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Balance Sheet Exchange Rate Exposure, Investment and Firm Value: Evidence from Turkish Firms

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Abstract

This paper provides evidence for the effects of a combination of balance sheet exchange rate exposure and real exchange rate movements on investment. In highly inflationary developing economies like Turkey, firms use the foreign currency denominated assets and debts to defend themselves against inflationary effects and try to benefit from open positions when the currency is undervalued or overvalued. With measuring balance sheet foreign currency exposures for Turkish Industrial firms in the period of 2000-2003, we show that the degree of exchange rate exposure is correlated with financial positions of the firms, but not with size and affiliation with either holdings or banks. Based on the evidence that firm value and investment are endogenous, we find that the firms with negative (positive) balance sheet exchange rate exposure decrease their investment by the depreciation (appreciation) of the value of TL. In addition, we show that there is a positive association of expansion in investment with the firm value.

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1. Introduction

The international finance theory states that variations in the exchange rates will affect the cash flows of a firm with foreign currency denominated debts and/or receivables, therefore its value. The empirical literature on the exchange rate exposure reveals that the degree of international activities is an integral predictor and an independent variable to be used in a study analyzing the relationship between exchange rate risk and the firm value. A great deal of studies tends to figure out the exchange rate exposure for the firms on the bases of their international activities. According to the standard economic analysis, unless they practice hedging activities, exporting companies are in long position and will benefit a depreciation of their home currency. In the same manner, importing companies are in short position and an appreciation of their home currency will be of their benefit.

In broad terms, a definition for exchange rate exposure can be stated as the change in the firm value emanating from the fluctuations in the exchange rates. We argue that being directly affected by the exchange rate fluctuations does not merely depend on international activities. There is a high possibility that the exchange rate exposure is related with foreign currency denominated balance sheet items. This relationship is tightly connected to the macroeconomic environments of countries, and especially to sudden and unexpected variations on some macro economical parameters such as inflation rates, interest rates, exchange rates and market dynamics. A consequence of the above definition on exchange rate exposure suggests that, it is hard to identify such an effect in environments where on and off-balance sheet hedging strategies against unexpected foreign exchange fluctuations are excessively applied. Unless such strategies are put into practice, the larger the percentage of foreign currency as a portion of its assets and/or liabilities for a firm, the more intensive the effect experienced by the company must be.

This study aims to point out the balance sheet exchange rate exposure for Turkish firms. This is very important for Turkish firms since they have preferred to hold foreign currency denominated assets due to the lack of trust in home currency, Turkish Lira (TL), and they also borrow foreign currency denominated debts in order to take advantages from interest rate arbitrage. More importantly, Turkish firms may have been applying one of these policies or both without considering their level of involvements into international activities. We measure several balance sheet foreign currency exposures for Turkish Industrial firms in the 2000 – 2003

period. The mean and median values of total exposure are negative for each sample year. The negative balance sheet foreign exchange exposure indicates that Turkish industrial firms on average hold more foreign currency denominated liabilities than foreign currency denominated assets. This indicates currency mismatching on the balance sheet. Our findings also show that firms in all industries, either import or export oriented, on average have negative balance sheet currency exposures indicating that their foreign currency denominated liabilities are more than foreign currency denominated assets. We also split the firms based on their total debt level to show that the degree of exchange rate exposure is correlated with financial position of the firms[1]. The results show that, export sales ratio is statistically the same for firms that have total debt level either more or less than the sample median, while the level of balance sheet currency exposure is different between the two groups. Moreover, export sales ratio is the same for firms in different level of balance sheet exposures. Based on this evidence, we argue that net balance sheet foreign currency position plays a crucial role for the exchange rate exposure analysis.

