.39
	0.31	-	0.84	0.45	0.66	1.19	0.76	0.59	0.52	0.16	3.23	0.12
	0.80	0.45	0.45	0.11	1.07	0.71	0.17	0.50	0.29	0.09	0.62	0.29
	0.47	1.51	0.09	7.58	0.94	1.26	0.58	1.00	1.00	4.00	0.02	3.22
	0.00	0.00	0.02	0.00	0.00	0.00	-	-	0.00	0.00	0.00	0.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	4.37	11.63	14.72	0.50	2.95	1.94	0.23	0.40	4.99	1.68	12.52	0.62
	6.27	12.30	11.88	0.51	5.45	3.39	0.14	0.23	4.90	1.44	18.42	0.04
	5.18	11.91	13.51	0.51	4.01	2.55	0.19	0.33	4.95	1.58	15.03	0.38

Table 1 Trade weight calculations for the EER-40 group (cont'd)

(percentages)

	Argentina	Brazil	Chile	Croatia	Iceland	India	Indonesia	Israel	Malaysia
1.1 Euro area exports									
Euro area exports	0.35	1.43	0.30	0.70	0.08	1.72	0.31	0.75	0.66
1.2 Supply structure matrix									
Australia	0.04	0.05	0.21	0.01	0.05	0.22	0.52	0.13	0.90
Canada	0.18	0.39	0.86	0.21	1.10	0.38	0.21	0.66	0.34
Denmark	0.09	0.10	0.27	0.52	7.76	0.10	0.03	0.20	0.06
Hong Kong	0.31	0.45	0.84	0.19	0.23	1.97	0.96	2.80	2.11
Japan	0.75	1.45	3.35	0.24	1.81	2.05	4.57	3.15	9.22
Norway	0.01	0.07	0.19	0.26	4.71	0.16	0.02	0.07	0.09
Singapore	0.08	0.42	0.10	0.03	-	2.67	9.99	0.89	19.53
South Korea	0.48	1.42	3.48	0.47	0.58	2.33	2.13	1.71	3.59
Sweden	0.19	0.35	0.68	0.72	5.58	0.51	0.25	0.62	0.33
Switzerland	0.31	0.60	0.44	1.02	0.48	0.68	0.15	1.74	0.36
United Kingdom	0.40	0.74	0.80	1.25	5.51	1.58	0.21	3.81	1.03
United States	4.91	7.41	14.62	0.59	4.66	4.53	1.13	20.91	7.08
Bulgaria	0.02	0.01	0.01	0.24	0.01	0.02	0.00	0.06	0.01
Czech Republic	0.11	0.09	0.11	2.11	0.69	0.19	0.03	0.69	0.05
Hungary	0.02	0.03	0.03	3.46	0.27	0.04	0.01	0.47	0.03
Latvia	0.00	0.00	0.00	0.01	0.65	0.00	0.00	0.01	0.00
Lithuania	0.01	0.00	0.00	0.03	0.47	0.05	0.00	0.02	0.01
Poland	0.07	0.09	0.08	1.53	1.29	0.08	0.04	0.50	0.11
Romania	0.02	0.02	0.04	0.25	0.08	0.11	0.00	0.19	0.01
China	3.74	4.48	11.96	5.88	1.73	9.07	6.03	7.31	12.80
Algeria	0.00	0.00	0.00	-	0.00	0.00	0.00	-	0.00
Argentina	73.13	2.36	3.94	0.09	0.01	0.02	0.02	0.08	0.02
Brazil	12.01	75.35	5.99	0.03	0.02	0.17	0.18	0.18	0.13
Chile	0.59	0.65	46.66	0.00	0.00	0.02	0.01	0.01	0.02
Croatia	0.00	0.00	0.00	78.95	0.01	0.01	0.00	0.01	0.00
Iceland	0.00	0.00	0.01	0.00	61.14	0.00	0.00	0.00	0.00
India	0.24	0.39	0.69	0.23	0.28	67.85	0.65	2.68	1.21
Indonesia	0.11	0.17	0.18	0.03	0.03	0.26	67.62	0.06	2.16
Israel	0.09	0.25	0.18	0.07	0.08	0.60	0.01	44.28	0.04
Malaysia	0.12	0.16	0.16	0.08	0.05	0.80	1.52	-	29.50
Mexico	1.04	0.81	2.42	0.01	0.03	0.13	0.02	0.13	0.07
Morocco	0.03	0.15	0.00	0.00	0.01	0.25	0.01	-	0.00
New Zealand	0.01	0.01	0.06	0.00	0.02	0.02	0.03	0.03	0.05
Philippines	0.03	0.02	0.08	0.00	0.00	0.06	0.18	0.05	1.23
Russia	0.17	0.41	0.04	0.17	0.06	1.07	0.11	0.84	0.12
South Africa	0.05	0.13	0.13	0.01	0.09	0.27	0.03	0.89	0.17
Taiwan	0.24	0.60	0.65	0.25	0.21	0.75	1.26	0.85	3.33
Thailand	0.33	0.27	0.50	0.08	0.11	0.88	2.02	0.98	4.25
Turkey	0.07	0.08	0.16	0.98	0.18	0.10	0.05	2.99	0.04
Venezuela	0.00	0.02	0.05	0.00	-	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.3 Double export weights									
Export weights	0.41	1.68	0.27	0.64	0.06	2.40	0.61	0.64	0.92
1.4 Import weights									
Import weights	0.14	0.97	0.57	0.34	0.13	1.80	0.63	0.73	1.21
1.5 Overall weights									
Overall weights	0.30	1.37	0.40	0.51	0.09	2.15	0.62	0.68	1.05

Source: ECB.
Note: Countries are ordered alphabetically, according to their introduction to the various groups. Hence, those countries included in the EER-12 basket are presented first followed by those added to form the EER-20 basket and all other remaining countries.

