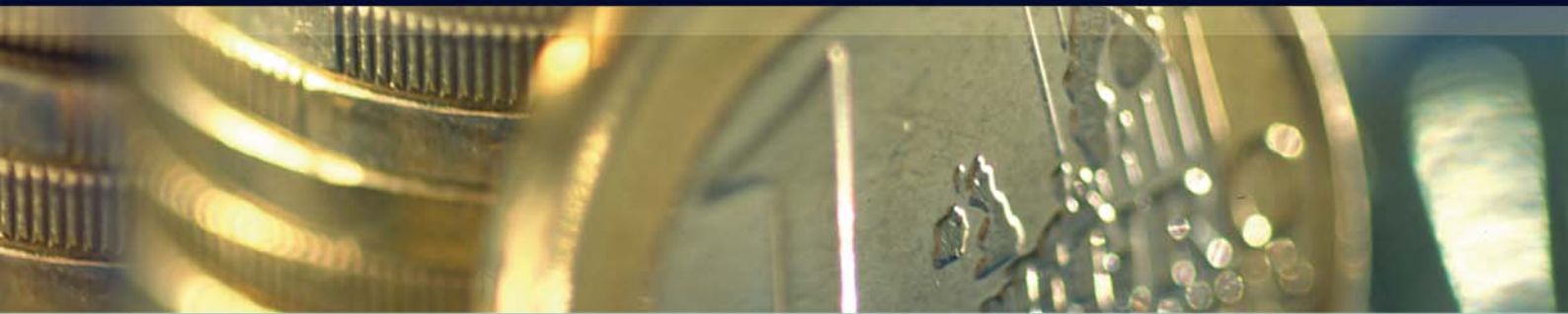


# EUROPEAN ECONOMY



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## Hedging and invoicing strategies to reduce exchange rate exposure: a euro-area perspective

Björn Döhring

### **EMU@10 Research**

In May 2008, it will be ten years since the final decision to move to the third and final stage of Economic and Monetary Union (EMU), and the decision on which countries would be the first to introduce the euro. To mark this anniversary, the Commission is undertaking a strategic review of EMU. This paper constitutes part of the research that was either conducted or financed by the Commission as source material for the review.

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# Hedging and invoicing strategies to reduce exchange rate exposure: a euro-area perspective<sup>1</sup>

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## Abstract

Domestic-currency invoicing and hedging allow internationally active firms to reduce their exposure to exchange rate variations. This paper discusses exchange rate exposure in terms of transaction risk (the risk of variations of the value of committed future cash flows), translation risk (the risk of variations of the value of assets and liabilities denominated in foreign currency) and broader economic risk (which takes into account the impact of exchange rate variations on competitiveness). The paper argues that domestic-currency invoicing and hedging with exchange rate derivatives allow a fairly straightforward management of transaction and translation risk and discusses under which circumstances their use is optimal. Economic risk is by its very nature harder to manage, but the paper argues that natural hedging provides possibilities for doing so. The discussion of management techniques for exchange rate exposure is complemented with an analysis of their actual use. This draws on data on the invoicing currencies of euro-area exports and on previous empirical work on hedging, which has, however, focussed largely on firms in the US and a small number of EU Member States. A novelty of this paper is a survey of actual hedging strategies and techniques of large corporations from a euro-area perspective. The paper finds that euro-area exporters have instruments at hand to limit the adverse impact of euro appreciation and that they make ample use of them.

**Key words:** exchange rate risk, invoicing currency, hedging, derivatives

**JEL classification:** F23, F31, G32

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<sup>1</sup> *The views expressed in this paper are those of the author and should not be interpreted as those of the European Commission or of the Directorate-General for Economic and Financial Affairs. The author gratefully acknowledges helpful comments by S. Deroose, M. Suardi and E. Ruscher. All remaining errors are the author's.*

## **1 Introduction**

As the euro exchange rate to the US dollar reached new record highs in the summer and autumn of 2007, concerns about the impact of the appreciation on euro-area exports have been voiced in the media. Earlier in 2007, then Airbus chairman Gallois famously estimated that a euro appreciation of 10 cent against the US dollar cost his company one billion euro due to the fact that a large share of the company's costs are denominated in euro, whereas the bulk of its revenues is in US dollar.

Previous analysis (e.g. in European Commission, 2007) argued that euro-area exports have held up well to the euro appreciation in recent years, as strong world demand more than compensated the negative impact of the appreciation on exports. Moreover, in real effective terms, the appreciation has not been as strong as the bilateral exchange rate of the euro against the US dollar suggests. This paper focuses on how euro-area exporting firms can (and do) protect themselves against exchange rate risk through euro invoicing and hedging and discusses interactions between domestic-currency invoicing and hedging. While the focus of this paper is on the implication of exchange rate risk for exporting firms, differences between (net) exporters and (net) importers are briefly discussed where relevant.

When exports are invoiced in domestic currency, the (short-term) exchange rate risk is borne by the importer rather than by the exporter. This paper draws on the literature to consider under which conditions such a shifting of the risk is possible and optimal for the exporting firm and then assesses the actual use of euro invoicing by euro-area exporters, based on data collected by the ECB.

Exchange rate risk can also be neutralised ("hedged") through financial instruments, such as exchange rate derivatives or foreign currency debt (financial hedges), as well as through the operational setup of the exporting firm (operational hedges). Financial derivatives have today become standard tools for hedging risks related to exchange rates, interest rates or commodities prices. This paper discusses hedging instruments and hedge design and surveys the literature on the use of hedging. For the US, the use of hedging strategies and instruments is empirically well documented. Other studies have covered firms in individual European countries, but to the author's knowledge, none has so far taken a euro-area perspective. This paper contributes to closing that gap through a survey of self-reported hedging strategies and instruments of euro-area blue chip companies.

While the approach of this paper is microeconomic, there are macroeconomic consequences of firms' hedging and invoicing strategies. These concern e.g. the impact of exchange rate variations on the trade balance<sup>2</sup> or the international role of the euro,<sup>3</sup> which are not discussed here.

The remainder of the paper is organised as follows: Section 2 categorises the types of risk related to exchange rate movements and briefly reports on the exchange rate risk exposure of euro-area firms. Section 3 discusses invoicing and hedging from a theoretical perspective and section 4 provides evidence on their use in practice. Section 5 concludes.

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<sup>2</sup> For a recent discussion, see Mihailov (2005).

