

## Exposure to Foreign Exchange Rate Risk: A Review of Empirical Evidences

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### ABSTRACT

Exposure to foreign exchange rate risk has become an increasingly important issue to investors and financial managers identical with the globalization of markets, and particularly in the wake of the events that occurred in the Asian financial markets. The impact of foreign exchange rate exposure on the value of the firm has been the subject of empirical literature for several decades. In recent times some empirical literature has also emerged. This study reviews the studies that investigate the exposure to currency risk of different economies. Both developing and developed economies has been subject to this study. It is concluded that most of the emerging and developing economies are exposed to higher level of foreign currency exposure. This is due to high level of openness and large amount of import and exports. In contrast, almost all closed and developed economies exhibits low level of exposure due to low amount of import and exports.

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## 1. Introduction

*"Derivatives are financial weapons of mass destruction carrying dangers that, while latent, are potentially lethal."* —Warren E. Buffett, 2003 *Berkshire Hathaway Annual Report*

Starting from 1970 and especially from 1990s there is drastic increase in the magnitude and types of risk for financial corporations. Variations in interest and exchange rates are becoming widened and, consequently, stock and bond markets showing increased volatilities and bringing about number of challenges for multinational corporations. Recent financial crises 2008 – 2009 convinced the managers to introduce more scrutiny towards the use of financial derivatives. In large countries, including US and UK, recent proposals necessitate the greater regulation of OTC (over-the-counter) and exchange traded derivatives market, including exchange traded regulations, maintenance margin, and capital requirements (Bartram, Brown, & Conrad, 2011).

One of the most important elements of firm's overall business strategy and financial policy is corporate risk management. Due to numbers of risk factors corporate managers have become very much anxious to reduce risk which their organizations face. The increased demand of risk reduction have led financial innovation towards producing potential and appropriate financial instruments that can assist managers in managing risk in a better way. These instruments known as "Financial Derivatives" used as effective tool for risk reduction. A drastic increase has seen in use of derivative securities during last decade by corporations. Progressively, the use of derivatives to counter risk is increasing day by day.

## 2. Foreign Exchange Risk Management at Corporate Level

Corporate risk management has got much consideration in corporate finance theory and playing important role in enterprise risk management with rapid development in financial derivative instruments. The processes of risk management require management to assess and identify comprehensively the entire firm risk in terms of magnitude and likelihood of effect and to evaluate the adequacy of methodology in place to mitigate, manage, transfer or avoid these risks. Recent failures of large companies, uncertainties in international market, and effective mechanism of corporate governance have increased the importance of corporate risk management.

The trend of introducing risk management is normally attributed to both: internal and external factors. Major external factors that have motivated firm to move towards risk management are more holistic in nature and wide scope of risks arise from factors like industry

deregulation and consolidation, globalization, increased regulatory interest toward corporate governance, and technological development that enables improved risk analysis and quantification. On other hand, major emphasis of internal factors is on shareholder wealth maximization.

### **3. Study Aims and Objectives**

Exposure to exchange rate, in simple words, can be defined as the extent to which fluctuations in exchange rate affect the returns of firm's stock and also its value (Fazillah, Hui, & Azizan, 2008). With the increase in international trade several firms are becoming globalize, hence foreign exchange rate fluctuations are becoming a major risk for these firms (Wong & Tang, 2009). So it can be said that, apart from other types of risks, foreign exchange rate risk is now deemed as significant risk for corporate firms. In order to encounter that risk, organizations are turning towards hedging instruments to alleviate their risk. Several hedging instruments and different types of contracts are used to encounter foreign exchange rate risk like forwards, futures, swaps, and options contract. Foreign exchange rate exposure is not only the factor to induce firms to use derivative instruments; rather there are several factors that contribute in derivative usage.