	Mexico	Morocco	New Zealand	Philippines	Russia	South Africa	Taiwan	Thailand	Turkey	Venezuela	Other Countries	Total
	1.16	0.76	0.14	0.21	4.78	1.06	0.69	0.46	2.86	0.23	14.34	100
	0.05	0.01	10.17	0.48	0.02	1.11	1.04	0.93	0.07	0.02	0.76	
	0.88	0.17	0.53	0.19	0.21	0.54	0.36	0.21	0.19	0.38	0.84	
	0.06	0.10	0.25	0.06	0.24	0.25	0.10	0.11	0.27	0.05	1.22	
	0.41	0.36	1.01	3.18	0.25	0.91	4.06	2.26	0.37	0.15	1.87	
	2.32	1.24	3.56	11.21	2.71	4.91	25.26	15.02	1.39	1.00	9.14	
	0.01	0.06	0.04	0.03	0.06	0.09	0.07	0.03	0.15	0.02	0.34	
	0.33	0.56	1.55	5.98	0.10	0.53	5.32	6.55	0.15	0.04	2.29	
	2.12	1.20	1.11	4.96	1.90	1.64	7.03	2.88	2.00	0.83	8.42	
	0.17	0.79	0.29	0.21	0.79	1.15	0.23	0.21	0.78	0.16	2.06	
	0.30	0.91	0.39	0.27	0.63	0.82	0.83	0.55	1.17	0.26	1.67	
	0.34	1.21	1.17	0.55	1.38	4.38	0.75	0.66	2.04	0.28	4.80	
	29.60	1.85	4.07	7.38	1.49	5.68	11.81	3.78	2.26	9.35	13.23	
	0.00	0.04	0.00	0.01	0.11	0.01	0.01	0.01	0.60	0.00	0.23	
	0.06	0.38	0.06	0.08	0.85	0.37	0.05	0.05	0.44	0.02	0.70	
	0.07	0.23	0.03	0.02	0.81	0.37	0.03	0.02	0.71	0.01	0.85	
	0.00	0.01	0.01	0.00	0.24	0.01	0.00	0.00	0.00	0.00	0.07	
	0.00	0.00	0.01	0.00	0.53	0.00	0.00	0.00	0.02	0.00	0.24	
	0.05	0.47	0.04	0.01	1.64	0.37	0.07	0.05	0.88	0.06	1.43	
	0.01	0.42	0.00	0.00	0.20	0.06	0.01	0.01	0.95	0.01	0.42	
	3.31	7.00	4.47	9.90	6.79	9.52	14.16	7.90	5.40	3.10	22.84	
	0.00	0.21	-	-	0.00	0.00	0.00	0.00	0.00	-	0.02	
	0.24	0.01	0.02	0.01	0.02	0.13	0.02	0.05	0.02	0.79	0.58	
	0.96	0.41	0.06	0.15	0.09	1.33	0.39	0.29	0.19	3.11	2.09	
	0.30	0.00	0.01	0.01	0.00	0.09	0.93	0.04	0.16	0.41	0.31	
	0.00	0.01	0.00	0.01	0.04	0.05	0.00	0.00	0.04	0.00	0.32	
	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
	0.15	0.68	0.33	0.58	0.20	1.50	0.36	0.84	0.76	0.14	5.10	
	0.09	0.10	0.34	1.46	0.04	0.44	0.63	1.31	0.31	0.05	1.04	
	0.07	0.06	0.09	0.14	0.12	0.42	0.24	0.25	0.60	0.03	0.30	
	0.34	0.14	0.93	1.91	0.11	0.55	1.89	4.06	0.30	0.04	1.43	
	56.92	0.05	0.06	0.08	0.02	0.18	0.12	0.07	0.03	2.01	1.35	
	0.00	77.44	0.10	0.00	0.01	0.00	0.01	0.03	0.07	0.00	0.14	
	0.01	0.01	67.18	0.08	0.00	0.07	0.05	0.04	0.01	0.01	0.12	
	0.04	0.00	0.03	42.60	0.01	0.10	0.98	0.71	0.03	0.00	0.15	
	0.10	0.62	0.01	0.26	77.04	0.02	0.47	0.34	2.41	0.16	3.72	
	0.03	0.14	0.17	0.04	0.02	59.80	0.43	0.17	0.13	0.03	1.43	
	0.39	0.23	0.72	4.83	0.21	0.98	20.81	2.67	0.71	0.19	2.40	
	0.21	0.43	1.09	3.24	0.12	1.28	1.44	47.89	0.42	0.12	2.54	
	0.03	2.44	0.08	0.06	1.02	0.32	0.05	0.04	73.95	0.03	3.41	
	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.13	0.13	
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
	1.58	0.64	0.15	0.25	4.79	1.11	1.26	1.15	3.28	0.20	-	
	0.72	0.49	0.05	0.36	1.49	0.74	1.66	1.03	2.94	0.08	-	
	1.22	0.58	0.11	0.30	3.39	0.95	1.43	1.10	3.13	0.15	-	

In 2007, the Eurosystem decided to update the trade weights more frequently. As a result, since 2009, trade weights have been updated every three years (i.e. instead of every five years) for a more timely reflection of recent developments in the pattern of international trade.

The weighting scheme for 1995-97, as calculated in 2004 and as adjusted after euro area enlargements, was maintained under the second update of 2009. In addition, new trade weights were calculated on the basis of revised manufacturing trade data for the three-year periods 1998-2000, 2001-03 and 2004-06. Besides these two updates, the trade weights have been recalculated following each enlargement of the euro area.

In the third and most recent update carried out in January 2012, all existing periods were updated with revised manufacturing trade data; moreover, trade weights for the period 2007-09 were also included.

As a result, five sets of weights are currently available, based on trade data for the periods 1995-97, 1998-2000, 2001-03, 2004-06 and 2007-09. For the EERs of the euro, fixed chain-linking on a three yearly basis is used. This means that the indices are chain-linked at the end of each period. A disadvantage of chain-linking is that changes in trade weights have a permanent effect on EERs, even when exchange rates and weights revert to initial levels (Klau and Fung, 2006).[14]

Meanwhile, a central argument in favour of more frequent updates concerns the development of emerging market economies (most notably China) as important global trading partners over the last decade. Consequently, less frequent updates of trade weights may result in a biased effective exchange rate.[15] Di Mauro et al. (2008) have constructed an effective exchange rate of the euro using quarterly time-varying weights for the euro area's 24 most important trading partners and find that the impact of more frequent updates is relatively limited – there is a deviation of about 4%, at most, compared to the official euro EER. Moreover, at higher updating frequencies, third market effects cannot be calculated due to data availability constraints.

PATTERNS OF TRADE WEIGHTS

In recent years, the geographical composition of euro area trade has undergone significant change, which is also reflected in the trade weights of the EERs of the euro. In particular, the growing importance of emerging economies and the steadily intensifying integration of economies in Europe are increasingly shaping the trade linkages of the euro area. Table 2 presents the average trade weights of each country included in the broad EER-40 group for all available periods.

Advanced economies continue to account for a sizeable share of total euro area trade, although the importance of the largest advanced economies in the EER-40 of the euro has been declining over time. Between 1995 and 2009, the two individual countries with the greatest weights were, on average, the United States and the United Kingdom, which together accounted for almost one-third of the EER-40 basket. With Japan, they also were among the euro area's three largest single trading partners in the early period 1995-2000, with a combined weight of, on average, around 45% of the EER-40 basket. However, their combined share in this basket declined to around 30% in the period 2007-09.

The decrease in the share of the largest advanced economies in the EER-40 basket is not due to a decline in trade with the euro area, but reflects instead the growing importance of other regions in the global economy, in particular, the emerging market economies. As a consequence, the combined weight of trading partners from emerging Asia in the EER-40 increased from below 19% in the period 1995-97 to above 27% in the period 2007-09. This expansion results almost exclusively from a substantial increase

14 See Ellis (2001) for more details on the chain-linking of effective exchange rates.

15 The Bank of England uses a time-varying sample of trading partners (Lynch and Whitaker, 2004): a country is included if its average trade weight over the previous three years is higher than a specified threshold value (1% for a narrow group and 0.5% for a broader group of trading partners).