<sup>3</sup> Cf. Hartmann and Issing (2002).

## 2 *The impact of exchange rate risk on exporting firms*

Categorisations of exchange rate risk in the literature differ somewhat. There is broad agreement, however, that the relevant dimensions are: i) certain versus uncertain transactions, ii) long run versus short run and iii) risks concerning the value of cash flows versus risk concerning the valuation of assets.

For the purpose of this paper:

- **transaction risk** refers to the impact of exchange rate changes on the value of committed cash flows (cash flows that lie in the future, but the nominal value of which is known). These are mostly receivables (payables) from export (import) contracts and repatriation of dividends. Usually, the time frame for committed transactions (the time between contracting and payment) is relatively short. However, it can in some cases reach several years, where deliveries are committed a long time in advance (e.g. US dollar-denominated forward sales of planes or building contracts).
- **economic risk** refers to the impact of exchange rate movements on the present value of uncertain future cash flows. It comprises the impact of exchange rate variation on future revenues and expenses through both variations in price and volume.
- **translation risk** refers to the impact of exchange rate changes on the valuation of foreign assets (mainly foreign subsidiaries) and liabilities on a multinational company's consolidated balance sheet. Usually, translation risk is measured in net terms, i.e. net foreign assets minus net foreign liabilities.

To understand the difference of transaction and economic risk, take the example of a euro-area car manufacturer. Transaction risk would e.g. refer to the order received today for a shipment of cars to the US payable in three months. The quantity and the US-dollar price are already known today. The transaction risk only concerns the euro value of the dollar payment in three months. Economic risk most notably includes the adjustment of export demand to exchange rate variations, i.e. neither quantities nor prices in domestic currency are certain.

It is clear that importing firms also face exchange rate risk. Transaction risk arises from foreign-currency denominated imports in the same way as from foreign-currency denominated exports. The economic risk to which an importing firm is subject concerns the variation of its costs induced by exchange rate fluctuations. As in practice most multinational firms are at the same time importers and exporters, their exposure to exchange rate risk is limited to net cash flows in a particular currency. Finally, translation risk arises from the holding of foreign assets irrespective of the net direction of trade flows.

A gauge of the actual relevance of exchange rate risk for firms can be found in the literature. Muller and Verschoor (2006) use a sample of 817 multinational firms that are exchange-listed and have their headquarters in the euro area to estimate their exposure to exchange rate variations. They follow a widespread empirical approach by estimating the impact of exchange rate variations on the firm's stock market returns, controlling for the returns of the entire market. Over the entire period 1988-2002, 22% of firms had significant exposure<sup>4</sup> to the GBP exchange rate, 14% to the USD and 13% to the JPY. The exposure takes a different

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<sup>4</sup> In the sense that the impact of the exchange rate on their stock market returns was significantly different from zero, either positively or negatively.

sign depending on whether the firm is a net exporter or a net importer. Interestingly, the majority of firms in the sample with an exchange rate exposure are net importers, i.e. euro appreciation increases their share value. The exposure of net exporters is as follows: 3% of firms have exposures to the GBP, 6.5% to the USD and 3% to the JPY. The exposure increases over the time horizon under consideration. Only 14% of firms in the sample have significant exchange rate exposure as measured over a one-week period, but 67% of the sample firms have exchange rate exposures when measured over a 54-week horizon. The authors suggest that short-term exposures are more effectively hedged than longer-term exposures. Geographically, the authors note a concentration of firms with significant exposures in France, Germany, the Netherlands and Spain.

While this is to our knowledge the only analysis so far at euro-area level, it has to be noted that studies on individual European countries have found larger shares of firms with exchange rate exposure (while studies on US companies have generally found low rates of exposure).<sup>5</sup>

### **3 *Instruments to reduce the exposure to exchange rate risk***

#### **3.1 Some theoretical considerations on euro invoicing**

By invoicing in domestic currency, an exporter is able to shift transaction risk to his customer abroad. One would therefore expect a strong interest from the side of exporters for invoicing in domestic currency. However, once economic risk and market structures are also taken into account, it becomes less certain that the exporter always has an interest in using domestic currency for invoicing (cf. the overview in Kamps, 2006).

The traditional literature on the choice of the invoicing currency of international trade starts from two different stylised facts. On the one hand, "Grassman's law" (referring to articles by S. Grassman published in 1973) starts from the observation that trade in manufactured goods between industrial countries is mostly invoiced in the exporter's currency. The rationale developed in the ensuing strand of literature is that both importers and exporters seek to avoid exchange rate risk by using their domestic currency. In trade between industrial countries with similar monetary stability, the exporter would usually be able to impose his own currency, because he enjoys a first-mover advantage in bargaining over the invoicing currency,<sup>6</sup> and because he often has some market power when faced with atomistic demand.

On the other hand, much international trade is denominated in a vehicle currency (i.e. the currency of neither the importer nor the exporter), a fact unexplained by Grassman's law. Already McKinnon (1979) argued that it may be optimal for an exporter of homogeneous

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<sup>5</sup> A potential explanation could be related to sampling - firms in the rather large sample used by Muller and Verschoor might be smaller, on average, than those in smaller-scale studies, and exchange rate exposure is known to depend on firm size. E.g. the large multinationals analysed in section 4.2.2 all report foreign exchange exposures. It seems also normal that studies that deal with economies that are more open to trade than the euro-area average, such as the Netherlands or Germany, find a higher exposure to the exchange rate – in particular where such studies are based on surveys carried out before the introduction of the single currency, which abolished exchange rate risk among euro-area Member States.

<sup>6</sup> One can imagine that the exporter has incurred sunk costs for building up a presence in the destination market, printing catalogues etc.

goods<sup>7</sup> to align himself to the same invoicing currency as his main competitors, which may lead to using a vehicle currency. Vehicle currencies are chosen with respect to their stability, liquidity and low transaction costs. This can explain why international trade in commodities usually takes place in a single vehicle currency, in most cases the US dollar.

Other extensions of the basic model have also called into question the exporter's preference for using his domestic currency for invoicing. If prices do not adjust instantly, the exporter who invoices in his own currency runs the risk of a reduction in demand when his currency appreciates (referred to as "economic risk" in section 2 above). Note that, as exchange rates fluctuate by the minute, instant price adjustment would be extremely costly for the ordinary exporter (cf. Friberg, 1998). Then, the choice of the preferred invoicing currency is dependent on the elasticity of foreign demand and the volatility of the exchange rate.

