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**NO 94 / SEPTEMBER 2008**

**THE CHANGING ROLE OF  
THE EXCHANGE RATE IN A  
GLOBALISED ECONOMY**

by Filippo di Mauro,  
Rasmus Ruffer and Irina Bunda



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# THE CHANGING ROLE OF THE EXCHANGE RATE IN A GLOBALISED ECONOMY<sup>1</sup>

by Filippo di Mauro<sup>2</sup>, Rasmus Ruffer  
and Irina Bunda



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<sup>2</sup> Corresponding author: Head of Division of the External Developments Division, European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany; e-mail: [filippo.di\\_mauro@ecb.europa.eu](mailto:filippo.di_mauro@ecb.europa.eu).

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**Address**

Kaiserstrasse 29  
60311 Frankfurt am Main  
Germany

**Postal address**

Postfach 16 03 19  
60066 Frankfurt am Main  
Germany

**Telephone**

+49 69 1344 0

**Website**

<http://www.ecb.europa.eu>

**Fax**

+49 69 1344 6000

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## ABSTRACT

In addition to its direct effects on the global trading and production structure, the ongoing process of globalisation may have important implications for the interaction of exchange rates and the overall economy. This paper presents evidence regarding possible changes in the role of exchange rates in a more globalised economy. First, it analyses the link between exchange rates and prices, showing that there is at most a moderate decline in exchange rate pass-through for the euro area. Next, it turns to the effect of exchange rate changes on trade flows. The findings indicate that the responsiveness of euro area exports to exchange rate changes may have declined somewhat as a result of globalisation, reflecting mainly shifts in the geographical and sectoral composition of trade flows. The paper also provides a firm-level analysis of the impact of exchange rate changes on corporate profits, which suggests that overall this relationship appears to be relatively stable over time, although there are important cross-country differences. In addition, it studies the overall impact of exchange rates on GDP and the potential role of valuation effects as a transmission channel in the case of the euro area.

Key words: Globalisation, exchange rate, trade, exchange rate pass-through, valuation effects.

JEL: E3, F15, F31.



**NON-TECHNICAL SUMMARY**

Globalisation has resulted in a new configuration of world trade, production and finance, and has had a direct impact on international competitiveness, trade and financial flows and relative prices. In addition, it has brought about changes in the dynamic interactions of economic variables, including possibly the way changes in the exchange rate affect the economy. Should these changes prove to be substantial, this could have far-reaching implications for the international transmission of shocks and, above all, for the mechanism through which monetary policy is transmitted and affects inflation. Given the relevance of this subject for policy-making, the objective of this Occasional Paper is to establish whether and how the forces of globalisation may have altered the way exchange rate changes impact on the euro area economy.

From a conceptual point of view, the response to the above issue is far from unambiguous. On the one hand, stronger international competition may have, for example, weakened the link between exchange rate movements and trade volumes, as more intense competition intensifies the pricing-to-market behaviour of exporters. Similarly, the higher import content of exports associated with globalisation tends to reduce the effect of an exchange rate change, as the impact on export prices is partly offset by the change in the price of imported inputs. On the other hand, increased competition may imply that importers react more strongly to changing relative prices between different suppliers, thus increasing the responsiveness of trade flows to changes in the exchange rate. Moreover, lower trade costs, by making access to foreign markets easier, may also contribute to increasing the sensitivity of trade along the extensive margin, i.e. through entry and exit. As a result, the overall impact of globalisation on the way exchange rate swings affect the economy depends on the relative strength of these different factors, and can thus be assessed only from an empirical standpoint.

To set the scene, the first chapter presents some general information about the historical

evolution of the euro exchange rate along with an overview of the globalisation process and its impact on the euro area economy. In that context, it is important to note that the exchange rate is only one factor affecting the euro area, amid a broad range of transmission channels of the external environment. Simulations using the Area Wide Model suggest that, on average, during the first half of the 2000s, positive and negative variations in competitors' export prices in foreign currency, as well as in the nominal effective exchange rate of the euro, have been partially cancelled out in a context of strong global demand driving euro area growth. In the latter part of the chapter, a statistical analysis is undertaken aimed at investigating whether the globalisation process has altered the information content of the euro real effective exchange rate. After introducing a number of adjustments to the calculation of individual countries' weights in order to capture globalisation-related changes to the trade configuration, it is shown that, overall, the currently used measures of cost and price competitiveness are still broadly appropriate for international and historical comparisons.

In the second chapter, the relationship between nominal exchange rates and prices and possible changes therein are analysed. Recursive estimates provide evidence of the rather stable pricing-to-market behaviour of euro area exporters, despite an acceleration in the pace of real integration and stronger competitive pressures over the recent period. Regarding possible changes in the relationship between nominal exchange rates and domestic prices over time, evidence for the euro area is less conclusive than for the United States, where studies have unanimously pointed to a decline in the exchange rate pass-through over time. Looking at the time-variability of the exchange rate pass-through to import prices, empirical results suggest that there may have been some decline in the pass-through for the euro area, possibly related to a shift to sectors with relatively low exchange rate pass-through in the import structure. As for the impact of globalisation on the relationship between exchange rates and consumer price inflation, the results of a rolling panel VAR estimation for the

period 1980-2007 point to a significant degree of heterogeneity within the euro area.

In order to empirically assess whether trade flows may have decoupled from the exchange rate, the third chapter analyses the relationship between real exchange rates – as an indicator of international price competitiveness – and trade flows. The recursive estimation of a standard econometric model of trade suggests that the impact of exchange rate changes on extra-euro area export volumes of goods may have somewhat declined over time. This decline is, however, not observed for all euro area countries, with cross-country heterogeneity possibly reflecting differences in the extent to which the use of imported inputs in the production of export goods has increased over time.

Based on a gravity model of trade, disaggregate estimates of exchange rate sensitivities of exports in different industries and to various export destinations are presented, showing significant sectoral and geographical heterogeneity. It is shown that changes in the sectoral composition of exports (“industry composition effects”) tend to reduce the overall responsiveness of export for all euro area countries examined, as exports have shifted towards sectors with relatively low exchange rate sensitivities. In contrast, changes in the geographical structure of exports (“geographical composition effects”) have been more diverse and may thus be more relevant in accounting for cross-country differences across euro area member states.

The fourth chapter analyses other effects of exchange rate changes on the economy. First, the overall relationship between exchange rates and GDP is investigated. The results of a rolling panel VAR regression suggest that the impact of an exchange rate shock on euro area GDP has remained fairly stable over time. Second, the chapter analyses the link between exchange rates and economic performance, taking a firm-level perspective. Drawing on an empirical analysis conducted at the ECB for listed firms in six industrial countries for the period 1973-2007, the response of corporate earnings to exchange

rate changes appears to be relatively stable over time for most countries. Third, the chapter shows that valuation effects, through the impact of an exchange rate change on the domestic currency value of foreign assets and liabilities holdings, may also play a role in the transmission mechanism of economic shocks. These effects are likely to have become stronger as a result of financial globalisation. The direction of this effect crucially depends, however, on the currency denomination of countries’ assets and liabilities. Calculations for the euro area show that these valuation effects are potentially becoming more important in the presence of tighter links between the euro area and its external environment.

In sum, the results suggest that the impact of the globalisation process on the effect of exchange rate movements on major economic aggregates in the euro area appears to be fairly moderate. While the evidence for the impact on prices and trade flows seems to indicate some reduction in the responsiveness to exchange rate changes, increased international financial integration suggests that the valuation channel should have been strengthened by globalisation. On the price side, the evidence is rather mixed, indicating at most a moderate decline in exchange rate pass-through to euro area import and consumer prices, which appears to be less pronounced than in other industrialised countries, most notably the United States. Regarding trade flows, the analysis provides some evidence that the responsiveness of euro area exports to changes in the exchange rate has declined somewhat for goods over the past decade. At the same time, the responsiveness of euro area services exports appears to have increased more noticeably. In general, disaggregate evidence on both prices and trade indicate that composition effects appear to play an important role in shaping the response of the economy to exchange rate changes. Thus, the main effect of globalisation on the role of the exchange rate may come through the changes in the regional and sectoral composition of trade flows rather than via other structural changes, such as increased competitiveness or the progressive internationalisation of the production process.

## INTRODUCTION

Globalisation, or the increased global interdependence of economies through trade, production and financial linkages, is a complex albeit not a new phenomenon. During the early stages of the globalisation process, the fall in transportation costs and the reduction in trade barriers enabled the geographical separation of production and consumption, contributing to a more efficient international allocation of resources and overall better growth outcomes for liberalising countries. The more recent wave of real and financial globalisation, which started around the mid-1980s, driven by the dismantling of trade barriers, the liberalisation of capital controls and significant technological advances in information and communication technologies, has brought about major changes in both production and trade patterns. Tasks that previously were performed in one firm have become tradeable owing to the decline in communication and transaction costs. The increasing international fragmentation of the manufacturing process internationally and the slicing up of the value-added chain across national borders are major features of this process. In addition, the globalisation process has been stimulated by the emergence of a number of new players, above all China, which has increased the effective global supply of cheap labour. All these changes have directly affected international competitiveness, trade flows and relative prices.

The acceleration of the globalisation process over the past decade, which has involved an unprecedented number of countries, has resulted in a new configuration of world trade, production and finance, while also modifying the way in which economies react to exogenous shocks. These structural changes have often translated into impacts of a qualitative rather than a merely quantitative nature, giving rise to calls for a new paradigm to capture all dynamic international interactions of macroeconomic variables.<sup>1</sup> To complicate matters, the formation of the European Monetary Union (EMU), with the introduction of the euro in 1999, has also affected trade and

financial flows, in particular, among euro area member states themselves. As a result – as will be seen later – globalisation impacts are extremely difficult to identify when intertwined with powerful phenomena such as EMU.

In addition to directly shaping international production and trading patterns, globalisation may have also affected economies in more subtle ways by altering the various international transmission channels. In particular, it may have changed the impact of exchange rate movements on economic performance. From a policy perspective, the understanding of the changing relationship between exchange rates and economic performance is extremely relevant for the euro area, given its relatively high degree of openness compared with other major economies, at both aggregate and country level. An analysis of possible changes in this relationship is crucial in order to appropriately assess the likely impact of monetary policy actions. Furthermore, apart from being an independent source of shocks, exchange rates may also act as an automatic stabiliser and have a role to play in the resolution of global imbalances.

Despite the potentially important policy implications of globalisation-related changes to the exchange rate-economy nexus, empirical evidence on this issue for the euro area is rather scarce and fragmented. The present paper aims to fill this gap in the literature and proposes a synthetic view of the evolving role of exchange rates for the economy by drawing on empirical work carried out at the ECB. The analysis focuses, in particular, on potential changes in the past ten to fifteen years, as this is the time frame during which the effects of globalisation have been most noticeable. The concrete sample periods used in the various sections may, however, vary due to data availability.

The paper is organised as follows:

The first chapter highlights some of the main developments in the exchange rate of

<sup>1</sup> See for instance Grossmann and Rossi-Hansberg (2006).



the euro in recent years and provides some evidence regarding the major direct impacts on the euro area economy of the increasingly global dimension of economic and financial transactions. In order to put the discussion into context, a broader perspective is subsequently taken by analysing more generally the effects of external influences on the euro area over recent years. The analysis shows that, while exchange rate changes can at times have a strong influence on the euro area, other influences appear, on average, to have been more important, in particular, developments in foreign demand. Lastly, the chapter provides a quantitative assessment of the impact of globalisation-related structural changes on the measurement of the real effective exchange rate – the traditional measure of a country's international cost and price competitiveness.

The second chapter focuses on the relationship between nominal exchange rates and prices, one of the most direct channels through which changes in exchange rates affect the economy. After reviewing some model-based evidence on exchange rate pass-through (ERPT) and the pricing-to-market behaviour of euro area exporters, the chapter investigates whether the link between exchange rates and euro area prices has undergone significant changes over time, possibly related to the ongoing process of globalisation. This analysis is undertaken at different stages of the pricing chain, including import prices and consumer prices. The chapter also provides some insights into the possible factors underlying the variability of exchange rate pass-through over time, with a special focus on potentially higher pricing-to-market in emerging market economies and changes in sectoral ERPT.

The third chapter turns to the link between exchange rates and trade flows by assessing how globalisation may have changed the traditional expenditure-switching effect of changes in exchange rates. To this end, two complementary approaches are used: an aggregate trade equation and a disaggregated sector-level, gravity-type analysis of bilateral trade flows. This analysis

is also employed to gain some understanding of geographical and sectoral composition effects in driving the dynamics in the relationship between exchange rates and trade flows.

The fourth chapter investigates the link between globalisation and other impacts of exchange rate changes on the economy. First, the chapter analyses the relationship between exchange rates and overall GDP, and possible changes therein over time. Contrary to Chapters 2 and 3, the fourth chapter takes a microeconomic view by focusing on how exchange rate changes may impact firm-level performance. To this end, it presents some findings on the link between the exchange rate and firms' earnings in selected industrialised countries. Furthermore, the chapter addresses other potential transmission channels of exchange rate changes on the euro area economy. In particular, against the background of increased financial integration and a significant increase in gross cross-border holdings of assets and liabilities, it focuses on the increasing role of valuation changes.

In sum, the results suggest that the impact of the globalisation process on the effect of exchange rate movements on major economic aggregates in the euro area appears to be fairly moderate. While the evidence for the impact on prices and trade flows seems to indicate some reduction in the responsiveness to exchange rate changes, increased international financial integration suggests that the valuation channel should have been strengthened by globalisation. On the price side, the evidence is rather mixed, indicating at most a moderate decline in ERPT to euro area import and consumer prices, with the decline appearing to be less pronounced than in other industrialised countries, most notably the United States. Regarding trade flows, the analysis provides some evidence that the responsiveness of euro area exports to changes in the exchange rate has declined somewhat for goods over the past decade. At the same time, the responsiveness of euro area services exports appears to have increased more noticeably. In general, disaggregate evidence on both prices and trade indicates that

composition effects appear to play an important role in shaping the response of the economy to exchange rate changes. Thus the main effect of globalisation on the role of the exchange rate may come through the changes in the regional and sectoral composition of trade flows rather than via other structural changes, such as increased competitiveness or the progressive internationalisation of the production process.

## I EURO EXCHANGE RATE AND GLOBALISATION: STYLISTED FACTS

In order to put the overall discussion into perspective, this chapter provides a general overview of the major trends in the exchange rate of the euro in recent years. In addition, it briefly reviews the main impacts of the real and financial globalisation process on the euro area economy. It also assesses the quantitative importance of external factors in shaping the evolution of economic activity in the euro area during the recent past, with special emphasis on the role of the exchange rate in that respect. Finally, the chapter presents a quantitative analysis of the potential impact of globalisation on the measurement of the real effective exchange rate of the euro, which is the most commonly used measure of international cost and price competitiveness of the euro area.

### I.1 OVERVIEW OF DEVELOPMENTS IN THE EURO EXCHANGE RATE

The euro – and prior to 1999 its legacy currencies – has experienced significant fluctuations vis-à-vis the currencies of its main trading partners in recent decades (see Chart 1). Since 1980 the euro has undergone two major swings against the

US dollar, depreciating noticeably in the first half of the 1980s, followed by a rapid turnaround in the second half of the decade. This episode was followed by a period of relative stability, which was, however, accompanied by significant shorter-term volatility. The second swing started in 1995, resulting in a significant weakening of the euro, which lasted until late 2000. Subsequently, the single currency recovered most of these losses relatively quickly. More recently, the euro has reached historical highs vis-à-vis the US currency, trading above USD 1.50. It has also exhibited significant fluctuations against the Japanese yen, with a general depreciating trend between 1980 and 2000. Subsequently, the euro appreciated noticeably against the Japanese currency in the context of more limited shorter-run volatility. However, this trend has come to an end in the context of the financial market turbulence, which started in the summer of 2007.

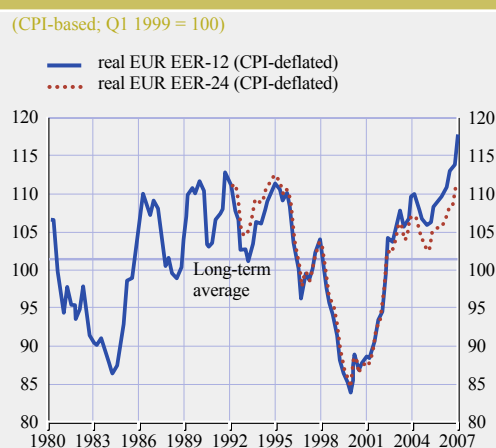
In real CPI-deflated effective terms, i.e. aggregating the bilateral exchange rates of the euro against the currencies of its major trading partners according to their weight in the euro area's overall trade flows, the euro has also exhibited significant swings over the past three decades (see Chart 2). Similar to developments

**Chart 1 Nominal exchange rate of the euro (on DEM basis) vis-à-vis the US dollar and the Japanese yen**



Source: ECB.  
Note: Last observation refers to May 2008.

**Chart 2 Euro real effective exchange rate**



Source: ECB.  
Notes: Trade-weighted average using double export weights. Long-term averages refer to 1980-2007 in the case of the EER12 and 1993-2007 in the case of the EER24. Last observation refers to December 2007.

in the bilateral rate vis-à-vis the US dollar, the real effective exchange rate (REER) of the euro experienced major troughs in 1985 and 2000 and major peaks in the mid-1990s, in 2004 and at the end of the sample period. In December 2007 the effective exchange rate of the euro against 12 and 24 major trading partners was about 16% and 10% above their respective longer-term averages, for the period 1980-2007 in the case of the REER-12 and 1993-2007 in the case of the REER-24.

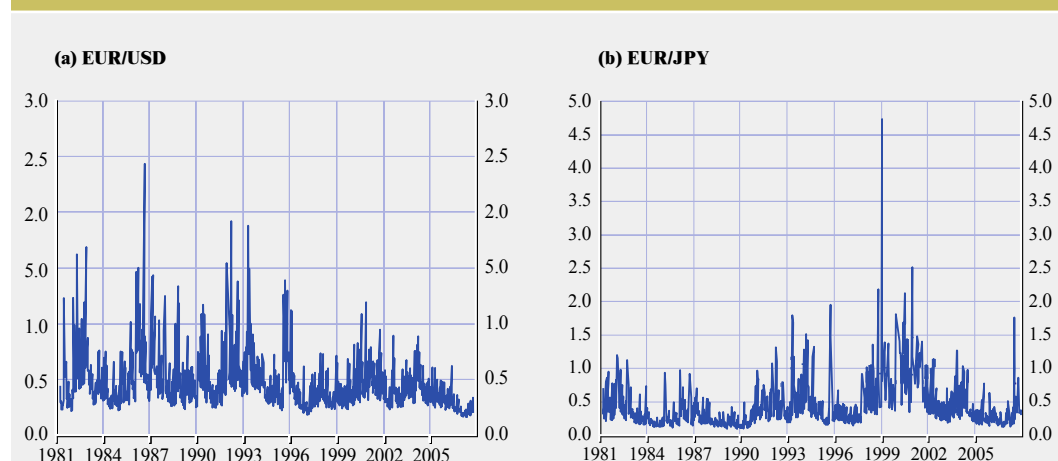
In analysing the impact of exchange rate changes – and, in particular, the way it has possibly changed over time – it is important to understand the extent to which exchange rate volatility has undergone structural changes, especially when non-linearities are important. For example, it is possible that economic agents do not respond strongly to relatively small changes in exchange rates, reflecting, among others, adjustment costs. By contrast, larger exchange rate shocks may trigger a disproportionately larger response, as agents are willing to incur the adjustment costs. If, in such a situation, the volatility of exchange rates, and thus presumably the size of exchange rate shocks, increases over time, this would result in exchange rate changes having a stronger effect

on economic variables. Rather than reflecting any fundamental change in the underlying relationship, this stronger impact would merely reflect the existing non-linearities. Overall, the evidence regarding possible structural changes in the size of exchange rate shocks is somewhat mixed.

During the post-Bretton Woods period of floating exchange rates, the degree of volatility of major exchange rates does not appear to have undergone significant changes over time. For example, the conditional variance of the exchange rate of the euro vis-à-vis the US dollar and the Japanese yen, while showing some short-run variability, has remained broadly stable over time (see Chart 3).<sup>2</sup> For the USD/EUR exchange rate, the conditional variance remained on average at around 0.4 over the period 1980-2007, with the short-term peaks declining somewhat in terms of magnitude (e.g. from 2.4% in the mid-1980s to

2 The Fractionally Integrated GARCH (FIGARCH) model of Baillie et al. (1996) was used to estimate the conditional volatility for the period from 1980 to the end of 2007. High frequency exchange rates have been shown to be conditionally heteroscedastic and display long-term dependence in the conditional second moment, as well as excess kurtosis (Baillie (1989), Hsieh (1989), and Baillie et al. (1996)). The FIGARCH model seems to be especially well suited to capture this volatility clustering and long-term persistence that characterise exchange rates.