Table 2 Trade weights of countries in the EER-40 group

(percentages)

Country	Period					Average	Change 1995-97 vs 2007-09
	1995-97	1998-00	2001-03	2004-06	2007-09		
United States	16.9	19.4	18.6	15.5	13.5	16.8	-3.4
United Kingdom	18.3	17.7	16.7	14.2	11.9	15.8	-6.4
China	4.4	5.3	7.6	11.4	15.0	8.7	10.6
Japan	9.7	8.8	7.6	6.7	5.8	7.7	-4.0
Switzerland	6.6	5.9	5.7	5.2	5.2	5.7	-1.5
Sweden	4.7	4.3	3.8	4.0	3.7	4.1	-0.9
Poland	2.4	2.8	3.3	3.9	4.9	3.4	2.6
Czech Republic	2.2	2.4	3.0	3.4	4.0	3.0	1.8
South Korea	2.9	2.7	2.8	3.2	3.1	2.9	0.3
Turkey	2.1	2.2	2.3	3.0	3.1	2.6	1.0
Russia	2.4	1.8	2.2	2.9	3.4	2.6	1.0
Denmark	2.6	2.3	2.3	2.2	2.1	2.3	-0.5
Hungary	1.5	2.2	2.5	2.6	2.6	2.3	1.0
Taiwan	2.3	2.4	2.1	1.8	1.4	2.0	-0.8
India	1.5	1.3	1.5	1.8	2.1	1.6	0.7
Hong Kong	2.0	1.7	1.5	1.5	1.3	1.6	-0.7
Canada	1.5	1.6	1.6	1.4	1.3	1.5	-0.1
Singapore	1.8	1.6	1.4	1.4	1.2	1.5	-0.7
Brazil	1.5	1.4	1.2	1.2	1.4	1.3	-0.1
Mexico	0.9	1.2	1.3	1.2	1.2	1.2	0.3
Malaysia	1.2	1.1	1.2	1.1	1.0	1.1	-0.2
Norway	1.3	1.2	1.0	1.1	1.1	1.1	-0.2
Romania	0.7	0.8	1.1	1.4	1.6	1.1	0.9
Thailand	1.2	1.0	1.0	1.0	1.1	1.1	-0.1
South Africa	0.9	0.9	0.9	1.0	1.0	0.9	0.0
Israel	1.0	1.0	0.9	0.7	0.7	0.9	-0.4
Australia	0.8	0.8	0.8	0.8	0.8	0.8	-0.1
Indonesia	1.0	0.8	0.7	0.6	0.6	0.7	-0.4
Morocco	0.6	0.6	0.6	0.6	0.6	0.6	0.0
Croatia	0.5	0.4	0.5	0.5	0.5	0.5	0.0
Philippines	0.4	0.5	0.5	0.4	0.3	0.4	-0.1
Bulgaria	0.3	0.3	0.4	0.4	0.5	0.4	0.2
Argentina	0.6	0.5	0.3	0.3	0.3	0.4	-0.3
Chile	0.3	0.3	0.3	0.4	0.4	0.4	0.1
Algeria	0.3	0.3	0.3	0.3	0.4	0.3	0.1
Lithuania	0.2	0.2	0.2	0.3	0.3	0.2	0.2
Venezuela	0.2	0.2	0.2	0.2	0.2	0.2	-0.1
Latvia	0.1	0.1	0.1	0.2	0.2	0.1	0.1
New Zealand	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Iceland	0.0	0.1	0.1	0.1	0.1	0.1	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	0.0

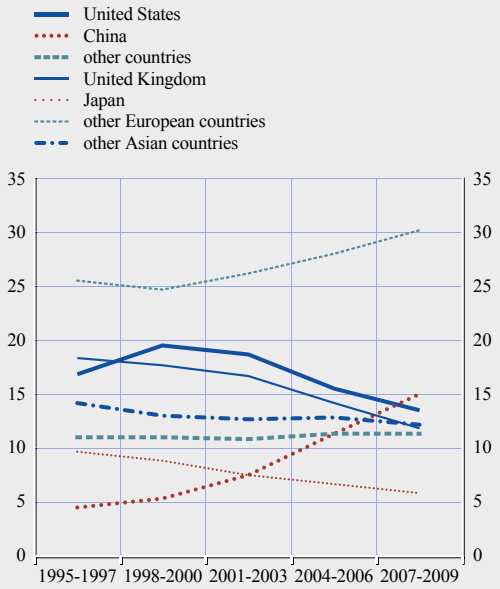
Source: ECB.
Note: trade weights for the EER-20 and EER-12 can be obtained by proportionally rescaling the corresponding countries' trade weights in such a way that they add up to 100.

of about 10 percentage points in the weight of China – this became the euro area's largest single trading partner in the period 2007-09. By contrast, the combined weight of the remaining "BRICs", i.e. Brazil, India and Russia, increased only marginally by 1.7 percentage points, and the share of emerging Asian economies other than China has remained broadly unchanged over time. These trends are all visible in Chart 1, which presents developments in the trade weights of major regions in the global economy, as well as those of the euro area's largest single trading partners.

Historically, in terms of combined weight, the largest group of trading partners in the EER-40 basket is that of "other European countries": the weight of this group increased steadily from

Chart 1 Evolution of trade weights in the EER-40 basket

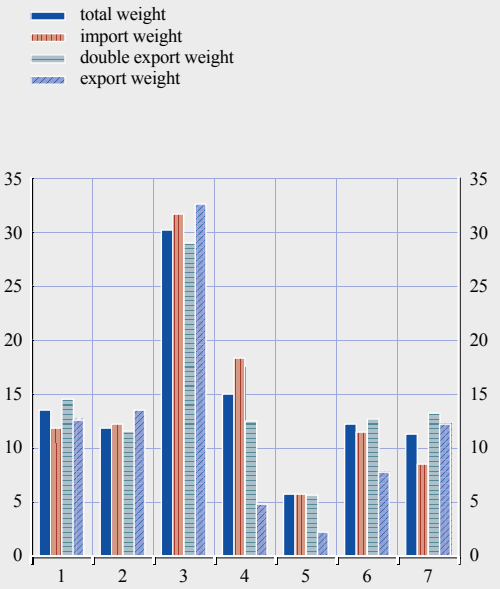
(percentages)



Source: ECB.

Chart 2 Comparison of trade weights for individual countries and country groups in the EER-40 basket

(percentages)



1 United States
2 United Kingdom
3 Other European countries
4 China
5 Japan
6 Other Asian countries
7 Other countries

Source: ECB.

slightly above 25% in the period 1995-97 to above 30% in the period 2007-09. The growing importance of other European economies as major trading partners reflects their geographical proximity and the increasing political, institutional and economic integration within Europe. In fact, the increase in the weight of this group of countries is largely explained by the non-euro area Member States that have joined the European Union since 2004. Since 1995-97, their combined weight has doubled to above 14% of the EER-40 basket, which corresponds to more than eight times their combined share of global GDP and thus underlines the particular importance of trade linkages between these countries and the euro area.

Geographical characteristics are also reflected in the composition of trade weights in terms of the contribution of import and export weights. Chart 2 displays a comparison of total trade weights with the import weights and double export weights that are used for their calculation. For illustrative purposes, simple export weights which ignore third market effects are also plotted. In the case of major advanced and other European economies, the simple export weight generally exceeds the import weight on account of the bilateral trade surpluses of the euro area with these countries. The opposite holds true for emerging Asian economies with which the euro area has an aggregate bilateral trade deficit, reflecting the strong export orientation of these economies.