### **4. Empirical Studies on Foreign Exchange Rate Exposure**

Several studies have been written in context of using hedging instruments and foreign exchange rate risk. These studies were conducted on different economies. Some studies addressed emerging and developing economies (for example Chue & Cook, 2008; Fornés & Cardoza, 2009; Fratzscher, 2006; Mihaljek & Packer, 2010) while others addressed developed economies (for example Bodnar & Gebhardt, 1999; Bodnar, Jong, & Macrae, 2003; Mallin, Ow-Yong, & Reynolds, 2001; Marshall, 2000; Nguyen & Faff, 2002). Similarly, a lot of studies tried to investigate reasons of using hedging instruments (Chow & Chen, 1998; Fok, Carroll, & Chiou, 1997; Goldberg, Joseph, Kim, & Tritschler, 1998; Hardwick & Adams, 1999; Nguyen & Faff, 2002; Wysocki, 1995). They explore the factors that induce the firms to use derivative instruments. Likewise, many authors tried to estimate foreign exchange rate exposure for different economies by using different methodologies. Some studies estimated foreign exchange rate exposure of emerging economies (Bartram & Bodnar, 2012; Chue & Cook, 2008; Du, Hu, & Wu, 2014; Fornés & Cardoza, 2009; Kiyamaz, 2003; Lin, 2011) while some estimated developed economies' foreign exchange exposure like US (Li, Moshirian, Wee, & Wu, 2009; Muller & Verschoor, 2006) and UK (Agyei-

Ampomah, Mazouz, & Yin, 2013; El-Masry, 2006; El-Masry, Abdel-Salam, & Alatraby, 2007). So there are several studies that have been written on different aspects of risk and hedging. All studies whether they addressed emerging or developed economies or explore hedging factors or estimating foreign exchange rate exposure, they all found divergent results and having different conclusions hence, so far, no consensus can be drawn from these studies. This study intends to provide short review of those studies that are written in context of foreign exchange rate exposure.

### **5. Estimation of Foreign Exchange Rate Exposure**

As a result of the increased volatility in FX rate movements, the volatility of both current and future cash flows of multinational and domestic firms has also risen (Bartov, Bodnar, & Kaul, 1996). The theoretical approach which relates to the discussion of the current study is that of Adler and Dumas (1984). The preliminary work of Adler and Dumas (1984) defines FX exposure as the magnitude of the sensitivity of the real market value of the firm, measure by its stock market returns, to random fluctuations in the FX rate over specific time period. The exposure can be estimated by the slope coefficient resulting from a regression of stock returns on the changes in the exchange rate. After that, Jorion (1990) derived second market model to estimate the FX rate exposure coefficient. This approach measured the foreign exchange rate exposure as a residual exposure after controlling for movements in the market as a whole. Jorion examines the exposure of US multinational corporations to foreign currency risk and found significant exposure for only 5.2% of the sample. Subsequently, several studies use Jorion's model with different time periods and using data from different countries such as Nguyen and Faff (2003), Zhou and Wang (2013), Yip and Nguyen (2012).

Bodnar and Gentry (1993) present evidence on the determinants of exchange rate exposure and the effect of exchange rate fluctuations on industry value using data on stock market returns to industry portfolios by studying a broad spectrum of industries encompassing traded and non-traded, manufacturing and service industries in Canada, Japan, and the USA. By using augmented market model they find between 20 and 35 per cent of industries have statistically significant exchange rate exposures and exchange rate fluctuations help determine industry returns at an economy-wide level. The data of their study also suggest that the impact of exchange rate movements on industry returns is larger for Canada and Japan than for the USA, which is consistent with the exchange rate having a larger impact on smaller and more internationally-oriented economies.

Similarly, Khoo (1994) using a sample of 98 Australian mining firms for the period from January 1980 to March 1987, found only weak evidence that their stock market returns were sensitive to exchange rate movements. The proportion of the stock returns explained by exchange rate changes was also very small. The study by Amihud (1994) used the 32 largest US exporting firms for the period 1982 to 1988, reported no evidence of a significant contemporaneous exchange rate exposure. Similar results were reported by Choi and Prasad (1995) and Miller and Reuer (1998). A study by Bartov et al. (1996) examined this relationship for a sample of U.S. multinational firms over two periods: January 1966 to December 1970 (five years of fixed exchange rates) and January 1973 to December 1977. These periods encompassed the 1973 transition to floating exchange rates. The authors found a significant increase in stock return volatility following the increase in exchange rate changes (around and after 1973) for the multinational firms, compared with the control firms. Finally, a sample of 171 Japanese multinational firms was examined by He and Ng (1998). The authors found that about 25% of the firms in their sample exhibited significant positive exposure for the period January 1979 to December 1993. The extent to which a firm was exposed to exchange rate fluctuations was determined by the magnitude of its export ratio as well as by variables which were proxies for the firm's hedging policies. For example, highly levered firms, or firms with low liquidity, had more incentive to hedge and, thus, had smaller exchange rate exposures, while smaller Japanese multinational firms tended to have lower exposure to exchange rate risk.

