The Impact of Corporate Derivative Usage on Foreign Exchange Risk Exposure

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Abstract

This paper not only determines why individual firms use foreign currency derivative but investigates also what effects this derivatives usage has on the foreign exchange risk exposure of 471 European non-financial firms. We find strong evidence in favor of the existence of economies of scale in hedging and show that European firms engage in hedging programs in response to tax convexity. Results tend to support financial distress motives to hedge, but no evidence is found in favor of agency costs related motives.
Whereas the degree of international involvement strongly determines the magnitude and significance of a firm's exchange rate exposure, it appears that large firms benefit from the diversification of their foreign operations and are to a greater extent capable of implementing operational hedging strategies. Our findings show furthermore that European firms use FCDs to hedge – and not to speculate –. The statistically weak effects these hedging strategies have on firms' currency exposures reveal, however, that European companies are hedging only a small proportion of the currency risk they are facing.

Keywords: risk management; foreign exchange risk; foreign currency derivative use; European multinational firms; optimal hedging theories.

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Introduction

Today all firms are facing various sources of exchange rate risk in exercising their daily activities. In this context, financial derivative contracts – such as forwards, swaps and options – provide managers with a whole series of instruments to manage these risks. However, the question whether companies should or should not implement hedging strategies to reduce their foreign currency exposure is still going on. While the Modigliani and Miller (1958) paradigm postulates that the financial risk management activities of a company are irrelevant to shareholder wealth since shareholders have access to the same risk management tools as corporate managers, more recent theories suggest that hedging activities could be value-increasing. Stulz (1984), Smith and Stulz (1985), DeMarzo and Duffie (1995), Froot *et al.* (1993), Nance *et al.* (1993), Mian (1996), Tufano (1996), and Geczy *et al.* (1997) among others have conducted research on potential hypothetical rationales for corporate risk management. They provide useful information on numerous valid reasons why companies should consider hedging to maximize shareholder wealth. As firms didn't reveal their position in derivatives until the 1990s, the empirical validation of these theories has, however, been confronted with the long-lasting unavailability of reliable data on hedging activities. Since then, widespread corporate use of derivatives has been documented in Dolde (1993), Bodnar *et al.* (1998), Berkman and Bradbury (1996), Berkman *et al.* (1997), Henstchel and Kothari (2001), and Bodnar *et al.* (2003). A recent stream of research has also sought to identify which hedging theories best describe a firm's choice to use financial hedging instruments (e.g., Nance *et al.*, 1993; Howton and Perfect, 1998; Joseph, 2000). More recent studies (e.g., Geczy *et al.*, 1997; Marshall, 2000; Judge, 2004) have even differentiated between different types of risks (e.g. interest rate, currency, commodity) suggesting that factors determining derivatives usage may differ for each type.

Since reasons to hedge may exist to either decrease or increase risk exposure, the expected effect of financial hedging instruments is primarily an empirical issue. However if we assume that the objectives of corporate derivative usage are to reduce firms' foreign exchange risk, the question emerges whether these activities may constitute one possible explanation for the fact that empirical research has found limited evidence of a significant link between exchange rates movements and firm value (see, e.g., Jorion, 1990; Amihud, 1994; Bodnar and Gentry, 1993). This argument has first been supported by Bartov and Bodnar (1994) who affirm that firms are aware of their currency exposures and efficiently manage it.[1] Analyzing the impact of currency fluctuations on U.S., Japanese

[1] See Loderer and Pichler (2000) for a discussion on firms' awareness of their foreign exchange risk exposure.

and Canadian industries, Bodnar and Gentry (1993) likewise suggest that the reported effect of exchange rates on industry returns is insignificant because companies are using various hedging instruments to hedge their exposure. The difficulty of quantifying the importance of hedging activities doesn't enable them however to test for the impact of these presumed hedging activities. Similarly acknowledging the impact of hedging activities on exchange rate exposure, several other studies (He and Ng, 1998; Chow and Chen, 1998) examine the relationship between variables that proxy firms' incentives to hedge and estimated exchange rate exposures. Their results suggest that firms with high leverage and low liquidity – thus, having more incentives to hedge – are nevertheless more sensitive to currency fluctuations.

Up till now, the direct interdependence between actual firms' risk management strategies and their risk exposures has not received much attention in the literature. Notable exceptions are provided in Simkins and Laux (1997) and Allayannis and Ofek (2001). While the former find no statistically significant impact of foreign currency derivative usage on exposure, the latter suggest that a firm's use of derivatives tends to reduce its exchange risk exposure. In a different context, Pantzalis *et al.* (2001) show that a firm's capacity to construct operational hedges moderates its sensitivity to currency fluctuations. Overall, the evidence is scarce and relatively little is known about the impact of corporate hedging activities on firms' foreign exchange risk exposure – leaving many questions unanswered: How widespread is the use of foreign currency derivatives? What are the main determinants of FCD usage? Do firms use derivatives to hedge – or to speculate? What are the real effects of their hedging strategies?

Regarding all these questions, this paper has four primary advantages over previous studies. First, it has to be emphasized that until now, continental European non-financial firms barely disclosed any information on derivative usage. Consequently, there is only very limited knowledge about their hedging patterns and motivations. Hardly any empirical studies have been able to investigate the determinants of derivatives' usage in continental Europe. With the exception of Bodnar and Gebhardt (1998) and De Ceuster *et al.* (2000) who have respectively explored German and Belgian companies, this study is, hence, the first extensive analysis on the foreign exchange risk management practices of a large sample of German, Dutch, Belgian and U.K. firms.[2] Thanks to this new extensive data set consisting of 471 European multinationals, we are able to provide not only descriptive but also analytical evidence regarding many questions raised in the literature. Second, while most studies exploring firms' hedging incentives employ a dependent

[2] It has to be noted that information on European risk management activities is as well discussed in Bartram *et al.* (2004) who provide large-scale international evidence on derivatives usage for a sample of 7,263 non-financial firms from 48 countries including the United States.

binary variable indicating whether a firm uses FCDs or not, we extend this methodology by investigating both the factors that determine a firm's decision to use FCDs and those affecting the level of external hedging activities. Third, as no study thus far has addressed the question of whether there is a direct relationship between European non-financial firms' use of FCDs and their currency risk exposure, we fill the existing gap. We examine whether FCD users are less exposed to market and exchange rate movements than FCD non-users and, specifically verify whether the level and significance of measured foreign currency risk exposures reflect the outcomes of financial risk management activities. Following Allayannis and Ofek (2001), we estimate therefore a multivariate regression linking a firm's exchange rate exposure to both its foreign sales ratio and its financial hedging activities. To extend Allayanis and Ofek's work, we include furthermore variables that are proxies for firms' operational hedging activities as well as for firms' incentives to hedge. Fourth, our analysis examines the impact of FCDs both on weekly and on monthly exchange rate exposures. The variation of the time period used in estimating the currency exposures gives us not only the possibility to perform robustness checks – by examining if our results vary with the exposure horizon – but it enables us primarily to evaluate the effectiveness of hedging techniques across different time horizons. Many authors (see, e.g., Chow and Chen, 1998; Griffin and Stulz, 2001; Dominguez and Tesar, 2001; Di Iorio and Faff, 2001; Muller and Verschoor, 2004) have indeed demonstrated that exchange rate exposure becomes increasingly evident when lengthening return measurement intervals. We are able, in this paper, to validate – or refute – one potential explanation for this horizon-dependent impact of currency fluctuations on firm value. A stronger impact of FCD usage on monthly than on weekly foreign risk exposures would de facto suggest that longer-term exposures characterize, to a larger degree, economic exposures that are unrelated to known transactions and hence difficult to hedge.

The paper is organized as follows. After reviewing our research questions in the next section, we describe the sample procedure and data characteristics in section 2. Section 3 provides empirical findings on the determinants of hedging while the impact of corporate derivative usage on foreign exchange risk exposure is presented in section 4. Section 5 concludes.

1 Research questions

1.1 Why do firms hedge?

Under the classical Modigliani and Miller (1958) paradigm, no financial derivative contract can influence firm value. Assuming perfect capital markets, the classical Modigliani and Miller paradigm implies thus that firms have no reasons to engage in hedging activities since shareholders of the company who wish to mitigate their risk exposures always have the possibility to perform the necessary hedging transactions on their own. In reality however, capital markets are imperfect and (i) financial distress, (ii) taxes, (iii) information asymmetries and (iv) agency problems are costly to firms. Smith and Stulz (1985), Bessembinder (1991), Nance *et al.* (1993) and Froot *et al.* (1993), among others, show why these market imperfections may lead to an increase in firm value through hedging activities. It has to be stressed, however, that, while capital market imperfections are necessary to justify hedging activities, the existence of sufficiently large risk exposures and the costs related to the implementation of these hedging programs have as well to be taken into account when ultimately evaluating the impact of financial derivative instruments usage on firm value.

But before analyzing the impact of corporate derivative usage, we will first construct the theoretical framework of this study and present hereafter a short and concise overview on the most popular hedging theories.[3] As already mentioned, most of them arrive at optimal hedging policies by introducing some frictions to the classical Modigliani and Miller model:

i. expected cost of financial distress

In real world, financial obligations that cannot be fully or timely settled due to illiquidity cause financial distress and lead to transaction costs (Shapiro and Titman, 1985). By reducing the variance of firm value and, with that, the probability that the firm will encounter financial distress, hedging can reduce these expected costs of financial distress (Smith and Stulz, 1985). As a consequence, firms with high leverage[4] and low liquidity are expected to have strong incentives to hedge their risky positions. However, as direct costs of financial distress have been shown to be less than proportional to firm size[5], Nance *et al.* (1993) maintain that smaller firms should hedge more than larger ones. On

[3] This overview provides as well useful insight in the choice of the variables to be used in section 3.

[4] Dolde (1995) and Haushalter (2000) use the debt ratio to measure expected costs of distress and find that hedging increases with the debt ratio.