The main purpose of this study is to figure out the effects of balance sheet exchange rate exposure and real exchange rate movements on investment. We hypothesize that a combined effect of fluctuating real exchange rates with net foreign currency position of Turkish firms will directly affect their investment decisions. Our expectations can be summarized as follows: When a firm has more foreign currency denominated assets than its foreign currency denominated debts, and the change in real exchange rate index is negative, which also means the depreciation of home currency, the firm will tend to invest more since a larger inflow than expected will occur. In such a case, a firm with negative total exposure will increase its investment under a positive change in real exchange rate index, revealing the appreciation of home currency, thus resulting in a smaller amount of outflow than expected by the firm. The contrary conditions must result in the opposite outcome. The firm will intend to avoid investment when total exposure and real exchange rates have the same signs. We, then, examine the relationship between investment and firm value measured by Tobin's Q as consistent with the related literature, and expect that investment affects firm value positively.

The results from fixed effects panel data regression analysis support our expectations that the firms with negative balance sheet exchange rate exposure are

[1] We are grateful to anonymous referee for raising this issue.

hurt by the depreciation of the value of TL, and that the firms with positive balance sheet exposure are hurt by the appreciation of the value of TL. We also show that investment and firm value are the determinant of each other and the effect of combined effect of fluctuating real exchange rates with net foreign currency position of Turkish firms on investment is still hold when firm value is used as determinant of investment.

The rest of this study is planned as follows. Next section scrutinizes the related literature. Section three gives information about the sample and the model. In section four, we present the empirical results and comments. Section five includes the final remarks.

2. Literature Survey

Literature review shows that Adler and Dumas (1984) were the first to claim that the exchange rate exposure exists if the firm's value is affected by the changes in the exchange rate and to measure this effect using a regression analysis. Jorion's (1990, 1991) two factor models reveal cross sectional discrepancies between security returns and exchange rates for multinational companies. He basically finds no strong evidence for the exchange rate and firm value relationship. This can probably be a result of the hedging strategies of these companies. Choi and Prasad (1995) depict an increase in firm value occurs due to a depreciation of US Dollar for more than half of the American multinational companies. On the other hand, Doukas et al. (1999) attracts attention to the fact that exchange risk premium is an integral part of the incomes for the Japanese firms and is higher for the multinationals and heavy exporters.

Nevertheless the expected relationship between the fluctuation of exchange rates and firm value has not been justified by empirical findings. Two of the basic problems on this area of research are shown to be the sample selection and the mispricing. Sufficient evidence could not be obtained for the exchange rate exposure problem within their study including the industry portfolios of Canadian, Japanese and American companies where the existence of the discrepancies between the industries' levels of international activity involvement is suspected to be the main reason. This was also the case which Bartov and Bodnar (1994) encountered. They found little evidence for the dependency between synchronous abnormal returns and the U.S. dollar fluctuations. An important finding of their study is the lagged effect, which can be described as a delayed response to the

exchange rate changes on firm performances due to a complex relationship between the two incidents. In addition, it can be stated that the investors are involved in a systematic error when evaluating the suggested relationship and the firm value may respond to a current exchange rate fluctuation in the future.

Bonomo, Martins and Pinto (2003) investigates this balance sheet effect by focusing on the Brazilian firms' debt composition based on the argument that firms' balance sheet structure affects their investment if they are exposed to foreign exchange risk. Although they don't find a negative relationship for the interaction between foreign-currency denominated debt and exchange rate devaluation, their results provide supporting evidence for imperfect capital markets. The results of Bonomo, Martins and Pinto (2003) only imply that when the exchange rate is depreciated, the firms in industries that have more imported input invest less. But their findings suggest that large firms have negative exchange rate balance sheet effect while small firms have neglible. Larger firms also tend to change debt composition more in response to a change in the exchange rate risk.

Harvey and Hooper (1999) argue that the exchange rate balance sheet effect greatly increased its intensity during the Asian Crisis. Forbes (2002) shows that more indebted firms have lower income growth after a large depreciation. Benavente, Johnson and Morande (2003) analyses the Chilean firms' debt composition and balance sheet effects of exchange rate depreciation. According to Benavente, Johnson and Morande (2003) private debt in foreign currency may be an important factor behind crisis. Their analysis shows that larger firms reserve higher proportion of dollar-denominated debt. Therefore, currency depreciation should cause a contraction of investment for these dollar-indebted firms if they don't have main foerign currency denominated incomes from their exports. But there is no evidence for the expansion in Chilean corporate investment or positive balance sheet effect because of the collapse of Chilean economy in late 1990s.