By using weekly data, Nydahl (1999) investigate the FX exposure for a sample of Swedish firms. Results revealed that 26% of the 47 firms in the sample are significantly exposed to FX rate changes which are significantly larger percentage than earlier results for US companies. They found little evidence that exchange rate affect firm value with a lag.

Various studies have implemented Jorion (1990) model using different versions of exchange rates (multilateral or bilateral), market risk factors, sample firms, periods, horizons, and also extending the model by including extra independent variables. For example, Di Iorio and Faff (2000) examined currency exposure using both the daily and monthly stock returns of 24 Australian industry portfolios and a bilateral AUD/USD exchange rate, for the period January 1988 to December 1996. When applying daily and monthly data, the researchers found that 8% and 22% of their industries, respectively, exhibited a significant relationship between stock returns and exchange rate changes. Although these results showed mixed signals in

terms of daily and monthly data, they provided stronger evidence of foreign exchange rate exposure compared to previous studies.

Allayannis, Ihrig, and Weston (2001) used a sample of 18 U.S. manufacturing industry groups for the period from 1979 to 1995, to examine currency exposure. Their study found evidence that the stock market returns of 4 out of the 18 groups, i.e. approximately 22%, of the U.S. manufacturing industries sampled, were significantly sensitive to exchange rate changes. On average, a 1% appreciation of the U.S. dollar decreased the returns of the average industry by 0.13%. The researchers also found a significant relationship between foreign exchange sensitivity and an industry's markup, with exchange rate movements having larger effects on an industry's returns during low markup periods.

De Jong, Ligterink, and Macrae (2006) examined how exchange rate changes affect the stock returns of a sample of Dutch firms. They find that more than 50 percent of their sample of 47 is significantly exposed to exchange rate risk. Their study is unusual in that they use a questionnaire to obtain information on the top three foreign currencies, as well as the firm's on- and off-balance sheet hedging practices. Their empirical results show that total assets and foreign sales ratio are positively and significantly related to the exposure of the firms in their sample. Furthermore, they find that while on-balance sheet hedging (foreign loans and foreign operations) significantly reduces exposure, off-balance sheet hedging (the use of derivatives) has no significant effects.

In a study using the monthly stock returns of 910 large U.S. firms, covering the 20-year period, January 1977 to December 1996, Bodnar and Wong (2003) found that both the return measurement horizon and the exposure model specification had an effect on estimates of foreign exchange rate exposure. In terms of the different time horizons, the authors reported that, while the precision of the estimates of exchange rate exposure increased with the time horizon, the impact of time horizon on the exposure was less significant than the impact of the independent 'market' variable used in the model to control for correlations between the exchange rate and broad macroeconomic factors.

Focusing on firms listed in an emerging market, Kiymaz (2003) used a sample of 109 Turkish firms exposed to currency fluctuations between January 1991 and December 1998. During March and April 1994, the Turkish Lira experienced a depreciation against foreign currencies (Turkish currency crisis). For the whole sample period, it was found that 67 out of 109 firms (i.e., approximately 61%) showed significant foreign exchange rate exposure coefficients. A

comparison between the before and after crisis periods showed that the number of significant foreign exchange rate exposure cases were considerably lower before the crisis. The study also showed that the degrees of foreign involvement (export and import) had significant impact on the level of exposure.

Pritamani, Shome, and Singal (2004) investigated the FX exposure of importing and exporting firms from the sample of S&P 500 firms as of December 1997 by identifying sub samples of domestic firms, export oriented firms and export oriented firms. Their results proposed that firms are affected by both the domestic economy and foreign markets. Their hypothesis argued that exporting firms are at least partially hedged with respect to total exposure that jointly incorporates the offsetting foreign and domestic market effects of change in exchange rates on the firm value.

Relatively strong evidence of significant exchange rate exposure was reported by Dominguez and Tesar (2006). Using both trade weighted and bilateral exchange rates the authors investigated the exposures in a sample of eight (non-US) industrialised and developing countries for the period from 1980 to 1999 (country specific). Their study found a significant exposure between excess returns and changes in foreign exchange rates at both the individual firm and industry levels. With respect to the firm-level, more than 20% of the firms from five of the eight countries were significantly exposed to weekly exchange rate changes. The exposure at the industry level was generally higher with over 40% of industries significantly exposed in Germany, Japan, Netherlands, and the U.K. On testing individual sub periods the authors could find no evidence that exchange rate exposure was declining, or becoming less significant over time.