[5] See Warner (1977) and Ang *et al.* (1982) for an analysis of the relationship between firm size and financial distress costs.

the other hand, one may as well support the point of view that large firms have more sophisticated risk management strategies and benefit from scale economies, being thus likely to hedge more (Martin and Mauer, 2004).

ii. taxes

Smith and Stulz (1985) argue that the structure of the tax code may determine a firm's decision to hedge. They demonstrate that for corporations facing tax-function convexity[6], hedging lowers expected tax liabilities by reducing the volatility of taxable income. Graham and Smith (1999) suggest that, in particular, carrybacks and carryforwards are strong incentives to engage in hedging activities while other tax-code provisions have minor impacts.[7]

iii. information asymmetries

Corporate risk management activities may also result from managerial incentives based on asymmetric information, i.e. managers as opposed to shareholders are better informed about the sources and extent of risk faced by the firm. While De Marzo and Duffie (1995) argue that firms are sometimes hedging based on private information that cannot be costlessly conveyed to shareholders, Breeden and Viswanathan (1998) claim that managers have incentives to hedge away uncertainty about future performance to influence the market's judgement about their management ability. Whatever justification preferred, shareholders in both situations may benefit from corporate hedging through the reduction of firms' profit variability and shareholders' noise perception in the information set regarding unobservable risks. Hence, the more the management of the firm possesses proprietary information, the more corporate hedging may be beneficial to shareholder wealth (De Marzo and Duffie, 1995).

iv. agency problems

Conflicts of interest between bondholders and shareholders give rise to underinvestment problems as residual claimholders may have the incentive not to realize all investment opportunities with positive net present values if the gains accrue primarily to fixed claimholders. Hedging mitigates this underinvestment problem because it redistributes cash from states in which cash flow exceeds fixed obligations to states with insufficient cash flow. The value of the debt becomes thus less sensitive to incremental investment decisions (Bessembinder, 1991). On the other hand, Froot *et al.* (1993) argue that by shifting internal funds into states where they would otherwise be scarce, hedging permits

[6] Graham and Smith (1999) show that the firms that are most likely to have convex tax functions are small firms which have expected income near zero and alternate between profits and losses.

[7] Graham and Rogers (2002) find no empirical evidence that companies hedge in response to tax convexity.

the company to engage in valuable investment projects with cheaper funds. In both cases, we predict that a firm's hedging activities should be positively related to proxies of potential underinvestment costs, i.e. leverage and growth opportunities. Nance *et al.* (1993) suggest, however, that firms have still the possibility to reduce the conflict between shareholders and bondholders by means other than hedging with financial instruments. They may, e.g., issue convertible bonds or preferred stocks.

Agency costs may as well emerge because managers act on behalf of their goals. As already mentioned above, managers may not be able to diversify away risks as they have an extremely undiversified wealth position resulting from their employment in the firm, the related current and futures incomes, and associated factors such as reputation and awards (Smith and Stulz, 1985; Bartram, 2002). Smith and Stulz (1985) demonstrate that the expected utility of wealth of risk-avers managers with large ownerships in the firm are significantly affected when expected profits are volatile.[8] As a result, managers with large firm ownerships have strong incentives to persuade the firm to engage in hedging activities.[9]

To conclude, it has to be emphasized that, in general, the presence of hedging substitutes is expected to reduce the need for hedging. Low dividend yields[10] and high liquidity ratios may, as an illustration, enable the firm to retain sufficient liquidity to make corporate hedging useless.[11] More specifically, when analyzing the use of foreign currency derivatives, the relative importance of foreign sales relative to total sales and the geographical dispersion of foreign operations have as well to be taken into consideration.

From an empirical point of view, earlier studies have examined the consistency between optimal hedging theories and derivatives usage in general (see, e.g., Nance *et al.*, 1993; Dolde, 1993; Mian, 1996; Pennings and Garcia, 2004). More recent studies tend to acknowledge, however, that factors determining derivatives usage may differ for each type of hedging (see, e.g., Tufano, 1996; Haushalter, 2000; Gezcy *et al.*, 1997;

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[8] Assuming no hedging costs, corporate hedging activities should hence increase managers' utility without reducing firm value. Froot *et al.* (1993) criticize, however, the argumentation of Smith and Stulz (1985) as it relies as well on the assumption that managers' personal hedging activities are very costly and leads to the conclusion that, without the introduction of transaction costs of hedging at the firm level, firms should hedge as much as possible, i.e. to minimize the stock price variance.

[9] Consistent with the argumentation of Smith and Stulz (1985), Tufano (1996) and Schrand and Unal (1998) find evidence that hedging increases with managerial shareholdings and decreases with managerial option ownership. Other studies (see, e.g., Geczy *et al.*, 1997 and Haushalter, 2000) find, however, no evidence that managerial risk aversion or shareholdings affect corporate hedging.

[10] As dividend yields proxy dividend restrictions as well as growth opportunities, the sign of the relationship between dividend yields and derivatives usage is theoretically difficult to predict.

[11] Low dividend yields (Nance *et al.*, 1993) and high quick ratios (Tufano, 1996; Minton and Schrand, 1999) have been shown to be empirically negatively related to derivatives usage.

Allayannis and Ofek, 2001; Judge, 2004; Bartram *et al.*, 2004).[12] Tufano's (1996) empirical findings on the use of commodity derivatives in the gold mining industry lend support to theories of managerial risk aversion, while the hypothesis that expected financial costs provide an incentive to hedge is confirmed in Haushalter (2000) and in Visvanathan (1998). Geczy *et al.* (1997) investigate the relation between the likelihood that a firm uses FCDs, proxies for incentives to hedge as well as proxies for foreign exchange exposure among U.S. non-financial firms.[13] Their findings suggest that the use of FCDs depends on a firm's degree of foreign sales, foreign trade and size. Consistent with the notion that hedging is used to mitigate the underinvestment problem, the amount of R&D expenditures is as well found to be an important determinant of hedging. However no clear relation between foreign debt and derivatives usage could be established. Judge (2004) explores the determinants of the decision to hedge among U.K. non-financial firms. Consistent with previous reported results, his findings ascribe strong explanatory power to firm size and the foreign currency transactions dummy, thus providing support for the economies of scale and exchange exposure hypotheses. Judge finds, moreover, proxy variables for the financial distress argument to be similarly significant in explaining FCD use. Conversely, Bartram *et al.* (2004) who investigate the use of currency, interest and commodity derivatives by non-financial firms from 48 countries come to the conclusion that none of the afore-mentioned hedging theories are clearly supported by the data. Recent studies exploring the determinants of hedging intensity based on continuous measures of corporate derivative usage lead to similar results. Howton and Perfect (1998), for instance, find that derivatives use is unrelated to most of the proxies for the theoretical hedging determinants.[14]

1.2 Does corporate derivative usage influence foreign exchange risk exposure?

If market imperfections – like those outlined in the previous section – exist, theory expects that the more derivatives a firm uses to hedge its exposures, the less risk exposure it will face. As a consequence the relationship between a firm's riskiness and its foreign currency derivative usage should be negative. This anticipation is nevertheless based on the assumption that FCDs are exclusively used for hedging while existing theories

[12] For a general overview on corporate derivative practices, we recommend the papers by Bodnar *et al.* (1998), Bodnar and Gebhardt (1999), De Ceuster *et al.* (2000), Marshall (2000), Guay and Kothari (2003), Bodnar *et al.* (2003), Bartram *et al.* (2004).

[13] Geczy *et al.* (1997) empirically investigate what factors influence the decision to hedge using a logit regression.

[14] The lack of link between derivatives use and theoretical hedging determinants is most apparent for currency contracts (Howton and Perfect, 1998).

suggest that firms might also use derivatives to take on additional risks.[15] As a consequence, the question whether FCD usage decreases – or increases – a firm's risk exposures remains unsolved.

Thus far, limited empirical evidence has been brought to answer this question for non-financial firms. In large part, the lack of evidence is attributable to poor data availability. Among recent papers, Guay (1999) uses an event-study approach and finds a statistically significant decrease in firm risk exposure, measured by interest rate and exchange rate exposures, following the initiation of derivatives usage.[16] In contrast, Hentschel and Kothari (2001) find that firms who hedge their exposures with derivative positions display few, if any, measurable differences in risk compared to firms that do not use financial derivatives. The analysis of 7,263 non-financial firms from 48 countries by Bartram *et al.* (2004) reveals some support for a positive value effect of general derivatives use but only for firms without exposure. The impact of FCD use, however, is found to be insignificant. Marshall (2000) empirically shows, furthermore, that contrary to the general view found in the literature derivatives use doesn't always decrease the variability of the firm's value and that the degree of usage of certain techniques is even associated with an increase in the variability of certain financial measures.

Focusing on the use foreign currency derivatives in a sample of 720 large U.S. multinationals, Allayannis and Weston (2001) find a positive relation between firm value and the use of FCDs. The hedging premium is statistically and economically significant for firms with exposure to exchange rates and is on average 4.87 percent of firm value. Using a similar methodology, Pramborg (2004) shows that for Swedish companies transaction exposure hedging seems to add value while there is no positive value effect from translation exposure hedging. Empirical evidence on the relation between a firm's currency hedging activities and its exchange risk exposure is provided in Allayannis and Ofek (2001) and Nguyen and Faff (2003). Whereas the former tend to suggest that firms use currency derivatives mainly for hedging – as their use tends to reduce the foreign exchange risk exposure firms face –, the latter find that the impact of FCD usage on exchange rate exposure is generally weak and lacks consistency. Moreover Nguyen and Faff fail to document any relationship between the use of FCDs and long horizon exposure. This last finding may lend support to the hypothesis formulated in the introduction according to which horizon exposure captures economic exposure which is difficult to hedge with financial derivatives.

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[15] An owner of a leveraged firm can, for instance, have incentives to increase the firm's riskiness in order to transfer wealth from bondholders to stockholders (Jensen and Meckling, 1976; Myers, 1977)

[16] It has to be underlined that this study is limited to new FCD users only.

