Exchange rate movements and firm value: Evidence from European firms across the financial crisis period

ABSTRACT

This study investigates the sensitivity of firm value to exchange rate movements, and the determinants of such exposure for 100 European blue chip companies over the period 2001-2012. We adopt a disaggregated framework that distinguishes between Euro zone and non-Euro zone firms, and between financial and nonfinancial firms across the pre-crisis, in-crisis, and post-crisis periods of the recent financial crisis. The results suggest that there is no significant difference between Euro zone and non-Euro zone, and financial and nonfinancial firms. However, exposure is found to be higher during the financial crisis, across all our sub-samples of firms. The majority of the significant exposure coefficients are positive indicating that European firms' stock returns are positively (negatively) affected by depreciation (appreciation) of exchange rates (indirect quotation). There is a positive and significant relationship between exposure and country specific trade openness whilst the relationship between exposure and firm specific variables is weak.

Keywords: Exchange rate risk; Exposure; Firm value; Financial crisis

1. Introduction

Foreign exchange risk is a major concern for both investors and corporate managers because exchange rate movements can directly or indirectly affect cash flows and the market value of firms, which is how we define the concept of exchange rate exposure (see also Jorion, 1990).

Nevertheless, many empirical studies (e.g., Amihud, 1994; Bartov and Bodnar, 1994; Jorion, 1990; Marston, 2001) indicate that foreign exchange movements have little or no impact on the value of firms. This evidence may be explained by either the fact that firms use effective currency risk management techniques to neutralise foreign exchange risk (e.g., through hedging instruments such as exchange rate derivatives) or, alternatively, by the failure of modelling, estimation or sampling techniques employed in such studies to detect a significant effect of exchange rate movements on firm value.

At a macro level, a number of studies (e.g., Alagidede et al., 2010; Giannellis et al., 2010; Tabak, 2006; Yau and Nieh, 2009) find a significant relationship between exchange rates and stock market indices. Bahmani-Oskooee and Sohrabian (1992) also found bi-directional causality between stock prices and exchange rates in the short run (though not in the long run). On the other hand, the results emerging from micro level studies that focus on exchange rate fluctuations and individual stock returns (see Agyei-Ampomah et al., 2012; Amihud, 1994; Bartov and Bodnar, 1994; Dominguez and Tesar, 2006; Hutson and Stevenson, 2010; Marston, 2001) are mixed.

This leaves the question of the impact of exchange rate exposure (the sensitivity of firm value to exchange rate movements) largely unanswered. The

aim of this article is to revisit this question by investigating empirically the sensitivity of 100 Euro zone and non-Euro zone blue chip companies' market value to exchange rate movements. The study also distinguishes between financial and nonfinancial firms. However, its main novelty lies in the adoption of a disaggregated framework that discriminates between pre-crisis, in-crisis and post-crisis periods in order to ascertain the extent to which the recent financial crisis affected the relationship in question, an aspect which has not been given any attention in prior work. To complement the analysis, the study also examines the determinants of significant exchange rate exposures of firms.

2. Brief literature review

Doukas et al. (2003) argue that the effect of exchange rate fluctuations on the market value of firms depends upon the exchange rate exposure of the firm. Exchange rate exposure can directly affect firms who are involved in international trade. Domestic firms can also be affected indirectly, through a mechanism whereby exchange rate exposure affects aggregate demand and industry competitiveness and concentration.

Transaction (or direct) exposure is defined by Dohring (2008) as the impact of exchange rate fluctuations on the cash flows from receivables (payables) from exports (imports) and the repatriation of dividends. Transaction exposure from foreign currency denominated imports arises in the same way as from foreign currency denominated exports. On the other hand, indirect exposure mainly depends upon the price elasticity of demand and the degree of substitutability of goods (Agyei-Ampomah et al., 2012).

With respect to the determinants of exchange rate exposure, De Jong et al. (2006) argue that firms' exchange rate exposures vary from country to country. They point out that firms in an open economy such as the Netherlands are more likely to be affected by foreign exchange risk than firms in a closed economy such as North Korea. De Jong et al. (2006) show in their study that 50% of Dutch firms in their sample have significant foreign exchange exposure. Hutson and Stevenson (2010) also find that there is a significant relationship between country trade openness and firms' exposure to exchange rate movements.