Chart 3 Estimated conditional variance in the euro exchange rate



Source: Authors' calculations. Daily data provided by Haver Analytics (last observation refers to 20 December 2007).  
Notes: The DEM exchange rate was used before 1999. Based on an fractionally integrated GARCH model (see Anderson and Bollerslev (1998) and Baillie et al (1996)).

approximately 1.8% in the mid-1990s and 0.9% in 2001) and in terms of average variability (see Chart 3a). Overall, the conditional variance on the JPY/EUR currency pair has also been relatively stable over the sample. However, unlike in the case of the USD/EUR, volatility increased somewhat between 1998 and 2002 (see Chart 3b).

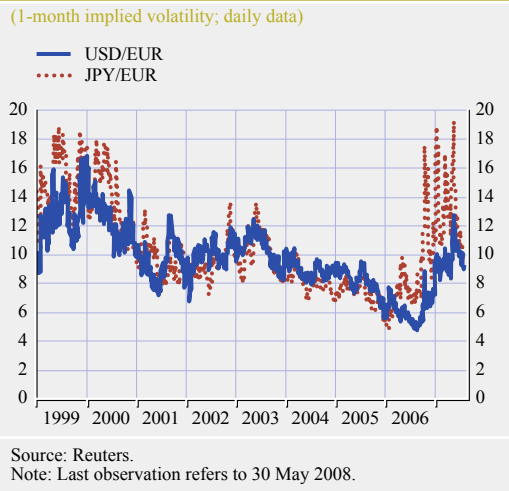
Turning to volatility expectations as captured by options prices, there is some evidence that implied volatility on major euro exchange rates declined somewhat over the past decade, but started to increase again from late 2006 (see Chart 4). Taken together, one could argue that exchange rate volatility may have declined somewhat over the past decade, as the conditional variance estimates also show a slight decline during this period. This decline in volatility could be an indication of smaller exchange rate shocks. In principle, this could lead to a reduced responsiveness of the economy to exchange rate shocks if non-linearities are important, with larger shocks having a more significant impact. However, it seems that the recent decline in volatility has not been strong enough in terms of magnitude and duration to be considered a major contributory factor to exchange rate impacts. In any case, the decline in volatility does not appear to have been a

permanent one, and volatility has increased recently, together with concerns about a pick-up in inflation.

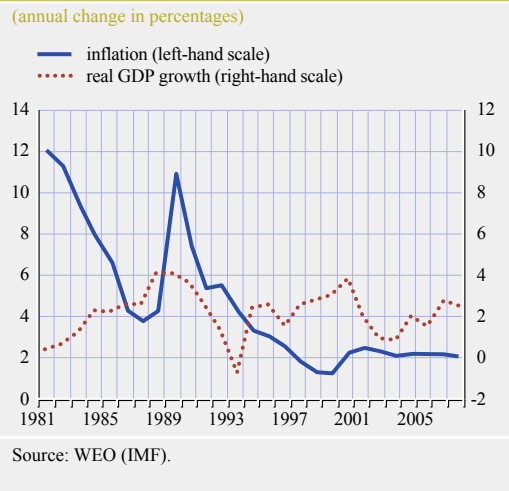
While exchange rate volatility has remained broadly unchanged, the volatility in key macroeconomic variables has declined somewhat in recent decades, possibly indicating a certain disconnect between developments in the exchange rate and its impact on the overall economy (see Chart 5).

Traditionally, the most important channel through which the exchange rate affects the economy is through its impact on trade performance. Also in the case of trade flows, despite significant variations in the real external value of the euro over the recent years, export volumes have continued to expand at relatively robust rates. While this certainly reflects to a large extent the buoyancy of foreign demand directed towards the euro area, there may also be some structural decoupling of trade developments from exchange rate fluctuations. One important structural feature of euro area trade developments is the declining trend of the share of euro area exports in world markets, which appears to be largely unrelated to developments in price competitiveness

**Chart 4 Implied volatility of USD/EUR and JPY/EUR**



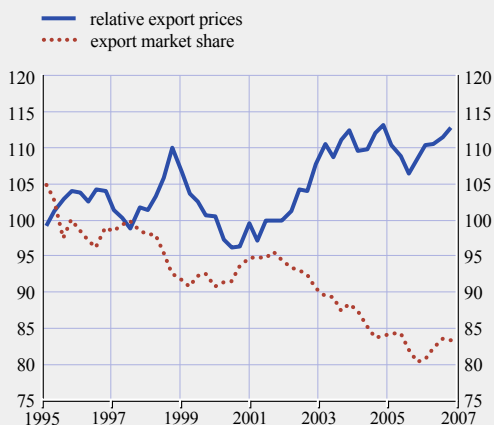
**Chart 5 HICP inflation and real GDP growth in the euro area**





**Chart 6 Relative export prices and euro area export market shares**

(quarterly data)



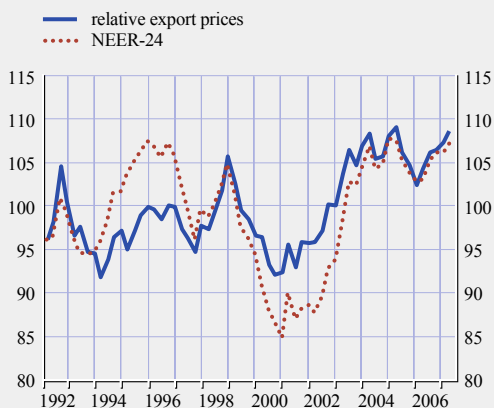
Source: ECB staff calculations.  
Notes: Last observation refers to Q3 2007. Relative export prices are defined as the ratio of euro area prices to competitors' prices.

(see Chart 6). Instead, it seems to be related to a large extent to the emergence of large and fast-growing, low-cost producers, above all China.

The link between exchange rate changes and trade flows may have also been affected by changes in the pass-through of exchange rate changes to trade prices. Chart 7 illustrates that

**Chart 7 Euro exchange rate and relative export prices**

(indices; Q1 1999=100)



Sources: Eurostat and ECB calculations.  
Notes: An increase indicates a loss. Last observation refers to Q1 2007.

the link between the nominal exchange rates and relative export prices is not one-to-one, but that the swings in the latter are somewhat less pronounced. This suggests that rather than passing on changes in the exchange rate to customers fully, exporters choose to absorb some of these changes in their profit margins, thereby stabilising sales and market shares. Against the background of greater competition, especially from low-cost countries, and greater substitutability between products and suppliers, the pressures to absorb exchange rate changes may have increased in a more globalised economy, thereby weakening the link between the exchange rate and euro area trade flows.

## I.2 GLOBALISATION AND THE EURO AREA

Globalisation or increased global trade and financial integration has been one of the major trends shaping the world economy over recent years. On the real side, the ongoing globalisation process has been characterised by significant changes in global trade patterns, with new players from low-cost countries taking a more prominent role. In addition, the international fragmentation of the production process has become a more widespread phenomenon, giving rise to a significant increase in the trading of intermediate products. On the financial side, the global integration of capital markets has led to an unprecedented increase in cross-border holdings of asset and liabilities, with international capital flows having increased even faster than product trade. These changes have, of course, also affected the euro area in important ways, as the euro area economy has become increasingly interconnected with its external environment. A brief review of the major features of this process may be helpful in explaining possible changes in the role of the exchange rate for the euro area economy.<sup>3</sup>

3 A more in-depth discussion of the impact of globalisation on the euro area can, for example, be found in Baumann and di Mauro (2006) and ECB (2008).

### I.2.1 TRADE INTEGRATION

Increased global trade integration has contributed to a steady increase in euro area import penetration and increased shares of exports in overall GDP. Euro area openness, measured by the average combined value of imports and exports of goods and services as a fraction of GDP, increased by 5 percentage points from 33% in late 1990s to 38% in the mid-2000s.

This trend has largely resulted from stronger trading ties with emerging market economies, which have been rapidly integrated into the global trading system. On the one hand, this has led to increased demand for euro area products from these countries, while on the other, it represents an additional source of imports and competition in third markets.<sup>4</sup> In particular, the rapid growth of China has played an important role in this respect as illustrated by the strong increase in China's share in world exports (see Chart 8). Together with similar, albeit less pronounced, increases in the shares of some other emerging market economies, this has contributed to a decline in the export market share of major industrialised countries, including

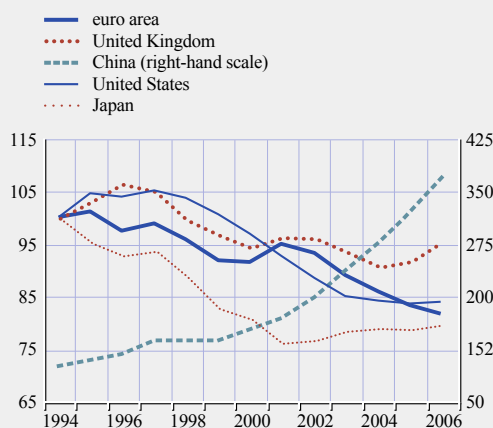
the euro area. Quantitatively, this decline has been broadly similar across the major economies, with Japan experiencing a somewhat larger and earlier decline. On the import side, the share of imports from low-cost countries in overall euro area imports has steadily increased in recent years, rising from below 40% to close to 50% between 2001 and the end of 2006 (see Chart 9).

In the case of the euro area, these trends have to a significant extent also resulted from more intense trade with the new EU Member States, in the context of the catching-up of these economies and their integration with the European economy. Part of this increased trade with new Member States is related to the process of internationalisation of production of large firms headquartered in the euro area and using production facilities located in the new Member States. This is reflected in a significant shift in the geographical composition

4 Simulations using the National Institute's Global Econometric model (NiGEM) show that removing the impact of China on world trade from 2000 onwards would lead to a loss in euro area foreign demand of between 5-6% after six years. Meanwhile, the negative time trend in the extra-exports equation implies a loss in market share of around 5.4% over the same period. Consequently, the positive and negative effects on euro area exports seem to roughly offset each other.

Chart 8 Export market shares

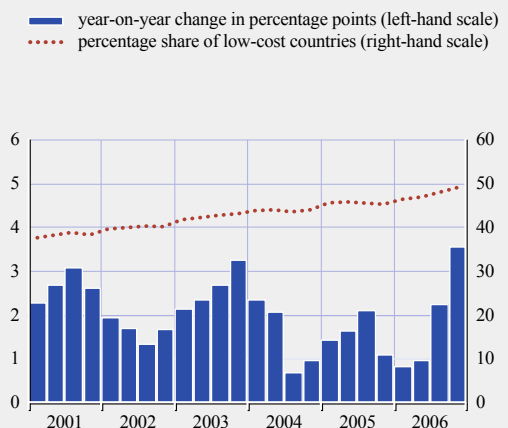
(in volumes; index 1994 = 100)



Sources: IMF, Eurostat and ECB calculations.  
Note: Last observation refers to 2007.

Chart 9 Share of euro area imports from low-cost countries

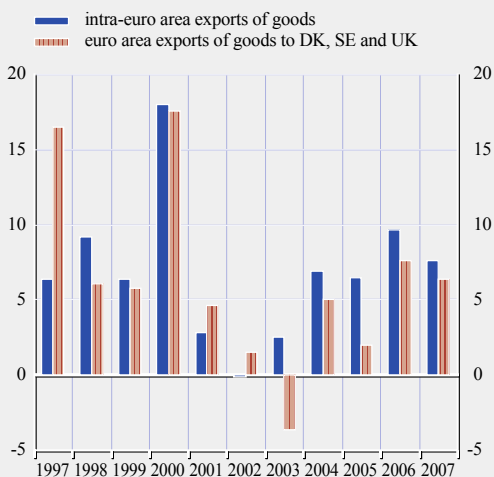
(values in euro; quarterly data)



Sources: Eurostat and ECB staff calculations.  
Note: "Low-cost countries" are: Algeria, Argentina, ASEAN, Brazil, Chile, Central America and the Caribbean, the CIS, China, India, eastern European countries that have joined the EU since 1 May 2004, rest of North Africa, rest of Africa, rest of Asia, rest of South America and Turkey.

**Chart 10 Euro area export growth – intra-euro area exports and euro area exports to selected EU Member States**

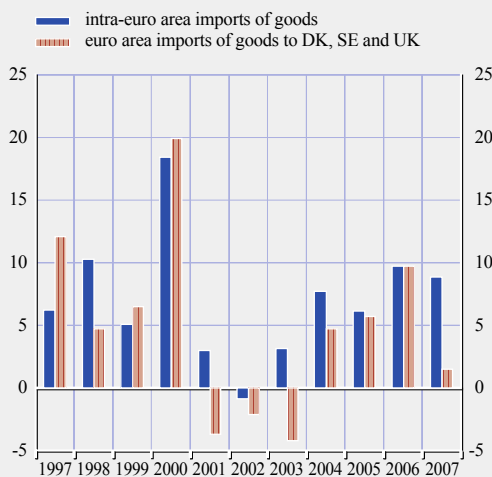
(year-on-year growth rates)



Source: ECB.

**Chart 11 Euro area import growth – intra-euro area imports and euro area imports from selected EU Member states**

(year-on-year growth rates)



Source: ECB.

of euro area imports from traditional suppliers in other industrialised countries to low-cost countries, including the new Member States. As a result, intra-euro area trade as a share of total euro area manufacturing imports has fallen by about 3 percentage points from 1995 to 2005, notwithstanding the trade-creating effect induced by EMU. Charts 10 and 11 provide some tentative evidence in support of this trade-creating effect, showing that intra-euro area imports and exports have generally grown faster than trade with the United Kingdom, Denmark and Sweden – the “old” non-euro area EU Member States. The simultaneous trade-creating effects of EMU and possibly trade-diverting effects of globalisation, of course, potentially complicate the assessment of the link between exchange rates and globalisation.

In general, the internationalisation of production has led to an increase in the import content of euro area exports and thus a reduction in the domestic value added content of exports.<sup>5</sup> This has also been reflected in an increase in the correlation between euro area imports and exports in recent years. In the presence of declining domestic value-added per unit of exports, the link between export growth and

overall GDP growth may be weakened. In fact, the magnitude of euro area net trade contribution to annual growth has declined over the past ten years, as shown in ECB (2005).

The impact of the abovementioned changes in trade patterns on euro area import prices, at the aggregate level, is ambiguous. On the one hand, the emergence of new players in global trade stimulates global demand, putting upward pressure on prices, in particular, on commodities prices. On the other, increased imports of both intermediate and final goods from low-cost countries may moderate import price pressures, estimated at the ECB at around 2 percentage points per year on average over the period 1996-2005.<sup>6</sup> During the catching-up period, the moderating effect on costs may also come from increased international competition in product and labour markets, which moderates wage demand and limits the pricing power of domestic firms.

5 At the country level, the rise in the import content of exports has been particularly strong for Germany, from 31% in 1995 to 43% in 2000. See also ECB (2005).

6 See European Central Bank, article entitled “Globalisation, trade and the euro area macroeconomy”, in the January 2008 issue of the ECB’s Monthly Bulletin.

### 1.2.2 FINANCIAL INTEGRATION

In addition to the real integration of economies in world trade, the wave of financial integration over recent decades, triggered by the gradual dismantling of Bretton Woods-inherited restrictions on international capital mobility and a decline in information processing and dissemination costs, has been another important feature of the ongoing globalisation process that has significantly affected the euro area.

The euro area provides more than one-third of the world's stock of foreign direct investment (FDI). At the same time, almost one-third of world FDI is invested in euro area Member States. At the same time, intra-euro area FDI stocks have grown robustly, increasing from almost 14% of euro area GDP in 1999 to around 24% by 2004, reflecting increased intra-euro area financial integration. Extra-euro area outward FDI stocks have also grown rapidly, increasing from 22% to 30% of euro area GDP between 1999 and 2004.

A commonly used measure of financial integration, the ratio of euro area foreign assets (including intra-European cross holdings)

relative to GDP has quadrupled since the beginning of the 1990s, outpacing the corresponding increases in the United States and Japan. On the liabilities side, the euro area position has even increased fivefold over the same period. As Chart 12 shows, the stocks of euro area foreign assets and liabilities as a percentage of GDP have substantially increased for all asset classes, with particularly large increases in the case of foreign direct investment.

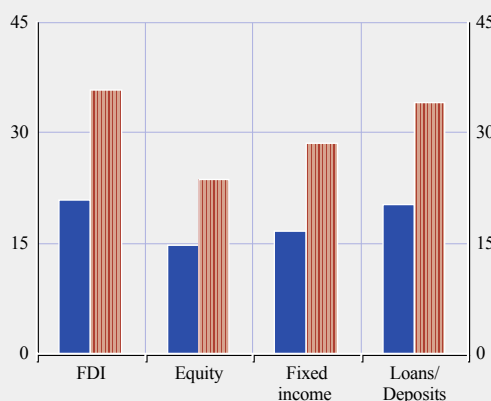
A more detailed analysis shows that, horizontal FDI flows, i.e. the acquisition of new technologies through mergers and acquisitions mainly in the United States and the United Kingdom, have accounted for a substantial part of total extra-euro area FDI flows from the mid-1990s onwards. At the same time, outward vertical FDI flows from the euro area, which are aimed at enhancing competitiveness by exploiting factor-cost differences across geographical locations, are mainly directed to the central and eastern European countries (CEECs). Overall, however, the share of the new EU Member States in outward FDI flows is relatively low, accounting for around 5% of overall outward FDI flows in 2003.

Chart 12 Euro area foreign assets and liabilities

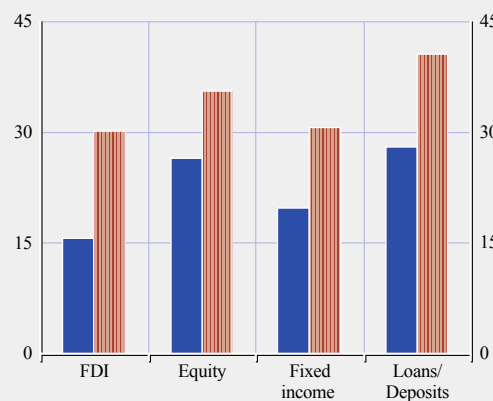
(percentage of GDP)

■ 1999  
■ 2006

(a) Assets



(b) Liabilities



Source: ECB calculations based on Balance of Payments data.  
Note: Foreign assets and liabilities do not include intra-euro area holdings.

This compares with shares of around 23% in the case of euro area FDI flows to the United States and United Kingdom.

Increased financial integration together with reduced information and communication costs are generally believed to have led to a reduction in the costs of financial hedging of exchange rate exposure by financial and non-financial corporations. In addition, the increasing internationalisation of the production base of many multinational companies has resulted in enhanced possibilities for real hedging through shifts in the geographical structure of production. Overall, a number of studies suggest that economies of scale may be important in the case of financial and real hedging. As a consequence, globalisation – through the emergence of large multinational corporations – may have been paralleled by more extensive hedging of exchange rate exposure.<sup>7</sup> Increased hedging could have important implications for the impact of exchange rate changes. Although it might not reduce the overall impact, it may result in a significantly delayed response of prices and trade volumes, as firms' profits are initially sheltered to a greater extent by fluctuations in exchange rates. The empirical evidence regarding firms' hedging behaviour is rather limited, especially with respect to euro area companies. Overall, turnover in global foreign exchange markets, in both the traditional and the over-the-counter derivatives segments, has expanded rapidly over the past decade, rising, in fact, faster than world trade, in particular, from 2001 onwards. While some of this increase may be related to non-commercial trading motives, it is also likely to reflect to some extent increased hedging by firms at a global level. Döhring (2008) provides evidence that euro area exporters make ample use of hedging strategies to limit the adverse impact of exchange rate fluctuations.

At the same time, one needs to take into account that globalisation is also likely to have brought about greater exchange rate exposure as a larger share of firms' sales and purchases are international rather than domestic. In the case of

European firms, the introduction of the euro and the associated elimination of various bilateral exchange rates may have at the same time reduced the overall exposure to exchange rate fluctuations. Bartram, Karolyi and Kleimeier (2002) show that this has been the case for firms with a large fraction of sales in the euro area. More generally, Muller and Verschoor (2006) find that between 13% and 22% of a sample of European multinational firms had significant exposure to the main currencies. While short-term exposure seems to be generally relatively well-hedged, the authors provide evidence of considerable long-term exposure, which is found to depend on firms' size and liquidity position. In a firm-level multi-country sample from 1984 to 2003, Hutson and Stevenson (2007) find a strong positive relationship between foreign exchange exposure and a country's economic openness, as measured by trade and FDI, which holds true even after controlling for firms' size. Thus, the overall impact of globalisation on firms' responses to exchange rate changes depends on the relative importance of greater globalisation-related exposure and more extensive use of hedging – real and financial. For a sample of French multinational firms, Capstaff et al (2007) show that the decline of risk exposure has been more pronounced than the decline in the amounts hedged by French multinational firms, suggesting that hedging of existing exchange rate risk has increased.