2. Data

This study analyses as of year-end 2003 the determinants of corporate FCD usage and its role in reducing foreign exchange risk exposure for European non-financial firms established in 4 distinctive sample countries: the U.K, Germany, the Netherlands and Belgium. The selection procedure for the sample used in this study encompasses 5 steps. First the constituents of the FTSE 350, the AEX, the DAX and the BEL 20 are identified.[17] Next, foreign firms, i.e. firms that do not have their headquarters in the U.K, Germany, the Netherlands or Belgium are excluded from the sample. Since financial firms' business nature causes them to use foreign currency derivatives also for purposes other than hedging, they are as well excluded. As we are interested in the attitude of corporations to foreign exchange risk, firms that are most likely to be exposed to these risks are considered. We therefore investigate whether firms included in the sample have international linkages. As exposures are most obvious for firms that sell abroad through foreign subsidiaries or export operations, reported foreign sales as provided in the notes to the financial statements, are taken as proxies for foreign operations.[18] Moreover, whenever a firm discloses any other type of information on foreign operations or currency risk in the operational and financial review of its annual report, we include it in the sample. All the final sample-firms meet at least one of the above-mentioned criteria. In a final step, only firms that have at least 2 consecutive years of weekly stock return data in the *Datastream International* database between January 2002 and October 2004 are included. The selection procedure provides thus an ultimate sample of 471 European non-financial firms. Weekly and monthly stock price series of individual companies are obtained from *Datastream International*.

In addition to stock return data, two economic factors are employed when estimating the foreign exchange risk exposure of the sample companies. The proxies used for the market factor are either national *Datastream* calculated total market return indices or the European *Datastream* calculated total market return index as provided by *Datastream International*. The exchange rates are respectively the effective euro

[17] All firms that are included in these indices are listed and stock price movements are provided by *Datastream International*.

[18] Firms may also be sensitive to exchange rate movements when utilizing imported inputs with prices that are influenced by currency fluctuations. They are however only required to disclose information on foreign revenues and don't report useful information on foreign expenses. Consequently, we concentrate in this paper on the ratio of foreign sales to total sales and assume it to be a reasonable proxy of a firm's international trading involvement.

exchange rate index[19] of the ECB, the effective U.K. pound exchange rate index of the Bank of England and the WMR bilateral euro, respectively U.K. pound exchange rates towards the U.S. dollar.[20] The sample period covers the period January 2002 to October 2004.[21]

A thorough analysis of the 2003 annual reports enables us to collect data on foreign operations and hedging practices of the 471 European non-financial firms. Information on notional as well as fair values of currency hedging positions is sourced from the notes to the annual accounts. As we do not restrict the definition of currency hedging to FCD usage, qualitative and / or quantitative data on any other type of currency risk management activity is as well investigated in financial reports, operational reports, footnotes and notes to the annual accounts. Finally, information on variables that are used in section 4 to proxy hedging incentives is likewise obtained from the annual reports.

Panel A of table 1 presents an overview on the balance sheet characteristics as well as the annual reports disclosures of foreign operations of Belgian, Dutch and German non-financial firms included in our sample. Out of these 335 firms, 223 (66.6 percent) report the use of FCDs.[22] If we compare companies that use FCDs with companies that don't, we note that FCD users tend to be larger in terms of size[23], total assets and employees. This finding is in line with the existence of fixed costs related to FCD hedging that act as a barrier to hedging for small firms. Consistent with the financial distress motives to hedge, we observe moreover that debt ratios of FCD hedgers exhibit higher values. However, in contrast to the underinvestment hypothesis (Froot *et al.*, 1993; Allayannis and Weston, 2001; Graham and Rogers, 2000), the observations for the book to market variable tend to suggest that firms that have more investment opportunities use less derivative instruments. Regarding their foreign involvement, approximately 80 percent of the firms in our sample provide precise information on the volume of foreign sales.[24] Among these firms foreign sales account on average for approximately 34 percent of total sales for FCD users while these sales represent on average only 14 percent of total sales for FCD non-users. The exposure to foreign currency movements through

[19] The effective U.K. pound (euro) exchange rate index is calculated by geometrically weighting together bilateral exchange rates against sterling for 21 (23) currencies where each currency is given a competitiveness weight reflecting that currency's relative importance in U.K. (EU) trade.

[20] All exchange rate series are measured in terms of foreign currency price per unit of domestic currency.

[21] A 34-month return period surrounding the disclosure year 2003 is assumed to provide a good basis to analyze the contemporaneous impact of FCD use on sample firms' foreign currency exposure.

[22] Among all derivative instruments, forwards appear to be the most intensively used by our sample firms. This observation is consistent with previous empirical findings (Bodnar *et al.*, 1998, Bartram *et al.*, 2004).

[23] Size is measured as the sum of the market value of equity and book value of total debt.

[24] When precise information on the volume of foreign sales isn't provided in firms' annual reports, we consider these variables as missing and don't assume them to be zero.

foreign sales and trade seems thus to be an important factor explaining the use of FCDs. Usable information on the volume of foreign debt is only disclosed by 94 companies in the Belgian, Dutch and German firm sample. The ratios of volume of foreign debt to size appear to be larger for firms that use financial derivative instruments.

Equivalent information on U.K. companies is displayed in Panel B of table 1. Overall observations are in agreement with those reported above. However, in contrast to panel A, only 3 out of 136 U.K. firms do not declare the use of foreign currency derivatives.[25] U.K. companies seem moreover to rely on a higher degree of overseas business and to have stronger international linkages than Belgian, Dutch and German companies.[26] Among FCD hedgers foreign sales amount on average to roughly 60 percent of total sales whereas this percentage approximates 30 percent on average for FCD non-users.[27] The ratio of foreign debt to size is similarly higher for FCD hedgers compared to companies that don't use FCDs.

2. Empirical evidence on the factors determining corporate foreign derivative usage

Consistent with Allayannis and Ofek (2001), we examine the decision and the level of FCD usage in a two-step procedure originally suggested by Cragg (1971). We explain thus separately the firm's choice to hedge using FCDs – or not – and the firm's decision of how much to hedge with these instruments.[28]

To model the decision to hedge – or not – we use a binary measure of FCD usage. Companies that use FCDs are assigned a value of 1 while all other firms are assigned a value of zero. Variables that have been found to make cash flow volatility costly for companies (see, e.g., Geczy *et al.*, 1997; Schrand and Unal, 1998) are chosen to explain the decision or not to use FCDs. Specifically, to test theories of hedging related to

[25] These findings are consistent with Marshall's (2000) observations on hedging practices of U.K. firms. He noted indeed that a high proportion of U.K. firms that responded to his questionnaire ranked foreign exchange risk management as significantly important or most important.

[26] Almost all U.K. firms included in our sample disclose precise information on their volume of foreign sales and foreign debt.

[27] Compared to the values reported for Belgian, Dutch and German firms, the higher values exhibited by the ratio of foreign sales to total sales for U.K. firms may be due to the fact that for U.K. firms foreign sales correspond to sales outside of the U.K. whereas for Belgian, Dutch and German firms, foreign sales correspond to sales outside of the Euro-zone.

[28] We presume here that firms use FCDs primarily for hedging purposes - as claimed in their annual reports-. This assumption enables us to test the optimal hedging theories described in section 1. However the question, whether firms use FCDs for hedging or speculation motives will be empirically tested in section 4.

financial distress costs motives, we use leverage[29] – measured as the ratio of total debt to total assets –, the ratio of EBIT to total interest expenses and the ratio of EBIT to total assets. Agency costs related incentives to hedge are tested using the ratio of book to market value. Firms with lower book to market ratios are expected to have greater investment opportunities. These firms are potentially facing higher underinvestment costs and are expected, hence, to hedge more. To verify whether liquidity may serve as a hedging substitute, we add the quick ratio to our model. Nance *et al.*'s (1993) argument that firms retain dividends to reduce their need to hedge is also considered. The tax incentive to hedge is verified by the inclusion of a tax dummy variable that is equal to 1 if the firm has tax-loss carryforwards and 0 otherwise. We test the managerial risk aversion hypothesis by the inclusion of a variable that measures the option holdings of CEOs.[30,31] The information asymmetry hypothesis is verified by adding the log of the number of analysts that follow the company. The log of the sum of the market value of equity and book value of debt is used to proxy firm size. The ratios of foreign sales to total sales as well as of total foreign debt to firm size are employed to measure the firm's international linkages.

The first two columns of table 2 present the results of the binomial probit model estimated using all sample-firms. In line with previous studies, we observe that foreign involvement, measured as the percentage of foreign sales and size are significantly positively related to the decision to use FCDs. These results are in contradiction with the bankruptcy costs and informational asymmetries motives to hedge that predict that small firms have a greater incentive to hedge. They lend nevertheless support to the existence of economies of scale in hedging. These economies of scale facilitate the justification of hedging programs when the firm is larger and the volume of foreign activity is sufficiently large to justify the costs (Martin and Mauer, 2004). Additionally, the significance of the positive tax dummy[32] coefficient in model 1 seems to confirm the convexity-based tax incentive to hedge. The statistically significant positive coefficient of the dividend yield factor indicates moreover that retained dividends may be regarded as a substitute for hedging. The 4 last columns of table 2 describe the estimation output when

[29] According to Stulz (1996), Ross (1997) and Leland (1998), leverage and hedging practices may also be positively correlated due to the positive effect of hedging on firms' debt capacity. This increased debt capacity may result in an effective increase in leverage, thus increasing interest deductions, decreasing tax liabilities and finally increasing firm value.

[30] CEO's option holdings are calculated as the ratio of the number of options held by CEOs multiplied by the year-end price of the share to the sum of the market value of equity and book value of debt.

[31] The share holdings of CEOs have also been considered. Results are weaker but consistent.