At the same time, accounting for third market effects leads to some adjustment in the overall trade weights via the double export weights. In particular, in the case of China (and also Japan and other Asian economies), competition between euro area and Asian exporters in third countries results in a significant increase in the overall trade weight assigned to these countries; one beyond the levels implied by direct export linkages.

CAVEATS

Effective exchange rates constructed in the way described in this paper rely on the theoretical foundations outlined by Armington (1969). In particular, it is assumed that there is only one type of good, which is differentiated by the country of origin and exhibits a constant elasticity of substitution.

As highlighted by Klau and Fung (2006), there are some caveats with regard to these assumptions. First, the elasticity of substitution between imports from different countries may differ, given the high degree of international product differentiation. Hence, the effect of identical bilateral exchange rate movements on the domestic economy, taking into account the respective trade weights, may vary across trading partners. Second, due to the one-good assumption, aggregate manufacturing trade data are used for each country. This approach does not take into account the fact that elasticities of substitution may differ across various types of manufactured goods. Added to this, demand for such goods may have different price and income elasticities. More specifically, this assumption has adverse consequences if the product mixes of two competing economies differ substantially, as may be the case when comparing advanced and emerging economies (as in the EER-40 index).

Furthermore, vertical specialisation implies that products from different countries often do not compete with each other but are complementary parts of the international supply chain, which, for example, is relevant for emerging Asian countries. This can lead to biased trade weights, as gross value trade data may obscure the value added at different stages of production. Moreover, for countries involved in international supply chains, this may imply that imports (intermediate goods) and exports (final goods) are complements. As production becomes more specialised across the globe, the elasticity of substitution between goods from different countries may vary even more.

POTENTIAL EXTENSIONS

As indicated above, given improved data coverage trade weight calculations could be extended in the future by broadening the underlying basis to trade in services. In addition, some enhancements to the method used for calculating trade weights for EERs have been proposed over the last decade.[16]

In the light of increasing global trade linkages and country-specific product specialisation, it may be important to take into consideration the sectoral composition of trade. This is particularly relevant in assessing third market effects, as two countries that export to the same third market may not be direct competitors if they sell very different baskets of goods. Esteves and Reis (2006) propose a triple-weighted REER in order to capture the sectoral aspects of competition: first, double weighted export weights are calculated at a sectoral level; second, these sector-specific export weights are aggregated using the weights of each sector in total manufacturing exports. Di Mauro et al. (2008) compare a triple-weighted REER index of the euro with the double-weighted euro REER index and find the differences to be quantitatively relatively small in the case of the euro area as a whole, while they are more sizeable as regards the HCIs of individual euro area Member States.

Another aspect of increased international trade integration is the internationalisation of production processes, including the growing trade in intermediate goods – particularly that directed to countries involved in the labour-intensive, assembly stages of production. Hence, the import content of exports from these countries is relatively high, resulting in the value added of domestic production being relatively

16 In addition to the possible extensions presented, which aim at improving the quality of measures of effective exchange rates vis-à-vis the analysis of competitiveness issues, Lane and Shambaugh (2010) have also developed a financial exchange rate index. This index is weighted by the currency composition of a country's international investment position and can be applied to the analysis of the impact of exchange rate movements on a country's foreign assets and liabilities.

small compared to the reported value of exports. Consequently, countries with a higher than average share of imported intermediate products in the production of exports receive a trade weight that is greater than that which would be implied by the "domestic value added". This could result in a bias when EERs are used in order to assess international competitiveness. Di Mauro et al. (2008) have produced an alternative EER based on the domestic value added content of exports by employing the import content of intermediate consumption from the input-output tables of the Organisation for Economic Co-operation and Development (OECD) as a proxy for the share of imported goods in overall exports. They find that trade weights for industrial countries tend to be higher than under the traditional REER index, while those of emerging Asian and central and eastern European countries (CEECs) tend to be lower. The aggregate effect on the effective exchange rates of the euro is, however, not sizeable.

The BIS has introduced an adjustment for entrepot trade between China and Hong Kong, as a substantial share of China's external trade takes place in the form of re-exports via Hong Kong (Klau and Fung, 2006). Specifically, the BIS corrects the official statistics for trade between China and Hong Kong by using detailed bilateral re-export data in order to identify, for example, the final destination of Chinese exports shipped via Hong Kong. There is some evidence that this type of trade also plays a role in certain euro area countries, such as the Netherlands, possibly leading to biases in the trade weight calculations, especially for HCIs. Currently, data availability constraints for the euro area do not allow for a consistent adjustment of international trade data to take account of entrepot trade.

2.4 THE REAL EFFECTIVE EXCHANGE RATE AND ITS DEFLATORS

FORMULAE AND THEORETICAL CONSIDERATIONS

The real effective exchange rate serves as an indicator of international price and cost competitiveness. In accordance with the calculations of the nominal effective exchange rate, the REER of the euro is calculated as the geometric weighted average of bilateral nominal exchange rates which are deflated using relative price or cost measures:

$$REER^t = \prod_{i=1}^{N} \left(\frac{d^t_{euro} e^t_{i,euro}}{d^t_i} \right)^{w_i} \quad (9)$$

where N stands for the number of competitor countries in the reference group of trading partners, $e^t_{i,euro}$ is an index of the average exchange rate of the currency of partner country i vis-à-vis the euro in period t, d^t_{euro} and d^t_i are, respectively, the deflators for the euro area and partner country i, and w_i is the trade weight assigned to the currency of trading partner i (as calculated in the previous section).

One can infer from equation (9) that it is essential that an appropriate deflator is chosen. Conceptually, Chinn (2006) defines the real exchange rate between two countries (domestic and foreign) as:

$$q_t \equiv e_t + p_t - p^*_t \quad (10)$$

where e_t is the log exchange rate expressed in terms of foreign currency per unit of domestic currency, and p_t and p^*_t are, the domestic and foreign price levels (in log form), respectively. One can decompose p_t into:

$$p_t = \alpha p^N_t + (1-\alpha) p^T_t \quad (11)$$

where p^N_t and p^T_t are the price indices of non-tradable goods and tradable goods, respectively.[17] In addition, α indicates the share of non-tradable goods in the domestic country's aggregate price index. Assuming an equivalent decomposition for the foreign country and substituting equation (11) for equation (10), one obtains:

$$q_t \equiv (e_t + p^T_t - p^{T*}_t) + \alpha (p^N_t - p^T_t) - \alpha^* (p^{N*}_t - p^{T*}_t) \quad (12)$$

17 This decomposition is possible if the price index is a geometric average of the prices of tradable and non-tradable goods.

Hence, one can observe three components of the real effective exchange rate: first, the relative price of tradable goods across the two countries; second, the relative price of non-tradable goods in terms of tradable goods in the domestic country; and, third, the relative price of non-tradable goods in terms of tradable goods in the foreign country.

One can further simplify the formula by assuming that α is equal to α^*. It then follows that:

$$q_t \equiv (e_t + p_t^T - p_t^{T^*}) + \alpha (\hat{p}_t^N - \hat{p}_t^T) \quad (13)$$

where the circumflex denotes the country difference in log terms.

