Foreign Exchange Rate Exposure and Its Determinants on Performance of Manufacturing Firms in Turkey

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Abstract

The study investigates foreign exchange rate risk exposure of 37 manufacturing firms traded in Istanbul Stock Exchange in Turkey during the period of 2005-2014 by using Jorion (1990) regression model. Unlike previous studies, the relationship has been conducted by regressing ratio of return on capital employed instead of stock returns of firms against both contemporaneous and lagged exchange-rate changes. The findings show that analyzed firms exposed to exchange-rate fluctuations can be explained by the level of its export ratio and size of assets. The firms with high level of export ratio and large size of assets tend to have less exposure. The evidence also indicates that age of firm is not determining factor for exchange exposure.

Keywords: corporation performance, exchange-rate exposure, manufacturing firms.

1. Introduction

Today's firms are open to be affected from macro-economic variables due to the rapid globalization of national economies, and foreign exchange rate is one of those variables. Unexpected fluctuations in foreign exchange rate may alter return, operating cash flows, financial decisions, investment and market value of a firm. Even, firms that have little or no discernible international transactions may also face indirect significant exchange rate exposure (Aggarwal and Harper, 2010). Therefore, exposure to currency movements is an important risk for growing number of domestic and multinational firms since the adoption of flexible exchange rate system in an increasingly globalizing economy.

According to Adler and Dumas (1984), economic exposure to exchange rate can be determined by the regression coefficient of the firm's value in case of affected firm's value from fluctuations in exchange rates. The other similar definition refers to the sensitivity of stock prices (or firm value) to the changes in exchange rate (Heckman, 1983). There have been numerous studies about exchange rate exposure of various firms and industries; Jorion (1990) found that only 15 of 287 U.S multinational companies have significant exchange rate exposure. His results did not show a statistically significant regression between foreign sales and exchange rate exposure. Bartov and Bodnar (1994) set a new problem/analysis about US companies, and they didn't find any significant correlation between stock prices and exchange rate exposure, but they found a strong relationship with lagged exchange-rate fluctuations. They argued that since financial statements are announced to the public with a time lag, exchange rate fluctuations would not immediately affect a firm's stock price. On the other hand, He and Ng (1998) found that about 25 percent of 171 Japanese multinational firms' stock returns have significant positive exposure effects. Their study revealed that highly leveraged firms and firms with low liquidity tend to have smaller exposures. Dominguez and Tesar (2001) stated that 12-23 % of firms are exposed to exchange rate movements in a pooled sample of eight (non-US) industrialized and emerging markets. Their study noted that exposure is not systematically related to firm size, industry affiliation, multinational status, foreign sales, international assets and industry-level trade.

As mentioned above, many studies have failed to establish a statistically significant relationship between firm value and exchange rate changes. Levi (1994), Dahlquist and Robertsson (2001) argue that the main cause for the lack of exchange rate exposure is due to the use of aggregated economic measures and difficulty in obtaining stable measures of exchange rate exposure. They claimed that exchange rate exposure is idiosyncratic, and it does not show any relation to the firm's risk premia by conforming in the evaluation of an international asset pricing model. Aggarwal and Harper (2010) focused on domestic firms that face significant foreign exchange exposure, and they found that, on the average, domestic firm exposure to foreign exchange risk is not significantly different from the exposure faced by multinational

firms. Their additional claim was that the number of exposed domestic firms and their exposure level increase with the time horizon used to estimate exposure. They also noted that the level of domestic firm exposure is negatively related to firm size and asset turnover, and positively to the market to book ratio and financial leverage. Bodnar and Marston (2002) developed a simple model to measure a firm's exposure elasticity to the exchange rate fluctuations without the need to use stock return data. Their model was established for the firms which both produce and sell at home and abroad. The percentage of revenues denominated in foreign currency, the percentage of costs denominated in foreign currency and the profit rate for foreign sales were included as input. They pointed out that foreign exchange exposure is comparatively low for multinational firms with significant revenues and costs in foreign currency since they match their proportion of foreign currency revenues and costs. Chamberlain et al (1996) studied the exchange rate of exposure of US and Japanese banks. Using daily data, they constructed a model to estimate the exchange rate sensitivity of the equity returns of U.S. bank holding companies, and compared them to those of Japanese banks. They found that the stock returns of a significant fraction of the U.S. companies move with the exchange rate while few of the Japanese returns appear to be sensitive to exchange rate changes. Aabo and Brodin (2014) argued that previous studies have used the stock market approach to find the aggregate number of firms with foreign exchange exposures in a given country, region, or industry. Their study was based on the analysis of exchange rate exposures at the firm-specific level for large and non-financial firms in Scandinavia in the period of 1999-2006. They found that the significance of exchange rate exposures at the firm-specific level is highly sensitive to these basic changes (observation frequency and market index) in methodological set-up.