Bodnar and Gentry (1993) argue that firms' exchange rate exposure varies significantly across industries, its extent being dependent upon industry specific factors such as industry competitiveness. Bodnar et al. (2002) add that firms' indirect exposure to exchange rate movements depends on firms' ability to pass on to customers the increased costs (or prices) as a result of exchange rate fluctuations. Bodnar and Gentry (1993) find that 23% of 39 US, Canadian and Japanese industries in their sample have significant exchange rate exposure. Williamson's (2001) findings also point in the same direction.

However, other literature on the relationship between international stock prices and exchange rates finds only weak evidence of systematic exchange rate exposure (e.g., Doidge et al., 2003; Griffin and Stulz, 2001). Dominguez and Tesar (2006) suggesting that trade measured at industry level has a marginal impact on the exposure of firms. This literature also suggests that firms in sectors with a high level of foreign transactions are more likely to hedge.

Doukas et al. (2003) emphasize that in addition to macroeconomic variables and industry competitive structures, firm specific characteristics such as foreign operation, foreign currency debt, hedging activities, firm size, leverage, liquidity and growth opportunity also affect firms' foreign exchange exposure. They show that firms with a high level of exposure are more likely to use foreign currency hedging instruments. They also argue that the extent of hedging undertaken is itself dependent upon the cost of hedging and mangers' familiarity with hedging instruments. As such, small firms and firms with less foreign exchange exposures are less likely to hedge.

Turning to the purely empirical literature, the evidence is conflicting, making it difficult to discern a conventional wisdom. Whilst the findings by Amihud (1994), Bartov and Bodnar (1994), and Jorion (1990) indicate that foreign exchange movements do not affect firm value, the more recent studies by Agyei-Ampomah et al. (2012), Choi and Prasad (1995), Dominguez and Tesar (2006), El-Masry (2006), and Hutson and Stevenson (2010) find that firms have significant exchange rate exposure.

There are only a few studies which examine exchange rate exposure of European firms. El-Masry (2006) investigates exchange rate exposure of UK nonfinancial companies. By splitting the entire sample period into pre-ERM (European Exchange Rates Mechanism), in-ERM, and post-ERM, he finds that stock returns of UK firms are more sensitive to exchange rate fluctuations in the pre-ERM and post-ERM period. Agyei-Ampomah et al. (2012) also examine exchange rate exposure of UK nonfinancial firms and find that 14.93% of firms are directly or indirectly exposed to exchange rate fluctuations

when the standard Jorion's (1990) model is used. However, the estimated exposure increases to 85.13% when using the time-varying regression with orthogonalized market returns.

Among the studies which examine exchange rate exposures of both Euro zone and non Euro zone firms, Hutson and Stevenson (2010) find that exchange rate exposure of Euro zone firms is significantly higher than that of non Euro zone firms in the post-Euro period. However, after controlling for country and firm specific variables, they find no evidence in support of a significant difference between exchange rate exposures of Euro zone and non Euro zone firms. On the other hand, Bartram and Karolyi (2006) find that exchange rate exposure of nonfinancial Euro zone firms decreases slightly in absolute terms in the post-Euro period.

The above review of relevant literature reveals that the impact of exchange rate movements on the market value of firms is inconclusive. To our knowledge, previous studies also neglect the potential role of financial crises in affecting the relationship in question, making our study - which benefits from the latest available data - particularly opportune, and its contribution timely.

3. Methodology

3.1 Econometric approach

Following Jorion (1990), firms' exchange rate exposure is estimated by regressing firms' stock market returns on the orthogonal component of the portfolio returns and the changes in exchange rates:

$$R_{it} = \alpha_i + \beta_{xi}X_t + \beta_{Fi}F_t + \upsilon_{it} \quad (1)$$

where R_i represents the stock return of firm i (constituents of Eurofirst 100); X_t denotes the percentage change in exchange rates (USD Euro, USD GBP NEER Euro and NEER GBP) at time t; F_t is the orthogonal component of the market portfolio returns (Eurofirst 100 index); α_i is a constant term; and υ_{it} is the residual error term expected to possess white noise properties.

