



A three-factor model investigation of foreign exchange-rate exposure

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ABSTRACT

We investigate the likelihood of extreme foreign exchange-rate exposure (FXE), conditioning upon key firm factors and an expanded view of hedging. Our investigation incorporates the Fama and French (1993) three-factor (FF three-factor) model terms in reconciling equity returns vis-à-vis exchange-rate exposure. Our results suggest the following conclusions. First, consistent with effective hedging, non-hedging firms tend to have greater FXE than hedging firms. Second, all key factors that explain the likelihood of high FXE are economically and statistically significant using the more complete FF three-factor model. Third, we note that firm size is important in explaining FXE. Fourth, we find more FXE coefficients that are significant using the FF three-factor model compared to the traditional market model.

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1. Introduction

Although [Shapiro \(1975\)](#) suggests that firm value is sensitive to changes in currency exchange rates, the empirical evidence supporting this theory varies (e.g., [Vygodina, 2006](#)). Researchers have relied primarily on returns-based estimates of foreign exchange-rate exposure (FXE), using a market-model approach (e.g., [Adler & Dumas, 1984](#); [Jorion, 1990](#); [Choi & Prasad, 1995](#); [Miller & Reuer, 1998](#), [Ihrig, 2001](#); [Bodnar & Wong, 2003](#); [Dominguez & Tesar, 2006](#)). The extant evidence suggests that a firm's FXE depends in large part on its size, foreign sales ratio, and the effective use of hedging. In this study, we focus on the role of these 3 key factors in understanding the likelihood that a firm will face extreme levels of FXE, as measured by the Fama–French three-factor model ([Fama & French, 1993](#)).

Recent research in the asset-pricing literature indicates that the Fama–French three-factor (FF three-factor) model often outperforms the traditional market model (e.g., [Lawrence, Geppert, & Prakesh, 2007](#);

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Hung, 2008; Simpson & Ramchander, 2008). To date, however, studies have not integrated this asset-pricing model into returns-based estimates of FXE. We augment the traditional market-model approach by including the Fama and French book-to-market and size factors.

Size is of particular interest to understanding the likelihood that a firm will have FXE. Using returns-based estimates of FXE, prior research has provided mixed evidence in this area. Bodnar and Wong (2003) and He and Ng (1998) show that large firms have more exchange-rate exposure than small firms. In contrast, Dukas, Fatemi, and Tavakkol (1996) report an inverse relationship between firm size and FXE. Dominguez and Tesar (2006) suggest that exchange-rate exposure varies little with size. Faff and Marshall (2005) review 3 specific global regions and conclude that size is not universally consistent. In all these studies, the estimation of FXE does not control for the relationship between size and returns.

Our paper makes a notable contribution to the current literature by merging the asset-pricing literature with the FXE literature. We investigate the likelihood that firms will face extreme levels of FXE, conditioning upon the key firm factors identified above and an expanded view of hedging instruments, and incorporating the FF three-factor model terms in reconciling equity returns vis-à-vis exchange-rate exposure of multinational corporations (MNCs). To date, no study has investigated exchange-rate exposure in the context of all these conditions.

Utilizing the FF three-factor model produces more FXE coefficients that are statistically significant, compared to the traditional market-model approach, which does not control for the relationship between firm size and returns. A logit regression analysis, based on the absolute values of FXE estimates using the FF three-factor model, indicates that small firms with higher foreign sales that do not use financial hedges will have greater exchange-rate exposure. Further analysis of the logit probabilities suggests that firm size remains a primary determinant of FXE despite the use of the FF three-factor model. Finally, consistent with effective hedging, we find that the use of financial hedging is important in understanding the likelihood of extreme FXE.

The remainder of the paper is organized as follows. Section 2 presents the data and methodology used to estimate and analyze FXE. The results are detailed in Sections 3, and 4 concludes the paper.

2. Data and foreign exchange exposure

2.1. Building the model

The focus of this study is to expand the literature in several directions. First, we use the Fama–French three-factor (FF three-factor) model to generate exchange-rate exposure betas and compare those results to estimates generated with the traditional market-model method (FX market model). Second, conditioned upon key firm-level factors, we use a logit regression estimation to investigate the likelihood that firms face extreme levels of foreign exchange-rate exposure (FXE). Third, for quintiles formed on size or foreign sales ratios, we examine the probability of extremely high and low FXE levels. Fourth, we expand the quintile comparisons of FXE levels for the use of financial hedging.

As introduced in Section 1, prior FXE research has relied primarily on the traditional market-model approach that was introduced by Adler and Dumas (1984). In a recent summary of the FXE empirical work, Bartram and Bodnar (2007) express surprise at the lack of compelling FXE evidence, and refer to this gap in our understanding as the “exchange-rate exposure puzzle.”¹ Indeed such evidence is at odds with the asset-pricing literature. In particular, it is puzzling why exchange-rate risk would be priced if it is insignificant in practice.

Bartram and Bodnar (2007), and other FXE studies (e.g., Dewenter, Higgins, & Simin, 2005; Doidge, Griffin, & Williamson, 2006) attribute this exchange-rate puzzle, in large part, to the methodological challenges in estimating FXE and to the possibility that firms effectively manage currency risk. We address

¹ In their Table 1, Bartram and Bodnar (2007) summarize the most important FXE studies using large samples in the non-financial sectors. Subsequent to their 2007 literature review, researchers have remained focused on the non-financial sector, given the complexity of a financial firm's FXE and risk management practices (e.g., El-Masry, Abdel-Salam, & Alatraby, 2007; Makar & Huffman, 2008). In contrast, recent studies in the financial sector that are not summarized by Bartram and Bodnar include the FXE of banks (e.g., Elyasiani, Mansur, & Pagano, 2007), and insurance and real estate (e.g., Muller & Verschoor, 2008; Li, Moshirian, Wee, & Wu, 2009).

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