As recently mentioned above; Most of the studies have been conducted on developed countries and industrialized economies. The number of studies about emerging markets and developing countries has increased in recent years. Kıymaz (2003) shown that Turkish firms are highly exposed to foreign exchange risks during the period of 1991-1998, and exporting and importing firms tend to have the highest exposure to exchange rate risk. Olufem (2011) investigated foreign exchange rate risk exposure of 117 samples of Nigerian Listed firms for the period 1996 – 2005 by using Jorian (1991) approach for measuring economic exposure. Findings revealed that Nigerian listed firms are generally exposed to adverse exchange rates risks of three currencies (US Dollar, UK Pound, Euro) included in his research; even US dollar has more effect on the firms. He concluded that exchange rate change is a major barrier to performance of a firm. Salifu et al (2007) examined the foreign exchange exposure of listed companies on the Ghana Stock Exchange over the period of January 1999 to December 2004. Their study indicated that about 55 percent of firms in the sample have a statistically significant exposure to the US dollar whilst 35 percent are statistically exposed to the UK pound. Sector specific exposure results shown that the manufacturing and retail sectors are significantly exposed to the US dollar exchange rate risk, but financial sector does not show any risk exposure to any of the international currencies. Hussein and Khan (2014) investigated the exchange rate exposure of pharmaceutical industry of Pakistan in long and short run. Their results shown that there is long run relationship between stock returns, exchange rate and market return index, and there is a negative short run significant relationship between stock returns of pharmaceutical multinationals of Pakistan and exchange rate. Akay and Cifter (2014) examined industry-weighted exchange rate exposure at the firm and industry level for Turkish plants. They used unbalanced panel of plant-level data for manufacturing firms in Turkey between 2002 and 2010 for seven different industrial areas. They noted that macro indicators seem to be more significant influence on the exchange rate exposure, and industry-weighted openness is the most important factor to determine the exchange rate exposure for Turkish firms, and the direction of exposure varies at the industry level.

The previous empirical studies (Dewenter et al, 2005; Muller et al, 2008; Dahlquist et al, 2001) focused on the theoretical perspective that exchange rate fluctuations should influence firm value, but the findings revealed weak relationship between exchange rate and stock return in contrast to their expectations. The unavailability of satisfied relationship had been attributed to some reasons. The authors argued that the weak existence of exchange rate exposure might be due to the problems resulted from research design, sample selection, use of the trade-weighted value of foreign currency or both the use of too aggregated economic variables and ignorance of the intervaling effect. Bartram et al. (2010) explain this discrepancy as "puzzle" that firms pass through part of currency changes to customers and utilize both operational and financial hedges in order to restrict their exchange exposures.

The results of above studies seem to be not consolidated around a specific finding. Several studies(Önal et al, 2002; Yucel and Kurt, 2003) conducted on Turkish firms have so far documented weak or no statistically

contemporaneous relationship between exchange rates and stock returns of firms traded on the Istanbul Stock Exchange (ISE). The reasons for the apparent lack of exchange rate exposure were expressed by some empirical, such that those studies implying that ISE is not efficient market or weak efficient market (Disario 2008; Cevik, 2012). Unlike previous studies, this study has been designed to analyze the impacts of exchange rate fluctuations on the performance instead of stock returns of firms registered to Istanbul Stock Exchange (ISE). Moreover, this study will also make the difference on the contemporaneous and lagged impacts of exchange rate changes on the performance of 37 firms from 2005Q1 to 2014Q4 using ratio of Return on Capital Employed (ROCE) as the measure of firm's performance. Our results indicate that about fifty percent of selected 37 manufacturing and trading firms' performance has experienced significant exposure effects with contemporaneous and lagged exchange-rate changes. In the second step analysis, the determinants affecting the sensitivity of firms' performance to exchange rate fluctuations have been investigated. The rest of the paper is organized as follows. Section 2 describes data and methodology. Section 3 presents and discusses the results. Finally, section 4 concludes the paper.