Chinn (2006) calls attention to the implications of equation (13): if one assumes a "dependent economy" that is small relative to the rest of the world and is thus a price-taker in global markets, the focus will be on achieving an internal balance (as represented by the second term in equation 13). If, however, prices of traded goods are not equalised across countries (as suggested by Engel, 1999), and there is little variation in the relative price of non-tradables, the first term of equation (13) is the dominant factor for the REER. Hence, the focus will then be on the external balance and price competitiveness vis-à-vis the rest of the world.

Consequently, the choice of appropriate deflators depends on the two theoretical concepts mentioned above. Under the internal balance scenario, a non-tradables to tradables price ratio would be needed.[18] Under the external balance approach – and the concept of "competitiveness" which is predominantly used in policy discussions – the producer price index could be used as a measure of tradable goods prices.

Another favoured concept is concerned with international cost competitiveness (Marsh and Tokarick, 1996), whereby wages and labour productivity are used to obtain a measure of the unit labour cost. Hence, in this case, the REER is deflated by a cost measure. Alternatively, one can employ the export prices of the domestic and foreign countries to directly determine the relative price of domestic exports.

CHOICE OF DEFLATORS

Aside from these theoretical considerations, it should be noted that there is a trade-off between the concepts of choice and the availability and quality of data. While some indicators are available on a monthly basis (such as consumer prices) and for a broad set of countries, others are only published on a quarterly basis and/or for fewer countries.

The most commonly used deflator is the consumer price index (CPI). This has the advantage of timely and broad data availability and also of comparability (being defined in a similar manner by many countries, in particular, industrial ones). However, CPI baskets include many non-tradable goods and services, while they exclude capital and intermediate goods. This makes the CPI less useful for analysing international competitiveness, particularly if there are significant differences in productivity between the tradable and non-tradable sectors. Moreover, consumer prices can be distorted due to taxes and subsidies.

The producer price index (PPI), on the other hand, includes industrial products and intermediate goods that can be traded internationally, while it excludes retail sales. Consequently, PPIs are viewed as a reasonable proxy for tradable goods prices. Having said this, however, they exclude services prices and their composition and compilation varies considerably across countries.

The GDP deflator (GDPD) also focuses on the production side of an economy. While this also includes non-tradable goods, it suffers from distortions stemming from taxes and subsidies. Furthermore, GDP deflators are published less frequently than CPIs or PPIs.

18 Chinn (2006) suggests using the ratio of the consumer price index to the producer price index for this purpose. However, he mentions several practical and theoretical difficulties associated with this measure.

Export prices would provide a direct measure of prices in foreign markets. Nevertheless, there are some potential drawbacks: export price indices are often only available with time lags, subject to considerable data revisions and not easily comparable across countries due to differences in the composition of export baskets. Moreover, they only include goods that have actually been sold, and typically do not cover transaction prices but unit values. Hence, they can change due to both price and composition/quantity movements. In addition, export price determination is often subject to pricing-to-market behaviour, i.e. exporters adjust their prices to those prevailing in their export markets. As a result, the underlying competitiveness of countries over longer periods might not be reflected.

Turning to cost measures, unit labour costs in the manufacturing sector (ULCM) are often used as a proxy for unit labour costs in the tradable goods sector. This popular measure of competitiveness may, however, be too narrow a concept as it only focuses on a certain sector of the economy. Using unit labour costs for the total economy (ULCT) has the disadvantage that it also reflects costs in non-tradable goods. In general, unit labour cost measures are rather volatile and sometimes subject to significant data revisions. As with GDP deflators, unit labour costs are published less frequently than CPIs or PPIs. In addition, they do not cover all of the costs incurred by firms (e.g. the cost of capital, distribution costs and taxes are excluded). Moreover, factor substitution may affect these indicators without necessarily resulting in a change in productivity. Finally, available cost measures are typically more affected by data quality issues than price measures.

Ca'Zorzi and Schnatz (2008) have empirically assessed which of the above-mentioned indicators performs best for the real effective exchange rates of the euro in terms of explaining export performance. Assessing "in-sample" properties of estimated export equations based on various indicators does not produce any strong conclusions.[19] Also, with regard to forecasting performance, they find that "no particular indicator appears consistently superior". Overall, they conclude that, as deflators, consumer and producer prices are "good approximations of euro area price and cost competitiveness conditions", particularly given the timeliness and historical availability of the related data.

THE VARIOUS REAL EFFECTIVE EXCHANGE RATES

The ECB currently uses a set of five deflators to calculate the real effective exchange rates of the euro: consumer price indices, producer price indices, GDP deflators, and two measures of unit labour costs, for the total economy or ULCT and in the manufacturing sector or ULCM. The consumer price index is available for all countries in the broad EER-40 group and

19 The real effective exchange rate based on consumer prices has a marginally lower standard error. A related test, however, suggests that the producer price-based indicator appears to perform marginally better.

Table 3 Overview of the deflators used to construct the real effective exchange rates of the euro

Deflator	Definition	Trading partners	Frequency
Consumer price index (CPI)	Harmonised index of consumer prices	EER-40 and EER-20	Monthly
Producer price index (PPI)	Producer price index	EER-20	Monthly
GDP deflator (GDPD)	Current price GDP divided by GDP volume	EER-20	Quarterly
Unit labour costs in the manufacturing sector (ULCM)	Compensation per employee divided by value added per employee	EER-20	Quarterly
Unit labour costs for the total economy (ULCT)		EER-20	Quarterly

Source: ECB.
Note: All of the same deflators and frequencies are also applied to the EER-12 group.

thus applied accordingly. However, all of the other deflators are only used for the EER-20 due to deficiencies in the quality and availability of the related data for certain EER-40 countries. Consumer and producer prices are available on a monthly basis, while the other deflators are published quarterly (see Table 3 above for an overview). Where deflators are only available with a time lag, estimations are used. The data are seasonally adjusted and disaggregated from annual data if quarterly data are not available.

Data for the deflators are collected from several sources (mainly Eurostat, the OECD, the BIS and the IMF). For both the euro area and European Union countries, cost and price measures are based on harmonised concepts. For example, the Harmonised Index of Consumer Prices (all items) of Eurostat is used for European countries, while similar national consumer price indices are used for all other trading partners. GDP deflators are derived from quarterly national accounts. Unit labour costs are calculated as the ratio of the compensation per employee and labour productivity, with labour productivity measured as GDP at constant prices divided by the total number of employees.

POTENTIAL EXTENSIONS

A possible extension would be to construct a REER based on export prices, ideally transaction price indices for non-domestic sales rather than unit value indices. Furthermore, a producer price index covering the services sector would be desirable, given the growing importance of the international trade in services.

In addition, Esteves (2007) notes that traditional REERs only take into account changes in prices and costs, and ignore differences in their levels. Differences in price levels could be important from a competitiveness perspective, for example, in the case of an emerging market economy with a low price level that enters the global market. Esteves introduces an indicator of relative price levels as an alternative deflator. This is essentially the difference between the market exchange rate and the purchasing power parity exchange rate. It should be noted, however, that focusing on price levels (rather than price changes) has potential drawbacks, as differences in price levels for tradable goods may be explained by differences in quality. Furthermore, the composition of the basket of tradable goods may differ substantially between two countries.