The sign of the coefficient indicates the direction of individual firm exposure. Significant positive (negative) sings of β_{xi} mean that stock returns increase when exchange rates increase/depreciate (decrease/appreciate), based on the indirect quotation. The standard 't test' is used to measure the statistical significance of the coefficients at the customary 5% level of significance.

The appropriateness of the 'two factors' regression model that we employ is confirmed by the fact that this estimation procedure has been used extensively in previous studies (e.g., Agyei-Ampomah et al., 2012; Amihud, 1994; Bartov and Bodnar, 1994; Choi and Prasad, 1995; Dominguez and Tesar, 2006; El-Masry, 2006; Hutson and Stevenson, 2010; Jorion, 1990; Kanagaraj and Sikarwar, 2011).

Following Agyei-Ampomah et al. (2012) and Hutson and Stevenson (2010), we estimate the determinants of exchange rate exposure of individual firms using the following equation:

$$\pi_i = \alpha_i + \gamma_i OP_{j,i} + \delta_i MV_i + \omega_i DA_i + o_i MB_i + \kappa_i QR_i + \mu_i \quad (2)$$

where π_i is the dependent variable measured as the squared root of absolute value of the exchange rate exposure of firm i (β_{xi}**).** There are five regressors: one country specific (trade openness, 'OP'), and four firm specific ('Market Value'; 'Debt to Asset'; 'Market to Book value'; and 'Quick Ratio'). Country trade openness is measured as exports plus imports as a percentage of GDP, with OP_j as the average trade openness of country j. Firm size, financial distress, growth opportunity, and liquidity of firm *i* are measured by market value (MV), Debt to Asset Ratio (DA), Market to Book Value (MB), and Quick Ratio (QR) of the firm i, respectively. α_i is a constant, and μ_i is the error term.

A significant positive (negative) sign of the coefficient γ_i means that the firm's exchange rate exposure increases (decreases) when country openness increases (decreases). A significant negative (positive) sign of the coefficient δ_i means that the firm's exchange rate exposure increases (decreases) when the firm's size (market value) decreases (increases). A significant positive (negative) sign of the coefficient ω_i, o_i and κ_i means that the firm's exchange rate exposure increases (decreases) when the firm's financial distress (Debt to Asset), growth opportunity (Market to Book Value), and liquidity (Quick ratio) increases (decreases), respectively.

In order to check the robustness of the estimates from equation (2), the model is extended as follows:

$$\pi_i = \alpha_i + \gamma_i OP_{j,i} + \delta_i MV_i + \omega_i DA_i + o_i MB_i + \kappa_i QR_i + \lambda_i SD_i + \theta_i ID_i + \psi_i ED_i + \upsilon_i, \quad (3)$$

where SD_i is a dummy variable taking the value of 1 when the market value of the firm *i* is less than $150 million, and 0 otherwise. Following Hutson and Stevenson (2010), we use the threshold of $150 million as the break point, as they find a nonlinear relationship between exchange rate exposure and firm size at that point. ID_i is a dummy variable taking the value of 1 when firm *i* is a financial firm, and 0 otherwise. ED_i is a dummy taking the value of 1 when firm *i* is a Euro zone firm, and 0 otherwise. Significant coefficients of λ_i, θ_i and ψ_i indicate the existence of non-linear relationships between the exchange rate exposures of firms and firm size, industry type and Euro zone firms, respectively.

Kanagaraj and Sikarwar (2011) point out that the time series regression model in equation (3) may create biased estimates if not corrected for potential problems of stationarity, multicollinearity, autocorrelation and heteroskedasticity. In the preliminary testing phase, we checked for the integration and cointegration properties of the series and found that the variables were indeed in a cointegrating relationship. The multicollinearity issue is already alleviated within our estimation framework by the orthogonalization of exchange rate factors mentioned above while potential autocorrelation and heteroskedasticity problems are eliminated by correcting the OLS standard errors.