### 1.3 THE EXCHANGE RATE AND EURO AREA GROWTH<sup>8</sup>

Increased globalisation over the recent period is likely to have resulted in a greater dependence of the euro area economy on developments outside the euro area. This section provides some model-based evidence on the quantitative importance of different external factors for euro area growth in the period 1999-2007. As the exchange rate is one of these external factors, it allows an assessment of the relative importance of exchange rate

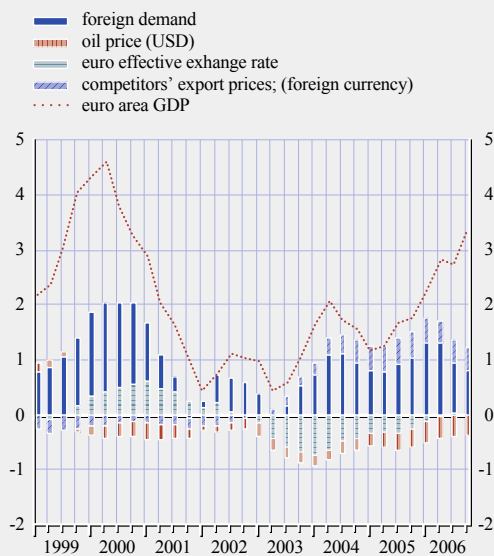
<sup>7</sup> See, for example, Bodnar, Hayt and Marston (1998) and Chow, Lee, and Solt (1997).

<sup>8</sup> This section has benefited from contributions by Jose E. Gumiel, European Central Bank.



**Chart 13 Impact of the external environment on euro area GDP**

(year-on-year growth rate and contributions; in percentage points)



Source: ECB staff calculations using the AWM. See also G. Fagan, J. Henry and R. Mestre (2005).

movements. In addition, the section analyses the correlation between the euro exchange rate and growth in order to assess the role of the exchange rate as an automatic stabiliser.

The ECB's Area-Wide Model (AWM)<sup>9</sup> is used to assess the impact of a number of external variables for euro area real GDP growth in the period 1999-2006. Concretely, the effect of foreign demand, competitors' export prices in foreign currency, the nominal effective exchange rate of the euro and the price of oil in foreign currency are analysed. The model also takes into account dynamic interactions between the different exogenous variables. For example, it considers that large swings in the exchange rate may reverberate through other variables of the external environment, in particular, through competitors' export prices and, to a lesser extent, oil prices, to ultimately affect euro area GDP.<sup>10</sup>

Overall, the simulation suggests that the euro effective exchange rate had a positive impact on euro area GDP growth over the period 1999-2001, adding to the positive impact

of foreign demand, which more than offset the negative impact of oil price increases and changes in competitors' export prices (see Chart 13). Conversely, at the early stages of the euro area recovery in 2003, the external environment of the euro area had a negative impact on euro area GDP, as the positive impact of the rise in foreign demand was more than offset by the negative impacts of the price of oil and the euro exchange rate appreciation.<sup>11</sup>

For the period as a whole, the effect of the euro exchange rate was broadly neutral, as the positive initial impact was offset in the latter part of the sample (see Table 1). Although the exchange rate has at times had a relatively large impact on euro area growth, other external factors generally outweighed the effect of exchange rate changes, with foreign demand developments being the most important driver.

9 The Area Wide Model (AWM) is a structural macroeconomic model of the euro area economy (see Fagan, Henry and Mestre (2005)). The model treats the euro area as a single economy. The main exchange rate channel is through import prices and the energy component of the HICP. It allows for second-round effects of exchange rate changes, i.e. the effect of import prices via wages, unit labour costs, and competitiveness on domestic prices, also allowing for substitution between domestic and imported goods.

10 In the AWM, an adverse change in the euro effective exchange rate leads to a decrease in foreign competitor prices in euro terms and affects the economy through two channels that operate in opposite directions. The first one is the substitution effect on imports and exports of an effective exchange appreciation, which reduces net trade and GDP (under the assumption of no wealth effects from the exchange rate movement). The second effect works through lower imported inflation, which raises real income for consumers and puts downward pressure on the cost of intermediate products for corporations. This effect dampens the first contractionary impact through trade. However, overall, lower foreign prices have a negative spillover to economic activity in the AWM model.

It has also been argued that the swings in the dollar effective exchange rate may play an important role in explaining the variations in the price of oil that further affect GDP growth in the euro area. On one hand, a falling dollar, for instance, increases demand outside the United States more than it decreases demand in the United States, and drives up prices. Commodity exporters may also raise prices in order to offset the loss, in domestic currency, on their dollar-based export sales. However, the swings in oil price have often surpassed the exchange rate movements and also, the long-run elasticity of the price of commodities to exchange rate is almost 1, suggesting that some other factors, rather than the exchange rate, are responsible for the evolution of oil prices.

11 For a more general discussion of the linkages between the euro area and its external environment see, for example, Anderton and di Mauro (2007).

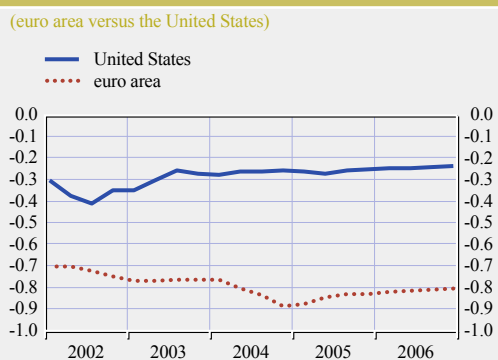
**Table I Contribution of the external environment to euro area GDP growth**

	Average 2000-2006
World (extra-euro area) real GDP growth	0.8
Change in oil prices in US dollars	-0.2
Change in the nominal effective exchange rate of the euro	0.0
Change in competitors' export prices	0.1
<b>TOTAL</b>	<b>0.6</b>

A related issue is whether the exchange rate acts as an automatic cyclical stabiliser or whether it rather tends to amplify business cycles. The correlation of the exchange rate with cyclical GDP growth, i.e. the counter or pro-cyclicality of the exchange rate, depends on the nature of the shocks driving the exchange rate movements. If exchange rate variations are related to trade balance developments, then the exchange rate may act as an amplifier, with a pro-cyclical impact on activity, in the case that the trade balance is driven by domestic developments. The deterioration in the trade balance brought about by a pick-up in domestic activity triggers a depreciation of the exchange rate in order to restore external equilibrium, thereby providing additional stimulus. Conversely, if the deterioration in the trade balance is the result of a slowdown in growth abroad, the exchange rate would act as a shock absorber, as the depreciation would tend to offset some of the decline in foreign demand. Similarly, if the exchange rate movements were mainly driven by interest rate differentials, then, the exchange rate is more likely to be counter-cyclical, as the increase in interest rates associated with a boom may trigger an exchange rate appreciation.<sup>12</sup>

Chart 14 illustrates the evolution of the 30-quarter rolling correlation coefficient between the cyclical components of the real effective exchange rate and real GDP, obtained by using HP-filtered series. The results indicate that the correlation between the euro exchange rate and euro area growth is relatively large and negative, suggesting that, in the 2000s, the exchange rate has been pro-cyclical rather

**Chart 14 Evolution of the correlation coefficients between the cyclical components of the real effective exchange rate and real GDP**



Source: ECB staff calculations.  
Notes: 30-quarter rolling correlation; cyclical components extracted via the HP filter. An increase in the exchange rate implies an appreciation. Thus a negative correlation coefficients implies a pro-cyclical behaviour of exchange rates, as the exchange rate depreciates when growth is strong and vice versa.

than counter-cyclical for the euro area. This correlation appears to have been fairly stable over recent years. In comparison, the correlation in the case of the United States is also negative, but much lower in absolute terms.

#### I.4 MEASURING EFFECTIVE EXCHANGE RATES IN A GLOBALISED WORLD<sup>13</sup>

It is obvious that, given the globalisation-driven structural changes presented so far, the way in which exchange rate movements are analysed and their impact on the economy may have to be reconsidered. In particular, globalisation may have altered the information content of the traditionally used trade-weighted real effective exchange rate (REER) indices or the benchmarks against which they are evaluated. The official real effective exchange rate index of the ECB is based on infrequently updated weights of individual countries in euro area manufacturing trade, taking into account third market competition effects through double export weights.<sup>14</sup> With increased globalisation and rapidly shifting trade compositions, a more frequent updating of weights might be

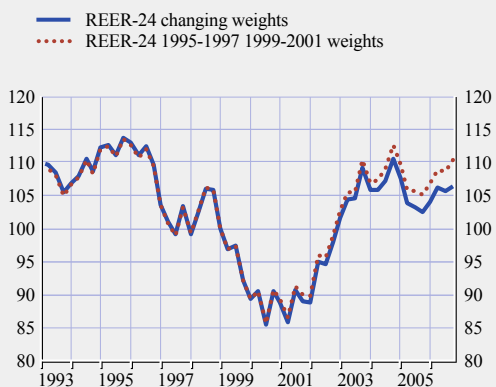
<sup>12</sup> See Kaminsky, Reinhart and Végh (2004).

<sup>13</sup> This section has benefited from contributions by Chiara Osbat.

<sup>14</sup> For a detailed description of the ECB methodology see, for example, Buldorini, Makrydakis and Thimann (2002).

**Chart 15 Evolution of the euro real effective exchange rate – ECB weights versus time-varying weights**

(index; Q1 1999 = 100; 24 trading partners; daily data)

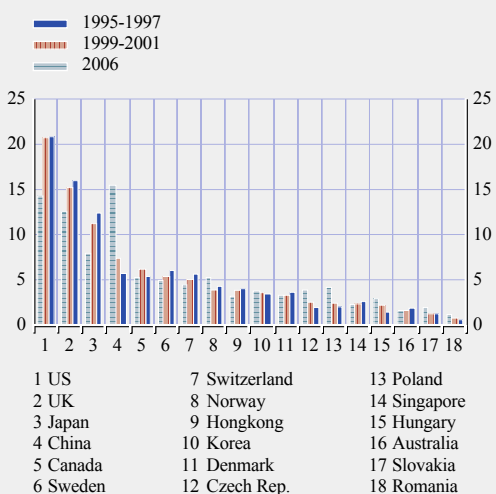


Source: ECB staff calculations.  
Notes: Based on internal calculations of weights, excluding domestic production. Weights may therefore differ from the official EER weights published by the ECB.

necessary to capture significant shifts in the regional trade structure and to provide a useful description of developments in price competitiveness. Furthermore, the improved tradeability of services may imply that a focus on manufacturing trade may be too narrow, and

**Chart 16 Weights in the REER-24**

(percentage)



Source: ECB staff calculations.  
Notes: Based on internal calculations of weights, excluding domestic production. Weights may therefore differ from the official EER weights published by the ECB.

the increasing internationalisation of the production process may imply that countries with a low domestic value-added content of exports are over-represented in the traditionally-measured REER index. A comparison of the traditional REER index with alternative measures resulting from a number of adjustments capturing these globalisation-related structural changes provides an assessment of the quantitative importance of such factors.<sup>15</sup>

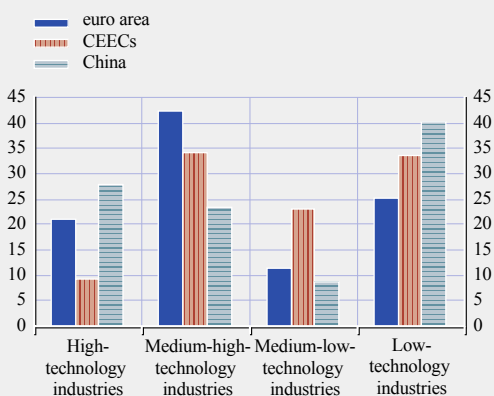
In order to capture globalisation-induced changes in the geographical composition of trade, a first exercise consists of computing the REER using quarterly time-varying weights over the entire period for which data is available for the 24 important euro area trade partners, that is from the first quarter of 1993 to the fourth quarter of 2006. A comparison with the index using the official updating frequency shows that the impact of these changes is relatively limited, with differences emerging mainly at the end of the sample (see Chart 15). The maximum deviation between the two series that could hypothetically be observed, depending on the choice of base period is about 4% for the whole sample period.

Chart 16 illustrates how changes in the geographical structure of euro area trade have affected individual country weights for the calculation of the euro effective exchange rate. The largest change in weights can be observed for China, with the weight doubling from 7% on average in 1999-2001 to 15% in 2006. At the same time, the weight of the CEECs also increased considerably. In particular, the shares of the Czech Republic and Poland have risen from 2.5% to more than 4% at the expense of the traditional main trading partners of the euro area, such as the United States, the United Kingdom and Japan. The use of less frequently updated weights may therefore

15 The analysis is limited to CPI-based REER indices. While there are several other measures of international cost and price competitiveness available, Ca'Zorzi and Schnatz (2007) show that these alternative measures display similar forecasting properties for euro area exports.

**Chart 17 Share of different product categories in overall exports**

(percentage; average 2000-2003)

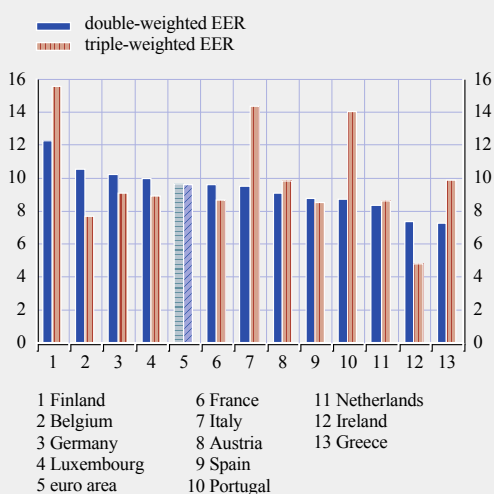


Source: ECB staff calculations based on Chelem database.  
Note: For sectoral definition of categories see ECB Occasional Paper No. 55.

lead to an overestimation of the exchange rate appreciation over the most recent period, as the share of currencies against which the euro has appreciated strongly, such as the US dollar and the Japanese yen, has decreased (partly offset by the increased share of China), whereas countries with a stronger currency (especially some of the

**Chart 18 Double and triple-weighted REER weights of China**

(percentage; based on 2004 trade)



Sources: Banco de Portugal and ECB staff calculations.  
Note: The calculations are based on weights for a subset of the 24 currencies usually included in the REER calculation. The currencies of Australia, Cyprus, Estonia, Latvia, Lithuania and Malta are omitted.

new Member States) have increased their share in overall trade.

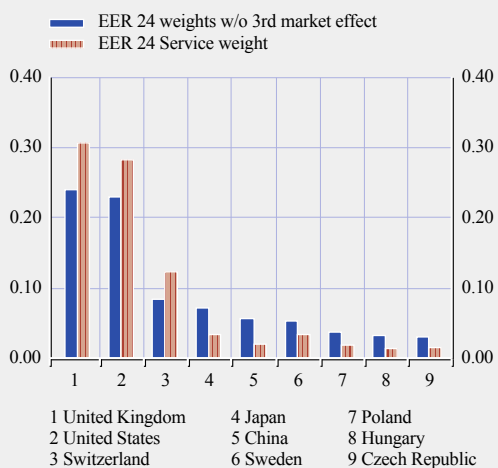
Given increased globalisation and the emergence of new trading partners with trading patterns that are often very different from those of the euro area, the assessment of third market effects (i.e. the fact that euro area exporters in foreign markets also face competition from third countries' exporters) may also have to take into account the sectoral composition of trade. For instance, euro area exports are concentrated in medium high-technology industries (accounting for roughly 40% of overall exports, see Chart 17) and low-technology industries (25%). In contrast, China's main export specialisation consists of low-tech (38%) and high-tech (26%) industries, while CEECs' exports are more concentrated in low-tech (35%) and medium high-tech (35%) industries.

A two-stage weighting can capture some of these sectoral heterogeneities, which potentially distort the information content of the REER. According to this method, in a first step, traditional trade weights are computed at a sectoral level. These sector-specific weights are then aggregated, based on the weights of each sector in countries' overall manufacturing trade.<sup>16</sup> A comparison of a triple-weighted REER index constructed in this way with the traditional double-weighted index shows that the maximum deviation between the two indicators is only around half a percent in the case of the euro. Thus, this effect appears to be quantitatively relatively small in the case of the euro area as a whole. However, at the level of individual euro area countries, more significant differences may emerge, as illustrated on Chart 18. For example, while the overall euro area trade weight of China is broadly the same for the two measures, it is significantly higher under triple-weighting in the case of Italy, Portugal, Greece and Finland, reflecting the greater similarity in the sectoral trade structure of these countries with that of China.

16 See also Esteves and Reis (2006).

**Chart 19 Manufacturing-based versus service-based trade weights**

(index; Q1 1999; 24 trading partners; quarterly data)

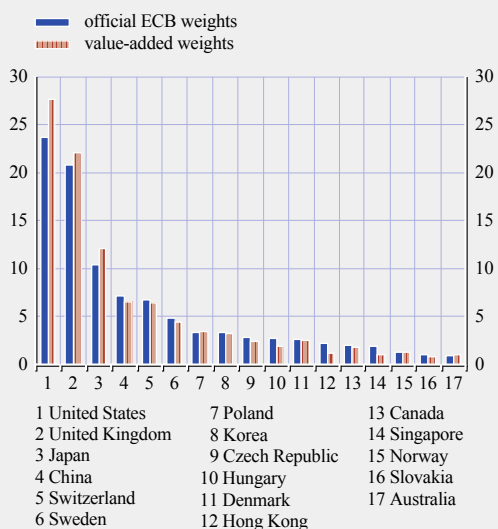


Source: ECB staff calculations.

Another salient feature of the ongoing process of globalisation has been the increased tradability of services. Consistent with this trend, the assessment of euro area's price and cost competitiveness should also reflect developments in services trade, especially if service-based weights are very different from

**Chart 20 Official weights versus weights based on domestic value-added content of exports**

(percentage)



Source: ECB staff calculations.

weights based exclusively on manufacturing trade. To highlight potential differences in the geographical structure of trade in manufacturing goods and in services, an alternative REER is calculated using services trade only. Chart 19 compares the traditional REER weights and the service trade-based REER weights for the euro.<sup>17</sup> The importance of some of the traditional main trade partners of the euro area like the United States, the United Kingdom and Switzerland tends to be underestimated when taking into account goods trade only in the computation of individual currencies' weights. In contrast, the weights of China and the CEECs are lower in the case of the service-based REER, reflecting the fact that these countries have a comparative advantage in the production of manufactured goods.

The increased cross-border segmentation of the production process, with trade in intermediate goods on a rapidly increasing trend, is another relevant feature of the ongoing process of real integration. An important implication of this process is that the domestically produced value-added contained in a country's exports may be significantly below the overall value of exports on which trade weights are traditionally based. Since the effect of an exchange rate change on the price competitiveness of a country's exports is largely restricted to the domestic value added part, the traditional REER measure is likely to give too high a weight to those countries which use a higher than average share of imported intermediate products in the production of exports. Therefore an alternative measure is constructed based on the domestic value added content of exports. For this purpose, the import content of intermediate consumption from the OECD input-output table for the year 2000 is used as a proxy for the share of imported goods in overall exports.<sup>18</sup>

The resulting weights, computed by applying the abovementioned measures of domestic value

17 Weights based on manufacturing trade exclude third market effect in order to make them comparable to the service trade weights for which no estimates of third market effects exist to date.

18 See Yamano and Ahmad (2006).

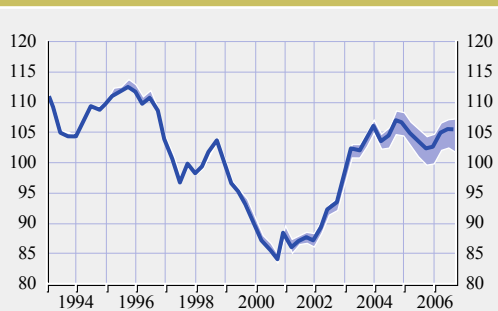


added to the trade weights of the traditional REER are illustrated in Chart 20. Given the relatively low share of imported intermediates in the production process, the weight of some of the euro area's main industrialised trading partners is higher in the alternative measure than in the official REER index. At the same time, the weight of many Asian countries and CEECs is lower, reflecting the fact that they specialise more in some downstream stages of the production process, which require a high share of intermediate imports. However, despite some noticeable differences in the weights of the two REER measures the historical evolution of the two measures has so far been fairly similar.

The above weight adjustments have addressed various aspects of globalisation which may limit the information content of the REER as an index of a country's price competitiveness. However, exchange rate changes also affect economies through other channels, with the financial valuation channel becoming increasingly important during the ongoing process of financial globalisation. Lane and Shambaugh (2007) suggest that trade-weighted exchange rates indices cannot capture these financial impacts of currency movements. Therefore, they propose a finance-weighted index, based on the currency and asset composition of each country's external asset and liability holdings, which should be used in parallel with the traditional effective exchange rate. They show that the net financial index and the trade-weighted index tend to be negatively correlated on average, for developing countries, as well as for the full sample of countries under consideration. However, the correlation is positive and very weak for advanced countries, and the overall final impact is quite low, owing to the offsetting impacts of currency movements on the value of foreign-currency assets and liabilities.