2.5 BASE PERIOD AND FREQUENCY

The bilateral exchange rates used in the calculations are, in most cases, the ECB's official daily reference rates (indicative rates published by other international organisations are used when these are not available). For the period before 1 January 1999, "proxies" for the bilateral exchange rates of the euro were calculated (see Section 2.6).

The nominal effective exchange rates for the EER-20 are available on a daily basis. Other indicators are available monthly, with the exception of the REER indices based on the ULCT, ULCM and GDP deflators, which are available quarterly. The base period for all indices is the first quarter of 1999 (i.e. 1999 Q1 = 100).

2.6 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 the EMU, earlier EER data are based on a basket of the currencies of those countries that formed the euro area in January 1999.[20] The weights for the pre-1999 "theoretical" euro exchange rates are based on the share of each euro area country in the total manufacturing trade of the euro area vis-à-vis non-euro area countries (from 1995 to 1997). The "theoretical" euro exchange rate for the time until 31 December 1998 is obtained by

20 The 11 initial euro area Member States are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

aggregating the exchange rates of the national currencies of the 11 initial euro area Member States according to the following formula:

$$e_{i,euro} = \prod_{k=1}^{11} \left(e_{i,k}\right)^{w_k^e}, \text{ i} = 1,2,...,N \qquad (14)$$

where $e_{i,euro}$ is the proxy for the exchange rate of the currency of partner country *i* against the euro before 1999, 11 is the number of EMU legacy currencies, *N* stands for the number of partner countries, and $e_{i,k}$ is the exchange rate of the currency of partner country *i* against euro area country *k*'s legacy currency.

The weight for each individual euro area country (among the first 11 Member States) corresponds to its share in the total gross trade flow of the euro area:

$$w_k^e = t_k^a / \sum_{k=1}^{11} t_k^a, \text{ k} = 1, 2,\ldots,11 \qquad (15)$$

where t_k^a denotes the gross trade flow of euro area country *k*. The total gross trade flow of the euro area is defined as total euro area exports to the *H* foreign markets plus total euro area imports from the *N* partner countries in the period 1995-97:

$$\sum_{k=1}^{11} t_k^a = \sum_{j=1}^{H} x_j^a + \sum_{i=1}^{N} m_i^a \qquad (16)$$

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.[21]

2.7 ADJUSTMENTS IN THE EFFECTIVE EXCHANGE RATES OF THE EURO DUE TO EURO AREA ENLARGEMENTS

The trade weights underlying the euro EER which are reported in Table 1 take account of the euro area enlargements of 2001 (Greece), 2007 (Slovenia), 2008 (Cyprus and Malta), 2009 (Slovakia) and 2011 (Estonia).

Specifically, following an enlargement of the euro area, the country joining the monetary union is excluded from the groups of euro area trading partners and included in the computation of euro area data. The overall trade weights and final EERs of the euro, as well as the HCIs of euro area countries, are all recalculated to reflect the changed composition of the euro area and its groups of trading partners.

Two sets of indices are calculated: one which reflects the physical expansion of the euro area over time (i.e. the index for 11 countries until end-2000, for 12 countries from 2001 to 2006, and so forth). For the other set, which is also the one most commonly used, countries that joined the euro area at a later stage are treated as if they had been in the currency union since its inception.

21 Only one weight is given to each of the 11 currencies, assuming implicitly that the importance of a given country's trade in overall euro area trade is the same with regard to all individual competitor countries (i.e. Germany's share in euro area trade with the United States is the same as that for 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, one could argue in favour of assigning a different set of weights to each competitor country currency. However, Buldorini et al. (2002) highlight the practical difficulties involved in such an approach. In addition, no quantitative differences between these two approaches were found when they were applied to the NEER index of the euro.

3 EFFECTIVE EXCHANGE RATES OF THE EURO AND HARMONISED COMPETITIVENESS INDICATORS OVER TIME

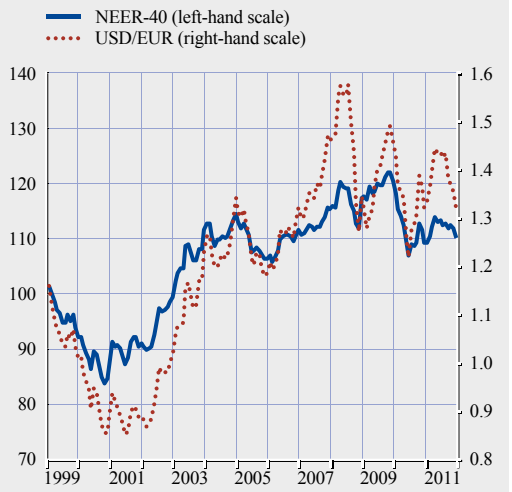
This section first briefly discusses the evolution of the nominal effective exchange rates of the euro, focusing on some of their main traits since the beginning of the EMU. It then presents evidence on developments in the competitiveness of the euro area as a whole as well as that of individual Member States, namely based on euro REERs and the HCIs of euro area countries, respectively.

3.1 NOMINAL EFFECTIVE EXCHANGE RATES OF THE EURO

The nominal EER-40 is presented in Chart 3, together with the euro/US dollar bilateral rate – the US dollar is the currency of the euro area trading partner with the greatest average weight (16.8%) in the EER-40 basket between 1995 and 2009. In addition, the currencies of some of the euro area's most important trading partners, in particular of countries in Latin America and Asia, were closely linked or even pegged to the US dollar. The average effective weight of the US dollar in the EER-40 basket was thus about 40% during the period 1995-2009. As a result, the nominal EER-40 broadly reflects movements in the euro/US dollar bilateral rate, despite some noticeable divergences (in particular in the wake of the global financial crisis that erupted in 2008).

Chart 3 Nominal EER-40 and the euro/US dollar rate

(January 1999-January 2012)



Source: ECB.
Note: A downward movement reflects a depreciation of the euro, while an upward movement indicates an appreciation of the single currency.

In a first period, after the introduction of the single currency in 1999 and up until the end of the year 2000, the nominal effective exchange rate of the euro depreciated, largely due to an appreciation of the US dollar against the single currency. Thereafter, in a second period that lasted until the beginning of 2004, this trend reversed as the euro started to appreciate steadily against the US dollar, prompting an increase in the euro EER over this period. Since then, and until early 2012, the nominal effective exchange rate of the euro has been oscillating in a relatively narrow band of roughly ±5%, while the euro/US dollar bilateral rate has fluctuated more substantially, particularly since the emergence of the first financial market turbulence in 2007. After this turbulence intensified and triggered the global financial crisis, movements in the effective exchange rate of the euro were, as with other financial market variables, to a large extent associated with increased risk aversion and rapidly changing financial market sentiment. Initially, the euro broadly appreciated against major currencies on account of increased global risk aversion, amid wide swings in its bilateral exchange rate with the US dollar. However, this trend reversed in late 2009 and early 2010, with the increased tensions in certain euro area sovereign debt markets. Although the euro EER remained relatively stable thereafter, the single currency continued to fluctuate significantly against the US dollar, in line with changing perceptions about fiscal prospects and the outlook for monetary and economic policies in the euro area and other major advanced economies.