[32] The tax dummy variable is equal to 1 if the firm has tax loss carryforwards, 0 otherwise.

additional explanatory variables are progressively added to the model.[33] Generally speaking, most results of column 1 and 2 are confirmed. Furthermore, the volume of foreign debt is found to be a strong incentive to hedge for European firms.[34] These results are in strong opposition with the expectations described in Geczy *et al.* (1997) and empirical evidence presented on U.S. multinationals by Elliott *et al.* (2003). They support however evidence provided by Fok *et al.* (1997) that natural hedges – like the use of foreign debt for net-exporting firms – complement and don't substitute for the use of FCDs in reducing currency risk. In model 6, the residuals of the regression of the ratio of foreign debt to size against the ratio of foreign sales to total sales and size replace the raw ratios of foreign debt to size in order to avoid the multicolinearity problems arising between these variables. The contemporaneous inclusion of all three variables enables us to identify among these variables the stronger incentives to hedge. Results suggest that the decision to use FCDs depends more on the percentage of foreign sales and the size of the firm than on the importance of foreign debt. In contrast to previous models, model 6 confirms moreover the financial distress hypothesis. Highly leveraged firms are shown to be significantly more inclined to hedge. In contrast, no evidence is found in support of liquidity acting as a hedging substitute. Similarly, the ratio of EBIT to total assets, the number of analysts and the options held by CEOs are found to have no influence on firms' decision to use financial derivative instruments.

The determinants of the extent of FCD usage are obtained by estimating a regression where we use the relative importance of the total notional value of FCD contracts to firms' total assets as dependent variable.[35] The sample is restricted to European non-financial firms that do use FCD contracts and provide useful information on the notional values of their foreign currency derivative holdings (290 firms[36]). In line with our results of table 2, the first 2 columns of table 3 reveal that international trade linkages - approximated by the ratio of foreign sales to total sales – and size are significantly positively related to the level of FCD usage. We note however that empirical findings reject the hypothesis that firms with more growth options in their investment

[33] Due to the strong correlation between some explanatory variables the inclusion of additional explanatory variables may require the exclusion of previously incorporated explanatory variables.

[34] A priori, foreign debt may be regarded as an operational hedging strategy for net exporting firms. In contrast foreign debt emphasizes the foreign currency risks importing firms are facing.

[35] As stressed in Allayannis and Ofek (2001) and Graham and Rogers (2000), the fact that firms net positions in individual currencies before disclosing them in the notes of their annual reports may introduce a bias in our measurement of the total notional values of the derivative contracts. However, we believe that our observations nevertheless provide valuable insights in the hedging practices of our sample firms.

[36] 66 firms of our sample state in their annual report that they use FCDs for hedging purposes but don't disclose the notional values of the FCD contracts. These values are either aggregated with other derivative holdings (e.g. interest rate swaps, commodity derivatives) or missing.

opportunity set – approximated by firms with low book to market ratios – suffer more from underinvestment costs and hedge more. To test in how far a convex tax schedule determines the hedging practices of European firms, the ratio of tax loss carryforwards to total assets is also included in the regression model. The significance of the positive tax coefficient strongly confirms the convexity-based tax incentive to hedge. Consistent with the financial distress costs motives to hedge, we find furthermore that less profitable firms are more inclined to use FCDs than highly profitable ones. Results obtained through the progressive inclusion of additional explanatory variables in our model don't contradict those reported in columns 1 and 2.[37] As expected, we observe in model 4, 5 and 6 that the volume of foreign debt strongly determines the extent of FCD hedging by European firms.[38] In addition, the extent of FCD usage is shown to be negatively related to liquidity which is consistent with liquidity serving as a hedging substitute. We find however no evidence that retained dividends could similarly serve as a hedging substitute. Similarly, neither the information asymmetry nor the managerial risk aversion hypothesis aren't empirically confirmed. While the positive sign of the debt ratio coefficient is consistent with financial distress costs related incentives to hedge, evidence in support of this hypothesis is overall statistically weak. These results are in line with Graham and Rogers (2000) and Allayannis and Ofek (2001).

4. Empirical evidence on the impact of corporate derivative usage on foreign exchange risk exposure

Following the extensive literature on foreign exchange rate exposure[39], we estimate the firm-specific foreign exchange risk exposure – defined as the effect of exchange rate changes on the value of a firm in excess of the global market's reaction to foreign exchange rate movements – with the following augmented market model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i X_t + \varepsilon_{it} \qquad (1)$$

where R_{it} designates the total return of firm i in period t, R_{mt} the *Datastream* calculated European total market index return in period t, β_i firm i*'s* return sensitivity to market

[37] Due to the strong correlation between some explanatory varaiables the inclusion of additional explanatory variables may require the exclusion of previously incorporated explanatory variables.

[38] For model 6, the ratio of foreign debt to the sum of the market value of equity and book value of debt is first regressed to the ratio of foreign sales to total sales and to the log of the sum of the market value of equity and book value of debt. The residuals of this regression are consecutively included in model 6.

[39] See for instance the pioneer studies by Adler and Dumas (1984) and Jorion (1990).

fluctuations, X_t the rate of return on the trade-weighted effective euro (U.K. pound) exchange rate index – measured as the foreign currencies' exchange price of one euro (respectively one U.K. pound) –,γ_i firm i's exposure to this exchange rate index independent of the effect these variations have on the overall market, and ε_{it} denotes the white noise error term.[40] Given the definition of our exchange risk factor, a positive exchange rate movement corresponds to an appreciation of the domestic currency (euro or U.K. pound). As we expect exporters to be hurt by an appreciation of their home-currency and importers to benefit from a similar positive exchange rate change, the γ_i coefficient should be negative for net-exporters and positive for net-importers.[41] Equivalently, if a firm has net exposed foreign denominated assets, it should suffer from a strengthening home currency, producing a negative exposure effect (i.e., the stock return should decrease in response to a positive exchange rate movement). On the opposite, if a firm has net exposed foreign denominated liabilities, then an appreciation of the domestic currency should benefit it (i.e., the stock return should increase in response to a positive exchange rate movement).

In order to check the robustness of our results to the use of a different source of exchange rate risk, we also perform the analysis using the bilateral U.S. dollar exchange rate vis-à-vis the euro (respectively the U.K. pound) instead of utilizing the trade-weighted currency indices. While the trade-weighted exchange rate indices translate more effectively all the exchange rate uncertainties influencing European firms in their trading relationships with different countries, the bilateral U.S. dollar exchange rates have the advantage of not being affected by the potential divergent off-setting effects between multiple currencies (Miller and Reuer, 1998). Results for both exchange risk factor specifications will be simultaneously presented in the rest of the paper. We will empirically verify that the choice of index doesn't lead to major differences in the conclusions of our analysis.

In consistence with Allayannis and Ofek (2001), we use a 3-year return period surrounding the year in which annual reports are collected to measure the

[40] Including the stock market return in Eq. (1) dramatically reduces the residual variances of the regression. Moreover, the market return implicitly controls for the value-relevant macroeconomic factors that are correlated with the exchange rates. It is, however, important to stress that according to Eq. (1), the empirical result of having zero exposure does not imply that the firm's value is independent of exchange rates; rather, a zero firm-specific exposure implies that the firm value is affected to the same degree as the market portfolio.

[41] The sign of the currency exposure becomes more ambiguous for a company that has importing as well as exporting activities. In this particular situation, the elasticity of the firm's demand for foreign goods relative to the elasticity of the foreign market's demand for the firm's goods have to be taken into account (Adler and Dumas, 1984; He and Ng, 1998).

contemporaneous impact of FCD use on a firm's exchange rate exposure.[42] The regression estimates obtained using weekly data are presented in table 4. First, we note that the majority of our European sample firms are facing a negative currency exposure.[43] This implies that most companies are negatively affected by an appreciating domestic currency and behave like net-exporters. European firms are, moreover, found to be more exposed to the changes in the bilateral U.S. dollar exchange rate vis-à-vis their domestic currency than to the movements of their currency's trade-weighted exchange rate index. Regarding both exchange risk factors, it appears that among FCD users a slightly higher percentage of firms is significantly affected by currency fluctuations than among FCD non-users. This doesn't necessarily imply that firms use FCDs to speculate but may simply translate the observation made above that FCD users have stronger international linkages than companies that don't use FCDs.[44] The difference in market risk and foreign currency exposure between both groups of companies is specifically examined by testing the null hypothesis of equality of mean (median) exposure values between both sub-samples. Results of these tests suggest that the average market beta of FCD users is statistically higher than the average market beta observed for FCD non-users. Regarding foreign currency exposure coefficients, it is interesting to note that FCD non-users show a statistically stronger negative mean exposure to fluctuations in the trade-weighted exchange rate index, whereas FCD users seem on average to be more strongly negatively affected by U.S. dollar movements.[45]

The monthly results of the augmented market model regression (Eq. 1) are displayed in table 5. In line with previous results our findings show that exchange risk

[42] Following Allayannis and Ofek (2001) we check the robustness of our results to an alternative time interval – 2 years – surrounding the year in which the annual reports are collected. Overall the modification of the estimation period doesn't affect the findings that are presented in this paper. Results are delivered from the authors upon request.

[43] At first glance these results appear to be in contrast to previous findings reported in Muller and Verschoor (2004). We have to stress, however, that both estimations of European firms' currency risk exposures have been performed on distinctive sample periods corresponding both to different economic episodes and to distinctive currency fluctuation patterns. The results presented in this paper provide hence further evidence in support of the time-varying behavior of exposure at the individual firm level that has already been empirically highlighted in Muller and Verschoor (2004).

[44] As mentioned in table 1, the average ratio of foreign sales to total sales is twice as high for FCD users compared to FCD non-users. This large difference in foreign trading activity is expected to lead to a large difference in the percentage of firms with significant foreign currency exposure. As we can't empirically verify this large difference in percentage of significantly exposed companies, we presume that this difference has been reduced through the implementation of financial hedging strategies by FCD users.

[45] These findings are in contradiction with the information collected in annual reports, reporting that almost 90 percent of companies use FCDs to hedge predominantly U.S. dollar currency fluctuations.

exposure becomes statistically more evident when increasing the observation horizon.[46] Approximately 42 percent (40 percent) of FCD hedgers (non-hedgers) appear to be significantly influenced by movements in the trade-weighted exchange rate index while roughly 62 percent (52 percent) are influenced by fluctuations in the U.S. dollar. Whereas FCD users as a group still count the higher percentage of firms with significant exposures, we observe nevertheless that non-users show consistently stronger negative mean and median exposures to movements in the trade-weighted exchange rate index. Finally, consistent with weekly results, most European sample firms appear to benefit from an appreciation of their home currency while being negatively affected by domestic currency depreciations.