More recently, general equilibrium models of the new open economy macro type have been applied to the choice of optimal invoicing currency. Sticky prices are a key feature in these models, i.e. they have built-in economic risk. The work by Bacchetta and van Wincoop (2005) confirms the earlier partial models with respect to product differentiation (which in turn affects demand elasticity) as a factor favouring invoicing in the exporter's currency. But now, also the total market share of the exporting country influences the choice of the invoicing currency. The intuition is that demand uncertainty is reduced if a large share of exporters invoice in the same, namely their domestic, currency. Put differently, a firm reduces its demand uncertainty by invoicing in the same currency as its competitors. If a large share of these competitors happens to be from its own country, using domestic currency for invoicing is attractive. If the market share of the exporter's country is small, it may be more advantageous for him to align with competitors by invoicing in the importer's currency (or a vehicle currency).

This has implications for EMU. In a monetary union, the market share of the union influences the optimal invoicing currency of its exporters. Euro-area exporters are, therefore, more likely to invoice in euro under EMU than they were to invoice in their respective domestic currencies before EMU. The share of euro invoicing should thus be higher than the added shares of pre-EMU domestic currency invoicing.

Finally, new open economy macro models also confirm the role of monetary stability in making a currency attractive to use as invoicing currency (Devereux et al, 2004).

Summing up, domestic-currency invoicing is favoured by the exporter's market power (through product differentiation, first-mover advantage), the market share of his home country in the importing country as well as the stability and low transaction costs associated with its currency.

### 3.2 Hedge design

Instead of shifting exchange rate risk to their counterparts, exporters can eliminate it, at least partially, through appropriate hedging. Here again, some classification is needed. Most of the literature (see section 4.2.1) distinguishes "financial" and "operational" hedges, where

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<sup>7</sup> A producer of homogeneous goods is faced with high demand elasticity. He can avoid the large swings in demand resulting from exchange rate movements by invoicing in the same currency as the majority of his competitors.

financial hedges comprise derivative instruments as well as foreign currency borrowing/loans and operational hedges refer to the geographical diversification of production, sourcing and sales. Unfortunately, the classification in the financial statements analysed in section 4.2.2 is different, with derivative hedges on one side and "natural" hedges (comprising foreign currency loans as well as operational hedges) on the other. As financial statements usually do not provide a breakdown of natural hedges into non-derivative financial and operational ones, this paper has to operate with the two classifications in sections 4.2.1 and 4.2.2, respectively.

**Table 1: Classification of hedging instruments**

classification in hedging literature	<b>financial hedges</b>		<b>operational hedges</b>
classification in financial statements	<b>derivative hedges</b>	<b>natural hedges</b>	
examples	forwards (futures), options, swaps	foreign-currency debt	diversification across currency zones, operational matching of revenues and expenditure

The standard derivative instruments are available both "over-the-counter" (OTC, i.e. non-exchange traded and with the contractual parties freely choosing amounts and maturities) and in the form of exchange-traded products. OTC instruments comprise forwards, swaps and options; the most common exchange-traded instruments are futures and options (see Box 1). The OTC market is huge and growing, while exchange-traded products play a minor role in Europe.

**Table 2: Over-the-counter (OTC) foreign exchange derivatives  
Notional amounts outstanding (bn US\$)**

<b>by instrument and maturity</b>	Dec-04	Dec-05	Dec-06	<b>by currency*</b>	Dec-06
<b>total contracts</b>	29,298	31,364	40,179	USD	33,775
forwards and swaps	23,174	24,377	30,600	EUR	15,907
<i>with maturity one year or less</i>	17,522	18,157	22,640	JPY	9,548
<i>maturity between 1 and 5 years</i>	3,676	4,050	4,886	GBP	6,128
<i>maturity over 5 years</i>	1,976	2,170	3,074	CHF	2,307
options	6,115	6,987	9,579	CND	1,764
<i>with maturity one year or less</i>	5,312	5,753	7,587	AUD	1,498
<i>maturity between 1 and 5 years</i>	710	1,115	1,772	SEK	1,219
<i>maturity over 5 years</i>	93	119	220	total	40,179

source: BIS Quarterly Review June 2007

\*As instruments may involve more than one currency, the sum of the instruments by currency is larger than the total of all instruments

Transaction risk can be easily hedged using standard products (in particular forwards). Hedging becomes more difficult for the longer term, because the cash flow may be uncertain (economic risk). Applying standard products to uncertain future cash flows creates the risk of over- or underhedging. Underhedging means that part of the underlying cash flow is not covered against exchange rate risk. Overhedging implies the existence of a residual open derivative position which is itself vulnerable to exchange rate changes. What is more, standard products for the long run may not be available (futures) or quite expensive (options). Derivatives with short maturities can in principle be "rolled over" to cover long-term exposure. However, rolling over short-term instruments does not eliminate risk in the same



way as an instrument with the correct maturity would. In particular, the value of rolled-over hedges is sensitive to changes in interest rates and forward rates.<sup>8</sup>

It should also be noted that even perfect derivative hedges can lead to temporary losses between the moment of purchase and their maturity due to accounting practices and obligations to "mark to market". Although such losses are temporary and unrealised, they can constitute a significant drain on a firm's liquidity.

An example illustrates the limitations of derivative hedges when it comes to economic risk. Consider a euro-area exporter who regularly receives orders for sales denominated in US dollar. As the time between the order and final delivery (payment) is several years, the exporter "locks in" the EUR-USD exchange rate using exchange-rate forwards each time an order is firmly committed. However, the forward exchange rate varies over time (it is a function of the spot rate and the interest rate differential between the euro area and the US). Therefore, the value in euro of equivalent hedged US dollar sales differs depending on the forward rate at which the transaction was hedged. In the case of a prolonged appreciation of the euro against the US dollar (assuming a constant interest-rate differential), the exporter thus has to accept less favourable forward rates for its exchange rate hedges, cutting into its profit margin. This is what the declaration by Airbus' Mr. Gallois' cited in the introduction refers to.<sup>9</sup>

Natural hedges are an alternative way of reducing exchange rate exposure. As explained in Box 1, foreign currency loans are functional substitutes to forwards and futures. However, loans can easily cover longer maturities than derivatives (e.g. a firm with access to international capital markets may hedge future revenues in US dollar by issuing a US dollar bond). More generally, exchange rate exposure can be reduced by matching foreign-currency revenues with foreign-currency expenditure. Operational hedges, as non-financial natural hedges, involve geographical diversification of production, sourcing and/or sales. Since operational hedges are less flexible than financial hedges, and involve higher sunk costs, they are typically used to reduce longer-term exposure to economic risk. The matching of foreign-currency assets with foreign-currency liabilities also offers protection against translation risk.