The relation between firms' foreign exchange exposure and the extent of their multinationality as a proxy for operational hedging was examined by Hutson and Laing (2014). Using a sample of 953 US firms over the period 1999–2006, results showed that there is a nonlinear relation between operational and financial hedging, confirming evidence that many highly multinational firms do not hedge with derivatives. Operational hedging and financial hedging are significantly inversely related to firms' foreign exchange exposure, providing evidence that the two hedging techniques are complementary for all but the most highly operationally hedged firms.

Du et al. (2014) conjecture that the insignificance of currency risk in emerging markets may be due to the co-movement between exchange rates and the market factor. They test this

conjecture with the Taiwan market data collected from Taiwan Economic Journal database and find supportive evidence. Monthly firm-level financial data was used for stocks listed on Taiwan stock exchange. The evidence in their paper suggests that a potentially promising approach instead might be to study the relationship between currency risk and the standard asset pricing factors. The standard asset-pricing models without currency risk may be sufficient for practical decision making in emerging markets (i.e. capital budgeting, portfolio evaluation, investment, and risk analysis decisions), since exchange rate changes may not have incremental information relative to the market factor in these markets.

By using weekly data from 2003 to 2011, Al-Shboul and Anwar (2014) examines the presence of exchange rate exposure in thirteen Canadian industry sectors of Canadian Stock Exchange from 2003 to 2011 by considering the presence of exposure not only in the full sample but also in the pre and post- Global Financial Crisis (GFC) periods and considering both linear and nonlinear exposure. They find some evidence of linear and nonlinear exposure in the full sample as well as in the pre and post-GFC sub-samples but find weak evidence of an asymmetric exposure sign effect on stock returns in the full and pre-GFC sample periods. Stock returns are found to respond asymmetrically to the positive magnitude of exposure in both the-pre and post-GFC sample periods. They found that the GFC appears to have weakly contributed to the overall strength of the exposure.

The analysis of the performance of 103 UK multinationals from FTSE-250 over the period of 2005-2010 was performed by Bhuiya, Islam, Ahmed, and Haque (2015) by considering stock return as an indicator of firm value and using two factor regression model. They could not found any significant relationship between pound sterling value and UK multinationals value. Regression analysis has shown that approximately 85% UK multinationals do not have any significant relationship between pound sterling fluctuation and firm value.

The relationship between the Japanese firms' exposure to the exchange rate risk and risk management was investigated by Ito, Koibuchi, Sato, and Shimizu (2015). They estimate firm's exposure to the exchange rate risk by co-movements of the stock prices and exchange rates by collected data from questionnaire survey covering all Tokyo Stock Exchange listed firms in 2009. Results showed that firms with greater dependency on sales in foreign markets have greater foreign exchange exposure. It was also found that higher the US dollar invoicing share, the greater is the foreign exchange exposure. But, risk is reduced by both financial and operational hedging. Finally, yen invoicing reduces foreign exchange exposure which



indicates that Japanese firms use the combination of risk management tools to mitigate the degree of the exchange rate risk.

An attempt to estimate whether firm-specific exchange rate exposures affected by hedging activities can be improved through financial regulation or supervision is carried out by Kim and Kim (2015). They compose three-step estimations by using a sample of KOSPI 200 firms during 1,803 trading days between 2005 and 2012 and estimated the relationship between exchange rate exposure and hedging activities to see whether financial regulation had any effect on hedging activities. Furthermore, using TSLS analysis, their study estimated the effect of hedging activities on exchange rate exposure, which is caused by tightened financial regulation in the form of corporate governance. Results report that, first, firms are less likely to be exposed to exchange risk with more hedging activities. Second, corporate governance has a strongly positive effect on the hedging activities. Firms use more hedging tools when they have a strong structure of shareholder's protection, clear outside ownership, and a better monitoring system; but the relationship becomes weaker in times of crisis.