3.2 Data

The dataset used in this study consists of weekly prices of 100 European blue chip stocks (constituents of FTSE Eurofirst 100), stock market

index (Eurofirst 100, see http://www.ftse.com/Indices/FTSE_Eurofirst_Index_Series/), spot nominal bilateral exchange rates (Euro per USD and GBP per USD), and nominal effective exchange rates (NEER Euro and NEER GBP). Following Bartram and Karolyi (2006), and Agyei-Ampomah et al. (2012), the present study uses weekly data in order to investigate exchange rate exposures of European firms. We use nominal exchange rates because of small inflation differentials between the UK, Euro zone and USA during the sample period. Data are obtained from Datastream. The weekly return series are calculated as $R_t = \ln (P_t / P_{t-1})$, where P_t is the weekly price at time t.

The full sample covers the period from 03/01/2001 through to 26/12/2012, yielding 626 observations. The sample is dictated by data availability as the Eurofirst 100 composite index starts at 2001. Based on recursive estimates, the full sample period is divided into three sub-periods: pre-crisis, in-crisis, and post-crisis periods. The pre-crisis period covers from 03/01/2001 to 25/07/2007, yielding 343 observations. The in-crisis period is from 01/08/2007 to 25/03/2009, totalling 87 observations, and the post-crisis period is from 01/04/2009 to 26/12/2012, yielding 196 observations.

The firms are the constituents of the FTSE Eurofirst 100 index. Eurofirst 100 companies are selected because they include both Euro zone and non-Euro zone firms. Out of the 100 firms, 63 are Euro zone firms and the remaining 37 are non Euro zone (UK) firms. The sample includes both financial firms (20) and nonfinancial firms (80). Out of the 80 non financial firms, 49 are Euro zone firms and 31 are non-Euro zone (UK) firms. Among

the 20 financial firms, 14 are from Euro zone and the remaining 6 are from the UK (the full list of firms and respective industry/country is available from the authors upon request).

< Table 1 about here >

Panel A of Table 1 exhibits the descriptive statistics of weekly return series of stock index (Eurofirst 100), nominal bilateral exchange rates (USD Euro and USD GBP) and nominal effective exchange rates (Euro NEER and GBP NEER**)**. Table 1 shows that the mean returns of the stock index, and exchange rates are negative. Hence, both stock and foreign currency markets in Europe did not perform well during the sample period. From Table 1 we can also evince that stock market volatility was higher than foreign currency market volatility, suggesting that transactional risk was higher within the former than the latter across the sample period.

Panel B of Table 1 shows the descriptive statistics of country and firm specific variables. Trade openness data are obtained from the Penn World Table (Version 6.2). Firm size, financial distress, growth opportunity and liquidity are represented by Market Value, Debt to Asset, Market to Book Value and Quick Ratio, respectively. The firm-specific data are obtained from Datastream.

The distribution of all the series is negatively skewed, with long left tails. The coefficients of kurtosis for all the series are greater than three, suggesting that the series are leptokurtic in nature, with a pronounced peak in their distribution. Not surprisingly, the Jarque-Bera statistics are highly

significant. Similar characteristics are found for the series pertaining to the financial data which display volatility clustering and leptokurtosis.

4. Results and discussion

Table 2 presents the regression results of exchange rate (bilateral) exposures of Euro zone vs. non-Euro zone firms, estimated from equation (1). Table 2 shows that the percentage of significant coefficients β_{xi} is almost the same for both Euro zone and non-Euro zone firms in all sample periods. Hence, there is no major difference across such firms in terms of exchange rate exposure after controlling for market effects. 18% of Euro zone firms and 16% of non-Euro zone firms are found to have significant exchange rate exposure in the full sample period. However, exchange rate exposure of both Euro zone and non-Euro zone firms increases to around 25% during the period of the financial crisis, indicating that firms, and their market value, are more sensitive to exchange rate movements during 'bad times'.

One possible explanation for this result is the *leverage effect*, meaning that a negative shock has greater impact than a positive shock (indeed, a striking and unexpected feature of the financial crisis has been the strong appreciation rather than depreciation of the USD against most currencies globally). Alternatively, the pattern that our data unveils may be rationalized by the fact that during a financial crisis firms become more sensitive to exchange rate movements because, being more liquidity constrained, they are unable to hedge as much.