2. Data and Methodology

In this study; the industrial and trading firms providing enough data to be analyzed in the period of January 2005 and December 2014 were chosen as candidates that they are not subject to consolidated financial statements∗. After eliminating other firms that do not have these characteristics, 37 firms traded on the Istanbul Stock Exchange (ISE) are left. Their quarterly basis data were included into the analysis.

The ratio of return on capital employed (ROCE) was used as measure of performance. The easiness calculation of financial measures is well known and agreed on advantage of them. Traditionally, the success of a manufacturing system or company has been evaluated by the use of financial measures (Almajali and Alamro, 2012). Glyn (1997) noticed in his study that rate of return on capital employed may be used for eliminating biases in estimation of relationship between profitability and capital stock growth. Narta and Singh (2011) used this ratio to measure firms' efficiency about utilization of resources. Mutluay and Turaboglu (2013) analyzed the effects of exchange rate fluctuations on performance of firms by using rate of return on capital employed (ROCE). Return on Capital Employed (ROCE) is calculated by Equation (1), such that EBIT and CE are earnings before interest and tax and capital employed, respectively.

$$ROCE = \frac{EBIT}{CE} \qquad (1)$$

CE in the denominator is the sum of shareholders' equity and debt liabilities, and it can be simplified as (Total Assets – Current Liabilities). ROCE has been calculated by the author using quarterly based data obtained from annual reports and financial statements of firms announced via Public Disclosure Platform developed by Istanbul Stock Exchange. The real effective exchange rate based on consumer and producer price index for the base year 2003 is obtained from Central Bank of Turkey's website. Since producer price index (PPI) consists of monthly data, the average values of 40 quarter period from 2005 to 2014 are calculated to adapt to our analysis.

The theoretical framework for the exchange rate exposure of firms is based on the fact that exchange rate exposure has potentially positive or negative impact on the profitability and value of the firm (Salifu et al, 2007). In many studies, exposure to exchange rate is measured by the regression coefficient of the real value of the firm on exchange rate (Adler and Dumas, 1984; Jorion, 1990; He and Ng, 1998; Dominguez and Tesar, 2006). Nevertheless, their findings are mixed, and the relationship between foreign exchange exposure and firm value has not been as powerful as expected based on theoretical framework. In order to measure Turkish firms' economic exposure, we based on the model generated by Adler & Simon (1986). In the second stage, the exchange rate exposure coefficient was used as a determinant of exposure by adaptation of Jorion (1990) model. However, as explained above, this study examined the effect of

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∗ Public companies have to issue their financial statements in the form of International Financial Reporting Standards (IFRS) since 2005. Financial statements of the group companies are presented as those of a single economic entity according to Turkish Accounting Standard 27 which have been applied in the preparation and presentation of consolidated financial statements for a group of entities under the control of a parent.

exchange rate risk on firm performance instead of stock return. In the first stage; we tested this relationship by regressing performance of firms against both contemporaneous and lagged exchange-rate changes, and measured economic exposure as the slope coefficient from a regression of performance on exchange rate. In the second stage; the slope coefficient of the regression describing the sensitivity of performance to unanticipated changes in exchange rates were used as the dependent variable. By this way, we analyzed firm-specific factors affecting on the firm's exposure to exchange rate movements. These factors were determined as; **(i)** Total assets, **(ii)** Share of export sales to total sales, (iii) Age. The unit root test, namely Augmented Dickey Fuller (ADF) was employed to examine the problem of non-stationary of the series of real exchange rate.

3. Empirical Analysis and Results

In the first stage of analysis, we employed ADF test to check the stationary of real exchange rates. The results of the ADF test given in Table 1 indicate that the variable of real exchange rate has no unit root after taking first difference of it. Therefore, we used quarterly data set of real exchange rate with first difference.

Table1: The result of unit root test with first difference

Variable		t-Statistics	p-Value
Real Exchange Rate		-6,008	0,000
Test Critical Values	% 1 level	-3,621	
	% 5 level	-2,943	
	%10 level	-2,610	

The exposure is measured by a regression model given in Equation (2) such that α_i, P_{it}, ε_{it} and EX_t are the constant term, performance of firm i at period t, error term and percentage change in real exchange rate at period t, respectively.

$$P_{it} = \alpha_i + \beta_{1i,t}EX_t + \varepsilon_{it} \tag{2}$$

Equation 2 was ran separately for each firm, and it was found that only 4 manufacturing firms have significantly exposed to exchange rate risk for the period of January 2005 to December 2014. As in the literature (Amihud, 1994; Bartov and Bodnar, 1994; He and Ng, 1998), we would like to check lagged changes in the exchange rate on the performance of firms. We therefore examined the lagged effects on the 37 manufacturing and trading firms by running the regression given by Equation (3) such that Parameter $\beta_{2i,t-1}$ in the Equation (3) measures the effect of lagged exchange-rate changes on the performance of firms.