It is a common belief that exchange risk exposure is created via foreign operations and may be reduced through the implementation of financial hedging strategies. However, foreign exchange risk effects may also be reduced through alternative channels. As a great number of distinctive exchange rates may affect firm value through many different ways, all these influences may naturally offset each other. When analyzing the impact of FCD usage on firms' foreign currency exposure, we therefore include firm size to proxy a firm's international diversification possibilities as well as its capacity to implement operational hedging strategies The ratio of foreign sales is also incorporated in subsequent models in order to take a firm's international involvement into account. As previous empirical evidence (Bodnar *et al.*, 1998) suggests that among firms with foreign exchange exposure that regularly hedge, there seems to be a tendency to hedge only a small fraction of the total foreign currency exposure, we expect that the use of FCDs doesn't completely offset the currency risk exposure firms are facing but we expect that it reduces its absolute value and statistical significance. We examine, hence, subsequently the link between FCD practices and the significance of firms' exchange rate exposures as well as the relationship between these strategies and the magnitude of the exposures.

Empirical findings regarding the impact of FCD use on the significance of foreign exchange risk exposure of European firms are presented in table 6. The dependent variable of the probit model is assigned the value 1 if the firm is statistically significantly[47] affected by currency fluctuations and 0 otherwise. Consistent with the view that the percentage of foreign sales to total sales is a reasonable proxy for firms' overall international trade linkages and hence their exposure to exchange rate uncertainty,

[46] See for instance Chow and Chen (1998), Griffin and Stulz (2001), Dominguez and Tesar (2001), Di Iorio and Faff (2001) and Muller and Verschoor (2004).

[47] Reported results have been obtained with the 10 percent statistical significance level. However to test the robustness of these results, we performed the analysis as well with the 5 percent statistical significance level. Results are consistent and may be obtained from the authors upon request.

results suggest that the importance of foreign sales is the major determinant of the significance of firms' currency exposure. The more companies are selling outside of their frontiers the more they seem to be significantly affected by exchange rate fluctuations. The size of a firm is also positively linked to the significance of its foreign exchange risk exposure. On the other hand, we find that firms' decision to use FCDs has a negative effect on the significance of their sensitivity to exchange rates. This negative relationship supports the view that non-financial firms use FCDs primarily for hedging purposes – and not for speculation. It is however statistically insignificant. We thus may conclude that the implemented foreign currency hedging strategies are not able to efficiently reduce the exchange rate risk European companies are effectively facing.

In order to further investigate the impact of FCD use on firms' exchange risk exposure, we focus now on the relationship between the extent of FCD usage and the magnitude of the exposure. As mentioned above, the total exposure of a company should be smaller in magnitude when currency derivatives offset exchange rate effects from foreign operations. To empirically assess the relationship between FCD use and the magnitude of foreign exchange risk exposure we estimate the following model:

$$Est.(\gamma_i) = \alpha_{1i} + \alpha_{2i}\, ln(Size_i) + \alpha_{3i}\, (FS/TS)_i + \alpha_{4i}\, (FCD/TA)_i + \mu_i \qquad (2)$$

where $Est.(\gamma_i)$ is a firm's exchange risk exposure estimated in (Eq. 1), $ln(Size_i)$ a firm's size – measured by the natural logarithm of the sum of market value of equity and book value of debt –, $(FS/TS)_i$ a firm's ratio of foreign sales to total sales and $(FCD/TA)_i$ a firm's ratio of foreign currency derivatives to total assets.

As the foreign operations of positively (net-importers) and negatively (net-exporters) exposed firms are presumably completely different in nature, we examine these sub-samples of firms separately.

In a first stage we estimate Eq. (2) using ordinary least squares The first regression outputs of panel A and B of table 7 show that while the link between foreign currency exposure and the level of FCD use has the expected sign, it is nonetheless again statistically insignificant.[48] These findings confirm our view that the use of financial derivative instruments by European firms doesn't significantly reduce their sensitivity to exchange rate movements. As expected, we find however that for net-importing companies – that are positively affected by currency movements – foreign sales tend to naturally offset the impact of exchange rate movements. Likewise, the exposure of net-exporting firms appears to be strengthened through the existence of high foreign sales

[48] Corroborating results are provided in De Jong *et al.* (2004) who find little evidence to suggest that external hedging activities decrease currency risk exposure on the Dutch market

volumes. Finally, the positive (negative) relationship between firm size and negative (positive) exposure coefficients supports the argument that larger firms have greater access to international diversification benefits and operational hedging practices. Pantzalis *et al.* (2001) similarly conclude that firms with a greater breadth of foreign operations have lower foreign exchange rate exposure.

Following Chow and Chen (1998) and Nguyen and Faff (2003) we examine next whether our results are robust to the inclusion of additional explanatory variables that are considered in the literature as proxies for firms' incentives to hedge:

$$Est.(\gamma_i) = \alpha_{1i} + \alpha_{2i}\, ln(Size_i) + \alpha_{3i}\, (FS/TS)_i + \alpha_{4i}\, (FCD/TA)_i + \alpha_{4i}\, (Quick)_i + \alpha_{4i}\, (LT\ Debt\ /\ Size)_i + \alpha_{4i}\, (BTM)_i + \eta_i \quad (3)$$

where $Est.(\gamma_i)$ is a firm's exchange risk exposure estimated in Eq. (1), $ln(Size_i)$ a firm's size – measured by the natural logarithm of the sum of market value of equity and book value of debt –, $(FS/TS)_i$ a firm's ratio of foreign sales to total sales, $(FCD/TA)_i$ a firm's ratio of foreign currency derivatives to total assets, $(Quick)_i$ a firm's quick ratio, $(LT\ Debt\ /\ Size)_i$ a firm's ratio of long term debt to size and $(BTM)_i$ a firm's book to market value.

Empirical findings of Eq. (3) are displayed in the second regression outputs of Panel A and B of table 7. We observe, in particular, that firms with high liquidity tend to be more exposed to currency movements. These results are in favor of Froot *et al.*'s (1993) argument that highly liquid firms have less incentive to hedge than firms that are facing strong liquidity constraints and are susceptible to be hurt by an increase in cash-flow volatility. Further empirical findings tend to support the view that firms with high debt ratios and strong growth opportunities tend to be affected by currency movements. These relations aren't however statistically significant.

Table 8 presents the coefficient estimates of Eq. (2) and (3) when weighted least squares are used. The weighting factors are the t-statistics of the exposure coefficients estimated by model (Eq. 1). This enables us to assign more weight to the exposure coefficients that have been estimated with higher precision and less to those estimated with lower precision. Results confirm previous findings but are generally statistically stronger compared to those obtained using ordinary least squares. Again we find that the extent of FCD use tends to reduce a firm's exposure to exchange rate risk. However this impact remains statistically weak. On the other hand, we observe once more that foreign sales significantly accentuate the exposure net exporters are facing while they tend to reduce the currency sensitivity of net-importers. The confirmation of the negative link between exchange rate exposure magnitude and firm size supports the argument that firm size is a proxy for a firm's ability to diversify international operations and implement operational

hedging strategies (Bodnar *et al.*, 1997). The inclusion of variables that approximate firms' incentives to hedge enables us to emphasize two additional features. In line with previous results, the liquidity of a firm is shown to be statistically positively linked to the magnitude of foreign currency exposure. Secondly, the weighted least squares regressions lead to strong evidence in favor of a positive relationship between leverage and exposure magnitude. The impact of the existence of growth opportunities has again the expected sign but remains statistically insignificant.

It is important to stress that the aforementioned probit, ordinary least squares and weighted least squares estimations almost unanimously disprove the assumption that financial hedging instruments have a stronger impact on weekly compared to monthly currency risk exposures. Two potential reasons may explain why currency exposure effects become more evident when lengthening the observation horizon: managers' stronger capacity to implement short-term hedging strategies and investors' short-term mispricing errors. Empirical evidence presented in tables 6, 7 and 8 reveals that one of these hypotheses has to be rejected: managers have no incremental knowledge of their weekly versus monthly exposures to currency fluctuations and are hence not able to hedge these short-term risks in a more efficient way. Consequently, empirical evidence suggesting that currency exposure effects are statistically stronger when they are estimated over longer return intervals should be predominantly attributed to the fact that it is difficult for investors to differentiate between temporary versus permanent currency shocks and, hence, to predict the impact of short-term exchange rate shocks on a firm's competitive and economic environment (Bodnar and Wong, 2003; Chow *et al.*, 1997a, 1997b; Di Iorio and Faff, 2000).

5. Concluding Remarks

This paper examines the foreign exchange risk practices of European non-financial companies. In a first stage, we are concerned with the motives that lead firms to use currency derivatives as well as the factors that affect their decision on how much to hedge with these instruments. In a second stage, the extent to which this usage affects their foreign exchange risk exposure is thoroughly investigated. The major contribution of this paper is that it provides a unique insight in European firms' hedging strategies as well as an in-depth analysis of the real impacts of these hedging strategies on firms' risk exposures.

Consistent with previous studies, the main determinants of FCD use are found to be the percentage of firms' foreign trading volumes and size. While these results seem to refute the financial distress costs and informational asymmetries motives to hedge, they

provide evidence in favor of the existence of economies of scale in hedging. When the firm is larger and the volume of foreign activity is sufficiently large to justify the costs, the implementation of hedging programs appears to be strongly facilitated. Further, our results lend support to the argument that the existence and extent of tax loss carryforwards play a significant role in explaining firms' use of financial derivative instruments. The positive relationship between the percentage of foreign denominated debt and the use of FCDs reveals moreover that both types of instruments are complements in hedging foreign currency risk. Finally, in contrast to optimal hedging theories (Froot *et al.*, 1993), our empirical findings suggest that the more growth opportunities companies have, the less they use FCDs.