Although it is true that globalisation may have significantly affected the relative weights of individual trading partners for the computation of the euro REER, the overall impact on the traditional indicator of international cost and price competitiveness appears to be rather limited, as

Chart 21 Comparison of REER based on different adjustments



Source: ECB staff calculations.  
Note: The thick line represents the traditional REER index based on infrequently updated double-export weights, while the shaded area indicates the range of alternative indices based on the various adjustments.

illustrated in Chart 21. The grey area shows the range of indices obtained by making adjustments for the globalisation-induced changes in terms of geographical and sectoral trade composition, internationalisation of production and services trade. Although this range widens towards the end of the sample, the overall extent of the variation is relatively limited, suggesting that the traditional REER continues to provide a reasonably good measure of international price competitiveness, notwithstanding the ongoing globalisation-related structural changes. In this context, however, it is important to note that these comparisons take each adjustment in isolation and may therefore underestimate the combined effect of the various structural changes associated with the globalisation process. In addition, the result of a relatively limited impact hinges to some extent on the current exchange rate constellation. In particular, the close tie between the Chinese renminbi and the US dollar limits the effect of a shift in the weights between the United States and China. In the presence of greater overall exchange rate flexibility, the deviations between different indicators may thus become more significant.

As the REER is an index, its level does not contain any useful information per se, but is useful only when compared to an appropriately chosen benchmark level. In addition to the measurement of the REER, this benchmark

may itself be affected by the structural changes related to globalisation.

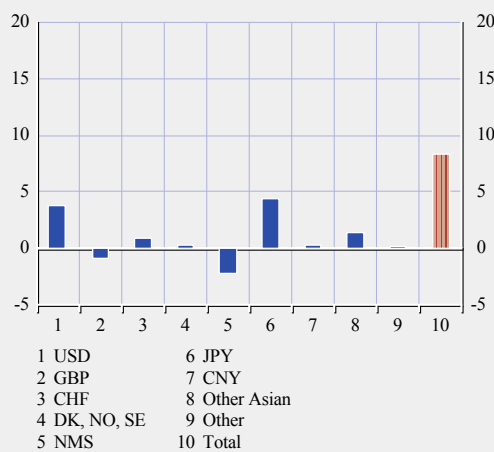
One of the most commonly used benchmarks for assessing the level of price competitiveness at any given time is the long-term average of the REER. The underlying rationale for using such averages is the assumed validity of relative purchasing power parity (PPP). Relative PPP implies that the nominal exchange rate offsets in the medium to long-term any changes in price competitiveness brought about by differences in inflation rates between two economies. Thus, in the medium to long-run, the real exchange rate reverts towards a constant equilibrium value. This constant equilibrium may be approximated by the observed average of the real exchange rate over a sufficiently long period assuming that positive and negative shocks to this equilibrium relationship more or less offset each other. As shown above (see Chart 2), at the end of 2007, the CPI-deflated REER of the euro was around 16% stronger than its long-term average.

A similar assessment would be achieved if absolute PPP is used instead of relative PPP as a benchmark. In the first quarter of 2007, the REER of the euro was somewhat less than 10% stronger than the absolute PPP benchmark (see Chart 22). On a bilateral basis, the US dollar and the Japanese yen contributed most to this deviation, with the contributions from the Chinese renminbi and other Asian currencies being much smaller. At the same time, the pound sterling and the currencies of the new EU Member States contributed negatively to the deviation of the PPP-based REER-24 from its 1993-2007 average.

A well-known limitation of absolute and relative PPP is that it fails to take into account changes in the relative price of non-tradeable goods for which international arbitrage does not ensure that prices are equalised internationally. One of the factors that may give rise to such a divergence in the relative price of non-tradeables, are differential rates of productivity growth between countries and sectors – the so-called Balassa-Samuelson

**Chart 22 Deviation of euro PPP-based REER-24 from 1993-2007 average**

(data refer to Q1 2007; weighted contributions in percentages)



Source: ECB staff calculations.

effect. This shortcoming might be particularly important in the context of the ongoing globalisation process, which is associated with the rapid catching-up of low-income countries through a progressive reduction in productivity differentials. The Balassa-Samuelson effect would imply a trend equilibrium depreciation of the euro vis-à-vis the currencies of the catching-up economies, a depreciation which should not be fully interpreted as a gain in international price competitiveness, as it is mainly concentrated in the prices of goods which are non-tradeable. Under those circumstances, the use of long-term averages may thus lead to the underestimation of a potential overvaluation or to an overestimate of a possible undervaluation of the REER of the euro.

## 2 EXCHANGE RATES AND PRICES

One of the major channels through which the exchange rate traditionally affects economic performance is through its impact on prices. The main direct effect occurs through the impact on import prices, which further reverberates along the pricing chain to consumer prices. These price changes give rise to important indirect and second-round effects through their impact on real incomes, consumer spending and trade flows, with feedback effects on overall price pressures.

Before turning to the issue of whether the relationship between exchange rates and prices has changed as a result of globalisation, the chapter provides some general quantitative information about the impact of an exchange rate shock on euro area prices, drawing on the results from models used at the ECB. The second section focuses on the response of the pricing behaviour of euro area exporters to changes in the exchange rate and investigates whether there have been significant changes in the pricing-to-market behaviour of exporters in recent years. The third section is devoted to the ERPT to import prices and uses standard trade equations and the area-wide model (AWM) of the ECB to assess its evolution over time. In addition, the section provides some evidence on sector-level differences in ERPT to euro area import prices and investigates the role of such differences in explaining changes in aggregate ERPT. The last section investigates the impact of globalisation on the relationship between exchange rates and consumer price inflation based on the results of a panel VAR estimation and simulation evidence from the AWM.

Overall, the chapter shows that the impact of increased globalisation on the relationship between the exchange rate and prices is rather mixed at the aggregate level for import prices. The empirical results suggest a decline in the ERPT to consumer price inflation in some euro area countries, in particular, for Germany and, to a lesser extent, for France and Italy. Some tentative evidence for such a decline in the

ERPT to HICP inflation is also provided by simulations using the AWM. These changes in the pass-through may in part be explained by shifts in the industry composition of euro area imports, as the share of imports in sectors with a relatively low pass-through has increased over time.

### 2.1 THE LINK BETWEEN EXCHANGE RATES AND PRICES – MODEL-BASED EVIDENCE

In order to provide an initial quantitative assessment of the importance of exchange rate shocks for euro area prices, this section presents some model simulation results. Concretely, the analysis draws on two models used at the ECB: the AWM and the Global VAR (GVAR).<sup>19</sup> With both models, the effect of a 10% uniform appreciation of the euro against all other currencies is simulated.

19 The GVAR is a global model developed in Dées, di Mauro, Pesaran and Smith (2005). It covers the period 1979-2005 and includes 26 countries/regions. It comprises country-specific models that relate the core variables of each economy to those in the rest of the world. By providing a framework that is capable of accounting for trade and financial transmission channels, the GVAR model is particularly suitable for analysing the transmission of real and financial shocks across countries and regions. The transmission of shocks takes place not only through trade, but also through interest rates, exchange rates and equity prices. Thus, a real shock directly affecting trade flows is also propagated through changes in various asset prices, in turn, generating spillover effects on real variables. See also Dees, Holly, Pesaran and Smith (2007).

**Table 2 Impact of a 10 percent appreciation of the NEER on prices**

(annual averages)	Percentage deviation from baseline (cumulated)		
	Year 1	Year 2	Year 3
<b>Import prices</b>			
AWM	-3.3	-5.1	-5.4
<b>Export prices</b>			
AWM	-2.1	-3.4	-3.8
<b>HICP</b>			
AWM	-0.3	-0.9	-1.4
GVAR	-0.2	-0.5	-1.0
<b>HICP excl. energy</b>			
AWM	-0.2	-0.8	-1.3

Source: ECB staff calculations.

Following the order in the pricing chain, the panel on the left-hand side of Table 2 shows the effect of the appreciation on trade prices and the panel on the right-hand side, shows its effect on consumer prices during the three years following the initial shock. The results suggest that the degree of ERPT declines along the pricing chain, with the estimated impact being lower for consumer prices than for trade prices.

According to the AWM, the appreciation leads to a decline in the annual rate of change of import prices by 3.3 percentage points in the first year and by a further 1.7 percentage points in the second year. After three years, the cumulated impact of a 10% appreciation is -5.4% on the level of import prices, which implies an estimated pass-through to euro area import prices (in the third year) of 54%, broadly in line with the results of other studies for the euro area.<sup>20</sup> Based on the same model, the impact of the euro appreciation on export prices amounts to -2.1% in the first year and -3.8% cumulated over three years. These findings suggest that euro area exporters lower their prices in euro in an effort to offset the loss in price competitiveness (pricing-to-market behaviour), although the export prices in foreign currency nonetheless increase following the appreciation.

As regards the impact of the exchange rate shock on the euro area HICP, AWM and GVAR models provide estimates of the pass-through to the HICP after three years in the range of 10-14%. These results are broadly consistent with the literature, which suggests the pass-through to consumer prices lies in the range of 8-20%.<sup>21</sup>

## 2.2 EXPORTERS' BEHAVIOUR AND PRICING-TO-MARKET<sup>22</sup>

Higher market integration and the resulting stiffer competition faced by exporters in international markets are likely to affect their pricing-to-market behaviour. On the one hand, increased competitive pressures, for example from low-cost countries, push producers to adjust their mark-ups and move towards greater local currency pricing strategies in order to limit

the negative volume effects. At the same time, in an increasingly competitive environment, the resulting general margin compression may limit the ability of a reduction in profit margins to absorb adverse movements in the exchange rate. The increased import content of exports may also dampen the response of export prices to an exchange rate change. Given these partly offsetting factors, the overall impact of globalisation on the link between export prices and exchange rates remains an empirical issue.

In order to assess the evolution of exporters' pricing behaviour empirically, a single-equation standard model of export prices is estimated, allowing for both short-term and long-term effects via an error-correction mechanism. The underlying idea is that export prices move in line with both exporters' costs and competitors' prices, which can be written as follows, as an error-correction equation (all variables are in logarithms):

$$\Delta xp_t = \alpha \cdot (xp_{t-1} - \beta \cdot c xp_{t-1} - (1-\beta) \cdot ppi_{t-1}) + \delta \cdot \Delta neer_t + \lambda \cdot \Delta ppi_t + v_t \quad (1)$$

According to (1), the change in export prices is a function of the deviation from long-run equilibrium and short-term dynamics. The long-run relationship is given by the expression in brackets, with euro area export prices of goods ( $xp$ ) depending on domestic prices as captured by producers prices ( $ppi$ ) and on competitors' export prices in euro ( $c xp$ ). In this long-run relationship, price homogeneity is assumed, which implies that a 10% increase in both competitors' prices and costs will also translate into a 10% increase in export prices. This homogeneity is captured by the fact that the coefficients for domestic costs and for competitors' prices add up to unity. The speed of adjustment towards this long-run relationship

20 See Campa and Gonzales (2006), Anderton (2003) and Ca' Zorzi, Hahn and Sánchez (2007).

21 See for instance Gagnon and Ihrig (2001), Campa and Gonzales (2006), Hahn (2003), Bailliu and Fujii (2004), Landolfo (2007).

22 This section has benefited from contributions from Katrin Forster, European Central Bank.

is governed by the coefficient  $\alpha$ . In the short run, export prices dynamics are also determined by changes in the nominal effective exchange rate (NEER) and in producer prices. The long-run pricing-to-market behaviour is captured by the coefficient  $\beta$  which can be viewed as the long-run elasticity of export prices to competitors' export prices.

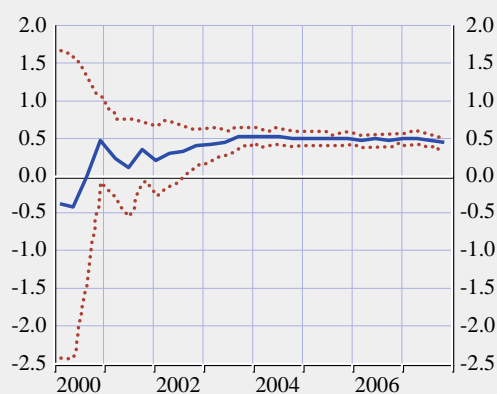
The econometric analysis is based on quarterly data covering the period from the first quarter of 1993 to the first quarter of 2007. The competitors' export prices are calculated using a double weighting method, adjusting the shares of each euro area market in total exports to account for third-market effects. The model is estimated recursively, for extra-euro export prices of goods starting with an initial sample from the first quarter of 1993 to the fourth quarter of 1999, adding at each step one further observation up to the end of the sample period. The impact of globalisation-related structural changes on exporters' pricing behaviour is reflected in the evolution of export price elasticities to changes in competitors' export prices.<sup>23</sup>

The estimation results indicate a long-run coefficient on competitors' export prices of 0.43 for the whole sample period, implying that the loss (gain) in price competitiveness owing to a real appreciation (depreciation) of the currency is about one-half of the change in the exchange rate. The other half of euro area export prices is determined by domestic prices and costs. Chart 23 illustrates the evolution of the pricing-to-market coefficient resulting from the recursive estimation of equation (1). Overall, the chart suggests that the pricing behaviour of exporters appears rather unchanged at the aggregate level.

This result may hide significant differences in the pricing-to-market behaviour of individual euro area countries. For instance, in the case of Germany, Stahn (2006b) finds evidence that pricing-to-market behaviour among German exporters has grown recently. This may also have contributed to the downward trend in the long-run price sensitivity of German exports to euro area and to non-euro area countries since

**Chart 23 Long-run coefficient on competitors' export prices in the export price equation for goods**

(Q1 1993 to Q1 2007; recursive estimation)



Source: ECB staff calculations.

the 1990s. The analysis of export volumes elasticities to changes in relative export prices across euro area countries, presented in the next chapter, confirms the presence of a large degree of heterogeneity in exporters' pricing behaviour at the country level.

## 2.3 GLOBALISATION AND TIME-VARIABILITY OF THE EXCHANGE RATE PASS-THROUGH TO IMPORT PRICES

### 2.3.1 CONCEPTUAL CONSIDERATIONS

The pass-through of exchange rates to prices at different stages of the pricing chain plays a central role in understanding the links between foreign prices, exchange rates and domestic prices. It may provide an explanation for the significantly more muted price volatility, compared with the volatility in nominal exchange rates.

The structural changes associated with globalisation may affect ERPT in various ways, with the overall impact being a priori ambiguous. On the one hand, the incentive to defend foreign market shares through an active pricing-to-market strategy may be reduced in an environment of reduced trade costs and overall

<sup>23</sup> The impact of structural changes could also be captured by the inclusion of a trend variable.



ERPT may thus be higher. More specifically, lower sunk trading costs facilitate the entry into and thus the exit from foreign markets. Therefore in the case of an adverse exchange rate movement, a company may choose to temporarily exit the foreign markets rather than reduce profit margins in order to defend its market presence, as it can easily re-enter the export market if the exchange rate moves in a more favourable direction.<sup>24</sup> Moreover, stronger competitive pressures from low-cost countries cause producers' average mark-ups to shrink. As a consequence, the ability of exporters to pursue pricing-to-market strategies through variations in their mark-ups may be reduced, at least in the case of an adverse exchange rate movement, thereby contributing to an increase in ERPT.

On the other hand, increased trade integration may foster strategic complementarities in exporters' price-setting and eventually work against the mechanism previously described. In general, firms' pricing decisions depend not only on their own marginal costs, but also on competitors' prices. Exporters will find it optimal to lower their mark-up when the currency appreciates, as this reduces the relative price of competitors. The presence of strategic complementarities implies that firms' decisions take into account the actions of competitors. In an attempt not to deviate too much from their competitors, their demand curve will show a variable exchange rate elasticity depending on the degree of competition i.e. with stronger competitive pressures they will vary the mark-up more and prices less in response to an exchange rate movement. Increased trade integration is likely to enhance this behaviour, thereby insulating import prices to some extent from exchange rate movements and potentially leading to a decline in the pass-through.<sup>25</sup> Other structural changes induced by the globalisation process, like shifts in the sectoral composition of imports away from commodity-based goods toward manufactured products, may work in the same direction, as pricing-to-market behaviour is more prevalent in the latter. Furthermore, an increased export content of imports and lower

cost of hedging per unit of risk may also dampen the impact of exchange rate changes on prices.

Another factor relevant for the euro area is the increasing use of the euro as an invoicing currency in the 2000s, again highlighting the difficulty in empirically disentangling the effects of globalisation from the parallel processes set in motion by the introduction of the euro. Mechanically, if foreign exporters fix their prices in their own currency, the ERPT to euro area domestic prices should be larger, while if they tend to set their prices in euro the pass-through should be smaller. As the euro has gradually come to play a more prominent role in international trade and finance over the 2000s, a higher share of euro area trade is denominated in euro, possibly contributing to a decline in the ERPT to euro area prices. The share of exports of goods denominated in euro increased noticeably after the launch of the euro, and in the first years had already surpassed the amounts previously recorded jointly by its legacy currencies. Kamps (2006) shows that the share of the euro as a settlement and invoicing currency in extra-euro area exports rose, for example, between 2000 and 2004 from 49% to 61.1% in Germany and from 44.6% to 52.6% in France. In 2005 this share appears to have somehow stabilised for most euro area Member States at levels around 50-60%.<sup>26</sup> Similarly, the share of the euro as an invoicing currency on the import side has also increased noticeably e.g. in France from 32.9% in 2000 to 45.3% in 2003 and in Germany from 48% in 2002 to 55.2% in 2005 (Kamps (2006)).

### 2.3.2 EXCHANGE RATE PASS-THROUGH TO EURO AREA IMPORT PRICES<sup>27</sup>

The issue of possible changes in ERPT over time has received considerable attention owing to its potentially important implications for

24 Trade along the extensive margin has been put forward as an important characteristic of trade integration (Hummels and Klenow (2005)).

25 See, for example, Gust et al. (2006) for a rigorous model-based treatment of this mechanism.

26 See ECB, Review of the International Role of the Euro (2007).

27 This section has benefited from contributions from Chiara Osbat and Martin Wagner.

monetary policy, the resolution of global imbalances and global inflation. A number of studies have shown that ERPT has gradually declined in recent years in many countries. For instance, Ihrig, Marazzi and Rothenberg (2006) show in a recent study conducted at the US Federal Reserve Board, that all G7 countries experienced a decline in ERPT to import price from 1990 to 2004 relative to the earlier period from 1975 to 1989, with the decline being statistically significant in the case of the United States, Japan and France. The ERPT estimates for the second sub-period are very low for France, Germany and Italy, (0.16, 0.29 and 0.46 respectively) when compared with those for other industrial countries (in particular, 0.32 for the USA, 0.59 for the UK and 0.61 for Japan).<sup>28</sup> Other studies have confirmed the finding of a decline in ERPT for advanced countries. For instance, Mumtaz, Oomen and Wang (2006) suggest that there has recently been a significant decrease in ERPT to import price in the United Kingdom, both economy-wide and at the industry level.

Although individual euro area countries are often included in these studies, the euro area as a single economy is generally not considered. Empirical evidence on changes in the ERPT to euro area prices over time is extremely scarce and the few results put forward so far are quite mixed.

In order to ensure comparability, the following regression equation, which is similar to the one used by Ihrig, Marazzi and Rothenberg (2006), is estimated:

$$\Delta \ln x_t = \sum_{k=1}^K \beta_{1k} \Delta \ln x_{t-j} + \sum_{k=0}^K \beta_{2k} \Delta e_{t-j} + \sum_{j=3}^n \sum_{k=0}^k \beta_{jk} \Delta \text{other reg}_{t-k} + u_t \quad (2)$$

Changes in euro area manufacturing import prices ( $\Delta \ln x_t$ ) are a function of their own lags, changes in the nominal effective exchange rate ( $\Delta e_{it}$ ) and a number of additional regressors like the foreign producer prices, global oil and

**Table 3 Euro area import price ERPT: regression results**

	Coefficient	Tail probability
Constant	0.00	0.1310
NEER	<b>0.72</b>	0.0000
Foreign PPI	0.57	0.1790
Industrial raw material price	<b>0.10</b>	0.0004
Oil prices	<b>0.10</b>	0.0000

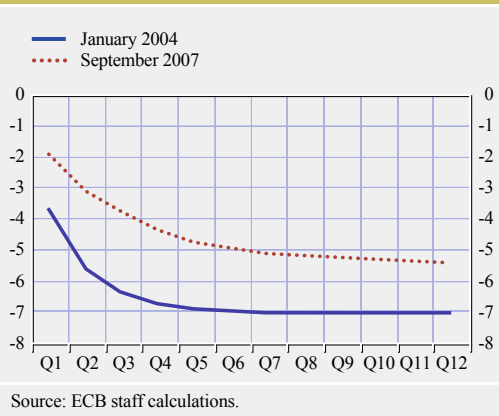
Source: ECB staff estimates.  
Notes: Long-run estimates. All variables are in growth rates.  
Coefficients significant at 5% level are in bold.

industrial raw materials prices (*other reg*). The pass-through is captured by the coefficient  $\beta_{20}$  in the short run, and by the ratio  $\frac{\beta_{20} + \dots + \beta_{2k}}{1 - (\beta_{11} + \dots + \beta_{1k})}$  in the long run.