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<sup>8</sup> Finance textbooks such as Franke (1995) provide the analytical details.

<sup>9</sup> Cf. EADS 2006 Annual Report, book 2: "Financial Statements and Corporate Governance", p. 30.

## Box 1: Overview of derivative instruments

### Forwards and futures

A **forward** foreign exchange rate contract is an agreement to buy or sell a given amount of foreign currency at a certain point in time at an exchange rate fixed today. For example, if an exporter knows that he will receive 83,000 USD in three months time, he can pass a forward contract with a counterpart who agrees to buy that amount in three months at a given exchange rate, the forward exchange rate.

The forward contract in the example above could be replicated by the following series of transactions: The exporter borrows today 81,773 USD at a US interest rate of, say 6%, and exchanges them into euro at today's spot exchange rate. He places the euro at the euro-area interest rate, say 4.5%. In three months, with the 83,000 USD received from his counterpart, the exporter pays back his US dollar loan and collects the euro he has placed. Since both operations are strictly equivalent, arbitrage ensures that today's forward exchange rate reflects nothing else than the spot exchange rate and the interest differential between the two currencies involved.

From the above, it is also clear that **borrowing / lending in foreign currency** is functionally equivalent to exchange rate forwards.

Forward contracts are traded "over-the-counter", in tailor-made amounts and maturities. Their standardised and exchange-traded equivalents are called **exchange rate futures**. E.g. the contract traded at Euronext-Liffe has a nominal amount of 20,000 USD and maturities of 1, 3, 6, 9 and 12 months and 3 years. The disadvantage of futures for hedging stems from the difficulty of matching maturities and amounts exactly to the underlying exposure. Moreover, they exist only for the most common currency pairs.

### Swaps

Cross-currency swaps exchange a cash flow in one currency against a cash flow in another currency. If, say, a multinational enterprise wishes to issue a bond to finance a subsidiary in an emerging market country, it may obtain best financing conditions by issuing a bond denominated in EUR, rather than in the local currency of its subsidiary and then use a swap to convert the payment of interest and principle into the relevant local currency.

### Options

Whereas a forward or future contains the contractual obligation to deliver at the agreed time and forward rate, an option offers a choice. Take the example of a euro-area exporter buying an option to sell 100,000 USD at an exchange rate (strike price) of 1.35 in three months. If at maturity the spot exchange rate of the euro is anywhere above the strike price, the exporter will exercise this option and receive 74,074 EUR. However, if the spot rate has moved to, say, 1.32, he will not exercise the option but sell his dollars in the spot market where he receives 75,758 EUR.

The option thus protects the exporter against adverse moves in the exchange rate without removing the opportunity to benefit from favourable movements. Put differently, hedging with an option leads to an asymmetric risk distribution. The seller of the option, however, faces a loss if the option is exercised and has no gain if it is not exercised. In order to compensate for this risk, he will demand a premium (rather like an insurance premium) for writing the option.

The differences between forwards and options can be summarised in three points:

- options cost a premium while forwards don't;
- at maturity, options offer a choice where forwards have an obligation to deliver;
- options create asymmetric hedges while forward hedges eliminate upward risk as well as downward risk.

Described above is the simplest single option. However, there exist more complex constructions such as "exotic" options or combinations of several simple options. It is, e.g. possible to reduce the option premium by combining sell and buy options with different strike prices. Of course, this also implies a more complex risk structure.

### 3.3 On the relationship between hedging and invoicing

From the perspective of the early models of invoicing, domestic-currency invoicing allows to eliminate transaction risk, much like hedging with an exchange-rate forward. Invoicing is then a substitute to derivative hedging, and firms would be expected to opt for the one or the other depending on the relative cost of these strategies.

In the more sophisticated models of invoicing, firms consider transaction risk and economic risk when deciding on the currency for invoicing. This also makes the decision on hedging more complex. As argued by Friberg (1998), the existence of forward currency markets may make foreign-currency invoicing more attractive; hedging and invoicing may become complements. An exporting firm faced with price-sensitive demand can use foreign-currency invoicing to reduce economic risk while at the same time eliminating transaction risk through derivative hedges.

A more comprehensive approach to reducing economic risk involves operational hedging. A complete operational hedge would consist of offshoring production and sourcing to the destination market. This fully eliminates transaction risk and economic risk (but at the price of creating translation risk). In this constellation - which supposes, however, that the destination market is sufficiently important for the firm to support full-blown subsidiary operations there - domestic-currency invoicing has no role to play.

To sum up, whether domestic-currency invoicing and hedging are substitutes or complements depends crucially on the size and geographical orientation of the exporting firm and on the structure of the destination market(s). The survey in section 4.2.2 suggests that operational hedging plays a significant role for many large multinational corporations, which can be assumed to reduce their (relative) reliance on euro invoicing. For smaller exporters, one would expect a higher degree of complementary use of hedging and invoicing.

## **4 Evidence on firms' strategies**

### 4.1 Euro invoicing by euro-area exporters

This sub-section examines the actual use of the euro as invoicing currency. Data based on national sources are compiled and provided by the ECB (cf. the annual "Review on the international use of the euro"). However, the data should be interpreted with care, as sources and definitions are somewhat heterogeneous.<sup>10</sup>

As predicted by the model of Bacchetta and van Wincoop (2005), the euro's role as invoicing currency has increased in the early years of EMU. The euro is today the dominant invoicing currency for euro-area exports to the rest of the EU and accounts for roughly half of the euro-area exports outside the EU. However, the US dollar plays a strong role in exports outside the EU, and even within the EU its role is significant. An important finding in terms of exchange

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<sup>10</sup> In particular, the data do not distinguish between the use of the euro as invoicing currency and the use as settlement currency. Generally, where data is taken from customs or surveys of exporting firms they refer to invoicing, while data provided by the banking sector refer to settlement. The difference may not be neutral in terms of exchange rate risk. Only invoicing in domestic currency shifts transaction risk to the foreign counterpart; the mere choice of the currency used for settlement does not. In what follows, however, it is assumed that data on settlement currency are a reasonably close approximation of missing data on invoicing currency, so that cross-country comparisons are possible, even where the data sources differ.

rate risk is that the role of US dollar invoicing is far larger than the share of euro-area exports to the US, and that invoicing in other currencies only plays a minor role.