< Table 2 about here >

The average absolute size of the exposure for Euro zone and non-Euro zone firms is almost the same in all sample periods. Nevertheless, as shown in Panel B of Table 1, the magnitude of exposure increases during the financial crisis for all firms. In terms of the direction of exchange rate exposure, most of the significant coefficients β_{xi} have positive signs. This indicates that a depreciation/increase (indirect quotation) of USD Euro and USD GBP exchange rates has a positive impact on the market value of both Euro zone and non Euro zone (UK) firms. This result is both expected and intuitively plausible given that a depreciation of local currency increases the competitive advantage of firms (indirect exposures) in the international market.

These results are consistent with those by El-Masry (2006) who found that 15% of the UK firms have significant exchange rate exposure, and those by Hutson and Stevenson (2010) who found that 10% of Euro zone firms have significant exchange rate exposure. The low number of both Euro zone and non-Euro zone firms exposed to exchange rate risk could be explained by the argument put forward by Bodnar et al. (2002) and Allayannis and Ofek (2001), according to which European 'Blue chip' companies systematically use financial derivatives to hedge transaction risks.

< Tables 3 and 4 about here >

Table 3 reports the regression results of exchange rate (bilateral) exposure of financial vs. nonfinancial firms. Table 3 indicates that there is no major difference between them in terms of exchange rate exposure. 20%

percent of financial firms and 16% of nonfinancial firms have significant exchange rate exposure across the full sample period. Our results align to those of Bodnar and Gentry (1993), who also fail to find any significant differences in exposure of financial and non financial firms. One possible explanation is that both financial and nonfinancial blue chip companies have equal knowledge and opportunities to hedge exchange rate risk. Significantly, however, our results reveal that the exposure of both financial and nonfinancial firms increases during the 'bad times' of the financial crisis period. This result may also imply that the financial crisis came unexpectedly and these companies, irrespective of whether they were financial or nonfinancial, were unable to take corrective actions soon enough. Most of the significant coefficients β_{xi} for both financial and nonfinancial firms have positive signs, indicating that a depreciation in the USD-Euro and the USD-GBP exchange rate has a positive impact on the market value of both financial and nonfinancial firms.

Table 4 presents the estimation results of equations (2) and (3), which estimate the determinants of significant exchange rate exposures of European firms for the full sample, and the pre-crisis, in-crisis and post-crisis sub-periods. As can be seen from Table 4, the estimated coefficients of trade openness are positive and significant at the customary 5% significance level in all sample periods for both equations. There is, therefore, a positive relationship between exchange rate exposure and country specific trade openness. These findings provide further empirical support to those by Bodnar and Gentry (1993), and Hutson and Stevenson (2010) which highlighted that

country trade openness has a positive impact on the degree of sensitivity of the market value of firms to exchange rate movements.

Table 4 also shows that the coefficients of firm size are negative and significant at the 5% significance level for equation (2) in the full sample. This indicates that smaller sized firms are more exposed to exchange rate movements than larger ones. The significant coefficient for the 'firm size' dummy in the full sample period also confirms that there is a non-linear relationship between firms' exchange rate exposures and firm size, which is consistent with the findings of Chow et al. (1997) and Hutson and Stevenson (2010). However, the results are mixed in other sample periods, especially for equation (3).

With regards to the coefficients of Debt to Asset, Market to Book Value and Liquidity, the findings are mixed. The coefficient of liquidity is positive and significant at 5% level in the full sample, whereas the coefficients of Debt to Asset and Market to Book value are insignificant. The results are mixed in the sub-periods. Overall, there is a weak relationship between exchange rate exposure and firm specific variables, which is consistent with the findings of Agyei-Ampomah et al. (2012).

As shown in Table 4, the coefficients for industry dummy (θ_i) and Euro zone dummy (ψ_i) are insignificant. This indicates that there is no difference between either Euro zone and non-Euro zone firms' or financial and nonfinancial firms' exposures to exchange rates, which confirms the findings of Table 2 and 3 after controlling for market effects.

< Tables 5 and 6 about here >

Table 5 compares the regression results of equation (2) and (3) between Euro zone and non-Euro zone firms. As can be seen from Table 5, the coefficients of country trade openness are positive and significant at the 5% level for both Euro zone and non-Euro zone firms, for both equations. The coefficients of firm size are negative and significant for both Euro zone and non-Euro zone firms for equation (2). The results of other firm specific coefficients are mixed for both Euro zone and non-Euro zone firms. The coefficients of the Euro zone dummy are insignificant for both equations, confirming that there is no major difference between Euro zone and non-Euro zone firms in terms of exchange rate exposures.