The results of dynamic regressions for the euro area over the period 1992-2004 are summarised in Table 3 for the long-run specification of the ERPT. Among the other explanatory variables, only nominal exchange rates, oil and industrial raw materials prices appear to have a significant effect, in the long run, on import prices. More importantly, the analysis indicates an estimated long-run ERPT coefficient of 0.72, higher than those found by Ihrig, Marazzi and Rothenberg (2006) for some individual euro area countries included in their sample and comparable to the ones found for the United States and the United Kingdom. However, this result is in line with other studies carried out on the euro area. For instance, based on sectoral estimates for all euro area countries, Campa and Gonzales (2006) find an average long-term pass-through coefficient on extra-euro area import prices of 81%. Limiting the analysis to manufacturing import prices, estimates by Anderton (2003) suggest that the pass-through in the long run is in the range of 50-70%. A more recent study based on vector autoregressive models by Ca' Zorzi, Hahn and Sánchez (2007) find a long-term pass-through coefficient of around 70% for the euro area.

28 For detailed technical discussions of the different methodologies and criticism of the one used in the papers mentioned in the text, see Osbat and Wagner (2006), as well as de Bandt, Banerjee and Kozluk (2007). See also Marazzi et al. (2005) for additional evidence on exchange rate pass-through to US import prices.

**Chart 24 Response of euro area import prices to exchange rate shock (over 12 quarters) based on the AWM in 2007 compared with 2003**



These findings are also broadly in line with the long-run ERPT embedded in the AWM. Chart 24 depicts the evolution of the euro area import prices response to an exchange rate shock resulting from the AWM simulation over a horizon of 12 quarters. Interestingly, the ERPT appears to be somewhat lower in the most recent version of the AWM from 2007 (at around 50%) compared with the previous 2004 version, for which ERPT is around 70%. Although a number of modifications have been incorporated in the new version of the AWM, this may tentatively suggest that the extent of ERPT to import prices may have declined somewhat in the euro area over recent years.

### 2.3.3 EXCHANGE RATE PASS-THROUGH TO EURO AREA IMPORT PRICES – A SECTORAL PERSPECTIVE<sup>29</sup>

While in the previous section the discussion on ERPT in the euro area focused on aggregate price indices, this section focuses on ERPT at the sectoral level. As industry characteristics differ significantly, the same may be true for sectoral ERPT, and shifts in the sectoral composition of euro area imports may therefore help to explain changes in ERPT at the aggregate level. For that purpose, the same specification as that used in the previous section is estimated at the sectoral level. However, rather than estimating a single-equation specification, the import price equation is estimated as part of a VAR-X model, which

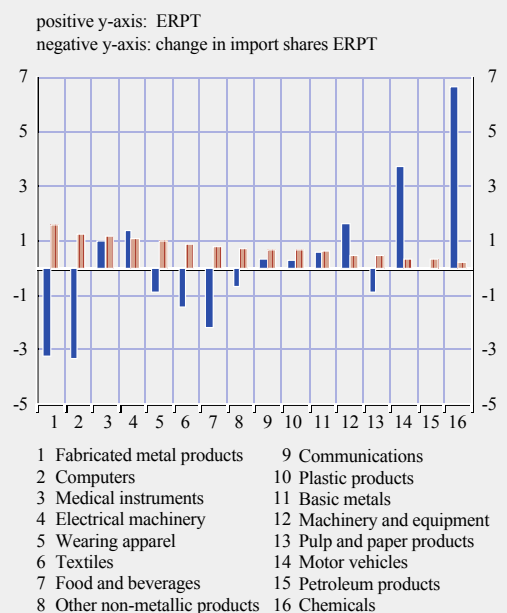
includes – in addition to the main endogenous variables – some exogenous variables, the dynamics of which are not explained by the model. These exogenous variables, contained in “*other reg*” in equation 2, include a measure of common external factors and demand side effects (proxied by commodity prices and the output gap respectively) which may condition both prices and exchange rates. In addition, domestic and foreign producer prices are included to proxy for the price of substitutes and foreign costs respectively. The model is estimated for 16 euro area industries. Long-run sectoral ERPT is calculated from the impulse-response function of import prices to a shock to the exchange rate at a 24-month horizon.

Chart 25 shows a large degree of heterogeneity in the estimates of ERPT to import prices across sectors. The estimated long-run ERPT varies from 0.22 (not significantly different from 0,

<sup>29</sup> This section has benefited from contributions from Chiara Osbat and Martin Wagner.

**Chart 25 Sectoral ERPT and change in sectoral import shares**

(percentage changes in case of import shares; 1988-2005)

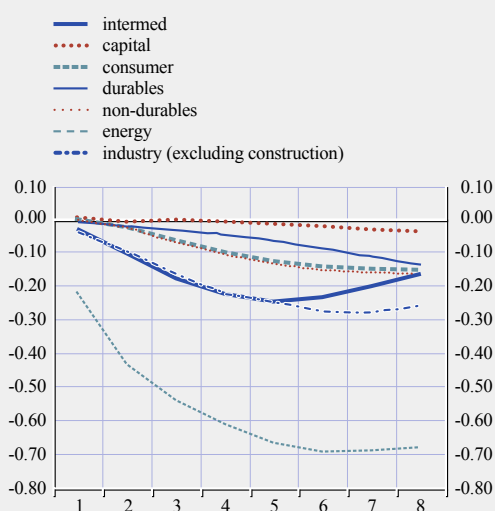


Source: ECB staff estimates.

i.e. no ERPT) for chemicals and motor vehicles to 1.57 (not significantly different from 1, i.e. full ERPT and local pricing) for fabricated metal products and computers. Overall, long-run ERPT is found to be not significantly different from 0 in three sectors and not significantly different from 1 in eleven sectors, with a variable degree of uncertainty across sectors. Recursive estimations of the VAR-X model at the sectoral level, for extra-euro area import price over the period 1988-2005<sup>30</sup> find very little evidence of decline in structural parameters for sectoral ERPT.

The presence of substantial heterogeneity in sectoral ERPT for the euro area is also the main conclusion of a recent analysis by Hahn (2007). The exchange rate is found to have the strongest impact on producer prices of energy, followed by intermediate and consumer goods producer prices, while hardly any response is recorded for producer prices of capital goods (see Chart 26). Data availability only allowed changes in the ERPT to be explored

**Chart 26 Impact of a 1 percent appreciation of the euro on producer prices in the main industrial groupings of the industrial sector**



Source: Hahn (2007).

Notes: The impact on producer prices is not statistically significantly different from zero for capital goods production. For some sectors, the impulse response shows a hump-shaped form. This is, in particular, the case for sector estimates, which are based on relatively short sample periods. This seems to suggest that this pattern is not based on economic grounds, but displays some uncertainty in the estimates. This interpretation is also in line with the estimated error bands.

over a five-year horizon, from 1995 to 2000, and the changes found over this period are relatively limited. According to Hahn (2007), there has been some small decline in the ERPT on producer prices in industry (excluding construction), as the weight of the sub-sector electricity, gas and water supply, which displays a high ERPT, decreased. However, the results appear to be highly dependent on the price index used as endogenous variable.<sup>31</sup>

Given the large degree of sectoral heterogeneity in ERPT, the time-variation in the aggregate ERPT may be a result of shifts over time in the sectoral composition of euro area imports. This explanation based on the presence of sectoral shifts had already been put forward by Campa and Goldberg (2005) for the United States, who argued that the decline in ERPT may come from shifts in the composition of the import bundle from high pass-through goods, such as energy and raw materials, to lower pass-through items, such as manufactured goods. Calculating aggregate euro area ERPT as the import-share weighted sum of sector-level ERPT shows that such a shift from high to low ERPT sectors has also occurred to some extent in the euro area. Comparing aggregated ERPT based on import shares in 1988 and 2005 shows that this would mechanically result in a decline of overall ERPT from 0.83 to 0.74.

### 2.3.4 EXPLANATIONS FOR HETEROGENEITY IN SECTORAL EXCHANGE RATE PASS-THROUGH<sup>32</sup>

An empirical analysis of the determinants of sectoral ERPT in the euro area can shed some light on the factors affecting ERPT. In particular, it is possible to assess whether globalisation-

30 See also for the euro area de Bandt, Banerjee, and Kozluk (2007), who find evidence of an increase in import price ERPT for some euro area countries and some sectors.

31 For instance, when considering the producer prices in the manufacturing sector, the study finds a small increase in the ERPT over the same period, related to an increase in the weight of high ERPT sector manufacture of coke, refined petroleum products and nuclear fuel. This might be the result of the surge in oil prices over the period under consideration.

32 This section has benefited from contributions from Chiara Osbat and Martin Wagner.

related structural changes, such as increased market integration and import penetration, can be expected to affect ERPT.

To this end, the sectoral ERPT coefficients discussed in the previous section are regressed against a set of proxies of sectoral characteristics, such as import penetration, market integration, operating surplus and revealed comparative advantage. Specifically, the import penetration, reflecting the proportion of foreign to domestic firms that are active in a given sector, is expected to enhance the pricing ability of foreign firms and therefore to be positively related to the ERPT. Conversely, a higher integration of a given sector in world markets is expected to lead to a decline in the ERPT. As far as the nature of competition is concerned, the expectation would be for the ERPT to decrease in a context of more intense competition, proxied by the operating surplus. Studies for the euro area show that, relative to value added, the operating surplus is highest in the petroleum sector and in other more commodity-based sectors, such as food and beverages, and tobacco and paper products. Finally, the model takes into account the revealed comparative advantage (RCA) – a measure of the degree of specialisation of exports introduced by Liesner (1958) and Balassa (1965). By limiting the pricing ability of competitors, higher competitiveness of the euro area in a given sector (proxied by higher operating surpluses and RCA) is expected to be associated with a decline in ERPT.

The cross-section regression can be written as following, with  $i$  indexing the various sectors:

$$ERPT_i = \mu + \delta_1 IP_i + \delta_2 MI_i + \delta_3 OS_i + \delta_4 RCA_i + v_i \quad (3)$$

IP denotes the ratio of imports to value added in each sector as a proxy for market penetration,<sup>33</sup> MI denotes the ratio of exports plus imports over valued-added, based on nominal values in euro, as a proxy for market integration, OS denotes the ratio of net operating surplus to

value added as a measure of the degree of competition (and hence profitability) or competitive pressure within the sector<sup>34</sup> and RCA denotes the ratio of a sector's share in the euro area's exports, divided by the same ratio for the rest of the world, as a proxy for revealed comparative advantage. This variable is equal to one for a given sector if the sectoral export share is the same as in the reference group and larger than one if the euro area has a revealed comparative advantage in that sector.

Table 4 reports the coefficient estimates for the various determinants of sectoral ERPT. As expected, higher import penetration leads to increasing ERPT, whereas higher market integration contributes to a decrease in ERPT. This points to the presence of offsetting forces at the sectoral level, which may provide a partial explanation for the mixed aggregate results. Moreover, these results imply that sectoral competitiveness, as measured by the operating surplus, has no significant impact on the pass-through when the degree of specialisation at the sectoral level, measured by the revealed comparative advantage, is taken into account.

33 Value added was used instead of the nominal value of total production, because data for the latter have a much poorer coverage over sectors, countries and time periods.

34 It is very important to note that operating surplus is a very indirect measure of profits, as it also includes the remuneration of capital and taxes.

**Table 4 Determinants of sectoral exchange rate pass-through: regression results**

	Specification 1 Coefficient	Specification 2 Coefficient
Intercept	<b>2.058</b> (0.001)	<b>1.695</b> (0.000)
Import penetration	<b>1.682</b> (0.047)	<b>1.885</b> (0.004)
Market integration	<b>-0.983</b> (0.046)	<b>-1.089</b> (0.005)
Operating surplus	-3.495 (0.135)	<b>-2.967</b> (0.001)
Revealed comparative advantage	-0.314 (0.486)	-
R <sup>2</sup>	0.623	0.617

Source: ECB staff estimates.

Notes: Long-run estimates. All variables are in growth rates. Coefficients significant at 5% level are in bold.

### 2.3.5 PRICING BEHAVIOUR OF EMERGING MARKET EXPORTERS<sup>35</sup>

The analysis of export pricing behaviour of euro area trading partners may provide an alternative explanation for the dynamics of aggregate ERPT. In particular, higher pricing-to-market among several emerging markets, especially in some Asian countries in the wake of the Asian crisis of 1997-98, has been put forward as one major reason for the decline in pass-through among some advanced countries, noticeably the United States.<sup>36</sup> Given the growing importance of emerging market exporters for euro area trade, this explanation may also be relevant in the context of euro area ERPT.

There is some evidence that some emerging market exporters may have indeed shifted towards a strategy of greater pricing-to-market in recent years. This result is based on the recursive estimation over a window of 30 quarters in a standard trade equation. Pass-through seems to have decreased in South Korea and Thailand in the wake of the Asian

crisis (see Chart 27).<sup>37</sup> In Mexico, pass-through fell at the time of the 1995 crisis, but has been on an upward trend since 2002. Similar developments have been recorded in other countries, such as Israel, Turkey and the Philippines, as a result of specific developments and structural changes affecting their economies over the recent period. In particular, the adoption in several emerging economies of regimes that allow for greater exchange rate flexibility, as well as the ongoing move of economies towards lower inflation regimes, possibly indirectly linked to globalisation, may have increased their propensity to price to market. However, in Latin American emerging countries, such as Peru, the degree of pass-through seems to have been broadly constant since the early 1990s.

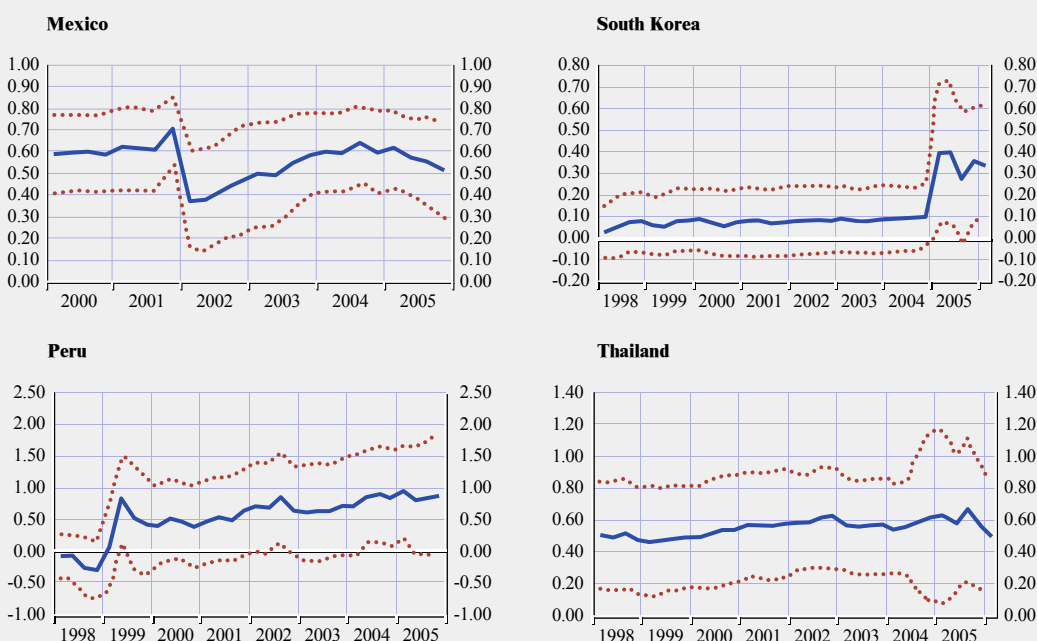
35 This section has benefited from contributions from Matthieu Bussière and Tuomas Peltonen, European Central Bank.

36 See Vigfusson, Sheets and Gagnon (2007).

37 The Asian crisis episode is included in all samples which end less than 30 quarters after the crisis. Thus the effect of the crisis is generally seen around 2004/2005, when the crisis drops out of the rolling sample.

Chart 27 Evolution of export price response for selected emerging market economies

(estimated export price elasticity (OLS); rolling sample with a window of 30 quarters)



Source: ECB staff estimates.



Thus, overall the results exhibit considerable differences across individual emerging market economies. The finding of an increase in pricing-to-market behaviour for some important emerging market is, however, consistent with the observed decline in pass-through to import prices in several developed economies and may provide an explanation for this decline, particularly in the United States, as argued by Vigfusson, Sheets and Gagnon (2007). At the same time, the lower significance of the emerging market trading partners in the export structure of euro area, compared to the United States, for instance, may also explain why the results for the euro area are not as conclusive, at the aggregate level, as they are for the United States or Japan.

#### 2.4 HAS THE PASS-THROUGH TO EURO AREA CONSUMER INFLATION CHANGED OVER TIME?<sup>38</sup>

This section presents some results regarding ERPT to consumer prices. While import prices are the prices most directly affected by changes in exchange rates, final prices at the consumer level are more relevant from an overall welfare perspective and are therefore the main focus for most central banks.

The impact of globalisation on the traditional relationship between exchange rate movement and CPI inflation for a sample of countries can be assessed on the basis of a panel VAR methodology. This technique treats all the variables in the system as endogenous, while allowing for unobserved individual heterogeneity. Consumer price inflation ( $\Delta p_{it}$ ) is assumed to depend on the change in the nominal effective exchange rate ( $\Delta e_{it}$ ), real GDP growth ( $\Delta gdp_{it}$ ), the domestic short-term interest rate ( $\gamma_{it}$ ), the change in oil price ( $\Delta oil_{it}$ ) and an error term capturing both fixed individual ( $f_i$ ) and temporal ( $e_t$ ) effects. Such a model is estimated for the sample period from the second quarter of 1980 to the first quarter of 2007 for a panel of 11 industrial countries.<sup>39</sup> Identification of the structural shocks is achieved through the traditional Choleski decomposition. In that respect, it is assumed that the exchange rate, as

a financial market variable, can react contemporaneously to innovations in all other variables and is thus ordered  $\{\Delta gdp_{it}, \Delta p_{it}, \gamma_{it}, \Delta oil_{it}, \Delta e_{it}\}$ . Concretely, the following first-order VAR model is estimated:

$$\Delta p_{it} = \alpha + \beta_1 \Delta e_{it} + \beta_2 \Delta gdp_{it} + \beta_3 \gamma_{it} + \beta_4 \Delta oil_{it} + f_i + e_t \quad (4)$$

with corresponding equations for each of the other four variables.

The dynamic response of CPI inflation to a one-standard deviation exchange rate shock, equivalent to a 3.4% appreciation of the nominal effective exchange rate, is shown in Chart 28. The evolution of the impulse-response function indicates that the maximum response occurs after 2-3 quarters. Moreover, after three years, a 10% appreciation of the nominal effective exchange rate results in a cumulative fall in CPI inflation of 1.1%.

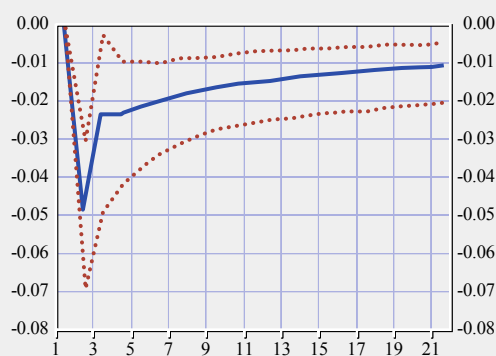
The impact of structural changes taking place during the period under consideration can be

38 This section has benefited from contributions from Isabel Vansteenkiste, European Central Bank.

39 Belgium, Canada, Switzerland, Germany, Spain, France, Italy, Japan, Singapore, the United Kingdom and the United States.

