The foreign exchange exposure of UK non-financial firms: A comparison of market-based methodologies

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ARTICLE INFO

ABSTRACT

We use a sample of 269 UK non-financial firms to study the sensitivity of foreign exchange exposure, and its determinants, to the different estimation methods. The standard Jorion's model suggests that 14.93% (30.50%) of the firms in our sample are exposed directly or indirectly to the fluctuations in the TWC (the US\$, the Euro or the JP¥). However, the exposure increases substantially to 85.13% (96.65%) when time varying exposure regressions with orthogonalized market returns are used. We also show that the determinants of currency exposure are model-dependent. While the cross-sectional results suggest very little or no relationship between firm-specific factors and currency exposure, the explanatory power of these factors increase when data is pooled across firms and time.

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1. Introduction

Several studies predict that all firms should be subject to foreign exchange exposure as their cash flows are affected, directly or indirectly, by exchange rate movements (Heckman, 1985; Levi, 1994; Marston, 2001; Shapiro, 1975). In the light of this, it is puzzling why most empirical studies show that foreign exchange fluctuations have little or no impact on stock returns (Bartov & Bodnar, 1994; El-Masry, Abdel-Salam, & Alatraby, 2007; Hutson & Stevenson, 2010; Jorion, 1990).

This study uses a sample of 269 UK non-financial firms to investigate whether the weak empirical association between exchange rate changes and stock returns can be attributed to bad model problems. Our analysis makes three important methodological contributions to the literature on the foreign exchange exposure of individual firms. First, we relax Jorion's (1990) assumption that foreign exchange exposure is constant over time. Several studies (Allayannis & Weston, 2001; Dunne et al., 2004; Smith & Stulz, 1985) show that a firm's exposure to exchange rate movements is related to firm-specific factors, such as size, liquidity, hedging activities and growth opportunities, which are expected to vary over time. We use GARCH-based two-factor asset pricing model with time varying coefficients (GARCH-TVC hereafter) to model the

time varying nature of firms' exposure to currency movements.[1] Second, Priestley and ⊘degaard (2007) argue that the exposure coefficient obtained from Jorion's model does not capture the stock's total exposure to the foreign exchange movements. Instead, it only measures the stock's exposure over and above that of the market portfolio. Priestley and ⊘degaard (2007) suggest that orthogonalized, rather than actual, market returns should be used to estimate the exchange rate exposure. We improve on Priestley and ⊘degaard's (2007) methodology by allowing the coefficients and the residuals of the orthogonalized regressions to vary over time. Finally, previous studies use cross-sectional analysis to examine the determinants of the foreign exchange exposure. Although some of these determinants, such as industry, vary only across firms, others vary across firms and time.[2] We contend that cross-sectional analysis is likely to generate biased estimates, as it ignores the temporal dimension of both dependent and explanatory variables. To overcome these potential estimation biases, a panel approach is used to examine the determinants of foreign exchange exposure.

Our analysis yields two important results. First, we show that the foreign exchange exposure of individual firms is highly sensitive to the estimation methods. Jorion's model implies that 14.93% (30.50%) are exposed, directly or indirectly, to TWC (US\$, Euro or JP¥). However,

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[1] A similar model is adopted by Patro et al. (2002) to study the foreign exchange exposure of stock indexes.
[2] See, for example, Baltagi (2005) for more details on the advantages of panel data analysis.

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the GARCH-TVC indicates that 75.84% (78.07%) of the sample firms exhibit at least one yearly significant exposure to the TWC (US$, Euro or JP¥) over the study period. These percentages increase further to 85.13% (96.65%) when orthogonalized GARCH-TVC model is adopted. This evidence indicates that failure to account for the time varying nature of currency risk exposure helps to explain the weak empirical relationship between stock returns and currency fluctuations reported by most studies in the literature. Second, we show that the determinants of currency exposure are also model-dependent. While cross-sectional analysis reveals little or no relationship between currency exposure and firm-specific factors, such as size, growth opportunities, liquidity and leverage, the explanatory power of some of these factors improve substantially under the panel data approach. Specifically, the panel results indicate that small firms and firms with low growth opportunities tend to be more exposed to exchange rate movements.

The remainder of the paper is structured as follows. Section 2 provides a brief review of the literature on the foreign exchange exposure and its determinants. Section 3 presents our methodology. Section 4 describes the sample and provides descriptive statistics. Section 5 reports empirical findings on foreign exchange exposure and its determinants. Section 6 concludes.

2. Literature review

2.1. Currency exposure

Economic theory suggests that firms are subject to foreign exchange exposure as their cash flows are driven, directly or indirectly, by changes in exchange rates. The direct exposure involves transaction exposure of expected future foreign currency cash flows (i.e. foreign currency receivables and payables). Indirect exposure arises from the impact of foreign exchange movements on the competitiveness of the firm. Consistent with these arguments, analytical research (see e.g. Heckman, 1985; Levi, 1994; Marston, 2001; Shapiro, 1975) predicts that exchange rate fluctuations are a major source of macroeconomic uncertainty that influence the returns and cash flows of corporations.