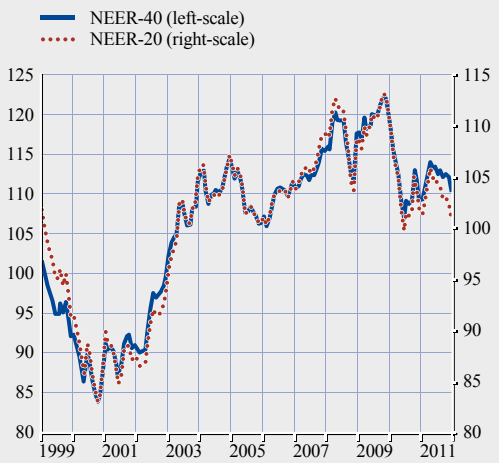
A noticeable characteristic of the nominal EER-40 is that, since the introduction of the single currency, it has been less volatile than the euro/US dollar rate as well as the bilateral

rates for most of the other floating currencies included in the EER-40 basket. Indeed, euro NEER volatility, as measured by the monthly standard deviation of percentage changes in the EER-40, has been about 1.5% since the inception of the EMU. To put this into perspective, this compares with a figure of 2.8% for the bilateral exchange rate of the euro against the Japanese yen and the US dollar and the volatility of 1.8% in the euro/sterling rate over the same horizon. This, in turn, reflects the fact that changes in bilateral rates can offset each other in the calculation of effective exchange rates and thus lower the volatility of the latter; perhaps a desirable property of the exchange rate indicators used in empirical economic analysis.

The NEERs of the euro constitute a coherent set of indicators summarising the evolution of the euro against the currencies of a broad set of trading partners. As shown in Chart 4, the nominal EER-40 is highly correlated with that of the EER-20, which is based on a smaller set of trading partners. In fact, the correlation between both indices reaches 99%, implying an almost perfect comovement of both measures. This close correlation reflects the fact that the currencies included in the EER-20 basket account for more than 80% of those in the basket for the EER-40. It also indicates that the EER-20 provides a representative picture of the evolution of the euro's external value against the currencies of a broader set of trading partners.

Chart 4 Nominal EER-40 and the nominal EER-20

(January 1999-January 2012)



Source: ECB.
Note: A downward movement reflects a depreciation of the euro, while an upward movement indicates an appreciation of the single currency.

3.2 REAL EFFECTIVE EXCHANGE RATES OF THE EURO

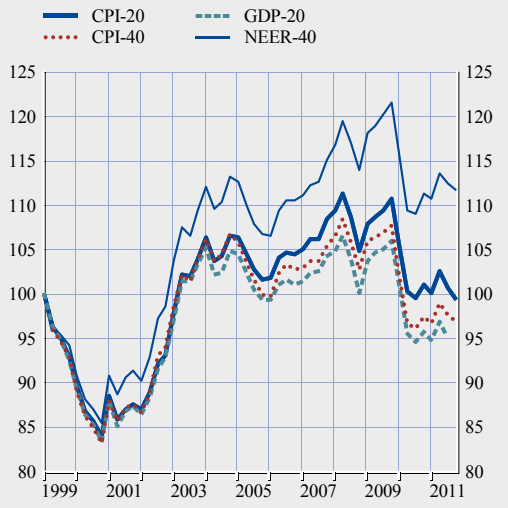
The close comovement between the nominal EER-20 and EER-40 is particularly advantageous, given that real effective exchange rates (except the one based on CPI deflators) can only be computed for countries included in the EER-20 due to limitations in the availability of data on price and cost developments in some of the euro area's trading partners (as already described in Section 2.4).

Chart 5 demonstrates that most of the variation in the CPI-based REER-40 is accounted for by movements in the nominal EER-40. Furthermore, the CPI-based REER-40 has deviated only very slightly from the corresponding REER-20 since the introduction of the euro, i.e. by around 2% in cumulative terms.

Altogether, this suggests, first, that changes in euro REERs are dominated by movements in euro NEERs and, second, that developments in relative prices between the euro area and countries included in the EER-20 basket are broadly representative of the evolution of euro area competitiveness, also against a broader set of trading partners. Thus, overall, it is plausible that REERs based on deflators other than consumer prices, while only computed against the currencies of 20 trading partners, still provide a fairly accurate picture of the euro area's competitiveness in terms of other price and cost measures.

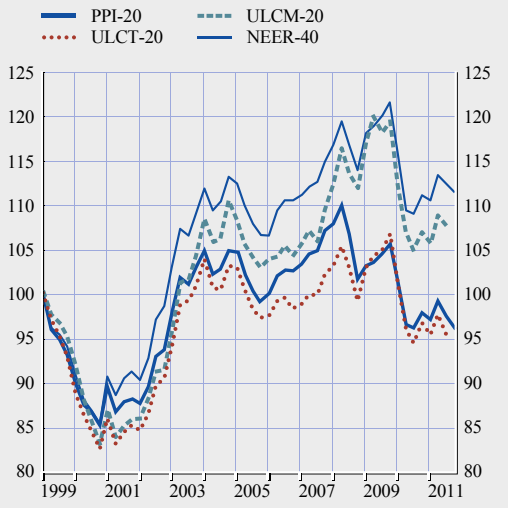
In fact, the cross-correlations between the real effective exchange rates based on different deflators reach 99% in all cases. As a result, all but one of the euro REERs deflated by different price and cost indicators point to a slight improvement in euro area competitiveness since

Chart 5 Nominal EER-40 and selected REERs



Source: ECB.
Note: A downward movement reflects a depreciation of the euro, while an upward movement indicates an appreciation of the single currency.

Chart 6 Nominal EER-40 and selected REERs



Source: ECB.
Note: A downward movement reflects a depreciation of the euro, while an upward movement indicates an appreciation of the single currency.

the introduction of the single currency. Given that euro NEERs have also appreciated slightly since then, the modest depreciation of the euro that has taken place in real terms since its launch reflects an overall lower rate of increase in the deflators compared to the euro area's main trading partners. The only exception here is the REER-20 based on unit labour costs in the manufacturing sector, which has appreciated since the inception of the EMU (see Chart 6).

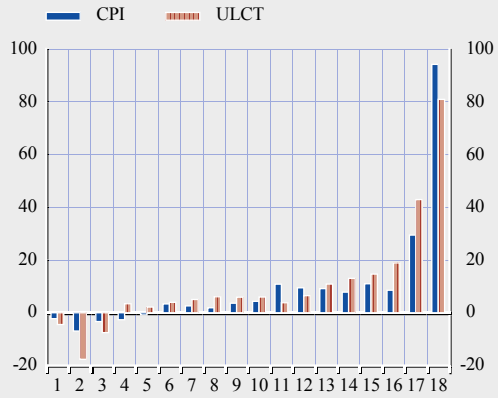
The divergence between the REER deflated by manufacturing sector unit labour costs, on the one hand, and the REERs based on alternative deflators, on the other, partly reflects the growing importance of emerging and transition economies in the trade weights used to calculate the effective exchange rates of the euro (as described in Section 2.3). First, emerging and transition economies are subject to a process of economic convergence which is often accompanied by a gradual upward shift in price levels and thus higher rates of inflation, prompting continued real currency appreciation. At the same time, productivity gains in emerging and transition economies are typically most pronounced in the manufacturing sector. These lead to a reduction in unit labour costs in this sector, which partly explains the loss in euro area competitiveness indicated by the REER-20 based on unit labour costs in the manufacturing sector.