In the first quarter of 2006, 49.7% of euro-area exports of goods to non-EU countries were denominated in euro. The share of euro-denominated exports of goods has increased in the early years of EMU and roughly stabilised since 2003. The share of services exports (excluding travel) invoiced in euro is still increasing, albeit from a lower level.

**Table 3: Invoicing currency (in %) of euro area exports of goods...**

	... to outside the euro area		... to non-EU countries		... to EU countries outside the euro area		
	EUR	USD	EUR	USD	EUR	USD	GBP
<b>AT</b>	na	na	62.9	2.3	na	na	na
<b>BE</b>	55.0	34.0	50.0	39.6	na	na	na
<b>DE</b>	61.0	23.9	na	na	na	na	na
<b>FI</b>	na	na	44.0	47.6	na	na	na
<b>FR</b>	50.0	39.5	43.2	50.5	63.4	12.9	20.5
<b>EL</b>	38.6	57	28.1	70.7	64.1	23.9	10.8
<b>IE</b>	na	na	46.6	50.1	na	na	na
<b>IT</b>	57.3	37.5	53.7	43.4	68.5	19.8	na
<b>LU</b>	54.0	32.7	29.6	68.0	73.7	4.1	15.6
<b>NL</b>	52.0	35.2	52.5	42.1	na	na	na
<b>PT</b>	55.8	35.9	48.9	47.1	68.3	15.8	13.6
<b>ES</b>	61.0	31.2	53.6	43.4	72.2	12.6	13.5
<b>euro area</b>	na	na	49.7	44.0	na	na	na

Source: ECB; data for 2006Q1, except BE, DE, IT (2005); NL (2002)

The US dollar is a strong second, with a share of 44% of euro-area exports of goods outside the EU. This is three times the share of euro-area exports to the US (14.9% in 2005) and leaves only 6.3% for other currencies. Table 3 shows the shares of the main invoicing currencies for euro-area goods exports to the rest of the world (left panel), to non-EU countries (middle) and to EU countries outside the euro area (right).

For most euro area Member States, between 50% and 61% of goods exports to the rest of the world are invoiced in euro, with Germany and Spain at the upper end of the scale, and France at the lower end. Greece is an outlier; according to the ECB, this is due to a high share of ships, which are predominantly traded in US dollar, in Greece's total exports.

**Table 4: Invoicing currency of imports of goods by non-euro area EU countries (in %)**

	EUR	USD	local currency
<b>BG</b>	55.5	42.5	
<b>CY</b>	58.0	30.7	
<b>CZ</b>	69.7	17.4	
<b>DK</b>	32.7	18.1	38.9
<b>EE</b>	56.7	24.3	
<b>HU</b>	70.8	18.8	
<b>LV</b>	60.4	28.0	
<b>LT</b>	51.3	44.8	0.7
<b>PL</b>	60.4	26.5	
<b>RO</b>	71.1	25.7	
<b>SL</b>	81.7	14.6	
<b>UK</b>	27.0	37.0	33.0

source: ECB

2006Q1 with the exception of: UK (2002); DK, HU (2004); LT, PL, RO (2005)

Although data availability is somewhat limited, a clear regional pattern emerges. Exports to EU Member States that have not yet adopted the euro are far more likely to be invoiced in euro than exports to countries outside the EU. In exports to non-EMU EU countries, the US dollar and the pound Sterling compete for the second rank, with shares around one sixth. Note that this is somewhat less than the share of the UK in euro-area exports (16.4% in 2005).

This regional pattern of euro invoicing should benefit exporters that are mostly active in the vicinity of the euro area, which is probably the case for many smaller and medium-sized exporters.

Seen through the lenses of EU importers outside the euro area, the share of the euro is particularly high in the new Member States, while the UK and Denmark pay a more important share of their imports with domestic currency (table 4).

**Box 2: Some considerations on euro invoicing of imports**

The share of the euro in imports from outside the euro area is lower than its share in exports in all euro area Member States for which data are available, which is in line with the predictions of Grassman's law. At the same time, a much higher share of imports is denominated in US dollar than corresponds to the share of the US in euro area imports, reflecting mainly the important role of the dollar as a vehicle currency for international trade. (Note that, as the share of the US dollar is higher in imports than in exports, the euro area should reap net welfare gains from an appreciation of the euro against the dollar, all other things being equal.)

**Invoicing currency (in %) of euro area exports and imports of goods vis-à-vis countries outside the euro area**

		BE	DE	FR	EL	IT	LU	NL	PT	ES
<b>Exports</b>	<b>EUR</b>	55.0	61.0	50.0	38.6	57.3	54.0	52.0	55.8	61.0
	<b>USD</b>	34.0	23.9	39.5	57	37.5	32.7	35.2	35.9	31.2
<b>Imports</b>	<b>EUR</b>	51.9	55.2	42.9	32.8	37.7	44.1	48.0	51.2	53.8
	<b>USD</b>	40.7	37.1	46.5	64.3	59.5	40.9	43.8	43.8	43.8

Source: ECB; data for 2006Q1, except BE, DE, IT (2005); NL (2002)

Importing firms can shift transaction risk to their foreign counterpart if the imports are invoiced in the importers' currency. As discussed in section 3.1, importers of differentiated goods will, however, have little chance of enforcing this. Importers of homogeneous goods stand better chances of seeing them denominated in their own currency, as this may also be the exporters' interest, in particular if the importer's domestic market is large. Accordingly, the denomination of euro-area imports in euro has initially increased after the introduction of the single currency. It has decreased more recently, probably due to the increase in energy prices, as energy imports are denominated in US dollar (ECB, 2007).

On the import side, commodities denominated in US dollar as vehicle currency play an important role (e.g. the goods category 'mineral fuels and lubricants' alone represents one fifth of euro area imports). For euro area importers, this represents a substantial foreign exchange risk vis-à-vis the US dollar – both transaction risk and economic risks considering the medium-term impact on their costs. At the same time, fairly inelastic demand allows them to pass on a large share of the economic risk to consumers.