In a second stage, we investigate the role of FCD usage in influencing the significance and magnitude of firms' sensitivity to exchange rate fluctuations. The relationship between firm value and currency movements has been documented both for weekly and monthly observation horizons to examine the effect of FCDs on both the short- and medium-term currency exposures of European firms. Overall, most European companies in our sample are found to behave like net-exporters – being negatively affected by a depreciation of foreign currencies. Empirical evidence reveals as well that the impact of exchange rate changes on firm value becomes more evident when lengthening the observation horizon.

Our empirical results lend strong support to the hypothesis that the degree of international involvement – approximated by the percentage of foreign sales – is a major determinant of firms' currency risk exposure. Size, on the other hand, appears to be negatively related to exchange rate exposure. The negative role of size tends to support the argument that larger firms benefit from the diversification of their foreign operations and are to a greater extent capable of implementing operational hedging strategies. Furthermore, firms with high liquidity ratios and firms with high growth opportunities and leverage appear to be more sensitive to currency fluctuations. These findings are informative since they show that companies that use liquidity as a substitute for hedging as well as companies that are particularly vulnerable to cash-flow-volatility tend to be particularly affected by exchange rate movements. Ultimately, our evidence supports unanimously the assumption that European companies use FCDs not to speculate on the foreign exchange markets but to protect themselves against currency fluctuations. However these hedging strategies are shown to have statistically weak effects. Similarly, no conclusive evidence could be found to corroborate managers' stronger capacity to hedge the short-term versus long-term currency exposure of the company..

It is important to note that when investigating the relation between the utilization of FCDs and firms' currency exposure, our empirical findings are shown to be robust to

the use of a wide range of alternative specifications. Results lead to the same conclusions when a different exchange risk factor or a shorter sample period is utilized for the estimation of firms' exposure to currency movements. Findings are likewise found to be robust to the use of different estimation methodologies (e.g., ordinary least squares, weighted least squares and probit regressions).

Our results have strong implications for managers, investors and regulators. They may be interpreted as further evidence that managers are using FCDs to hedge only a small proportion of the currency risk they are facing and that these hedging activities are mostly unsystematic. Additionally, the fact that the relationship between currency movements and firm value is statistically and economically weaker in the short-run – as compared to the long-run – may not be attributed to managers' stronger capacity to hedge short-term versus long-term currency exposure. It reveals, in reality, that short-term returns contain errors made by investors in forecasting the long-term effects of current exchange rate fluctuations.

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Table 1: Sample description

Panel A: Belgian, German and Dutch firms

	FCD Users				FCD Non-Users			
	Obs.	Mean	Median	Std. Dev.	Obs.	Mean	Median	Std. Dev.
Size[†] (in mio Euros)	223	18.800	873	135.000	112	505	209	778
Total assets (in mio Euros)	223	8.280	700	26.000	112	386	134	557
Employees	223	25.530	4.167	62.407	112	2.710	852	4.484
Book to market value	223	0,8649	0,8915	0,3823	112	0,7593	0,7767	0,3058
Debt ratio[‡]	223	0,1661	0,1299	0,1549	112	0,1175	0,0682	0,1518
Quick ratio	223	0,4371	0,2228	0,7235	112	1,9357	0,1577	8,2593
Dividend yield	223	0,0196	0,0173	0,0202	112	0,0158	0,0117	0,0187
EBIT / Total asets	223	0,0099	0,0379	0,1268	112	0,0001	0,0281	0,3863
Foreign sales[§] / Total sales	187	0,3574	0,3600	0,2126	83	0,1449	0,0600	0,2025
Foreign float debt / Total assets	61	0,0093	0,0000	0,0211	33	0,0000	0,0000	0,0000
Foreign fixed debt / Total assets	61	0,0542	0,0083	0,0916	33	0,0060	0,0000	0,0173

Panel B: UK firms

	FCD Users				FCD Non-Users			
	Obs.	Mean	Median	Std. Dev.	Obs.	Mean	Median	Std. Dev.
Size[†] (in mio UK pounds)	133	8.450	1.710	47.700	3	367	428	161
Total assets (in mio UK pounds)	133	16.700	1.680	103.000	3	294	335	149
Employees	131	19.700	11.123	22.575	3	1.103	988	735
Book to market value	133	0,9710	0,9419	0,4284	3	0,7870	0,6969	0,1660
Debt ratio[‡]	133	0,2123	0,1892	0,1670	3	0,0595	0,0291	0,0630
Quick ratio	133	0,0633	0,0092	0,2662	3	0,0099	0,0099	0,0010
Dividend yield	133	0,0297	0,0321	0,0185	3	0,0000	0,0000	0,0000
EBIT / Total asets	133	0,0358	0,0403	0,0687	3	0,0634	0,0974	0,0821
Foreign sales[§§] / Total sales	133	0,6065	0,6902	0,2709	3	0,2991	0,2991	0,3614
Foreign float debt / Total assets	131	0,0883	0,0723	0,0844	3	0,0440	0,0000	0,0762
Foreign fixed debt / Total assets	131	0,0878	0,0357	0,1083	3	0,0000	0,0000	0,0000

The total sample of 335 Belgian, German and Dutch firms as well as the sample of 136 U.K. firms is subdivided between FCD users and FCD non-users. Reported data are obtained of the 2003 annual reports.

[†] Size is measured as the sum of market value of equity and book value of debt.

[‡] Leverage is defined as the ratio of long term debt to total assets.

[§] Foreign sales for Belgian, Dutch and Gerrnan companies are sales to non-Euro zone countries (Sales to non-Euro zone countries are sometimes approximated by sales to non-European countries).

[§§] Foreign sales for U.K. companies are sales to non-U.K. countries.

Table 2: Factors explaining the decision to use FCDs

	Dependent variable: Use FCD = 1 otherwise = 0					
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-9.4991***	-8.2269***	-9.6051***	-8.3984***	-10.5028*	-9.4717***
	-5,0271	*-4,2322*	*-4,0418*	*-3,3699*	*-1,7487*	*-2,9850*
Foreign Sales[a] / Total Sales	3.1412***	3.2397***	3.6836***			5.0068***
	5,9489	*4,8820*	*4,7586*			*3,4104*
Ln (Size[b])	0.4131***	0.3591**	0.4017***	0.4096***	0.5108*	0.3470**
	4,4191	*3,6626*	*3,5005*	*3,2461*	*1,6773*	*2,1564*
Long term debt / Size[b]	0,9497	0,7980	0,9826			3.8166*
	1,1166	*0,3568*	*0,9143*			*1,8783*
Quick ratio	0,2710		0,4887	-0,0183	0,5763	0,4981
	1,1679		*1,4197*	*-0,4268*	*0,9540*	*0,7043*
EBIT / Interest Expenses		0,0013				
		0,3757				
Market to Book Value	0,5747	0,4975	0,7709	-0,0214	0,7416	0,6033
	1,4587	*1,1774*	*1,5971*	*-0,0401*	*0,9064*	*0,8194*
Dividend Yield	10.8939*	8,2903	8,5212	15,8340	30,0315	23.9608*
	1,7036	*1,1739*	*1,1019*	*1,5357*	*1,4490*	*1,7274*
Tax convexity[c]	0.5129**	0,3975	0,3675	0.6198*	0,2166	0.8533*
	2,1805	*1,3368*	*1,1602*	*1,7278*	*0,4071*	*1,8461*
EBIT / Total Assets		-0,4481	-0,6355			
		-0,8101	*-0,7386*			
Ln (# of analysts)					0,3052	
					1,0541	
Managerial options[d]			12,3101			
			0,6971			
Foreign debt / Size[b]				13.3336***	15.6878**	6.3932[e]
				3,1456	*2,3205*	*1,2697*
Observations	406	406	204	228	142	228
Likelihood	-31,5416	-57,7185	-47,6440	-47,0471	-18,3864	-30,8849
Mc-Fadden R^2	45,42%	45,53%	49,05%	47,40%	52,48%	57,89%

This table presents logit regression estimates of the relation between the likelihood that a firm hedges foreign currency exposure with FCDs and proxies for incentives to hedge respectively proxies for complement or substitute hedging activities.
*, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics.
[a] Foreign sales for Belgian, Dutch and Gerrnan companies are sales to non-Euro zone countries (Sales to non-Euro zone countries are sometimes approximated by sales to non-European countries). Foreign sales for U.K. companies are sales to non-U.K. countries.
[b] Size is measured as the sum of market value of equity and book value of debt.
[c] Tax convexity is measured by a dummy variable that is assigned the value 0 if the firm has tax loss carryforwards and 0 otherwise.
[d] Managerial options are calculated as the ratio of CEO's option holdings multiplied by the year-end price of the firm share to the sum of the market value of equity and book value of debt.
[e] In model 6 the ratio foreign debt to size is replaced by the residuals of the regression of the ratio of foreign debt to size against the ratio of foreign sales to total sales and size.