Carranza et al. (2003) in their study including 163 nonlisted Peruvian companies, examine the relationship between currency depreciation and firms' investing behavior. They claim that there should be a negative relationship between investment and the interaction effect of dollar denominated debt with the real exchange rate depreciation. Based on their argument, high dollar concentrated debt companies suffer with the real exchange rate depreciation by itself and then tend to invest less. Their evidence supports this hypothesis. However, their results show that export and tradability were not factors to explain investment level.

In their firm level study amongst Mexican companies, Pratap et al. (2003) find a negative relationship between holding dollar denominated debt or earnings and investment of a company especially in case of devaluation. They also show that the negative balance sheet effect on investment expressed in terms of both foreign debt and the interaction of foreign debt with exchange rate changes exists. In Mexico, it also seems to be the case that large firms and export-oriented firms engage in intensive foreign currency borrowing.

Kiymaz (2003), in his study examining 109 Turkish companies in the 1991 – 1998 period, states that Turkish companies, especially those which operate at textile, machinery and chemical industries, are seriously subject to exchange rate exposure. Furthermore he claims the exchange risk augments where the export or import rates of the companies increase and less exchange rate risk exists in the period following the 1994 economic crisis with respect to the pre – crisis period. However, inconsistent with the theory, only a negative effect was obtained in this study.

3. Summary Statistics of Currency Exposures and the Model

This study covers the 2000 – 2003 period for Turkish industrial firms that are listed in the Istanbul Stock Exchange (ISE). Banks, mutual funds, investment and insurance companies are excluded from the sample because of the differences of financial characteristics that are very important in terms of examining the effect of balance sheet exchange rate exposure on firms' investment. Since investment is defined as increasing in capital stock of firms in a particular year, the objectives of making investment to tangible assets for industrial and financial firms are also different.

The main source of the data used in this study is the ISE database. The ISE publishes financial tables of firms listed in the exchange with their footnotes. The firm level data regarding the level of investment and balance sheet foreign currency exposure are gathered from footnotes of each firm. Firms show their annual investment in the footnote 8 and their foreign currency denominated assets and liabilities in the footnote 30. Unfortunately, there is no standardization on reporting of foreign currency positions. Therefore, we create some sub classifications of foreign currency denominated assets and liabilities. We report the descriptive statistics for several balance sheet exposures in corresponding years from year 2000 to 2003 in Table 1.

Our primary measurement of foreign currency exposure for Turkish industrial firms is total exposure, which is the difference between TL value of foreign currency denominated assets and TL value of foreign currency liabilities at time *t*. This difference is scaled by the TL value of tangible assets at time *t-1*. We multiply lagged value of tangible assets with the annual inflation rate at time *t* because of high inflation rates in Turkish economy. The annual inflation rates in the sample period are 39 %, 69%, 30 %, and 23 % for the years 2000, 2001, 2002, and 2003 respectively. Other balance sheet exposure measures are short and long-term exposures, which are calculated as the difference between TL values of foreign currency denominated short and long-term assets and liabilities at time *t*. Debt exposure is the ratio of total foreign currency denominated financial debts. All the exposure measurements are scaled by tangible assets at time *t-1* multiplied by the annual inflation rate at time *t*.

The mean values of total exposure are negative for each sample year. The negative balance sheet foreign exchange exposure indicates that Turkish industrial firms on average holds more foreign currency denominated liabilities than foreign currency denominated assets. This indicates currency mismatching on the balance sheet. We can surely say that Turkish industrial firms on average do not hedge their positions with on-balance sheet activities. However, we cannot say that they don't hedge their risk because we don't have available information on whether Turkish firms use off-balance sheet risk management instruments.