**Table 1**  
Literature Summary of Foreign Exchange Rate Exposure

Author(s)	Country	Sample (Period)	Methodology	Key Finding
Jorion (1990)	US	287 multinationals firms (1971 to 1987)	Two factor Jorion's market model	5.2% firms out of sample are significantly exposed to exchange rate movements
Pritamani et al. (2004)	US	Sample of Importing and exporting firms from S&P 500 (1997)	Firm level total and residual exposure model	4% and up to 43% of the exporting and importing firms sample exhibit negative and positive significant FX rate exposure respectively
Hutson and Laing (2014)	US	953 firms listed in NYSE, AMEX <sup>2</sup> and NASDAQ (1999 to 2006)	Two factor Jorion model and extended market model	Overall, 5.2% firms significantly exposed to FX risk. Domestic firms have highest exposure as opposed to globally multinational firms.
Loudon (1993)	Australia	141 listed firms (1984 to 1989)	Two factor Jorion's market model	6.4% of the sample firms significantly expose to FX rate risk
Di Iorio and Faff (2000)	Australia	24 Australian industry portfolios (January 1988 to December 1996)	Two factor augmented market model	With daily and monthly data, 8% and 22% of their industries, respectively, show significant exchange rate exposure
Bodnar and Wong (2003)	US	910 large US firms (1977-1996)	Firm level total and residual exposure model	20% to 25% firms highly exposed to FX rate risk. Return measurement horizon and specification of exposure model both affect on FX rate exposure.
Dominguez and Tesar (2006)	Developing countries <sup>3</sup>	2387 firms from 8 developing countries, 300 firms, on average, from each country (1980 to 1999)	Two factor augmented market model	Around 20% of the total sample firms significantly influenced by weekly changes in FX rates. Industrial exposure was over 40% in UK, Netherland, Japan and Germany.
Allayannis et al. (2001)	US	18 manufacturing industry US groups	Two factor augmented market model	22% of US manufacturing industries sample were significantly affected by exchange rate

<sup>2</sup> NYSE stands for New York Stock Exchange, whereas AMEX stands for American Stock Exchange

<sup>3</sup> The United kingdom, Thailand, the Netherlands, Japan, Italy, Germany, France and Chile

				changes
Al-Shboul and Anwar (2014)	Canada	13 Canadian industry sectors (2003 to 2011)	Use linear, nonlinear and asymmetric effect models	23% of their sample firms significantly affected by FX rate fluctuations.
He and Ng (1998)	Japan	171 Japanese multinational firms (January 1979 to December 1993)	Two factor Jorion's market model	25% of Japanese sample firms are significant positive exposure
Bhuiya et al. (2015)	UK	103 firms listed in FTSE <sup>4</sup> -250 index (2005-2010)	Two factor regression model	No significant relationship found for 85% of sample firms between changes in UK pound value and firm value
Nydahl (1999)	Sweden	47 Swedish firms (January 1990 to February 1997)	Two factor Jorion's market model	26% of the firms are significantly exposed to changes in FX rates
Du et al. (2014)	Taiwan	132 firms listed in Taiwan stock exchange	One, two, three, and four factor augment models	31% firms out of their total sample are significantly affected by variations in FX rate.
De Jong et al. (2006)	Dutch	47 Dutch firms (1994 to 1998)	Use two factor augmented market model & questionnaires	50% of Dutch firms are significantly exposed to volatilities in FX rates.
Choi and Prasad (1995)	US	409 multinational firms of US (1978 to 1989)	Two factor Jorion's market model	60% sample firms have significant FX rate exposure at the time of dollar appreciation
Kiyamaz (2003)	Turkey	109 firms from Istanbul stock exchange (1991 to 1998)	Two factor augmented market model	61% of overall sample firms while financial industries, chemical, machinery and textile are more pronounced to exposure
Bacha et al. (2012)	Malaysia	158 firms listed in Bursa Malaysia (1990 to 2005)	Multivariate regression model	71% of firms expose significant exchange rate exposure during whole period
Ito et al. (2015)	Japan	227 firms listed at Tokyo Stock Exchange (2005 to	Use total and residual exposure models	Japanese firms have significant exposure to FX rate that have foreign sales and higher USD

<sup>4</sup> The Financial Times Stock Exchange

## 6. Conclusion

It is generally believed that foreign exchange rate fluctuations have important implications for firm profitability and for financial decision-making. The existing literature on the relationship between international stock prices and exchange rates finds mixed evidence of systematic exchange rate exposure. This study summarizes the finding of empirical studies that estimate foreign exchange rate exposure of different economies. It can be concluded that most of the studies that addressed developed economies (like USA, UK) found weak evidence for exchange rate exposure due to low level of imports and exports. While, on the other side, the results are in contrast for developing economies that exhibits high level of exposure due to high level of market openness.

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