Table 3: Factors explaining the level of FCD use

	Dependent variable: FCD[e] / Total Assets					
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-0.1778*	-0,1604	-0,1908	-0,1442	-0,1539	-0,2066
	-1,6751	*-1,2809*	*-1,4096*	*-1,0052*	*-0,7731*	*-1,2398*
Foreign Sales[a] / Total Sales	0.0644**	0.0696**	0,0557			0,0476
	2,0980	*2,0154*	*1,5291*			*1,1720*
Ln (Size[b])	0.0124**	0.0123*	0.0125*	0.0115*	0,0101	0,0131
	2,3347	*1,9377*	*1,8779*	*1,7289*	*1,0050*	*1,5298*
Long term debt / Size[b]	0,0799	0,0475	0,0757			0,1038
	1,2958	*0,7113*	*1,0443*			*1,3704*
Quick ratio	-0,0100		-0,0169	-0,0002	-0.0875**	-0.0705*
	-0,5642		*-0,8289*	*-1,1047*	*-2,1295*	*-1,6772*
EBIT / Interest Expenses		-0,0003				
		-1,3369				
Market to Book Value	0.0519**	0.0649**	0.0541**	0,0450	0,0398	0,0509
	2,0616	*2,4163*	*1,9646*	*1,6157*	*1,3799*	*1,6007*
Dividend Yield	-0,3012	-0,1432	0,0684	-0,1411	0,0922	-0,0301
	-0,6748	*-0,2931*	*0,1321*	*-0,2408*	*0,1375*	*-0,0334*
Tax convexity[c]	0.3068**	0.4751***	0.5911***	0.7193***	1.0373***	0.6547**
	2,1102	*2,6081*	*2,9675*	*3,0626*	*3,7133*	*2,4633*
EBIT / Total Assets		-0.0909*	-0.1455**			
		-1,9313	*-2,4556*			
Ln (# of analysts)					0,0033	
					0,1910	
Managerial options[d]			1,3548			
			0,9623			
Foreign debt / Size[b]				0.1474**	0.2248***	0.1838* [f]
				1,9974	*2,7895*	*1,7439*
Observations	290	290	204	192	142	192
Likelihood	157,26890	120,3224	109,92560	111,55780	86,72860	88,34760
Adjusted R^2	6,27%	8,24%	7,24%	6,31%	11,78%	7,46%

This table presents OLS regression estimates of the relation between the extent of utilization of FCDs and proxies for incentives to hedge respectively proxies for complement or substitute hedging activities.
*, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics.
[a] Foreign sales for Belgian, Dutch and Gerrnan companies are sales to non-Euro zone countries (Sales to non-Euro zone countries are sometimes approximated by sales to non-European countries). Foreign sales for U.K. companies are sales to non-U.K. countries.
[b] Size is measured as the sum of market value of equity and book value of debt.
[c] Tax convexity is measured by the ratio of tax loss carryforwards to total assets.
[d] Managerial options are calculated as the ratio of CEO's option holdings multiplied by the year-end price of the firm share to the sum of the market value of equity and book value of debt.
[e] FCD usage is approximated by the total notional value of foreign currency derivative contracts.
[f] In model 6 the ratio foreign debt to size is replaced by the residuals of the regression of the ratio of foreign debt to size against the ratio of foreign sales to total sales and size.

Table 4: Descriptive statistics for FX exposure coefficients estimated using weekly data

	FCD Users			FCD Non-Users		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Panel A: Exposure to the trade-weighted exchange rate index						
Intercept	-0,0007	0,0004	0,0056	-0,0005	0,0003	0,0063
European Stock Market	0,8865	0,7534	0,6227	0,7597	0,6841	0,5498
TW Exchange Rate Index	-0,9676	-0,7054	1,1674	-1,1839	-1,0448	1,0969
# of positive / negative FX exposures	291 / 66			105 / 11		
% of significant FX exposures	38,10%			38,79%		
Test for the difference in market risk between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	1.9588*	0,0507				
Equality of median	1,0868	0,2972				
Test for the difference in FX exposure between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	1.7589*	0,0792				
Equality of median	5.4056**	0,0201				
Panel B: Exposure to the bilateral US dollar exchange rate						
Intercept	0,0000	0,0009	0,0054	-0,0001	0,0006	0,0065
European Stock Market	0,9635	0,8284	0,6795	0,8037	0,6904	0,5866
US$ Exchange rate	-0,8208	-0,7182	0,6384	-0,6841	-0,6484	0,5968
# of positive / negative FX exposures	333 / 24	24,00000		109 / 7		
% of significant FX exposures	54,19%			43,97%		
Test for the difference in market risk between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	2.2722**	0,0235				
Equality of median	1,0866	0,2970				
Test for the difference in FX exposure between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	2.0359**	0,0423				
Equality of median	3.0143*	0,0825				

This table reports cross-sectional summary statistics of the parameters estimated from the following regression model for the period from January 2002 to October 2004 using maximum likelihood:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i \theta_t + \varepsilon_{it}$$
$$with \quad \varepsilon_{it} = \mu_{it} * (h_{it})^{1/2} \quad h_{it} = \delta_i + \tau_i \varepsilon^2_{i,t-1} + \nu_i h_{i,t-1}$$

where R_{it} designates the total return of firm i in period t, R_{mt} the *Datastream* calculated European total stock market return in period t, β_i firm i*'s* return sensitivity to market fluctuations, θ_t the movement in the trade-weighted euro (U.K. pound) exchange rate index – Panel A –, respectively the movement in the bilateral euro (U.K. pound) / U.S. dollar exchange rate – Panel B –, γ_i firm i's exposure to these exchange rate movements, $h_{i,t}$ denotes the conditional variance of the residuals; δ_i, τ_i *and* ν_i unknown parameters; and $\mu_{i,t}$ represents the white noise error term. The GARCH (1, 1) specification is added to Eq. (1) to take the heteroskedasticity of weekly returns into account.

*, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics.

† The equality of mean hypothesis is tested using a t-test verifying whether the variability between the sample means (between groups) is the same as the variability within any subgroup.

‡ The equality of median hypothesis is tested using a Ch-squared rank-based ANOVA test based on the comparison of the number of observations above and below the overall median in each subgroup.

Table 5: Descriptive statistics for FX exposure coefficients estimated using monthly data

	FCD Users			FCD Non-Users		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Panel A: Exposure to the trade-weighted exchange rate index						
Intercept	-0,0034	-0,0011	0,0219	-0,0010	0,0018	0,0306
European Stock Market	1,1881	0,9869	0,8436	1,1232	1,0112	0,8905
TW Exchange Rate Index	-1,6125	-1,0314	2,1126	-2,2561	-1,5550	2,3371
# of positive / negative FX exposures	295 / 63			102 / 14		
% of significant FX exposures	42,18%			39,66%		
Test for the difference in market risk between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	0,7072	0,4798				
Equality of median	0,0576	0,8104				
Test for the difference in FX exposure between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	2.7768***	0,0057				
Equality of median	10.2726***	0,0014				
Panel B: Exposure to the bilateral US dollar exchange rate						
Intercept	0,0004	0,0023	0,0211	0,0003	0,0027	0,0312
European Stock Market	1,2332	1,0089	0,8492	1,1311	1,0307	0,9274
US$ Exchange rate	-1,1762	-1,0035	0,9654	-1,1295	-0,9478	1,1540
# of positive / negative FX exposures	334 / 24			102 / 14		
% of significant FX exposures	61,90%			52,59%		
Test for the difference in market risk between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	1,0969	0,2733				
Equality of median	0,2058	0,6500				
Test for the difference in FX exposure between FCD Users (356 firms) and FCD Non-Users (115 firms)						
Equality of mean	0,4303	0,6672				
Equality of median	0,1826	0,6691				

This table reports cross-sectional summary statistics of the parameters estimated from the following regression model for the period from January 2002 to October 2004 using ordinary least squares:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i \theta_t + \varepsilon_{it}$$

where R_{it} designates the total return of firm i in period t, R_{mt} the *Datastream* calculated European total stock market return in period t, β_i firm i*'s* return sensitivity to market fluctuations, θ_t the movement in the trade-weighted euro (U.K. pound) exchange rate index – Panel A –, respectively the movement in the bilateral euro (U.K. pound) / U.S. dollar exchange rate – Panel B –, γ_i firm i's exposure to these exchange rate movements and $\varepsilon_{i,t}$ represents the white noise error term.

*, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics.

† The equality of mean hypothesis is tested using a t-test verifying whether the variability between the sample means (between groups) is the same as the variability within any subgroup.

‡ The equality of median hypothesis is tested using a Ch-squared rank-based ANOVA test based on the comparison of the number of observations above and below the overall median in each subgroup.

Table 6: FX exposure and the use of FCDs (Probit)

	Exposure to TW index				Exposure to US$			
	Weekly		Monthly		Weekly		Monthly	
Intercept	-0,7000	*(-0.9864)*	-1.4153**	*(-2.0054)*	-1.5994**	*(-2.1418)*	-0,5728	*(-0.8258)*
ln (Size†)	0,0346	*(0.9465)*	0.0736**	*(2.0291)*	0.0786**	*(2.0400)*	0,0423	*(1.2262)*
Foreign Sales§ / Total Sales	0.7341***	*(2.8321)*	0.8634**	*(3.3050)*	0.6699**	*(2.4502)*	0,1136	*(0.4764)*
FCD usage dummy‡	-0,1912	*(1.0377)*	-0,1112	*(-0.6053)*	-0,2113	*(-1.1309)*	-0,4591	*(-1.2698)*
Observations	406		406		406		406	
Mac Fadden R^2	0,0166		0,0269		0,0477		0,0075	
Intercept	-0,8624	*(-1.2346)*	-1.3979**	*(-2.0106)*	-1.8327**	*(-2.4897)*	-0,2765	*(-0.3905)*
ln (Size†)	0,0462	*(1.3343)*	0.0759**	*(2.1989)*	0.0958***	*(2.6141)*	0,0150	*(0.4111)*
Foreign Sales§ / Total Sales	0.6291***	*(2.6119)*	0.7763***	*(3.2196)*	0.7948***	*(3.1398)*	0,1671	*(0.6433)*
FCD usage dummy‡	-1,4627	*(1.4198)*	-0,9924	*(-1.0373)*	-0,3016	*(-0.3401)*	-1.1484**	*(-1.2698)*
Observations	406		406		406		406	
Mac Fadden R^2	0,0186		0,0261		0,0466		0,0166	

This table presents logit regression estimates of the relation between the likelihood that a firm is significantly exposed to currency exposure and firm size, the percentage of foreign sales to total sales and the use – or not – of foreign currency derivatives.
*, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics.
† Size is measured as the sum of market value of equity and book value of debt.
‡ The FCD usage dummy variable is assigned the value 1 if the firm reports the use of foreign currency derivatives in the notes to their annual reports and 0 otherwise.
§ Foreign sales for Belgian, Dutch and German companies are sales to non-Euro zone countries (Sales to non-Euro zone countries are sometimes approximated by sales to non-European countries). Foreign sales for U.K. companies are sales to non-U.K. countries.