Table 1
Descriptive Statistics for Balance Sheet Exposures
Exposures are measured as the difference between TL value of foreign currency denominated assets and TL value of foreign currency denominated liabilities at time *t*. This difference is scaled by the TL value of tangible assets at time *t-1* multiplied by the annual inflation rate for time *t*. Short term foreign currency assets have three sub classifications; cash and bank accounts, receivables and securities. All is scaled TL value of foreign currency assets. On the liability side, TL value of foreign currency short term debt, short-term and long-term financial debts are scaled by TL value of foreign currency liabilities. Debt exposure is TL value of total foreign currency denominated financial debts scaled by tangible assets at time *t-1* multiplied by the annual inflation rate at time *t*. Table also reports annual rate of inflation calculated using consumer price index and change in real exchange rate index (1995=100) calculated by the Central Bank using consumer price indices for 19 countries.

	2000		**2001**		**2002**		**2003**	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Total Exposure	-0.22	-0.17	-0.29	-0.15	-0.23	-0.13	-0.15	-0.10
Short-term Exposure	-0.17	-0.13	-0.23	-0.11	-0.15	-0.07	-0.07	-0.05
Cash and Bank Accounts	0.29	0.04	0.31	0.11	0.36	0.17	0.30	0.09
Receivables	0.69	0.95	0.55	0.64	0.48	0.47	0.52	0.56
Securities	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
Short-term Debts	0.37	0.18	0.34	0.11	0.32	0.15	0.34	0.15
Short-term Financial Debts	0.49	0.49	0.50	0.55	0.48	0.51	0.47	0.48
Long-term Financial Debts	0.10	0.00	0.09	0.00	0.11	0.00	0.10	0.00
Long-term Exposure	-0.04	0.00	-0.06	0.00	-0.07	0.00	-0.07	0.00
Debt Exposure	0.23	0.14	0.33	0.16	0.29	0.14	0.21	0.14
Change in Real Ex. Rate Ind.	0.15		-0.22		-0.04		0.27	
Annual Inflation	0.39		0.69		0.30		0.23	

The mean values of short and long-term foreign exchange balance sheet exposures are also negative, but the ratio of short term exposure is higher. Moreover, the median values of total, short and long term exposures are still negative, but lower than the mean values. This also indicates that the number of firms that have currency matching on the balance sheet is not large. Examining the composition of short term foreign currency denominated assets shows that around 30% of them are cash and bank accounts. Receivables are around 60%, and 10% is for other foreign currency denominated short-term assets. On the liability side, 50% of foreign currency denominated liabilities is short-term financial debts and 10% of them is long-term financial debts.

The main issue here is that foreign currency exposure should be related with the change in real value of TL. Therefore, we also report the annual percentage change in real foreign exchange rate index (1995=100) calculated by the Central Bank from consumer price indices for 19 countries. The changes are positive 15% and 27% in 2000 and 2003 and negative 22% ad 4% in 2001 and 2002. The positive change indicates that TL has been overvalued (we may also say that TL has appreciated, on average, against the 19 countries' currencies). This makes import (because imports goods get cheaper) or foreign debts (because of the opportunity to get profit from covered interest arbitrage) more attractive. On the other hand, the negative change may indicate that TL has been undervalued. However, we can say that TL has approached to its value measured by purchasing power parity since the real exchange rate index is over 100 in the sample period. The negative change may also indicate that TL has depreciated, on average, against the 19 countries' currencies. In this case, exporting is more attractive, or TL value of foreign currency denominated liabilities increases and TL value of foreign currency denominated assets decreases. With the negative exposure, that is large fraction of firms' debt is foreign currency denominated while assets are mostly denominated in domestic currency, a large real depreciation deteriorates the firms' net worth. This will affect firms' investment.