In recent years, the appreciation of the euro has limited the impact on the euro area of increasing global commodity prices. For example, in 2007, the US dollar price of Brent increased by 68%, while its euro price increased by a more moderate 50%.

At the same time, many oil exporting countries limit their exposure to exchange rate risk by pegging their currency to the US dollar. However, as there is a mismatch in the currency denomination of their imports and exports, variations of the dollar exchange rate against other currencies impact their terms of trade. Often, oil exporting countries have attempted to compensate the impact of dollar depreciation on their terms of trade by increasing the price of oil.

## 4.2 Use and effectiveness of hedges

Surprisingly little is known about hedging strategies of European companies. Much of the empirical literature focuses on the US, although some comparisons of hedging strategies between US firms and German firms, and US and Dutch firms are available. Also, the use of derivatives by Swedish firms has been surveyed. In this sub-section, first the available literature is presented, providing some indications on the extent of hedging in practice, on firms' hedging strategies and the reduction of exchange rate exposure they are able to achieve. Then, a qualitative survey of exchange-listed non-financial firms from the euro area is presented, drawing on information provided in financial statements.

### 4.2.1 Survey of the literature

In the macroeconomic literature, there is generally no direct analysis of hedging. Where the traditional macro-empirical literature fails to find substantial negative effects of exchange rate variability on trade, hedging has, however, often been offered as an explanation. Wei (1999) takes this as starting point for his discussion of hedging. His hypothesis is that among countries where hedging instruments are available, exchange rate volatility should have no or little negative impact on trade as suggested by the traditional literature. At the same time, exchange rate variability should negatively affect trade among countries where hedging instruments are not readily available. However, the data do not bear out this hypothesis, so Wei concludes that hedging cannot play a major role for reducing exchange rate risk. These findings by Wei contrast with the evidence of widespread use of hedging by firms and with the microeconomic literature on the effectiveness of hedging.

**Table 5: Use of financial derivatives**  
(%age of firms using financial hedges)

country	US	DE		US	NL
survey year	1995	1997		1998	1998
<b>- by firm size (sales in m USD)</b>					
>6600	90	75			
3300-6600	73	94			
1660-3300	57	88			
660-1660	64	84	>800	82	88
330-660	44	55	250-800	46	57
<330	18	50	<250	12	42
<b>- by industry sector</b>					
utilities	48	74	manufacturing	46	66
service	56	100	trade	27	58
retail	42	76	services	41	48
motors	58	77			
mining	81	68			
metals	80	93			
machinery	62	100			
electro	69	87			
consumer	56	75			
construction	42	62			
chemicals	82	85			

source: Bodnar and Gebhard (1999); Bodnar et al (2003)

For the US, evidence on hedging has been gathered in the "*Wharton Surveys for Financial Risk Management*" carried out between 1994 and 1998 among large non-financial firms and published in several articles by G. Bodnar. The 1998 survey finds 44% of respondents used

financial derivatives, 79% of which used them to hedge currency risk (73% hedged interest rate risks and 44% commodity risks). Bodnar et al (2003) provide comparable data for US and Dutch firms; Bodnar and Gebhard (1999) comparable results for US and German firms. The main features of these surveys are summarised in tables 5 and 6.

**Table 6: Types of derivatives used to hedge exchange rate risk**  
(instrument found "most important" in %)

	US 1995	NL 1998
OTC forwards	56	77
futures	12	0
swaps	8	2
OTC options	16	12
exchange-traded options	1	0
structured derivatives	6	7
hybrid debt	2	2

source: Bodnar et al (2003)

The surveys indicate that derivative use increases with firm size. This suggests that there are fix costs involved in running a derivative hedge programme (Alkeback et al, 2006, and Hagelin, 2003, come to the same conclusion). European firms are generally more likely to use derivative hedges than their US counterparts. The difference is particularly large for the smaller firms in the survey and holds across industrial sectors. Several authors (e.g. Hagelin, 2003, de Jong et al, 2006) have since stressed that an economy's openness to trade increases the likelihood of its firms to hedge exchange rate risk.

The euro has had an impact on the use of derivatives to hedge exchange rate risk. Capstaff et al (2007) find that practically the same number of French multinational firms used derivatives to hedge exchange rate exposure before and after the introduction of the euro. As the euro reduced their exposure to exchange rate risk, the notional amounts of derivatives outstanding decreased. However, the exchange rate exposure decreased more strongly than the amounts hedged, indicating that hedging of the remaining risk may have become more intense.

Are (foreign exchange) derivatives used to hedge (exchange rate) risks or for speculation? The analysis by Alayannis and Ofek (2001) suggests that US firms indeed use currency derivatives and foreign-currency debt predominantly for the purpose of hedging. LeI (2006) analyses the purpose of derivatives use across a broad set of countries and concludes that derivatives are more likely to be used for hedging rather than speculation where firm governance is strong.

Firm-level studies that analyse the impact of exchange rate variations on share prices generally find hedging to be effective (i.e. hedging reduces the impact of exchange rate fluctuations on the share price). However, there is some disagreement as to the respective effectiveness of financial and operational hedges. Alayannis et al (2001) analyse the effectiveness of operational and financial hedging by US non-financial multinationals in 1996-1998. The authors use various measures of the geographical dispersion of the firm's operations as a proxy for operational hedging. They find that operational hedging on its own does not, on average, reduce exchange rate risk exposure. Financial hedges are effective on their own, and so is a combination of financial and operational hedging. Carter et al (2003) also analyse US multinationals (1994-98), and are more positive about the effectiveness of operational hedges. They find that operational hedges and financial hedges reduce exchange rate risk, whether used on their own or in a coordinated manner and conclude that:

"operational and financial hedges are complementary risk management strategies". Cowan et al (2005) reach similar conclusions for a sample of Chilean firms. In a survey of Swedish firms, Hagelin and Pramborg (2004) find that derivative hedging as well as hedging with foreign-currency denominated debt reduces firms' exchange rate exposure. Moreover, they find that hedging can reduce both transaction risk and translation risk. However, the effectiveness of financial hedges is disputed by de Jong et al (2006), who use a sample of Dutch firms. Their results suggest that financial hedging does not reduce exchange rate exposure, while operational hedging does.