**Chart 28 Response of CPI inflation to a one standard deviation shock to the nominal exchange rate**

(sample: Q2 1980 – Q1 2007; all 11 countries)

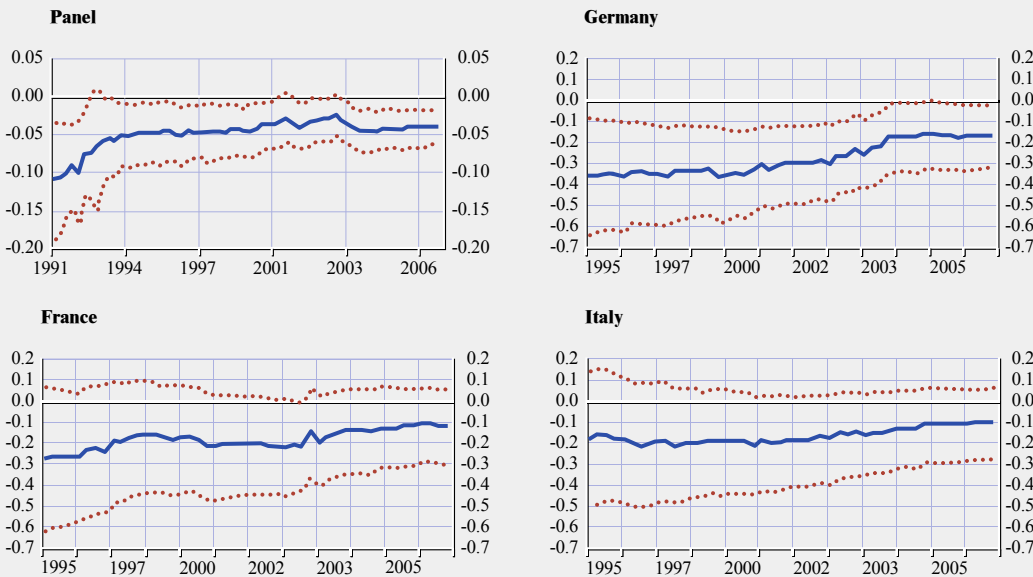


Source: ECB staff estimates.

Note: Confidence intervals of the impulse-response functions calculated using Monte Carlo simulations.

Charts 29 Evolution of CPI response to an exchange rate shock

(impulse response after four quarters; recursive estimation results)



Source: ECB staff estimates.  
Note: Standard errors of the impulse-response functions by using Monte Carlo simulation to generate their confidence intervals.

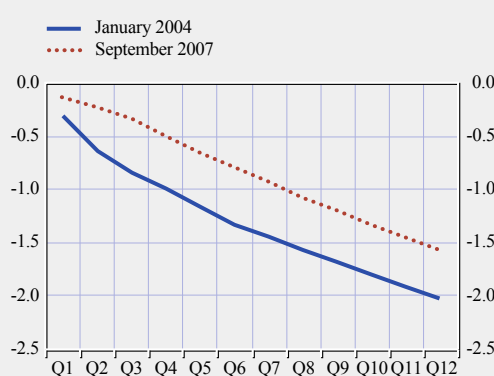
taken into account by performing recursive panel VAR regressions, starting with the shortest sample that is thought to still give reasonable estimates (concretely, the first ten years of observations were used, from the second quarter of 1980 to the second quarter of 1990) and then gradually adding, at each iteration, a quarter at the end of the sample moving forward toward the end of the sample period. Chart 29 depicts the evolution of CPI responses at a horizon of ten quarters, with each point on the chart representing the estimate for a particular sample, in chronological order from left to right. The last point then represents the estimated ten-quarter response based on the entire set of observations.

The results of the rolling VAR analysis point to some tentative evidence that the impact of an exchange rate shock on CPI has declined through time for the entire panel of industrial countries. Specifically, during the first subperiod, from the second quarter of 1980 to the second quarter of 1990, the impact of a one-standard deviation exchange rate shock on the CPI inflation is close to -0.4, whereas for the full

sample (i.e. from the second quarter of 1980 to the first quarter of 2007), the response is less than half this amount.<sup>40</sup> VAR estimates for some individual euro area countries point towards

40 However, considering the standard error bands surrounding the response, it is found that the response at the end of the sample is still within the standard error bands of the short sample, suggesting that the difference is not statistically significant.

Chart 30 Response of euro area HICP to exchange rate shock (over 12 quarters) based on the AWM



Source: ECB staff calculations.

some cross-country differences in the evolution of the ERPT over time. As Chart 29 shows, the decline in the pass-through to consumer prices is particularly pronounced for Germany and, to a lesser extent, for France and Italy.

Simulation results from the ECB's AWM provide additional tentative evidence for a possible decline in ERPT to euro area HICP. As depicted on Chart 30, the response of euro area HICP to a 10% appreciation of the euro vis-à-vis all trading currencies declined in 2007 compared with the response obtained using the 2004 version of the AWM. The decline in ERPT appears to be smaller for consumer prices than for import prices.

### 3 EXCHANGE RATES AND TRADE

One of the key channels through which changes in exchange rates affect an economy is through its expenditure-switching effect on trade flows. An exchange rate appreciation makes a country's products more expensive relative to foreign goods and services and therefore leads to a shift of global demand away from domestic products towards foreign ones. This implies a reduction in exports and an increase in imports, resulting overall in a deterioration in the trade balance and thus a reduction in the contribution of net trade to GDP growth.

For a number of reasons, the ongoing process of globalisation may have resulted in a change in this expenditure-switching effect. This chapter reviews some of the evidence regarding possible structural changes in the relationship between exchange rates and trade flows, and investigates, in particular, the hypothesis of an increasing exchange rate “disconnect”. After some conceptual considerations are described in Section 1, Section 2 presents an analysis of aggregate euro area trade flows, focusing on the link between real exchange rates and exports, and possible changes thereof. Section 3 takes a more disaggregate view by analysing the effect of exchange rates on bilateral trade flows at the sectoral level. In particular, this analysis provides some evidence that geographical and industry composition effects may be part of the explanation for the observed changes in the responsiveness of exports to exchange rate changes.

Overall, this chapter shows that increased globalisation might have reduced the responsiveness of euro area export volumes to exchange rate movements at the aggregate level. Nevertheless, at the sectoral level, increased trade integration has led to higher levels of exchange rate elasticity for euro area exports addressed to some groups of countries. Taking a country-level approach, it is shown that the ongoing globalisation process has weakened the responsiveness of export volumes to exchange rate changes in countries like Germany, whereas

it has increased their responsiveness in France and Italy through shifts in the trade composition across industrial sectors characterised by different elasticities.

#### 3.1 CONCEPTUAL CONSIDERATIONS

The issue of how globalisation is likely to affect the link between exchange rates and trade flows is closely related to the issue of ERPT. Only to the extent that a given change in the nominal exchange rate translates into a change in export and import prices in the customers' currencies will this trigger a demand response. As discussed in Chapter 2, the effect of globalisation forces on the degree of ERPT is a priori ambiguous. Empirical evidence, however, suggests that there might have been some decline in ERPT to import prices for a number of countries, including the euro area, with this decline being, at least in part, attributable to the structural changes associated with globalisation. This should have by itself weakened the link between changes in the nominal exchange rate and import volumes. At the same time, the pricing behaviour of euro area exporters appears to have remained relatively stable over recent years. Thus, this channel should not have contributed to alter the sensitivity of euro area exports to changes in the nominal exchange rate.

In addition to such price-related effects, the various aspects of globalisation can be expected to also have a more direct impact on the exchange rate-trade flows link. The entry of new players in the global trading system and lower trading costs have resulted in a larger variety of similar products being traded. This has increased the substitutability between products and suppliers. Consequently, changes in relative prices between products from different source countries may result in a more pronounced demand response to fluctuations in the exchange rate. In addition to these demand-side effects, the reduction in trading costs may have also resulted in a stronger supply response to changes in exchange rates. This applies, in particular, to “sunk” trading costs, i.e. the costs of entering a new market

which cannot be redeemed in case of a later exit from the market, such as setting up of a distribution network or initial marketing expenses. The existence of such costs introduces a degree of sluggishness into trade flows. Even though, at a given exchange rate constellation, it might be profitable to enter a new market, an adverse move in the exchange rate may subsequently render exporting unprofitable. Without sunk costs this would not represent a problem for the firm contemplating whether or not to export, as it could just withdraw from that market again. With sunk costs, however, a firm might choose to wait a little longer in order to ensure that the exchange rate moves in the “right” direction, as otherwise the initial outlays would be irredeemably lost. Similarly, a firm that has already entered the market may not immediately react to a deterioration in its profitability owing to an appreciation of the currency in order to protect the value of its initial investment. By analogy, this would of course imply that a reduction in sunk costs, possibly related to the process of globalisation, would reduce this sluggishness in the supply response by facilitating the entry or exit of new firms. Thus, not only the responsiveness of trade along the intensive margin (existing firms trading more or less), but also along the extensive margin (entry and exit of firms), may increase.

One other relevant facet of globalisation is the increasing internationalisation of the production process, involving more extensive sourcing of intermediate inputs from entities located abroad. As a consequence, the import content of exports has increased in many cases. Similarly, imports may contain a higher share of previously exported intermediate products which have been processed further abroad and then re-imported. This development should have by itself contributed to a reduced responsiveness of trade flows to exchange rate changes. For example, an appreciation increases the foreign currency price of exports. However, to the extent that parts of the exports do not constitute domestic value added, but rather imported inputs, this effect is mitigated,

as the price of these imported inputs declines owing to the appreciation. The same argument applies to imports in the case where the foreign value-added content decreases. A further potentially relevant aspect of globalisation is that progressive financial integration and innovation have reduced the costs of exchange rate hedging. As a result, firms may choose to hedge a larger share of their exchange rate exposure and may therefore reduce the supply response to an adverse change in the exchange rate.

Last, but not least, globalisation has resulted in significant changes in the product and geographical composition of euro area trade, driven in part by the emergence of new and important players in the global trading system. The responsiveness of trade flows to exchange rate changes generally differs between industries and trading partners, reflecting in part differences in the competitive structure. Thus compositional shifts may result in changes in the exchange rate elasticity of aggregate trade flows, with the direction of these changes being a priori indeterminate and dependent on the concrete changes induced by globalisation.

In sum, globalisation and globalisation-related structural changes can be expected to affect the link between exchange rates and trade flows through a multitude of different channels, with the overall net effect depending on the relative strength of the various effects. Thus, whether the responsiveness of euro area trade flows to exchange rate changes has increased or decreased over recent years remains an empirical question. The remainder of the chapter will provide some selected evidence regarding this issue.

### 3.2 THE EMPIRICAL LINK BETWEEN EXCHANGE RATES AND EURO AREA TRADE FLOWS<sup>41</sup>

Before analysing possible changes in the relationship between exchange rate changes and trade flows, it appears useful to review

41 This section has benefited from contributions by Katrin Forster, European Central Bank.

**Table 5 Trade impact of a 10% appreciation of the euro**

(deviation from baseline; annual averages)

	Percentage deviation from baseline (cumulated)		
	Year 1	Year 2	Year 3
Export volumes	-1.2	-1.9	-1.9
Import volumes	-0.6	-0.8	-0.7

Source: ECB staff calculations, using the Area Wide Model.

the evidence regarding this relationship more generally. For that purpose the ECB's Area Wide Model (AWM) is used to simulate the effect of a 10% appreciation of the euro in effective terms on export and import volumes.

The ensuing loss in price competitiveness resulted in a decline in export volumes concentrated in the first year (1.2% lower relative to baseline) and lower impact thereafter (see Table 5).<sup>42</sup> On the import side, the effective appreciation of the euro would tend to increase import demand on impact given the decline in import prices denominated in euro. However, this direct price effect is more than offset by the indirect quantity effects stemming from the reduction in overall demand owing to the decline in net exports and thus overall activity. According to the AWM simulations, import volumes decrease by 0.6% relative to baseline in the first year and by 0.7% in the third year.

**Chart 31 AWM response of euro area export volumes to exchange rate shock over 12 quarters**

Source: ECB staff calculations.

In order to assess possible changes in the trade effect of exchange rate changes, the most recent version of the AWM from 2007 is compared with an earlier version from 2003. The export volume response indeed decreases to a cumulated -1.9% after three years, compared with almost -3% suggested by the older estimates (see Chart 31). However, these findings must be interpreted with caution since the most recent version of the AWM also includes some structural changes with respect to the earlier version, in addition to more recent data.

In order to analyse in more detail the link between export volumes and exchange rates, a fairly standard trade equation is used. It includes a long-term equilibrium relationship as an error correction term, as well shorter-term dynamics around this long-term equilibrium. In this setting, current changes in export volumes are explained not only by contemporaneous changes in a set of exogenous variables (i.e. foreign demand<sup>43</sup>, a trend component and the relative export prices<sup>44</sup>), but also by the degree to which these variables diverge from the equilibrium state in the previous period.

The error correction equation can be written as follows (all variables are in logarithms):

$$\Delta x_t = \alpha \cdot (x_{t-1} - \beta_1 \cdot fd_{t-1} - \beta_2 \cdot rxp_{t-1} - \beta_3 \cdot trend_{t-1}) + \gamma_1 \Delta fd_t + \gamma_2 \Delta rxp_t + v_t \quad (5)$$

where  $x$  denotes extra-euro area export volumes,  $fd$  foreign demand and  $rxp$  the relative export prices. The estimated long-run relationship between the variables is captured

42 In the AWM, trade volumes are modelled in a standard fashion, whereby market shares – in terms of world demand and domestic demand respectively – are a function of a competitiveness indicator involving trade prices, the competitors' index being computed as a weighted average of external and internal prices. Thus, the downward reaction of export volumes is mitigated by the reaction of export prices.

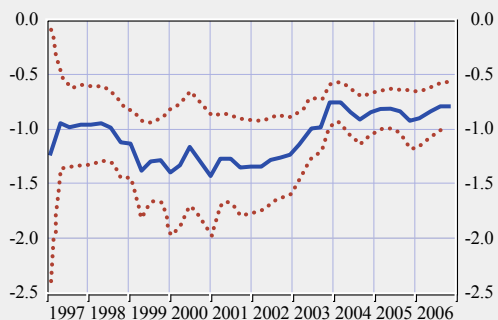
43 Foreign demand is defined as the weighted average of real imports of the main export markets of the euro area, using weights defined as the shares of each country or region in total extra-euro area exports.

44 The relative export prices are defined as the euro area export price divided by competitors' export prices in euro, calculated using double weights.



**Chart 32 Long-run coefficients on relative export prices for export volumes of goods**

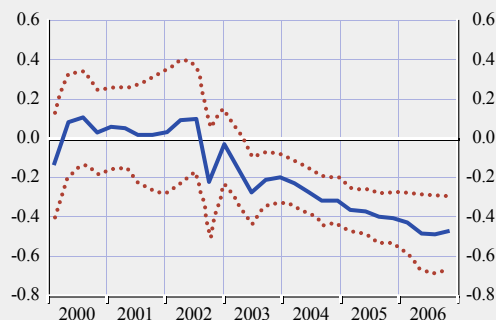
(sample: from Q1 1993 to Q1 2007; recursive estimation)



Source: ECB staff calculations.  
Notes: The chart shows recursive estimation of  $\beta_2$  in Equation 5 (standard specification), including a deterministic trend and imposing a unit elasticity on the foreign demand trend in the long run. The endogenous variables enter with one lag only for saving the available degrees of freedom.

**Chart 33 Long-run coefficients on relative export prices for export volumes of services**

(sample: from Q1 1995 to Q1 2007; recursive estimation)



Source: ECB staff calculations.  
Notes: The chart shows recursive estimation of  $\beta_2$  in Equation 5 (standard specification), including a deterministic trend and imposing a unit elasticity on the foreign demand trend in the long run. The endogenous variables enter with one lag only for saving the available degrees of freedom.

by the coefficients  $\beta_i$ ,  $i=1,2,3$ , whereas the rate at which export volumes converge towards the long-term equilibrium relationship is given by the error correction coefficient  $\alpha$ . The coefficient of interest for our analysis is  $\beta_2$  which reflects the equilibrium effect of relative export prices on the level of exports.

The estimation of the trade equation over the full sample period indicates that the coefficient on relative export prices has the expected negative sign, with the long-run elasticity equal to -0.80. Chow-breakpoint tests for the years 1999 and 2002 do not point to a break in the relationship. To allow for the possibility of a more gradual structural shift in the relationship, the model is estimated recursively, with the initial sample spanning from the first quarter of 1993 to the first quarter of 2000 in the case of goods exports and from the first quarter of 1995 to the first quarter of 2000 in the case of services exports. At each step, one further observation is added until the end of the sample period is reached.

The results suggest that the responsiveness of export volumes of goods to exchange rate changes may have diminished somewhat over time. The (negative) coefficient for the long-run elasticity on relative export prices shows a slight

upward trend (see Chart 32). By contrast, the recursive estimation for extra-euro area export volumes of services provides some evidence of increased responsiveness to changes in the exchange rate (see Chart 33). This may be owing to services becoming increasingly tradeable due to lower costs of information processing and communication.

To better understand the changes in the goods export equation, the long-run relationship is estimated alternatively with dynamic OLS-regression.<sup>45</sup> To test for structural changes, the various explanatory variables are interacted with a dummy ( $d_{00-07}$ ), taking the value 0 over the first sub-sample (until end-1999) and 1 thereafter. Expressed in this way, the coefficients on the interacted terms illustrate whether and how the influence of the regressors, i.e. the elasticities, has changed in the later period.<sup>46</sup> More particularly, this approach

45 As initially shown by Saikkonen (1991), asymptotically efficient estimates can be obtained by including leads and lags of the regressors' first-differences among the explanatory variables, which presents the advantage of correcting for endogeneity and serial correlation.

46 A similar approach was followed by Stahn (2006a) who tested for changes over time in the impact of the key determinants of German exports.

involves estimating the following equations for export volumes:

$$y_t = \beta \cdot X + \gamma \cdot d_{00-07} \cdot X + \sum_{j=k_1}^{k_2} (\eta_{1j} \Delta X_{t+j} + \eta_{2j} \Delta d_{00-07+j}) + \varepsilon_t \quad (5i)$$

where  $X$  denotes the set of regressors (including the constant),  $k_1$  and  $k_2$  the number of leads and lags respectively and  $\varepsilon_t$  the error term.

As far as the long-run elasticities are concerned, the results of dynamic regressions with time-dummies support the previous findings from the recursive error correction model estimations (see Table 6). The coefficient on relative export prices is clearly lower (-0.27) in absolute terms when it is interacted with the globalisation dummy than the coefficient for the whole sample (-0.63). The estimation also shows that the negative time trend becomes significant only in the period after 2000. The responsiveness of export volumes of goods to changes in relative export prices appears to have declined somewhat during the early 2000s, although the extent of this decline is relatively limited.

To check whether these results hide important differences at the product, or the country-level, dynamic regressions were also performed for broad product categories and three major euro area countries. For manufacturing, capital and consumer goods, the results confirm the previous finding, displaying lower coefficients on the relative export prices variables over the more recent period. For intermediate goods, in equation (5i) both coefficients for the relative export price variables and time variation are insignificant.

Estimating the model for the extra-euro area export volumes of Germany, France and Italy provides some evidence that cross-country differences may be important. The results for Germany are very similar to the findings for the euro area and are also in line with the results of Stahn (2006a), who performed a similar analysis for Germany. In particular, there is a notable and statistically significant reduction in the relative

Table 6 Dynamic regression results

	Export volumes (goods, extra-euro area)			
	Full sample	Germany	France	Italy
constant	4.610**	0.260**	0.430*	0.830
$d_{00-07}$	-0.870	0.540**	1.950**	1.720**
relative export prices ( $rxp$ )	-1.050**	-0.440**	-0.640**	-0.160
$d_{00-07} \cdot rxp$	0.450**	0.320**	-0.100	-0.270
Foreign demand ( $fd$ )	0.980**	0.960**	0.920**	0.820**
$d_{00-07} \cdot fd$	-0.251**	-0.130**	-0.430**	-0.380**
Adj. $R^2$	0.990	0.990	0.980	0.970
SE	0.017	0.017	0.025	0.030

Source: ECB staff estimates.

Notes: Coefficients are significant at the 5%/10% level based on standard errors adjusted for heteroskedasticity and autocorrelation (Newey-West covariance estimator).  $d_{00-07}$  represents a dummy variable, taking the value 0 before 2000 and one thereafter,  $rxp$  denote relative export prices,  $fd$  foreign demand. All variables are in logarithms.

price coefficient suggesting a significant decline in the responsiveness of trade flows to exchange rate movements.

### 3.3 A DISSAGGREGATED APPROACH TO TRADE ELASTICITIES<sup>47</sup>

Additional insights into the evolving relationship between exchange rates and trade can be gleaned from a study of disaggregate trade flows in the context of a gravity model. The advantage of a more disaggregate approach is that it may also provide information on the underlying causes for structural changes, as differences across industries and destination countries and the associated composition effects in aggregate trade flows can be studied.