There could be a lot of strategies that Turkish firms could have followed with their expectations on foreign exchange rate. Moreover, it is clear that the change in value of TL affects the composition of balance sheet for Turkish firms. Our objective is not to examine how foreign currency positions change with the change in the value of TL. We can only say in this point as shown in Table 1 that, anyhow, foreign currency denominated liabilities of Turkish industrial firms are more than

their foreign currency denominated assets. Our study focuses on the effect of exchange rate changes on the level of investment through several types of balance sheet foreign exchange rate exposures. Therefore, our analysis is designed to examine only this issue.

Table 2 presents number of observations and three balance sheet exposures (total, short and debt exposures) of the firms classified into major industrial groups. We see from this table that firms in all industries (except wholesale trade and transportation, communication and distribution) have negative balance sheet exchange rate exposures. Exposures are higher in following industries; food-beverages-tobacco, textile-clothing-leather, chemicals-petroleum-rubber-plastic, material construction, electric-gas-water, retail trade.[2] More interestingly, export oriented sectors, such as textile and material construction have the highest negative exposures whereas one may expect just the opposite. One reason behind this might be that these firms need financing to support their export sales and foreign currency denominated debt financing is cheaper in the case of overvalued TL. However, an unexpected depreciation of domestic currency may hurt them.

The first analysis that we use in this study is the comparison of balance sheet exposures of the firms that are split based on size, indebtedness, affiliation with holdings and banks. We also compare some financial characteristics of the firms that are classified according to total balance sheet exposures for each sample year. F-statistics that depend on the normal distribution are used for comparing the statistical significance differences between the mean values of the variables for the two defined groups. Wilcoxon test statistics are also employed to compare the median values. Fixed effects panel data analysis that controls both the differences between firms and time effects is performed to examine the effects of balance sheet exchange rate exposure and real exchange rate movements on investment, and the effects of investment on the firm value.

The following equations present fixed effect panel data regression models that we use in our analysis.

[2] We do not mention industries of health services and defense because there is only one firm representing these industries.

Investment Equation:

$$(I_{it}/K_{it-1}) = \alpha + \beta_1 (Exp_{it}/K_{it-1}) + \beta_2 (Exp_{it}/K_{it-1})\, RER_t + \beta_3 (ES_{it}/K_{it-1}) + \beta_4 (NWC_{it}/K_{it-1}) + \beta_5 \log(K_{it-1}) + \beta_6 (\text{Tobin's Q}) + \eta_{it} + \mu_t + \varepsilon_{it} \quad (1)$$

where, I_{it} is investment level, which is measured by the amount of tangible assets bought at time *t*. It is scaled, as every other variable is, by lagged tangible assets multiplied by the annual inflation rate at time *t* (K_{it-1}). Exp_{it} represents balance sheet foreign exchange exposure. We use three different balance sheet exposure measures; total exposure, short-term exposure, and debt exposure. Interaction variable [$(Exp_{it}/K_{it-1})\, RER_t$] is created by multiplying balance sheet exposure with annual change in real exchange rate index (RER_t). The estimated coefficient of this interaction term will measure the effect of balance sheet exposure and real exchange rate movements on investment. Control variables are export sales (ES_{it}), liquidity measured by the difference between current assets and short-term liabilities (NWC_{it}). These two variables are also scaled by tangible assets at time *t-1* multiplied by the annual inflation rate at time *t*. $\log(K_{it-1})$ is used to control firm size. Tobin's Q measures the firm value. η_{it} is for firm specific dummies and μ_t for time dummies in the panel data analysis. Time dummies also control all macro variables including the direct effect of real exchange rate change [Carranza et al. (2004)]. For instance, the dummy for the year 2001 enables us to control the effect of the economic crisis.