Finally, risk managers may want to create asymmetric hedges as discussed in section 3.2. Carter et al (2005) demonstrate that operational hedging can produce the desired asymmetry. They show that US multinationals' flexibility in international marketing, sourcing and production provides real (i.e. non-financial) options. "*Operational flexibility enables the firm to selectively exploit favourable currency movements to maximise profit potential and minimise the impact of adverse currency movements.*" As the authors stress, static geographic diversification reduces exchange rate risk in a symmetric way. Operational flexibility increases the protection and adds an option value.

#### 4.2.2 Self-reported hedging by euro-area blue chip companies

Information on large corporations' hedging strategy was gathered from financial publications<sup>11</sup> of the 33 non-financial firms included in the EuroStoxx50 index (as of March 1997). The analysis of financial statements is a common approach in the literature on hedging practices (cf. Capstaff et al, 2007). The 33 firms analysed cover the following sectors: Utilities (6 firms), telecommunications (4), three each from oil & gas, chemicals, personal & household goods and technology, two each from automobiles & parts, food & beverage, retail and construction & materials, one each from health care, industrial goods & services and media. As customary in the literature, financial firms have been excluded. It is reasonable to assume that they hold significant amounts of derivatives that are not related to exports and imports of goods and services.

The amount of information on the management of exchange rate risk provided in Annual Reports and consolidated financial statements varies across firms. For example, not all firms provide details on their hedging principles or on the relative importance of natural hedges vs. hedging with derivatives. Some also do not provide the notional amount of derivatives outstanding (which corresponds to the underlying exposure being covered) but only their fair value (which corresponds to the unrealised gains or losses from the hedging instruments). Reporting on maturities is also unsystematic. These gaps notwithstanding, the information gathered is quite consistent across firms, and rich enough to allow some generalisations.

All firms analysed operate internationally, have subsidiaries abroad and are exposed to exchange rate risk. All but one of those companies that provide information on the main currencies to which they are exposed (table 7) report exposure to the US dollar, be it directly and/or through currencies pegged to the USD. The pound Sterling is also mentioned by most. Many report additional exposures to other currencies, without there being any clear sectoral pattern. Among other currencies in Europe, the Polish zloty and the Swiss franc play the

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<sup>11</sup> In most cases, Annual Reports contain sections on risk management, where the strategy for managing exchange rate risk is exposed in general terms. More detailed information can generally be found in the notes to the consolidated financial statements.



largest roles. Some have exposures in yen, with currencies from emerging markets in Asia also sometimes mentioned. Others have exposures to Latin American currencies, among which the Brazilian real plays an important role. Self-reported exchange rate risk exposure is thus both larger and (despite the strong role of the US dollar) more diverse than found in Muller and Verschoor (2006).

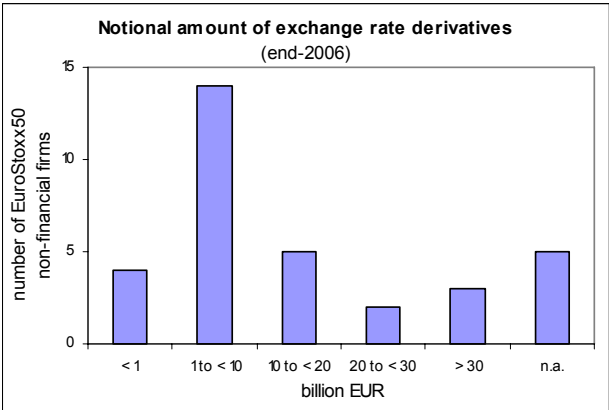
**Table 7: Main currency exposures**

(number of mentions among main exposures, multiple mentions possible)	
To North American currencies	
USD	29
CAD	3
To European currencies	
GBP	20
PLN	5
CHF	4
Other European currencies	8
To Asian currencies	
JPY	8
CNY	4
KRW	3
Other Asian currencies	3
To Latin American currencies	
BRL	6
Other Latin American currencies	5

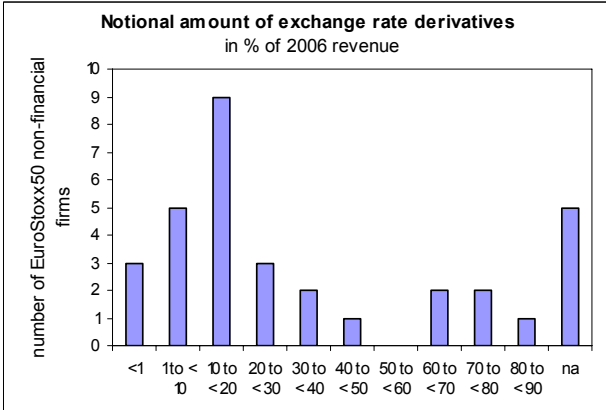
Source: Annual Reports and Financial Statements for 2006

All firms report using derivative instruments to hedge exchange rate risk. The reported notional amounts of derivatives outstanding range from 45 million euro to above 30 billion euro, with the largest number of firms reporting amounts in the range of one to ten billion euro (median: 5.6 billion, see graph 1). Holdings of exchange rate derivatives are quite substantial compared to annual revenue (see graph 2). In most cases, they amount to 10-20% of revenue (median 15.7%), but substantially higher holdings of exchange rate derivatives are also not uncommon. Again, there is no clear sectoral pattern.

Graph 1



Graph 2



source: Annual Reports and Financial Statements for 2006

A majority of surveyed firms uses a mix of forwards, options and swaps.

- Exchange rate forwards are the most commonly used derivative tool. Most companies use them to hedge future cash flows that are firmly committed or highly probable (transaction risk). Maturities up to 12 months are the most common, with some instruments maturing after 2-5 years, while maturities above 5 years are rare. Some

firms cover longer-term exposure through rolling-over of derivatives with short maturities.

- Most firms use exchange rate options at least on an occasional basis, in particular to hedge uncertain / estimated future cash flows. Maturities are strongly concentrated in the segment up to 12 months.
- Swaps are mainly used to hedge longer-term regular transactions, in many cases cash flows arising from debt financing, but also long-term delivery contracts, e.g. in the energy sector. Maturities can be substantially longer than for the other instruments, in some cases well beyond 10 years.

The findings on the relative importance of the different instruments are broadly in line with the surveys in Bodnar et al (2003). The maturity distribution reported by the blue chips roughly corresponds to that of outstanding OTC derivatives reported by the BIS (table 2).