Berthou (2008) studies these issues for bilateral trade flows between 17 exporting and 56 importing countries, disaggregated for 26 industries. The study uses annual data for the period from 1989 to 2004. Following Flam and Nordström (2003), the value of bilateral trade flows is modelled as a function of the real bilateral exchange rate between exporting and importing country, the real effective exchange rate vis-à-vis third-country competitors and a range of

47 This section has benefited from contributions by Antoine Berthou.

traditional gravity variables related to bilateral market access. In addition, the estimation specification includes fixed effects for exporting and importing countries, industries and time period. Concretely the following model of bilateral trade is estimated

$$x_{ijkt} = FE + \alpha_1 \ln \left( \frac{P_{it}(i)}{P_{jt}(j)} e^{jit} \right) + \alpha_2 \ln \left( \frac{P_{ct}(c)}{P_{jt}(j)} e^{jct} \right) + \alpha_3 X_{ij} + \varepsilon_{ijt} \quad (6)$$

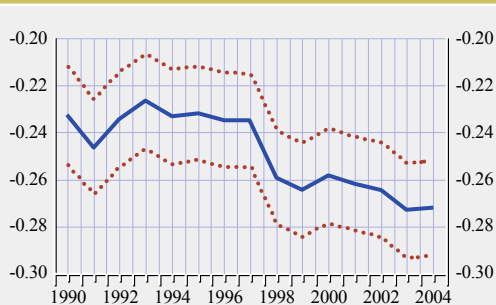
where  $x_{ijkt}$  denotes the log of the value of exports from country  $i$  to country  $j$  in industry  $k$  at time  $t$ . FE represent the various fixed effects and  $X_{ij}$  subsumes the various gravity variables, such as bilateral distance, a common border dummy, a common language dummy and bilateral exchange rate volatility. The second term represents the real bilateral exchange rate between countries  $i$  and  $j$ , while the third term represents the real exchange rate vis-à-vis third market competitors, with  $e$  being the nominal exchange rate and  $p$  a measure of producer prices. Of particular interest in the present context is the parameter  $\alpha_1$  which captures the sensitivity of trade flows to a change in the real exchange rate.

The estimation results of the gravity equation suggest that a 10% real appreciation leads to a decline in the bilateral value of exports of around 2.5%. The sensitivity of euro area exports to exchange rate movements appears

to be somewhat lower, with a corresponding figure of 1.5%, compared with 3.6% for other OECD countries. In order to assess whether this export-exchange rate link has changed over time, the model is modified by combining the coefficient on the real exchange rate with time dummies. The results indicate a moderate increase in the sensitivity of trade flows to exchange rate changes over time (see Chart 34). This is consistent with the hypothesis that globalisation is associated with a decline in trading costs and thereby facilitates the entry and exit of firms into foreign markets and may thus increase the responsiveness of trade flows.<sup>48</sup>

Although at first sight this finding appears to contradict the results of a decline in the exchange rate sensitivity for aggregate euro area exports, it is important to note that the gravity model does not take into account the relative importance of different export destinations and industries for the euro area. In addition, it does not take into account the effect of possible changes in the industry and geographical composition of trade, which may, as in the case of ERPT, be an important determinant of time variations.<sup>49</sup>

Chart 34 Evolution of exchange rate coefficient over time



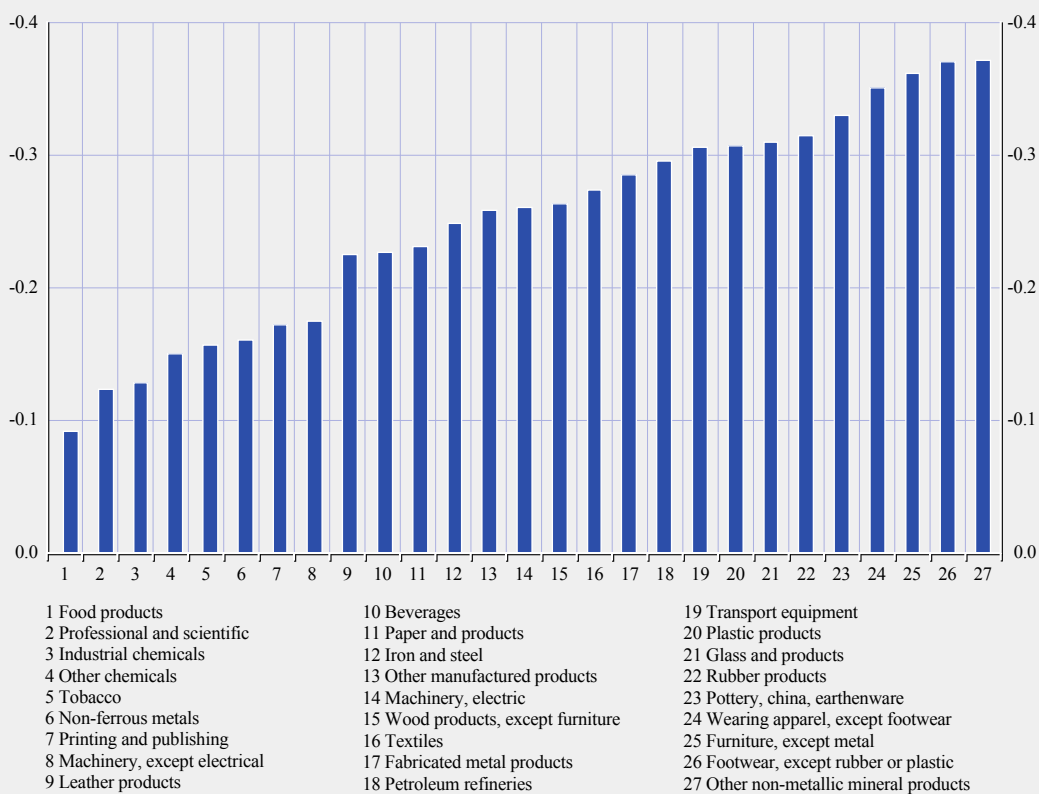
Source: Berthou (2008).

48 Although it is difficult to obtain measures for the evolution in trading costs over time directly, distance may be a useful proxy for trading costs along the cross-sectional dimension. Therefore the exchange rate variable is combined with a measure of bilateral distance to analyse whether an increase in trading costs, i.e. distance, is associated with a decline in the sensitivity of trade flows to exchange rate changes. This indeed appears to be the case, as the interaction term is statistically highly significant. Thus, if one applies this cross-section finding to the effect of globalisation over time, this finding would suggest that the globalisation-related decline in trading costs would result in an increase in the sensitivity of bilateral sector-level trade flows to changes in the exchange rate.

49 A number of other factors are also relevant in this respect: First, the gravity model is not restricted to euro area exporters, but includes other OECD exporters as well. Second, the gravity model analyses trade values, whereas the euro area export model focuses on volumes. Third, increased sensitivity of bilateral, industry-level flows does not necessarily translate into large aggregate sensitivity. For example, it is perceivable that increased competition and lower fixed cost of establishing trading relationships could increase the substitutability of goods from different suppliers. As a consequence, bilateral trade flows react more strongly to changes in relative prices. As this does not necessarily imply an overall reduction in trade, but merely a switch between suppliers, the impact on aggregate trade flows may be more limited.

Chart 35 Real exchange rate impacts on exports

(across industries)

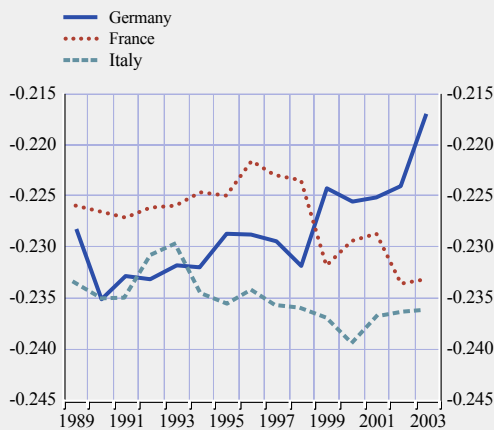


Source: Berthou (2008).

To assess the importance of industry and geographical composition effects in driving the finding of reduced sensitivity of aggregate euro area exports to exchange rate changes, the gravity model is used to derive industry and country/region-specific exchange rate elasticities. The exchange rate elasticity of trade flows exhibits significant heterogeneity across industries, ranging from around -0.09 in the case of the food industry to around 0.37 in the case of footwear and mineral products (see Chart 35). Thus, changes in the composition of actual trade flows could have important effects on the aggregate responsiveness of exports. The use of weighted averages of the industry-specific elasticities, with time-varying shares of the various industries in overall exports

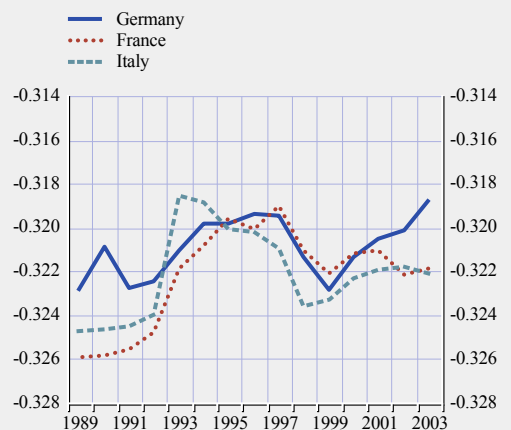
as weights, shows that these effects can be significant. For the euro area as a whole, this industry composition effect would have resulted in an overall decline in the exchange rate elasticity of exports. On a country basis, industry composition effects appear to have contributed to a decline in the exchange rate elasticity of German exports over time (see Chart 36). By contrast, for France and Italy, the exchange rate sensitivity of exports appears to have increased somewhat. These findings are in line with the estimation results for aggregate exports presented in Section 3.2 and point towards a shift in the industrial composition of euro area and German exports towards sectors with relatively low exchange rate elasticity as a possible explanation for the decline in exchange rate sensitivity.

**Chart 36 Evolution of exchange rate elasticity of exports – the industry composition effect**



Source: Berthou (2008).  
 Note: The exchange rate elasticity of a country's overall exports is calculated by weighting the sector-specific elasticities with the (time-varying) share of the sector in overall exports.

**Chart 38 Evolution of exchange rate elasticity of exports – the geographical composition effect**

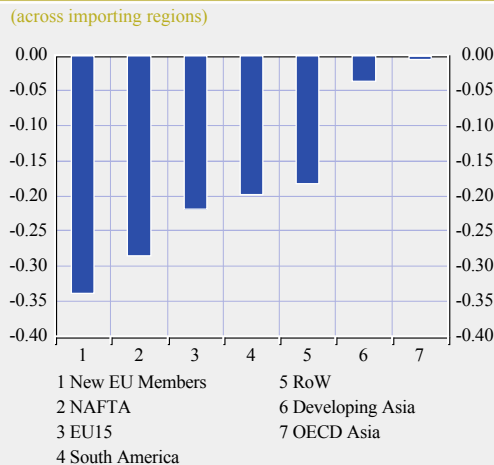


Source: Berthou (2008).  
 Note: The exchange rate elasticities of a country's overall exports is calculated by weighting the region-specific elasticities with the (time-varying) share of the region in overall exports.

In order to examine impacts of a similar nature related to changes in the geographical composition of exports, exchange rate elasticities for various destination regions are estimated. The results indicate considerable heterogeneity across geographical destinations. In general, the exchange rate elasticity appears to be somewhat higher for OECD destination countries than for non-OECD countries (see Chart 37). The

effect of exchange rate changes is particularly large in the case of new EU Member States and lowest – in fact, close to zero – for exports to the Asian region. Owing to this heterogeneity, shifts in the country composition of a country's exports may therefore lead to changes in the aggregate responsiveness of exports.

**Chart 37 Real exchange rate impacts on exports**



Source: Berthou (2008).

Similar to the approach taken in the case of industry effects, the quantitative importance of composition effects is assessed by calculating weighted averages of the regional elasticities, with the weights given by the share of the various destination regions in overall exports. For the euro area as a whole, this weighted elasticity exhibits a slightly declining trend over the sample (in absolute terms), with considerably short-term variability. The same exercise for some of the large euro area countries shows a very similar pattern of overall decline, with cross-country differences being much less pronounced than in the case of the industry effects (see Chart 38). The rapid integration of Asian countries – above all China and India – into the global trading system may explain some of this overall decline, given the significant increase in these countries' share in euro area trade.

In sum, the results from the gravity model complement the findings from the aggregate trade model in Section 3.2 by suggesting that disaggregated trade flows may have become somewhat more responsive to exchange rate changes, consistent with the globalisation-related decline in trading costs. At the same time, the results show that industry and geographical composition effects may explain part of the decline in the responsiveness of aggregate euro area exports to changes in the exchange rate.



## 4 OTHER EFFECTS OF EXCHANGE RATE CHANGES

### 4.1 GLOBALISATION AND THE IMPACT OF EXCHANGE RATE MOVEMENTS ON GDP GROWTH<sup>50</sup>

In order to assess the impact of exchange rate changes on activity some model simulations are used as a starting point. Once again, the ECB's area-wide model is used, as well as the GVAR – a model of the global economy estimated for 26 countries.

On impact, a 10% appreciation of the real effective exchange rate of the euro causes euro area GDP to decline in both models by 0.2% in the first year (see Table 7), predominantly owing to a lower contribution to growth from net exports. In the AWM, the drop in domestic demand and imports moderation initially have a roughly equal and opposite impact on GDP, but by the third year the negative impact on consumption and investment becomes dominant, resulting in a cumulated reduction in GDP of 0.9% relative to baseline. The slightly more optimistic results from the GVAR derive from favourable second-round effects coming from higher foreign demand.

Chart 39 compares the most recent simulation results of the ECB's AWM with an analogous simulation in 2004. The GDP impacts are somewhat larger (around 3% after four quarters). Although at face value these results may suggest that the impact of exchange rate changes on aggregate euro area activity has declined somewhat in recent years, the same caveats apply as for the abovementioned structural changes.

Owing to these limitations, a more direct approach is chosen to assess possible changes in the relationship between exchange rates and euro area GDP. The panel VAR methodology described in Section 2.4 is applied to estimate the dynamic impact of an exchange rate shock on GDP for the period from the second quarter

**Table 7 Impact of a 10 percent appreciation of the NEER on prices and activity in 2007**

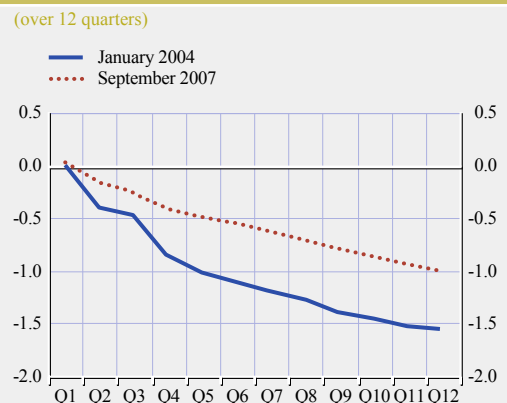
(annual averages)			
	Percent deviation from baseline (cumulated)		
	Year 1	Year 2	Year 3
<b>Real GDP</b>			
AWM	-0.2	-0.6	-0.9
GVAR	-0.2	-0.4	-0.6

Source : ECB staff calculations.

of 1980 to the first quarter of 2007. Consistent with the results from the AWM, the effects on output materialise fairly quickly, with the maximum impact on GDP growth occurring from two to three quarters after the shock (see Chart 40). According to these estimates a 10% shock to the nominal effective exchange rate would result in a cumulative decline of GDP growth by 0.3% after three years for the five euro area countries included in the panel (namely Belgium, Germany, Spain, France and Italy). With regard to possible changes in this relationship, the model was estimated recursively, with an initial sample for the period from the second quarter of 1980 to the second quarter of 1990, and a quarter being gradually added in each separate iteration at the end of the sample. Chart 41 depicts the

50 This section has benefited from contributions by Isabel Vansteenkiste, European Central Bank.

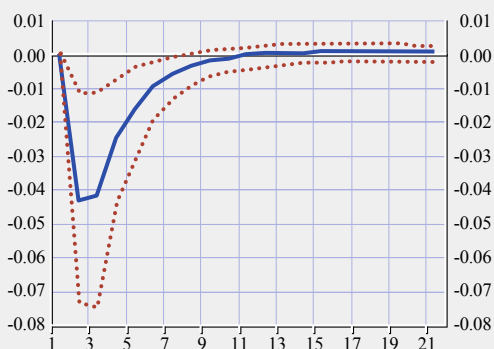
**Chart 39 Response of euro area GDP to a 10 percent appreciation of the euro**



Source: ECB staff calculations.

**Chart 40 Response of GDP growth to a one standard deviation nominal exchange rate shock**

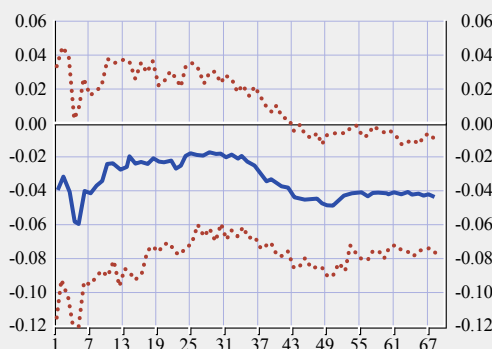
(sample: from Q2 1980 to Q1 2007; quarters)



Source: ECB staff estimates.  
Note: Dotted lines indicate the confidence interval.

**Chart 41 Evolution of GDP response after ten quarters**

(sample: from Q2 1980 to Q1 2007; recursive estimation; quarters)



Source: ECB staff estimates.  
Note: Dotted lines indicate the confidence interval.

impulse response of GDP after ten quarters for each recursive estimation. Although there are some variations in this response over the sample, these changes appear to be relatively limited and within the “normal” range of variation given the statistical uncertainty surrounding the estimates, as indicated by the 95% confidence bands. Thus, while the AWM results tentatively indicate some decline in the responsiveness of GDP to changes in the exchange rate, this finding does not seem to be confirmed by the panel VAR; any change is therefore likely to be fairly limited and difficult to detect at this point.

#### 4.2 THE IMPACT OF EXCHANGE RATE CHANGES ON FIRMS’ PROFITABILITY<sup>51</sup>

This section turns from the aggregate macroeconomic view to a more disaggregated microeconomic view by focusing on the link between exchange rate movements and the performance of firms in the presence of increased globalisation. Changes in exchange rates may affect the profitability of a firm in a number of ways. For example, an appreciation will result in a loss of international price competitiveness of an exporting firm. As a consequence, export volumes and thus earnings and profits are likely to decline. This decline in profits may be mitigated to some extent by firms absorbing part of the exchange rate change

through a reduction in export prices (in domestic currency), thereby mitigating the decline in volumes through a decline in margins per unit of exports. At the same time, an appreciation will reduce the cost of imported intermediates, thus improving firms’ profitability. Even firms that are not directly engaged in international transactions may see their profits affected by exchange rate fluctuations through competition from foreign firms in the domestic market. The overall impact of an exchange rate shock thus largely depends on the extent to which a firm is involved in international transactions, either on the input or on the output side, and on the competitive environment within which the firm operates. In addition, firms may choose to eliminate part of their exchange rate exposure – at least in the short to medium-run – through hedging strategies.

Increased globalisation may significantly affect these various channels. Increased trade integration in many cases implies that a larger share of a firm’s sales revenue stems from international sales, thereby amplifying the negative effect of an appreciation on profits. At the same time, stronger penetration of the domestic market by foreign firms is likely to lead to a more competitive operating environment,

<sup>51</sup> This section has benefited from contributions by Fabio Fornari, European Central Bank.

with increased substitutability between domestic and imported products. This effect would also tend to amplify the negative profitability effect of an appreciation. By contrast, increased sourcing of intermediate inputs as a result of reduced trading costs and the emergence of additional low-cost producers may reduce the profit-reducing effect of an exchange rate appreciation. However, increased competition could also imply that a larger share of any cost reductions brought about by an appreciation would have to be passed on to consumers, thereby limiting the positive effect on margins. At the same time, increased financial globalisation can be expected to reduce the costs of hedging against exchange rate fluctuations, which may, in turn, increase the share of the overall exchange rate exposure that a firm insures itself against. Thus, a priori it is difficult to predict the magnitude and even the direction of the effect of globalisation on the link between firms' profits and exchange rate movements.

The empirical literature on the exchange rate exposure of firms provides evidence for significant cross-country variation, with the overall level of exposure appearing to be relatively low. Early results (Jorion (1990) and Bodnar and Gentry (1993)) unanimously showed that exchange rate fluctuations influence firms' profits in the United States to a very low extent. In particular, there is a weak contemporaneous relationship between exchange rates and stock returns of US multinational firms. As shown by Jorion (1990), for instance, only 15 out of 287 US multinationals exhibit significant exchange rate exposures which increase with the share of foreign operations<sup>52</sup>. For other countries, the literature provides evidence of some stronger exchange rate exposure. In Canada and Japan, for instance, Bodnar and Gentry (1993) find more significant exchange rate exposure using industry returns instead of stock returns. The result for Japanese multinationals is also supported by He and Ng (1998). However, on large samples of countries, both developed and developing, Griffin and Stulz (2001) show that exchange rates do not matter much for the value of industries. Overall, the empirical findings

seem unanimously to favour the idea that contemporaneous exchange rate fluctuations affect shareholder wealth mainly in the case of non-US stocks. In addition, the empirical literature suggests that the risk exposure patterns are to a large extent industry-specific and tend to vary with the time horizon.