Firm value equation:

$$\text{Tobin's Q} = \alpha + \beta_1 (I_{it}/K_{it-1}) + \beta_2 (NWC_{it}/K_{it-1}) + \beta_3 \log(K_{it-1}) + \beta_4 (D_{it}/K_{it-1}) + \eta_{it} + \mu_t + \varepsilon_{it} \quad (2)$$

Tobin's Q ratio is the market value of equity plus short-term liabilities plus long-term liabilities at time *t* scaled by lagged assets multiplied by the annual inflation rate for time *t*. D_{it} is the sum of short and long-term debts. (D_{it}/K_{it-1}) controls for total debt level of firms.

We also test the endogeneity of investment and firm value by using the Hausman test [Wooldridge (2000, pages 483-484)]. This test is a two-stage test. First, the residuals are obtained from investment (firm value) equation and then are used in firm value (investment) equation as a control variable. The estimated coefficients and their significance levels are reported as Hausman test statistics (Table 6). Significant estimated coefficient would indicate that the related variable is endogenous.

4. Empirical Results

4.1. Univarite Analysis for Exposure and Financial Characteristics of Firms

In the first part of our analysis, we would like to examine the determinants of the degree of exchange rate exposure. We would like to see if some firms have different levels of balance sheet exchange rate exposure. For instance, large firms are involved in more foreign currency financing because they are more diversified and have less bankruptcy risk. On the other hand, as discussed by Rajan and Zingales (1995, p:1451) size is a proxy for the information that outsiders have. This means that asymmetric information problems may be less severe in large firms. If this is the case, they prefer equity relative to debt. This may cause to reduce foreign currency financing of large firms.

Firms affiliated with a business group or owned by a bank have advantage to create internal financing opportunities and therefore, they gain advantages to have more foreign currency debt financing. We also split the firms based on their total debt level to show that the degree of exchange rate exposure is correlated with financial position of the firms. All these issues are important because the relationship between investment and firm value is directly related with how firms finance their investment.

Table 3 reports the comparison results of total and debt exposures of the firms divided according to the size in each sample year. Firm size is measured by the TL value of total assets. We use two different classifications. (1) We compare exposures of firms that have total assets level either more or less than the sample median, and (2) we compare exposures of firms in the first quartile (smaller firms) with the fourth quartile (bigger firms). The results show that mean and median values of total exposure are negative for small and large firms, and also for firms in each quartile. We also observe that there is no statistically difference in total and debt exposures between small and large firms. This is also true for firms in the first and the fourth quartiles with the exception in year 2002 (the median values are still statistically the same in this year). All these results indicate that size is not the determinant for the degree of exchange rate exposure.

Table 2
Descriptive Statistics for Balance Sheet Exposures for Industrial Clasifications
The table presents number of observations and balance sheet exposures of the firms classified into major industrial groups. Total exposure is measured as the difference between TL value of foreign currency denominated assets at time *t* and TL value of foreign currency denominated liabilities at time *t*. This difference is scaled by the TL value of lagged tangible assets multiplied by the annual inflation rate at time *t*. Short-term exposure is calculated in the same way by using TL value of foreign currency denominated short-term assets and liabilities. Debt exposure is TL value of total foreign currency denominated financial debts scaled by tangible assets at time *t-1* multiplied by the annual inflation rate at time *t*.