Table 2: Exposure of firms with one-lagged exchange rate

Code of Firms	Contemporaneous		One Lagged	
	$\beta_{1i,t}$	P-Value*	$\beta_{2i,t-1}$	P-Value*
Afx	0,717	0,004	0,577	0,015
Alx	-0,438	0,017		
Box			0,406	0,024
Dex	0,601	0,019	0,492	0,043
Gox	-0,485	0,044		
Hex			0,366	0,048
Kax	-0,813	0,001	-0,676	0,004
Kox	-0,901	0,000	-0,478	0,016
Sox	0,650	0,010	0,560	0,019
Vix	0,348	0,049		
Yax	-0,545	0,027		

* Significant at 5%.

$$P_{it} = \alpha_{it} + \beta_{1i,t}EX_t + \beta_{2i,t-1}EX_{t-1} + \varepsilon_{it} \qquad (3)$$

As seen in Table 2, 9 of 37 firms are significantly exposed to fluctuations with ($\beta_{1i,t}$) contemporaneous, and 7 of 37 firms are significantly exposed to fluctuations with ($\beta_{2i,t-1}$) one-lagged foreign exchange rates. An important feature of the results is that 4 of 9 firms and 5 of 7 firms have significantly positive exposures, implying that the performance of firms have been affected positively from appreciation in the value of Turkish lira relative to the foreign exchange. It therefore appears that appreciation (depreciation) of the Turkish lira against foreign currencies has a positive (adverse) impact on performance of these manufacturing firms. At this point, we performed a model described in Equation (4) by adding one more lag to Equation (3) that runs over the same analysis.

$$P_{it} = \alpha_{it} + \beta_{1i,t}EX_t + \beta_{2i,t-1}EX_{t-1} + \beta_{3i,t-2}EX_{T-2} + \varepsilon_{it} \qquad (4)$$

Where $\beta_{3i,t-2}$ represents the sensitivity of firm i's performance to two-lagged exchange-rate movements. Table 3 reports that 4 firms with ($\beta_{1i,t}$) contemporaneous, 4 firms with ($\beta_{2i,t-1}$) one-lagged, and 2 firms with ($\beta_{3i,t-2}$) two-lagged exchange rate changes have significantly explanatory power for current performance of firms. Additional lags beyond two-lagged treatments resulted in declining the sensitivity of performance, that's why we ignored them.

Table 3: Exposure of firms with two-lagged exchange rate

Code of Firms	Contemporaneous		One Lagged		Two-Lagged	
	$\beta_{1i,t}$	P-Value*	$\beta_{2i,t-1}$	P-Value*	$\beta_{3i,t-2}$	P-Value*
Box					0,430	0,028
Hex			-0,593	0,021	-0,596	0,015
Kox	0,947	0,006	-0,626	0,009		
Otx	0,759	0,045				
Sox	0,794	0,033	0,525	0,043		
Usx	0,761	0,038	0,462	0,011		

* Significant at 5%.

Venn scheme given in Figure 1 demonstrates the distribution of firms with significant exposure to no-lag, one-lagged and two-lagged exchange rates. As observed in Figure 1, the performance of 12 firms was affected from their exposure to the exchange rate without a lag whilst 8 have significantly exposed with one lag. On the other hand, only 2 firms have significant exposure to two-lagged exchange rate, and the number of firms affected from contemporaneous and one lagged is more than the number of firms with two-lagged exchange rate. Therefore, the firms significantly exposed to contemporaneous and one lagged exchange rates (12+8) were included in the second stage of analysis. We employed another regression model given in Equation 5 to investigate firm specific factors affecting exchange-rate exposure.

$$\beta_{1i,t} = \alpha_0 + \alpha_1 EXPR_i + \alpha_2 SIZE_i + \alpha_3 AGE_i + \eta \qquad (5)$$

