

# Asymmetric exchange rate exposure: theory and evidence

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## Abstract

This paper tests the hypothesis that exchange rate exposure is asymmetric over appreciation–depreciation cycles. More specifically, it investigates whether returns on nine sector indexes across four major countries are asymmetrically affected by exchange rate movements. The results show that in several instances exposure is asymmetric. Asymmetries are found to be more pronounced in the financial and non-cyclical sectors. Possible theoretical explanations are provided regarding the particular type of exposure found across sectors and countries.  
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## 1. Introduction

The work of Dumas (1978) and Adler and Dumas (1980, 1984) suggests that exchange rate exposure can be quantified as the sensitivity of stock returns to exchange rate movements. Consequently, there has been an increasing focus on understanding exchange rate exposure in this manner, e.g. Jorion (1990); Bodnar and Gentry (1993); Bartov and Bodnar (1994); Khoo (1994); Choi and Prasad (1995); Chow et al. (1997a,b); Martin et al. (1999); Allayannis and Ofek (2001), etc. With the exception of studies that focus on financial institutions (Chamberlain et al., 1997; Choi and Elyasiani, 1997), identifying significant exchange rate exposure has been

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met with limited success. For example, Jorion (1990) finds that exchange rate exposure of 287 US multinationals, measured as the sensitivity of stock returns to exchange rate changes, is mostly insignificant. Similarly Bodnar and Gentry (1993) report that only 11 out of 39 industries exhibit significant exchange rate exposure during the period 1979–1988. Chow et al. (1997a,b) argue that failure to discover exchange rate exposure is due to the fact that exchange rates affect cash flows over longer periods. Consequently, using short horizons may not be sufficient to capture exchange rate exposure. Using longer horizons, these authors find that all assets, i.e., stocks and bonds, are exposed to exchange rate risk. Choi and Prasad (1995) argue that using firm-level data is more appropriate because aggregate-level analysis may fail to reveal the sensitivity of returns to exchange rate changes. Additionally, Bartov and Bodnar (1994; p. 1761) recognize that past studies may fail to appropriately identify the relationship between exchange rates and stock prices due to ‘asymmetries in the impact of appreciations and depreciations’ among other complexities.<sup>1</sup>

The possibility that stock returns react asymmetrically to currency appreciations and depreciations has received very little attention in the literature.<sup>2</sup> Yet, asymmetric exposure is implied in theoretical models purporting to describe actual corporate behavior, such as, pricing-to-market (e.g. Marston, 1990; Knetter, 1994; Goldberg, 1995), hysteresis (e.g. Ljungqvist, 1994; Christophe, 1997), and asymmetric hedging. As an example, Knetter (1994) argues that pricing-to-market (PTM) will result in asymmetric reactions to exchange rate changes if firms attempt to build market share, or face capacity constraints and quantitative restrictions.

From a statistical perspective, all studies dealing with exchange rate risk exposure assume that the error term is independently and identically distributed (i.i.d.). There is an extensive body of literature, however, documenting second moment temporal dependencies in returns of speculative assets in general and exchange rate changes in particular (e.g. Bollerslev et al., 1992; Tse, 1998; Baillie and Bollerslev, 1989; Hsieh, 1989; among others). The presence of such dependencies is due to conditional heteroskedasticity, which is the tendency of large changes to be followed by large changes of either sign. The presence of conditional heteroskedasticity leads to inefficient parameter estimates as well as biased test statistics. It is possible that previous studies have had difficulty detecting significant exchange rate exposure, to some extent, due to the failure of these studies to explicitly account for conditional heteroskedasticity.

This paper contributes to the literature by providing evidence on the asymmetric sensitivity of sector index returns to exchange rate risk. More specifically, this study investigates whether returns on nine sector indexes across four major countries are asymmetrically affected by exchange rate movements. Furthermore, the exposure estimates are generated from a model that fully accounts for conditional heteroskedasticity in the error term.

<sup>1</sup> Since empirical studies measure exposure net of hedging, the difficulty in detecting significant exposure may be due to effective financial and operational hedging programs.

<sup>2</sup> Choi and Prasad (1995); Baba and Fukao (2000), and Di Iorio and Faff (2000) are the only papers that have attempted to model asymmetric responses to currency appreciations and depreciations.

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