	2000				2001				2002				2003			
	N	T.Exp.	S.Exp.	Debt E.	N	T.Exp.	S.Exp.	Debt E.	N	T.Exp.	S.Exp.	Debt E.	N	T.Exp.	S.Exp.	Debt E.
Food, Beverages, Tobacco	23	-0.31	-0.28	0.46	22	-0.34	-0.31	0.48	24	-0.47	-0.37	0.48	23	-0.36	-0.10	0.43
Textile, Clothing and Leather	33	-0.38	-0.33	0.44	33	-0.25	-0.20	0.39	35	-0.31	-0.22	0.38	35	-0.15	-0.11	0.35
Paper and Paper Pr., Print and Publish.	17	-0.13	-0.11	0.21	19	-0.14	-0.12	0.27	18	-0.32	-0.28	0.34	19	-0.12	-0.06	0.23
Chemicals, Petrol., Rubber, and Plastic	22	-0.26	-0.23	0.20	22	-0.35	-0.30	0.31	23	-0.25	-0.20	0.21	23	-0.21	-0.19	0.23
Stone and Soil Based Industry	31	-0.10	-0.09	0.26	30	-0.07	-0.06	0.24	32	-0.08	-0.06	0.18	31	-0.02	0.01	0.17
Metal Main Industry	13	-0.18	-0.17	0.34	13	-0.18	-0.16	0.41	13	-0.19	-0.19	0.36	13	-0.16	-0.15	0.34
Material Construction	27	-0.26	-0.16	0.37	28	-0.33	-0.16	0.40	28	-0.28	-0.05	0.39	29	-0.26	-0.08	0.33
Electric, Gas and Water	2	-0.24	-0.01	0.72	3	-0.16	0.01	0.73	4	-0.11	0.06	0.58	5	-0.04	0.07	0.59
Wholesale Trade	3	0.01	0.04	0.16	4	0.02	0.02	0.07	4	-0.03	-0.03	0.03	4	0.02	0.02	0.02
Retail Trade	6	-0.19	-0.12	0.30	7	-0.20	-0.14	0.28	6	-0.13	-0.10	0.28	6	-0.03	0.00	0.27
Restaurants and Hotels	5	-0.10	-0.10	0.28	6	-0.15	-0.14	0.41	8	-0.08	-0.01	0.32	8	-0.09	-0.09	0.36
Information Technology	6	0.07	0.07	0.03	6	0.08	0.08	0.03	6	0.10	0.10	0.13	5	0.03	0.03	0.24
Transport., Communication, and Distrib.	3	-0.07	0.16	0.28	5	-0.07	0.03	0.12	5	0.10	0.16	0.12	5	0.08	0.12	0.08
Health Services	1	-0.25	-0.09	0.34	1	-0.22	0.04	0.51	1	-0.11	0.03	0.48	1	-0.10	-0.01	0.45
Defense Industry	1	-0.27	-0.27	0.33	1	-0.50	-0.50	0.33	1	-0.30	-0.30	0.00	1	-0.23	-0.23	0.00
Total Number of Firms	193	-0.22	-0.17	0.23	200	-0.29	-0.23	0.33	208	-0.23	-0.15	-0.07	208	-0.15	-0.07	0.21

Table 4 reports the results of the comparison of balance sheet exposures of firms based on indebtedness, affiliation with holdings and banks for each sample year. In the first classification, we split firms by using the median value of sample firms' total debt levels. The results show that mean and median values of total exposure (debt exposure) are more negative (higher) for firms with total debt levels below sample median than for firms with total debt levels above sample median and the difference is statistically difference in each sample year. This result indicates that firms with higher level of debt use also more foreign currency denominated debt or vice versa, usage of more foreign currency denominated debts increases the level of total debts. For the possibility that firms with higher foreign currency denominated debt level may have more export sales based on balance sheet hedging principle, we compare export sales ratio between the two groups. We observe that in export sales ratio, there is no statistically difference between firms with total debt levels below sample median and firms with total debt levels above sample median. This finding again supports our argument that Turkish firms borrow foreign currency denominated debts without considering their level of involvements into international activities.

We also examine to figure out that the degree of foreign currency exposure of firms depend on their connection with a business group or a bank. It can be argued that firms can benefit from being in these types of relations due to presence of an active internal capital market. By pooling their available funds, firms are able to access to pooled resources for the most efficient use. By transferring funds from positive cash-flow generating divisions to financially constrained divisions with good investment opportunities, firms can finance their capital requirements by internal resources. This relation will also affect the relationship between investment and firm value. Therefore, we separate firms into two groups as firms with a bank or a holding participation in their capital and compare total and debt exposures between the two groups. The results are also reported in Table 4. Interestingly, we find no evidence that the degree of foreign currency balance sheet exposure of firms is related with the affiliation of firms with either holding or bank. This result has very important implication in terms of what we try to accomplish in this study. Our interpretation is that having affiliation with a holding or a bank has no effect to find sources for financing investment by using internal capital market on the relationship between foreign currency exposure and investment and between investment and firm value.