3.3 HARMONISED COMPETITIVENESS INDICATORS OF EURO AREA COUNTRIES

Changes in the real effective exchange rate of the euro reflect changes in the competitiveness of individual euro area Member States vis-à-vis their main trading partners outside the currency union. However, the real effective exchange rate of the euro does not show competitiveness developments within the euro area and the differences in this regard between individual Member States: their competitiveness is also shaped by developments in relative prices and costs between the euro area countries themselves. Chart 7 shows that developments in the price and cost competitiveness of individual euro area Member States, compared with the rest of the euro area and countries included in the EER-20 basket, have been very diverse since the inception of the euro.

Chart 7 Harmonised competitiveness indicators

(percentage change between 1999 Q1 and 2011 Q4)



1	Euro area	7	Netherlands	13	Malta
2	Germany	8	Italy	14	Cyprus
3	Austria	9	Slovenia	15	Ireland
4	France	10	Portugal	16	Luxembourg
5	Finland	11	Spain	17	Estonia
6	Belgium	12	Greece	18	Slovakia

Source: ECB.
Note: Countries ranked in ascending order according to the average percentage change for the CPI-deflated and ULC-deflated harmonised competitiveness indicators. The values for the euro area are based on the REER-20. A negative value indicates an increase in price or cost competitiveness and vice versa.

This diversity is partly explained by the fact that some euro area countries were subject to a process of economic convergence before introducing the single currency, for example, those that joined the currency union after 2007. Hence, such countries generally recorded a higher rate of increase in prices and costs. Having said this, other factors are also likely to have played a role. In fact, the divergence in competitiveness is more pronounced in the harmonised competitiveness indicators based on unit labour costs, while CPI-deflated harmonised competitiveness indicators have diverged less. For most euro area countries, the gap between the percentage change in CPI-deflated and ULC-deflated competitiveness is actually larger than that for the euro area as a whole. As a result, since the beginning of the EMU, developments in prices, wages and productivity have tended to diverge within certain Member States, albeit whilst remaining closely linked for the euro area as a whole and generally contributing to a slight improvement in euro area price and cost competitiveness.

4 CONCLUSION

This paper provides a detailed update of the ECB methodology for calculating euro effective exchange rates presented by Buldorini et al. (2002). In particular, it explains modifications in the methodology that have been introduced over the last decade regarding the partner countries included in the EER and HCI indices, the practice of calculating trade weights and the choice of deflators. Hence, the paper may serve as a comprehensive reference guide for researchers and users of the ECB's euro effective exchange rates.

Whilst the main focus is on the approach used to calculate effective exchange rates and harmonised competitiveness indicators, it also highlights the advantages and drawbacks of the Eurosystem's choices in constructing these indices. Consequently, the paper presents possible avenues for further enhancing the indices in the future and provides comparisons with the methodologies applied by other institutions.

It also notes the challenges arising from data constraints, both in respect of the quality and availability of the data required to calculate effective exchange rates. In particular, reliable data on unit labour costs may not always be available, as these are often volatile and subject to significant revisions. Furthermore, due to incomplete data coverage regarding the cross-sectional and time dimension, it is still not possible to use services trade data to the same extent as data on trade in manufactured goods in the calculation of trade weights.

Finally, the paper discusses the evolution and main traits of the effective exchange rates of the euro since the inception of the Economic and Monetary Union, and presents evidence on developments in the competitiveness of the euro area as a whole as well as of individual euro area Member States. While the growing importance of China is reflected in the updated trade weights of the effective exchange rates of the euro, it appears that the increasing integration of the euro area with other European economies accounts for the largest variation in trade weights. The US dollar, an anchor currency for a number of large emerging markets, continues to play an important role for the effective exchange rate of the euro and euro area competitiveness. Overall, since the introduction of the single currency, the competitiveness of the euro area has improved slightly relative to its main trading partners, but there remains a significant degree of heterogeneity across euro area countries. The harmonised competitiveness indicators are therefore a useful complement to the EERs in the analysis of euro area competitiveness.

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APPENDIX

A comparison of different methods used by selected organisations to calculate effective exchange rates

Institution	Trade basis	Trading partners	Euro area classification	EERs of the euro
ECB	Manufactured goods (SITC 5-8)	EER-40 EER-20 EER-12	Euro area as a single entity	EER-40 EER-20 EER-12
European Commission DG ECFIN	Total goods	IC41 IC36 EU27	The 17 euro area Member States are counted indiviudally in all groups	IC41: 24 trading partners IC36: 19 trading partners
BIS	Manufactured goods (SITC 5-8)	Broad-58 Narrow-27	B58 includes 15 euro area Member States and the euro area individually[1)] N27 includes 11 euro area Member States and the euro area individually	B58: 42 trading partners N27: 15 Trading partners
IMF	Manufactured goods (SITC 5-8)	26 countries	Includes 12 euro area Member States[2)]	14 partners
	Manufactured goods (SITC 5-8), commodities (overall weight in global markets), and services (same weights as manufacturing except for countries where tourism is important)	184 countries	Includes 17 euro area Member	167 partners
Federal Reserve Board	Total goods (excluding gold and military items from exports, oil from imports)	Broad Index: 26 OITP Index: 19 Major Index: 7	All indices include the euro area as a single entity	NA
Bank of England	Manufactured goods and services	Narrow ERI: 17 countries[4)] Broad ERI: 25[5)]	Both include the euro area as a single entity	Available

1) Estonia still featured as non euro area member, Luxembourg excluded from analysis.
2) Cyprus, Estonia, Malta, Slovakia, Slovenia not included individually.
3) The IMF does not update the weights at a regular frequency, but at infrequent intervals.
4) Time varying country coverage: included if trade weight average over the past three years >1%.
5) Time varying country coverage: included if trade weight average over the past three years >0.5%.

EERs/HCIs of EA countries	Weighting methods	Update of weights	Deflators
EER-20 and EER-40 composition plus the 16 other euro area Member States	Weighted average of import and double export weights (including weighted third market effects)	Average weight fixed over three years, updated every three years	CPI, PPI, GDP deflator, ULCM, ULCT
IC36 and IC41 composition plus the 16 other euro area Member States	Double export weights (including weighted third market effects)	Annual weights, updated yearly	CPI, GDP deflator, Export prices, ULCT, ULCM
N27 composition plus 10 othere uroa reaM emberS tates B58 composition plus 14 euro area Member States	Weighted average of import and double export weights (including weighted third market effects)	Average weight fixed over three years, updated every three years	CPI
14 partners + 11 other euro area Member States	Weighted average of import and double export weights (including weighted third market effects)		ULC
167 partners + 16 other euro area Member States	Weighted average of import and double export weights (including weighted third market effects) for manufacturing, simple weights for other categories	Average weight over 2004-2006, updated discretely[3)]	CPI
NA	Average of import and double export weights (including third market effects), equal weights for exports and imports	Annual weights, updated yearly	CPI
NA	Fixed weighted average of import and double export weights (including third market effects for manufacturing)	Annual weights, updated yearly	CPI

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