In the Equation (5), $\beta_{1i,t}$ is the regression coefficient representing the sensitivity of performance of firm i to exchange rate. $EXPR_i$, $SIZE_i$ and AGE_i are the ratio of export to total sales, total asset and age for firm i, respectively. η is the random error.
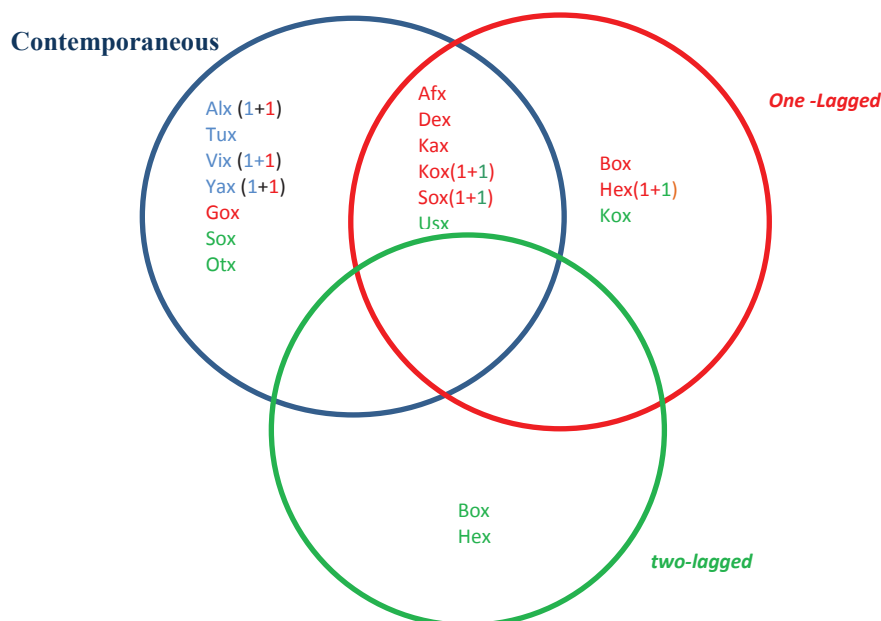

Figure 1: Venn Scheme with code of firms

Table 4a and Table 4b summarize the results of analysis. It appears that whilst exchange- rate exposure is negatively related to size and level of export to total sales, there is no significant relationship between exchange-rate and age. It has been found that firms with high ratio of export sales, and firms with large assets are less exposed to exchange rate fluctuations than other firms. Some of the studies that have been conducted in the literature are inconsistent with some of our results such as He and Ng (1998), Dominguez and Tesar, Dahlquist and Robertson (2001), and Kıymaz (2003) studies, but consistent with the results of Akay and Cifter (2014) who found that large firms tend to be less exposed to exchange rate exposure than small and medium firms, and Solakoğlu's study (2005) that indicated negative relationship between export revenue and exposure level.

Table 4a. Determinants of Exchange Rate Exposure

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2,604	3	0,868	4,264	0,025[a]
	Residual	2,85	14	0,204		
	Total	5,454	17			

a. Predictors: (Constant), Asset Size (TL), Export by Sale, Age
b. Dependent Variable: Beta

Table 4b. Determinants of Exchange Rate Exposure

Model		Standardized Coefficients	T	Sig.
		Beta		
1	Age	0,362	1,657	0,12
	Export by Sale	-0,471	-2,308	0,037*
	Asset Size (TL)	-0,585	-2,814	0,014*

* Significant at 5%.
a. Dependent Variable: Beta

4. Conclusion

This study examines whether there exists any relationship between the performance of firms registered to Istanbul Stock Exchange (ISE) and fluctuations in exchange rate. The previous studies in the literature focused on and used stock returns for evaluating exchange rate exposure, but so far documented a weak or no link between exchange rate fluctuations and stock returns. Therefore, author motivated to investigate the effects of exchange-rate changes on the performance of manufacturing Turkish firms for the period from January 2005 to December 2014 using ratio of return on capital employed (ROCE) as the performance measurement. Following Jorion's regression model (1990), this relationship was tested by regressing ratio of return on capital employed against both contemporaneous and lagged exchange-rate changes. We also conduct an exploratory investigation of whether exchange exposure can be determined by the level of export sales, asset size and age of firms or not. Findings indicate that exposure is negatively related to firms' export ratio and asset size, but no relation to age.

It can be concluded that obtained findings support that asset size and export rate are important determinants of exposure. This is as expected; since exporting firms and larger corporations tend to be more involved in foreign activities, they do hedge. If there were no hedging, exposure to exchange rate risk might increase with large asset and export sales. Allayannis and Ofek (2001) revealed in their studies that large firms are more likely to use currency trading and derivatives.

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