**Table 8: Observed hedging strategies**

**Of the 33 non-financial euro-area firms in the EuroStoxx50 index...**

- 33 are **multinationals** and exposed to exchange rate risk
- 33 **manage exchange rate risk**
- 33 use **derivative instruments** to hedge exchange rate risk
- 32 provide details on the types of derivatives used. Of these,
  - 31 use **forwards**
  - 28 use **options** at least occasionally
  - 22 use **swaps**
- 22 refer to **natural hedges**. In most cases, this involves systematically matching the currencies of revenues and expenditure / assets and liabilities.
- 15 mention **centralised hedging** of the group's net exposure to foreign exchange rate risk

Source: Annual Reports and Financial Statements for 2006

In many firms, derivative hedging is a responsibility of the central treasury, where exposures arising from all activities and locations are netted out before the residual is hedged. There is relatively little information on the strategy with respect to the coverage of exposures. The firms that do provide details generally hedge 100% of committed transactions and 75%-80% of anticipated transactions. A number of firms state that they use exchange rate derivatives exclusively for hedging purposes, not for speculation. Some firms explicitly take positions, while a majority is silent on this issue.

Some firms report limitations to their hedging strategy arising from market structures. For example, the local debt market may be too shallow to contract sufficient amounts of debt to provide a natural hedge to the translation risk arising from a foreign subsidiary. Two firms report that the interest rate differential between euro-denominated debt and debt denominated in Brazilian real is too large to allow hedging through cross-currency swaps. In such cases, firms sometimes resort to hedging in a proxy currency that is strongly correlated to the target currency (e.g. exposure to currencies that are pegged to the US dollar is often hedged with dollar-denominated derivatives). Others limit their coverage to hedging extreme exchange rate moves.

Out of the 33 firms analysed, 22 refer to natural hedges. However, this issue is not systematically covered in Annual Reports and financial statements, so the share of firms actually using natural hedges might be higher. In most cases, firms report matching foreign assets with foreign liabilities and foreign revenues with payables in foreign currency. For example, foreign subsidiaries are financed with local debt or inter-company loans denominated in their functional currency to offset translation risk. Similarly, foreign

subsidiaries try to match the currency denomination of their costs and revenues. In itself, a network of foreign subsidiaries with exposures to a variety of currencies provides a certain diversification of exchange rate risk, and thus reduces the sensitivity to movements in a particular exchange rate pair.

While all but one firm hedge transaction risk, most are not explicit about their approach to translation risk. Eight firms report systematically hedging it, two do so occasionally, and four state that they do not hedge translation risk.

To sum up:

- Euro area non-financial blue chip companies systematically use financial derivatives to hedge **transaction risk**. As suggested by the literature on optimal hedging, hedge ratios seem to be close to 100% for firmly committed cash flows and lower for estimated or expected flows. Short maturities up to two years are most widespread for exchange rate forwards and options, while it is not unusual to see cross-currency swaps with maturities of a decade or more.
- The management of **translation risk** is not completely documented and seems to vary a lot across firms.
- In their approach to longer-term **economic risk**, some firms rely on rolling over of short-term derivative hedges. Many reduce their exposure to economic risk by matching of costs and revenues, either through financial instruments or through the geographical structure of sourcing, production and sales. This is in line with part of the empirical literature that suggests that operational and financial hedges are complements. None of the companies surveyed explicitly refers to the option value of operational flexibility discussed in the literature on operational hedges.<sup>12</sup>

Operational hedging and hedging through foreign currency loans is almost by definition the domain of large multinational companies that have the capacity to relocate, to tap international financial markets and dispose of internationally accepted collateral. Real and financial globalisation is increasing these hedging possibilities with more widespread relocation of production and increased depth of local financial markets. What is more, the use of financial hedges is also positively related to firm size, probably due to fix costs for setting up a hedging function.

The EuroStoxx50 companies surveyed here are not representative for the larger group of euro-area exporters. Smaller, less diversified exporting firms may find it harder to manage their exchange rate risk than large multinationals. However, recent financial market developments and technological advances (IT, risk management techniques) have made the use of derivatives for hedging less costly and their design easier, and the use of financial hedges by smaller firms seems to be increasing.

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<sup>12</sup> Such use of functional flexibility as a hedge is analysed e.g. in Carter et al (2005). One euro-area carmaker, which is not included in the EuroStoxx 50, refers to the possibility of shifting activity among its foreign subsidiaries in order to adapt its cost structure to longer-term shifts in exchange rates.

## 5 *Conclusion*

This paper addresses exchange rate exposure in terms of transaction risk, translation risk and broadly defined economic risk and analyses risk reduction strategies of euro-area firms through euro invoicing and hedging. It argues that domestic-currency invoicing and hedging are under certain circumstances complementary strategies. The paper extends the existing empirical literature by a survey of self-reported hedging strategies and instruments of euro-area blue-chip companies.

The empirical literature and the survey of non-financial companies in the EuroStoxx50 index indicate that exposure to exchange rate variations is a major issue for euro-area firms. This contrasts somewhat with the literature on US corporations. It is plausible that the euro area as a more open entity is more exposed to exchange rate variations than the US.

Euro invoicing effectively shifts transaction risk to the foreign importers. Close to 50% of euro-area exports to countries outside the EU are invoiced in euro, and the share of the euro is higher in exports to other EU countries. As suggested by the literature on the optimal choice of invoicing currency, domestic-currency invoicing of euro-area exports increased with the introduction of the euro. At the same time, invoicing in US dollar continues to play a much larger role than the share of euro-area exports to the US would suggest.

This paper finds hedging with exchange rate derivatives such as forwards and options to be very widespread, in line with the literature that suggests it is effective in reducing exposure to exchange rate risk, at least over the shorter run.

However, neither domestic-currency invoicing nor derivative hedging easily lend themselves to managing the broader economic risk (i.e. the risk of loss of competitiveness as a result of exchange rate fluctuations). This paper discusses non-derivative financial hedges as well as operational hedges that address also economic risk. The survey of large euro-area companies shows that many make use of these instruments, in particular matching foreign currency revenues (assets) with expenditure (liabilities) in the same currency and the international diversification of sourcing, production and sales.

Overall, this paper suggests that euro-area exporters have instruments at hand to protect themselves against euro appreciation and that they make ample use of them. This has probably contributed to the simultaneous strength of euro-area exports and corporate profits in the face of the euro appreciation over the past years. However, the scope for managing medium-term economic risk is more limited than that for managing short-term variations of the exchange rate.

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