Given the theoretical expectation of a link between firm performance and exchange rates, one would expect empirical studies to establish this relationship. Yet, while early empirical studies (Amihud, 1994; Bartov & Bodnar, 1994; Jorion, 1990) almost suggest that foreign exchange movements do not affect stock prices, recent empirical research has produced mixed results. Dominguez and Tesar (2006) find that many publicly listed non-US firms from eight developed and emerging countries experience significant currency exposure. El-Masry et al. (2007) examine the foreign exchange exposure of 394 UK firms over the period 1981–2001. They show that only 15% of their sample firms are significantly exposed to the fluctuations in the TWC. In a multi-country study, Hutson and Stevenson (2010) find that only 8% of their 312 UK firms are exposed to currency index movements during the period 1984–2003.

Several firm-level studies attribute the weak empirical findings to exposure measurement biases. Fraser and Pantzalis (2004), for example, show that the exposure of US multinationals to exchange rate changes depends on the foreign exchange index used in the exposure regression. Specifically, they show that 5.5%, 8.7% and 12.6% of their 310 sample firms exhibit significant exposure to MAJCUR index, firm-specific exchange rate index and FRB's BOARD currency index, respectively. Rees and Unni (2005) examine the exchange rate exposure of large firms in the UK, France and Germany. They find that European firms exhibit more exposure to bilateral exchange rates than currency indices. Chow, Lee, and Solt (1997) show the exchange rate exposure of US multinationals increases with the length of return horizon. Muller and Verschoor (2006) find that US multinationals react asymmetrically to currency movements. They also show that asymmetries are more pronounced towards large versus small currency changes than over appreciation and depreciation cycle. Using a sample of 935 US companies with real operations in foreign countries, they find that the percentage of

firms with significant currency risk exposure increases from 7.27% to 29% after accounting for the asymmetric nature of the exposure. Tai (2008) also finds evidence of asymmetric currency exposure and asymmetry in the pricing of currency risk.

Several other methodological issues have been identified by industry- and index-level studies. Patro, Wald, and Wu (2002) examine the exchange rate exposure of index equity returns of 16 OECD countries. Using a GARCH specification, they find significant time-varying foreign exchange risk exposure. Priestley and ⌀degaard (2007) argue that since market portfolios are also exposed to currency fluctuations, including market returns in the exposure regression may cause spurious correlation between industry returns and exchange rate fluctuations. They show that the percentage of US industries exposed to movements of either JP¥ or Euros increases from 10.34% to 27.58% when orthogonalized, rather than actual, market returns and exchange rates are used in the linear exposure regressions.

This study contributes to the literature on foreign exchange risk measurements by examining the individual and the combined effects of time-varying risk adjustments and market return orthogonalization on the foreign exchange exposure of individual firms.

2.2. The determinants of currency exposure

The extant literature documents that foreign exchange exposure depends on a number of country, industry and firm characteristics. Patro et al. (2002) examines the extent to which equity index returns exposure can be explain by a country's macroeconomic variables. They find that imports, exports, credit ratings and tax revenues significantly affect currency risk. De Jong, Ligterink, and Macrae (2006) show that 50% of the Dutch firms are significantly exposed to exchange rate fluctuations. They argue that firms in open economies, such as the Netherlands, are likely to experience significant foreign exchange exposure. Hutson and Stevenson (2010) report a significantly positive (negative) association between country openness (creditor protection) and a firm's exposure to the exchange rate movements.

Many studies show that foreign exchange exposure varies significantly across industries. Bodnar and Gentry (1993) examines the foreign exchange exposure of the US, Canadian and Japanese industries. They show that the level of engagement in foreign transactions is an important determinant of industry sectors exposure. Similar results are reported by Williamson (2001) in the context of US and Japanese Automotive industry. Bodnar, Dumas, and Marston (2002) argue that a firm's exposure depends on its ability to pass on the increased costs or prices resulting from exchange rate fluctuations to their customers. This, in turn, depends on industry competitiveness, which determines the price elasticity of demand, and the degree of substitutability of the goods. Marston (2001) shows that industry competitiveness has significant effect on firm-level exposure. However, Dominguez and Tesar (2001) find that trade measured at the industry level has little impact on the exchange rate exposure of individual firms. Their findings, they argue, suggests that firms in sectors with great quantity of foreign transactions are more likely to hedge.

In addition to the macroeconomic variables and industry competitive structure, firm characteristics, such as foreign operations, hedging activities, size, leverage, liquidity and growth opportunities, are also shown to affect foreign exchange risk exposure. Jorion (1990) find that US firms with high levels of foreign sales exhibit more positive exchange rate exposure. Booth and Rotenberg (1990) show that foreign sales, foreign assets and foreign debt are amongst the determinants of the sensitivity of Canadian stock returns to the US dollar movements. However, Aggarwal and Harper (2010) show that the foreign exchange exposure faced by domestic companies is not significantly different from that observed in the sample of multinational corporations. Nydahl (1999), Allayannis and Ofek (2001) and Nguyen and Faff (2003), among others, establish that the use of derivatives reduces exchange rate exposure. Bodnar and Wong (2003) show that small firms are more exposed to