Table 6 compares the regression test results of equation (2) and (3) between financial and non financial firms. Like the results presented in Table 4 and 5, the coefficients of country trade openness are positive and statistically significant for both financial and nonfinancial firms for both equations, while the coefficients of firm size are negative and significant. Also, the results of coefficients of other firm specific variables are mixed across the sub-samples of firms. In addition, the coefficients of the industry dummy are insignificant for both equations, corroborating the evidence of insignificant differences between financial and nonfinancial firms in terms of exchange rate exposure.

To ascertain the robustness of the results reported above, we re-estimated all of the above regressions using the trade weighted Nominal Effective Exchange Rate (NEER) (results not reported to conserve space but available from the authors upon request). These additional results essentially

confirmed our previous findings based on bilateral exchange rates, with no significant differences in exposure between Euro zone and non-Euro zone or between financial and nonfinancial firms after controlling for market effects. However, it is worth mentioning that both Euro zone and non-Euro zone firms' value (for both financial and nonfinancial firms) was found to be more sensitive to trade weighted (NEER) exchange rates than bilateral exchange rates. One possible explanation for this result is that the majority of European firms' trade are in currencies other than the US Dollar. As found when using bilateral exchange rates, NEER exposures of both Euro zone and non Euro zone firms (both financial and nonfinancial) increased during the financial crisis. This confirms that firms are more sensitive to exchange rate movements during 'bad times'.

These additional estimations also corroborated the finding that a depreciation/increase (indirect quotation) of exchange rates (NEER Euro and NEER GBP) has a positive impact on the market value of both Euro zone and non-Euro zone firms as well as financial and nonfinancial firms. The majority of the signs of significant exposure coefficients are positive, confirming that both Euro zone and non-Euro zone (financial and nonfinancial) firms benefit from the depreciation of the Euro against bilateral (and NEER) exchange rates.

The regression results of equation (2) and (3), which re-estimate the coefficients of determinants of significant exchange rate exposures (using NEER) of European firms (Euro zone and non-Euro zone as well as financial and nonfinancial) for the full sample, pre-crisis, in-crisis and post-crisis periods were also broadly in line with the results presented in Table 4, 5 and 6 obtained

using bilateral exchange rates. Once again, the coefficients of country trade openness are positive and significant in all sample periods for both equations whilst a weak relationship between exposure and firm specific variables was found.

5. Conclusion

We tested the sensitivity of 100 European blue chip companies' market value to exchange rate movements, and the determinants of such exposure. Using data from January 2001 to December 2012, we found a significant amount of exposure (18% of Euro zone firms and 16% of non-Euro zone firms) with no significant differences in sensitivity across financial firms (20%) and nonfinancial firms (16%). However, the percentage of significant exposure increases to around 25% during the financial crisis, which indicates that firms are more sensitive to exchange rate movements during times of financial distress.

The study also reveals that there is a positive relationship between exchange rate movements and the market value of firms, indicating that a depreciation of exchange rates (indirect quotation) is likely to have a positive impact on the market value of European firms. This result holds across Euro zone and non-Euro zone firms, as well as financial and nonfinancial firms.

In relation to the determinants of exposure, there is no significant difference between Euro zone and non-Euro zone, and between financial and nonfinancial firms after controlling for market effects. There is a positive and

significant relationship between exposure and country specific trade openness. However, the relationship between exposure and firm specific characteristics is found to be weak, though smaller sized firms are found to be slightly more exposed to exchange rate movements than larger ones. These results are robust to estimations employing both bilateral, and trade weighted NEER exchange rates.

The main contribution of our findings lies in highlighting the significant higher levels of exchange rate exposure experienced by firms during the period characterized by the recent financial crisis.

Although with the exception of firm size, there is no evidence that other firm characteristics have strong explanatory power, a clear implication flows from these findings. Given that especially during times of crises, particularly smaller firms, are found to be subject to exchange rate exposure, it is recommendable that such firms' financial plans budget for higher liquidity levels in order to build up, during 'good times', a natural hedge for the higher exposure likely to be faced during periods that may be characterized by greater financial distress.

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