Table 7: FX exposure and the use of FCDs (Ordinary Least Squares)

	Negative exposures				Positive exposures			
	Weekly		Monthly		Weekly		Monthly	
Panel A: Dependent variable : exposure to the trade-weighted exchange rate index								
Intercept	-1.5177**	*-2.3943*	-5.5918***	*-4,7477*	0.9108*	*1.8783*	1,7572	*1,3501*
ln (Size†)	0,0056	*0.1784*	0.1471**	*2,5178*	-0,0269	*-1.1099*	-0,0462	*-0,7120*
Foreign Sales‡ / Total Sales	-0,3537	*-1.5935*	-0.7005*	*1,6731*	0,0139	*0.0943*	0,1046	*0,2399*
FCD§ / Total Assets	0,3171	*0.3944*	1,4466	*0,8779*	-0,2512	*-0.4045*	-0,6397	*-0,4967*
Observations	235		241		55		49	
Adjusted R^2	0,0000		0,0308		0,0000		0,0000	
Intercept	-3.2796***	*-4.2907*	-5.2717***	*-3.7239*	1.3645***	*2.7148*	3.8716**	*2.4375*
ln (Size†)	0.0933**	*2.4255*	0,1146	*1.6372*	-0.0574**	*-2.1955*	-0.1790**	*-2.1447*
Foreign Sales‡ / Total Sales	-0,1736	*-0.7451*	-0.8879**	*-1.9049*	0,1588	*1.0258*	-1.5444***	*-3.4534*
FCD§ / Total Assets	0,4783	*0.6200*	1,3740	*0.8345*	-0,2485	*-0.4114*	-0,1184	*-0.1028*
Quick Ratio	0,0166	*0.5781*	-0.5779***	*-3.1436*	0.5107**	*2.5726*	0,0421	*1.5683*
LT Debt / Size†	-0,2939	*-0.5875*	-0,7138	*-0.7911*	0,3708	*1.5413*	0,9573	*1.1784*
Market to Book Value	0,1746	*0.9052*	0,4261	*1.2399*	-0,0233	*-0.2658*	-0,0412	*-0.1244*
Observations	235		241		55		49	
Adjusted R^2	0,0145		0,0875		0,0594		0,2884	
Panel B: Dependent variable : exposure to the bilateral US dollar exchange rate								
Intercept	-0,3672	*-1,0556*	-2.4222***	*-4.2547*	0,7793	*0.9776*	2.7063**	*2.5007*
ln (Size†)	-0,1912	*-1,1103*	0.0538*	*1.9066*	-0,0349	*-0.8747*	-0.1125**	*-2.0848*
Foreign Sales‡ / Total Sales	-0.3369***	*-2,7654*	-0,1109	*-0.5481*	-0.7978***	*-3.2979*	-1.6278***	*-4.4912*
FCD§ / Total Assets	0,1996	*0.4523*	1,2663	*1.5901*	0,1876	*0.1837*	-0,2018	*-0.1885*
Observations	265		259		25		31	
Adjusted R^2	0,0241		0,0094		0,1931		0,3008	
Intercept	-1.3247***	*-3.1513*	-2.1221***	*-3.0793*	1,3566	*1.6675*	3.8716**	*2.4375*
ln (Size†)	0,0328	*1.5537*	0,0317	*0.9305*	-0.0715*	*-1.6890*	-0.1790**	*-2.1447*
Foreign Sales‡ / Total Sales	-0.4813***	*-3.7551*	-0,0174	*-0.0800*	-0.5343**	*-2.1322*	-1.5444***	*-3.4534*
FCD§ / Total Assets	0,1698	*0.4003*	1,2773	*1.5935*	0,3285	*0.3360*	-0,1184	*-0.1028*
Quick Ratio	-0,0246	*-1.5514*	-0.1908**	*-2.1325*	0.9098***	*2.8311*	0,0421	*1.5683*
LT Debt / Size†	-0,2665	*-0.9688*	-0,4726	*-1.0758*	0,3223	*0.8277*	0,9573	*1.1784*
Market to Book Value	0,0053	*0.0499*	0,1144	*0.6838*	-0,1426	*-1.0055*	-0,0412	*-0.1244*
Observations	265		259		25		31	
Adjusted R^2	0,0431		0,0315		0,2647		0,2884	

This table presents OLS regression estimates of the relation between the likelihood that a firm is significantly exposed to currency exposure and firm size, the percentage of foreign sales to total sales and the extent of FCD usage. The second OLS regression outputs reports results when liquidity, leverage and market to book value are included in the estimation model.

*, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics.

† Size is measured as the sum of market value of equity and book value of debt.

§ FCD usage is approximated by the total notional value of foreign currency derivative contracts.

‡ Foreign sales for Belgian, Dutch and German companies are sales to non-Euro zone countries (Sales to non-Euro zone countries are sometimes approximated by sales to non-European countries). Foreign sales for U.K. companies are sales to non-U.K. countries.

Table 8: FX exposure and the use of FCDs (Weighted Least Squares)

	Negative exposures				Positive exposures			
	Weekly		Monthly		Weekly		Monthly	
Panel A: Dependent variable : exposure to the trade-weighted exchange rate index								
Intercept	-2.3718***	*-4.2913*	-7.0573***	*-6.1702*	0.8385*	*1.9092*	3.2159*	*1.7421*
ln (Size†)	0,0059	*0.2207*	0.1789***	*3.1917*	-0,0186	*-0.8678*	-0,0877	*-0.8975*
Foreign Sales‡ / Total Sales	-0,4219	*-1.5758*	-1.6212***	*-3.3673*	0.5231***	*3.5158*	0,6557	*1.0311*
FCD§ / Total Assets	1,0770	*1.4992*	3.5836*	*1.8232*	-0,4869	*-0.6717*	-1,9450	*-0.8685*
Observations	235		241		55		49	
Adjusted R^2	0,7203		0,6487		0,8042		0,5539	
Intercept	-4.1883***	*-5.6431*	-8.4346***	*-5.5684*	1.0481*	*1.9168*	2.8231*	*1.8089*
ln (Size†)	0.0961**	*2.5374*	0.2088***	*2.9197*	-0,0305	*-1.0946*	-0,1150	*-1.4203*
Foreign Sales‡ / Total Sales	-0.6820**	*-2.3788*	-1.1783**	*-2.2195*	0.6009***	*3.9063*	-0,5113	*-1.0014*
FCD§ / Total Assets	0,6614	*1.0333*	3.8114**	*1.9466*	-0,4677	*-0.6686*	-2.6624*	*-1.7422*
Quick Ratio	-0,1056	*-1.3111*	-0,3193	*-1.6052*	0.3055**	*2.3650*	0.0425**	*3.2843*
LT Debt / Size†	-0,5405	*-0.8915*	-0,2530	*-0.2087*	-0,1504	*-0.5712*	7.9375***	*8.9104*
Market to Book Value	0,2927	*1.1350*	0,8409	*1.8994*	-0,0144	*-0.1367*	-0,1821	*-0.5378*
Observations	235		241		55		49	
Adjusted R^2	0,7422		0,6649		0,8232		0,8221	
Panel B: Dependent variable : exposure to the bilateral US dollar exchange rate								
Intercept	-1.6322***	*-4.5357*	-3.1114***	*-4.2941*	1,1034	*0.0761*	8.3768***	*5.9809*
ln (Size†)	0,0071	*0.4052*	0.0542*	*1,8936*	-0,0049	*-0.0762*	-0.3479***	*-4.9230*
Foreign Sales‡ / Total Sales	0,0613	*0.4312*	0,0503	*0,2282*	-1.5779***	*-5.1561*	-3.3949***	*-6.3221*
FCD§ / Total Assets	0,6642	*1.1314*	2.2253*	*1,8987*	-1,1347	*-0.5245*	-1,6748	*-0.3787*
Observations	265		259		25		31	
Adjusted R^2	0,7069		0,6257		0,7855		0,6667	
Intercept	-3.0451***	*-6.5161*	-3.2684***	*-4,2941*	-0,5342	*-0.4034*	9.5093***	*5,1509*
ln (Size†)	0.0842***	*3.5371*	0,0458	*1.2688*	0,0201	*0.3115*	-0.4334***	*-4,2877*
Foreign Sales‡ / Total Sales	-0,0853	*-0.5480*	0,2021	*0.8467*	-1.1665***	*-3.9646*	-3.1315***	*-5,1104*
FCD§ / Total Assets	0,4451	*0.9302*	2.5070**	*2.1251*	-2,2540	*-1.0558*	-1,2810	*-0,2910*
Quick Ratio	-0,0246	*-0.4035*	-0,0775	*-0.7505*	1.4178***	*3.4290*	0.0403*	*1,7941*
LT Debt / Size†	-1.2737***	*-3.5608*	0,6846	*1.1308*	0,5628	*1.4732*	2.0255**	*2,5238*
Market to Book Value	0,1522	*1.0581*	0,2390	*1.1501*	-0,1289	*-0.7448*	-0,0205	*-0,0680*
Observations	265		259		25		31	
Adjusted R^2	0,7261		0,6295		0,8327		0,7098	

This table presents WLS regression estimates of the relation between the likelihood that a firm is significantly exposed to currency exposure and firm size, the percentage of foreign sales to total sales and the extent of FCD usage. The second OLS regression outputs reports results when liquidity, leverage and market to book value are included in the estimation model. The weighting factors are the t-statistics of the exposure coefficients. *, **, *** denote significance at the 10, 5 and 1 percent levels, respectively. t-statistics are in italics. † Size is measured as the sum of market value of equity and book value of debt.
§ FCD usage is approximated by the total notional value of foreign currency derivative contracts. ‡ Foreign sales for Belgian, Dutch and German companies are sales to non-Euro zone countries (Sales to non-Euro zone countries are sometimes approximated by sales to non-European countries). Foreign sales for U.K. companies are sales to non-U.K. countries.