In order to analyse possible changes in the relationship between exchange rates and profits, data have been collected on a large number of firms from euro area countries using earnings as the measure of firms' profitability. The sample consists of 12,159 listed firms from six industrial countries<sup>53</sup>, namely the United States, Japan, Germany, France, Italy and the United Kingdom. The sample period is from March 1973 to June 2007. As the impact of exchange rate movements is likely to differ depending on the degree of international involvement of a firm, firms are classified in three categories according to the share of international sales in total net sales as of end 2005: large and small multinationals, i.e. firms with an above-median or below-median share of international sales in total net sales respectively and domestic firms, i.e. firms with no international sales.

Based on the cross-section of firms, the following equation is estimated for each country:

$$\Delta I_{t+1/t} = \alpha_i + \delta_i \Delta NEER_{t/t-4} + \varepsilon_{it} \quad (7)$$

where  $\Delta I_{t+1/t}$  is the quarterly rate of change (between (t+1) and (t)), of an earnings index calculated from the price to earnings ratio and the price index of stocks,  $\Delta NEER_{t/t-4}$  is the annual rate of change of the trade weighted nominal exchange rate index over the previous four quarters,  $\delta_i$  is the coefficient of interest, reflecting the elasticity of earnings growth

52 These findings are consistent with Amihud (1994), who reports no significant contemporaneous exposure for the 32 largest US exporting firms and Bartov and Bodnar (1994), who find no significant link between exchange rate changes and stock returns for a sample of 208 firms with international activity.

53 Germany (247 firms), France (9243 firms), Italy (142 firms), Japan (995 firms), the United Kingdom (543 firms) and the United States (989 firms).

to past developments in exchange rates and  $\varepsilon_{it}$  is the white noise error term. For most firms,  $\delta_i$  can be expected to be negative, as an appreciation leads to a reduction in earnings growth. Only in the case of a firm with largely domestic sales, limited foreign competition in the domestic market and significant international sourcing of imports could one expect a positive sign. In order to measure how the link between profits and exchange rates has changed over time as the operating environment has become increasingly globalised, the equation is estimated recursively, starting with the initial sample from March 1973 to January 1991.

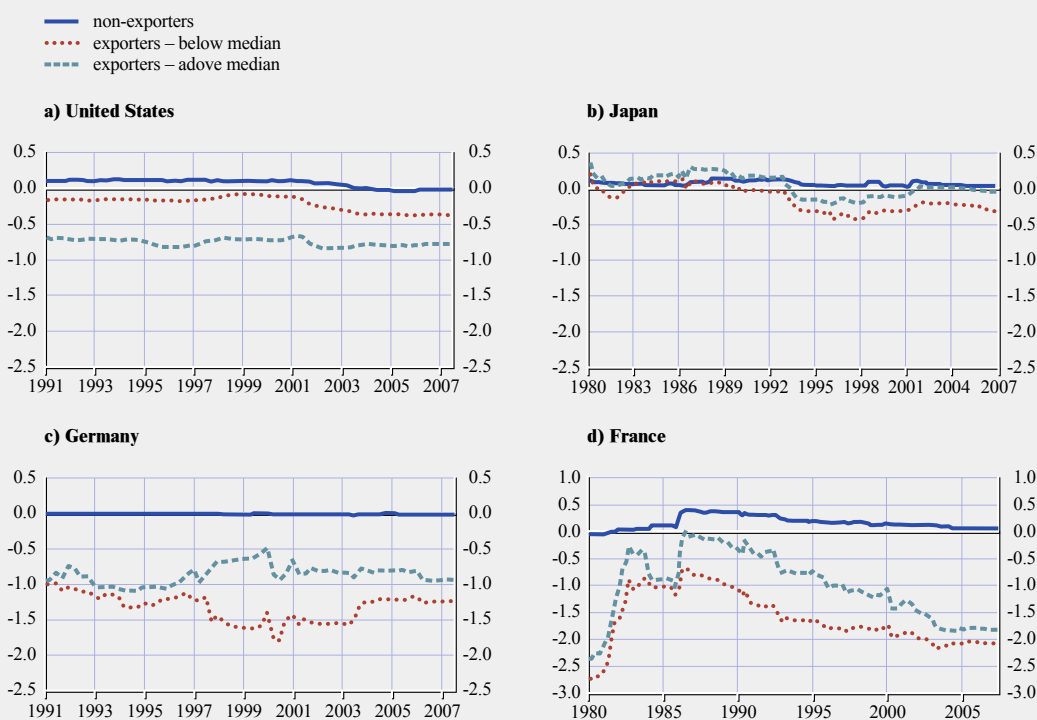
The evolution of FX exposure from the recursive estimation of equation (7) is reported in Chart 42 for the United States, Japan, Germany and France. Each point on the charts represents

the estimate of the firms' earnings sensitivity to exchange rate movements resulting from the cross-section regression of the quarterly rate of change in earnings against the annual change in the effective exchange rate.

Most of the time, the effect of a change in the exchange rate on the earnings of non-exporters is positive, but relatively small in magnitude. This suggests that the sourcing effect outweighs possible competition effects in the case of these firms. For firms with international sales, however, the competition effect dominates, implying that an appreciation reduces firms' earnings. The relative sensitivity of the earnings of small and large multinationals to a change in the exchange rate varies between countries, suggesting that firms with an above-average share of international sales are not necessarily more exposed to exchange rate changes. This

Chart 42 Impact of a 10% appreciation on earnings growth after one year

(sample: from March 1973 to June 2007; recursive estimation)



Source: ECB staff estimates.

Note: The categories “Exporters – above median” and “Exporters – below median” refer to exporters whose export earnings as a share of overall earnings area above and below the median share in the overall sample respectively.

could, for example, reflect the fact that large multinationals may in some cases also source a large part of their inputs internationally and/or that large multinationals more actively manage their sales in relation to exchange rate exposure. Regarding the evolution of the exchange rate sensitivity of earnings over time, for most firm categories and most countries, no clear trend can be identified, with French firms being the only exception.

Turning in more detail to the country results, US non-exporters appear to benefit moderately from an appreciation, with this effect disappearing in the latter part of the sample (Chart 42a). The impact on the earnings of small multinationals is relatively limited and close to zero in the middle of the sample. The earnings of large multinationals appear to be most affected, in line with the larger exposure on the sales side. According to these estimates, a 10% effective appreciation can be expected to reduce the earnings of large multinationals by around 0.7-0.8. Overall, the estimated coefficients for US firms are relatively stable over time. For Japanese firms, the estimated elasticities are generally small and close to zero in the case of non-exporters and small multinationals (Chart 42b). As in the case of US firms, the earnings of large multinationals in Japan are also most affected by exchange rate changes, with the overall impact being more limited, however, with an estimated elasticity of around 0.3.

In the case of Germany, the effect of a change in exchange rates on the earnings of non-exporters is virtually zero over the entire sample (Chart 42c). The effect on the earnings of multinationals is significant, with a 10% appreciation reducing earnings by around 1%. The effects for small and large multinationals were initially very similar in magnitude, with more notable differences starting to emerge in the late 1990s, as earnings of small multinationals were affected more strongly than those of those of large multinationals. Although the effects fluctuate somewhat over the sample, no clear trend over time is apparent. The

estimates for France indicate that the earnings of French firms may be particularly exposed to exchange rate fluctuations (Chart 42d). As in the case of German firms and in contrast to US and Japanese firms, the earnings of small French multinationals are more affected than those of large multinationals. This exposure increases more or less continuously up to 2003, with the elasticity estimate reaching around 2 in the case of both categories of multinationals.

Overall, the analysis provides evidence for significant heterogeneity in the extent of exposure across industrial countries, as well as large variation in the direction and magnitude of exposure. Exchange rate movements do matter for an important fraction of firms, although which firms are affected and the direction of exposure varies over time. However, the results suggest that despite the rapid internationalisation of firms' operating environments, this has not necessarily translated into an increased exposure of firms' earnings to shocks originating from the external side.

### 4.3 THE IMPORTANCE OF VALUATION EFFECTS FOR THE EURO AREA

The recent wave of financial globalisation has brought about a sharp increase in cross-border holdings of foreign assets and liabilities. Fluctuations in assets prices and exchange rates may thus affect country portfolios and trigger potentially large wealth transfers across countries, which are, in turn, likely to affect spending behaviour<sup>54</sup>. The currency denomination of assets and liabilities is of crucial importance for these wealth effects. In principle, if both assets and liabilities are denominated in the same currency the net external wealth position of a country with a net international investment position (NIIP) of zero would not be affected by a change in exchange rates. In the case of a net debtor with both assets and liabilities denominated in the same foreign currency, an appreciation of the domestic

<sup>54</sup> See, for example, Tille (2005) for a model-based assessment of the importance of wealth effects for the transmission of US monetary policy shocks.

currency would, however, imply an improvement in the NIIP position as the exchange rate effect on the quantitatively larger gross liabilities holdings would outweigh the effect on the asset side.

These effects may be exacerbated or mitigated if the currency denomination on the asset and liabilities sides of the balance sheet differs. For example, in the case of industrialised countries, assets are generally denominated in foreign currency, while liabilities are denominated in domestic currency.<sup>55</sup> Thus an exchange rate effect mainly affects the asset side and an appreciation actually worsens the NIIP (measured in domestic currency).

The importance of such exchange rate-induced valuation effects can be illustrated by the evolution of the euro area and the US net international investment position. In cumulated terms, from 2001 onwards, the euro area current account has been close to balance, shifting from a deficit in 2000 to a surplus in 2002-2005 and back to close to balance in 2006 and 2007 (Chart 43). By contrast, the net liability position of the euro area declined by around 10% of GDP over the same period, standing close to -15% in 2007, reflecting valuation related losses. In contrast, the US net liability position declined over the same period despite a large

and increasing current account deficit, which exceeded 5% of GDP from 2004 onwards.

In order to assess the relative impact of the exchange rate movements on the euro area, the change in the euro area net international investment position can be broken down into its components, which are mainly changes in net transaction volumes, asset prices and exchange rates,<sup>56</sup> over the period from 2000 to 2006.

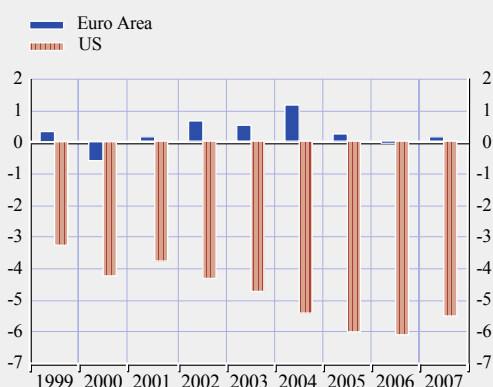
The results illustrated in Chart 45 and in Table 8 show that the euro area net international investment position has deteriorated over the period from 2000 to 2006 by almost 6% in cumulated terms. The exchange rate changes play a major role, accounting for around 5% of the negative variation, whereas actual transactions contributed by 1.8%. The impact of asset price movements in the euro area NIIP were relatively small and partly offset each other over time, mainly reflecting the relatively synchronised movements in price indices of foreign assets and liabilities, especially over the longer term. It is worth noting that the contribution of exchange rate movements to changes in the international investment position of the euro area has always been larger than the

55 Lane and Milesi-Ferretti (2006).

56 For methodological details see ECB (2007).

Chart 43 Current account balances

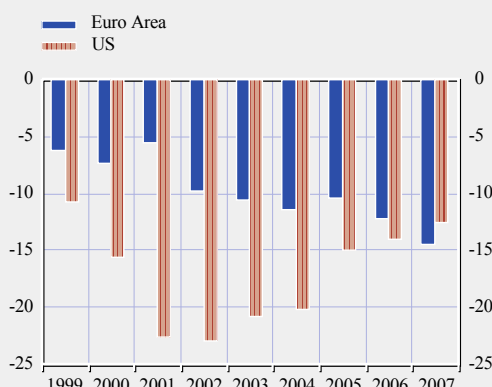
(percentage of GDP)



Sources: ECB and Haver Analytics.

Chart 44 Net international investment positions

(percentage of GDP; at end-period)



Sources: ECB and Haver Analytics.



contribution of actual transactions in the annual change in the euro area NIIP. The FX valuation effect can thus be seen as the main driver of changes in the euro area net investment position in recent years.<sup>57</sup>

As in most industrialised countries, euro area external assets tend to be more exposed to exchange rate movements than external liabilities. As a consequence, an appreciation of the euro lowers the domestic-currency value of external assets more than external liabilities, leading to a decline in the euro area's NIIP. This was, for example, the case during the period from 2002 to 2003. The appreciation of the euro in effective terms and the corresponding negative exchange rate valuation effects were the main determinants of the decline in the euro area NIIP in 2002 and the slight further decline in 2003. As Chart 45 shows, in 2002 and 2003, around 3 percentage points can be attributed to the exchange rate effect in the decline in the euro area NIIP.

The euro exchange rate vis-à-vis the US dollar plays a particularly important role in determining

**Table 8 Change in euro area NIIP**

(1999-2006; percentage of GDP)

Overall	-6.0
Transactions	-1.8
Asset prices	-1.3
Exchange rates	-5.1
Growth effect	2.3
Other	-0.1

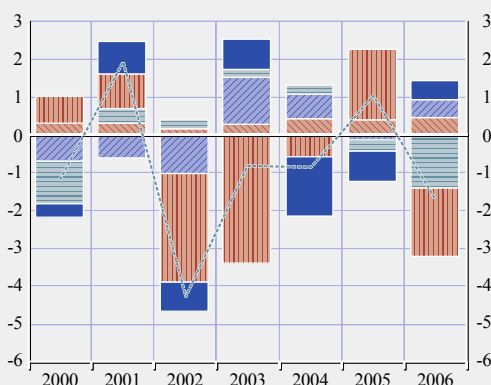
the returns earned on euro area foreign assets. Although the bulk of the euro area's external holdings are in other European countries, the currencies of which are in general relatively stable vis-à-vis the euro, the US dollar is the dominant foreign currency exposure faced by the euro area. Moreover, the euro area and the United States are major partners in cross-border financing, with the euro area holding around one quarter of its foreign financial assets in the United States, whereas both economies have the

<sup>57</sup> The growing importance of valuation effects worldwide has been reported by Lane and Milesi-Ferretti (2008), who show that the correlation coefficient between the cumulative current account balances and NIIP changes in industrial countries has been reduced by half, from 0.6 during the period 1982-1992 to 0.3 during the period 1993-2004.

**Chart 45 Changes in euro area NIIP**

(percentage of GDP)

■ valuation adjustments related to asset price changes  
 ■ valuation adjustments related to exchange rate changes  
 ■ financial transactions  
 ■ other adjustments  
 ■ denominator effect  
 - - - total change in the net international investment position

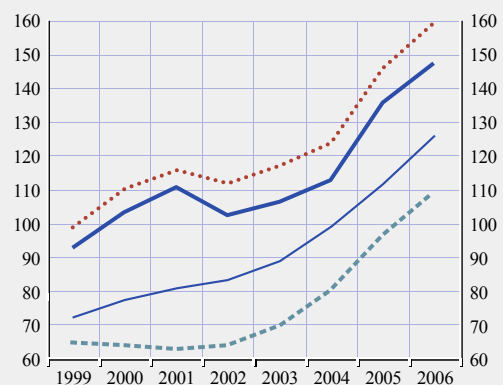


Source: ECB calculations based on Eurostat data.

**Chart 46 Gross external asset and liability positions of the euro area and the United States**

(percentage of GDP)

■ EA assets  
 ■ EA liabilities  
 ■ US assets  
 ■ US liabilities



Source: ECB staff calculations.

majority of their foreign liabilities denominated in their own currencies. Any changes in their relative asset prices and/or movements in the euro-dollar exchange rate, therefore, tend to be transformed into a revaluation adjustment with an opposite sign in the two economies, therefore generating transfers of net financial wealth.

At the same time, it is important to note that the size of the euro area gross external positions (147% and 159% of GDP at the end of 2005 for assets and liabilities respectively) exceeds the size of the corresponding stocks in the United States, thus rendering the euro area NIIP more exposed to valuation effects relative to the United States (Chart 46).

## 5 CONCLUDING REMARKS

Globalisation is not a new phenomenon, but recent years have witnessed an acceleration in its pace and significant modifications in its nature. Global trade patterns have changed, with emerging market economies, such as China and India, taking a larger share. The tremendous increase in world trade in goods and services, as well as the significant increase in capital flows has triggered a series of structural changes in product and factor markets.

Against this background, this paper has provided an analysis of the impact of globalisation forces on the relationship between exchange rates and the euro area economy. Although this relationship is clearly bidirectional, for reasons of space, this paper has mainly concentrated on the effect of changes in exchange rates on a number of economic variables. The issue of whether globalisation has altered the role of the exchange rate as a shock absorber of – or as a transmission channel for – external shocks has been left for future consideration.

Starting from the historical evolution in the euro exchange rate and in major globalisation-induced changes, the paper first shows that the exchange rate has been a critical, but not a unique element amid a broad range of external factors affecting the euro area. Simulation results from the ECB's AWM suggest, however, that, on average, during the first half of the 2000s, exchange rate changes have been broadly neutral on euro area activity, as positive and negative effects have almost cancelled each other out. Instead, foreign demand has been a key positive factor supporting euro area growth since 2000.

The paper addresses the question whether globalisation-related factors have affected the information content of the real effective exchange rates, seen as the traditional measure of international price competitiveness. By computing several measures of the real effective exchange rate using alternative weights, the paper finds that the range of results obtained is

rather narrow. This suggests that, in this respect, globalisation effects appear to be relatively limited quantitatively.

Instead, the relationship between exchange rates and prices appears to have been rather more clearly influenced by globalisation forces. The estimation of a standard equation of trade shows active, but rather stable pricing-to-market behaviour by euro area exporters over the recent period, notwithstanding increased competitive pressures from low-cost countries. However, a comparison of simulation results using two different vintage versions of the AWM provides some evidence of possible structural changes. Concretely, the overall price reaction to a change in the euro exchange rate may have become somewhat more muted over time.

A sector-level analysis of the time-variability of ERPT to import prices shows at most some moderate decline in the magnitude of aggregate ERPT. Moreover, estimation of ERPT to import prices at the sectoral level does not provide evidence of any significant instability in the relationship over time. Instead, the analysis reveals significant differences in the degree of ERPT across various sectors of the economy. This, in turn, may have caused a decrease in the overall ERPT, given that trade appears to have shifted over time to less exchange rate sensitive sectors.

Regarding the impact of globalisation on the relationship between exchange rates and consumer price inflation, a rolling panel VAR estimation over the period 1980-2007 suggests that, overall, for the 11 industrial countries included in the panel, the impact of an exchange rate shock on consumer price inflation appears to have declined somewhat over time.

Third, the paper provides an assessment of whether the hypothesis of an exchange rate “disconnect” from trade flows and GDP growth is relevant to the euro area economy. Based on the recursive estimation of a standard model of trade, it is shown that the impact of exchange rate changes on extra-euro area export volumes

of goods may have declined somewhat over time. As there is no evidence of increased pricing-to-market by euro area exporters, the decline in the responsiveness of trade flows over time may reflect possible structural changes in the exchange rate-trade flows nexus. This decline is, however, not found for all euro area countries, with cross-country differences possibly stemming from differences in the extent to which the use of imported inputs in the production of export goods has increased over time.

A gravity model of trade incorporating information at the sectoral level allows the conclusion to be drawn that changes in the exchange rate responsiveness of overall exports may well have been triggered by shifts in the industry and destination composition of euro area exports. While industry effects would tend to reduce this responsiveness for all countries examined, geographical composition effects are found to be particularly important in explaining cross-country differences. In contrast to goods exports, export volumes of services appear to be increasingly affected by changes in exchange rates, reflecting the increasing tradeability of services and, overall, stronger competitive pressures over the last decade.

Regarding the overall impact of exchange rate changes on real GDP, the paper investigates whether the responsiveness of overall GDP has also changed over time, reflecting, for example, the variability of trade volume responses over time. The results of the rolling panel VAR regression suggest that the impact of an exchange rate shock on euro area GDP has remained fairly stable over time.

Fourth, the link between exchange rates and economic performance taking a firm-level perspective is analysed. An empirical analysis of the link between exchange rates and earnings/returns for listed firms in several industrial countries over the period 1973-2007 shows no clear change in the responsiveness of earnings to changes in exchange rates for most countries.

Finally, other potential transmission channels of exchange rate fluctuations to the economy are investigated. Valuations effects through the impact of an exchange rate change on the domestic currency value of foreign assets and liabilities holdings become all the more important in the presence of tighter links between the euro area economy and its external environment. It is shown that, over the recent period, exchange rate movements have been the most important factor explaining changes in the euro area international investment position, even more so than actual transactions.

Admittedly, this paper has not fully taken into consideration that the mostly endogenous nature of the exchange rate calls for its role as a shock absorber to also be studied. This, however, was done expressly to limit the length of the paper and is an aspect that could be studied in the future.

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