Table 3
Comparisons of Balance Sheet Exposures Based on Size

Year 2000	Mean	Median		Mean	Median		F Test	Chi-Sq.
	T. Assets ≤ 37 Bil. TL			T. Assets > 37 Bil. TL				
Total Exposure	-0.21	-0.15		-0.23	-0.18		(0.15)	[0.87]
Debt Exposure	0.23	0.12		0.22	0.16		(0.00)	[0.62]
	Mean	Median	Mean	Median	Mean	Median	Mean	Median		
	1st Quartile (N=49)		2nd Quartile (N=48)		3rd Quartile (N=48)		4th Quartile (N=48)		Q1 vs Q4	
Total Exposure	-0.21	-0.11	-0.21	-0.19	-0.24	-0.16	-0.22	-0.23	(0.00)	[2.95]*
Debt Exposure	0.25	0.10	0.20	0.15	0.26	0.15	0.20	0.17	(0.51)	[1.24]
Year 2001	T. Assets ≤ 55 Bil. TL			T. Assets > 55 Bil. TL				
Total Exposure	-0.22	-0.12		-0.20	-0.17		(0.16)	[1.27]
Debt Exposure	0.26	0.13		0.26	0.19		(0.01)	[0.72]
	1st Quartile (N=50)		2nd Quartile (N=50)		3rd Quartile (N=50)		4th Quartile (N=50)		Q1 vs Q4	
Total Exposure	-0.22	-0.08	-0.23	-0.13	-0.19	-0.15	-0.21	-0.19	(0.01)	[1.43]
Debt Exposure	0.26	0.17	0.25	0.11	0.27	0.18	0.26	0.20	(0.00)	[0.00]
Year 2002	T. Assets ≤ 70 Bil. TL			T. Assets > 70 Bil. TL				
Total Exposure	-0.29	-0.13		-0.16	-0.13		(2.44)	[0.00]
Debt Exposure	0.32	0.11		0.25	0.18		(1.00)	[3.75]**
	1st Quartile (N=52)		2nd Quartile (N=52)		3rd Quartile (N=52)		4th Quartile (N=52)		Q1 vs Q4	
Total Exposure	-0.34	-0.11	-0.23	-0.14	-0.19	-0.11	-0.14	-0.14	(2.73)*	[0.15]
Debt Exposure	0.39	0.11	0.26	0.12	0.29	0.21	0.21	0.16	(2.65)*	[0.61]
Year 2003	T. Assets ≤ 81 Bil. TL			T. Assets > 81 Bil. TL				
Total Exposure	-0.18	-0.10		-0.12	-0.10		(1.07)	[0.00]
Debt Exposure	0.21	0.06		0.20	0.16		(0.05)	[6.20]***
	1st Quartile (N=52)		2nd Quartile (N=52)		3rd Quartile (N=52)		4th Quartile (N=52)		Q1 vs Q4	
Total Exposure	-0.17	-0.06	-0.18	-0.11	-0.15	-0.11	-0.08	-0.05	(1.46)	[0.15]
Debt Exposure	0.25	0.06	0.18	0.06	0.23	0.18	0.17	0.15	(1.39)	[1.37]

We would also like to examine some firm specific characteristics of Turkish industrial firms that have opposite balance sheet exchange rate exposure. Therefore, we compare financial characteristics of the firms that are classified according to total balance sheet exposures for each sample year. We use two classifications: (1) we separate firms into the two groups as firms having negative and positive total exposure. And (2) we divided firms into four quartiles and we compare the firms in the first quartile (the most negative total balance sheet exposure) with the fourth quartile (the most positive total balance sheet exposure). The results are reported on Table 5. First of all, in each sample year, large number of firms has negative total exposure. The numbers are 158 versus 35 in 2000, 144 versus 56 in 2001, 142 versus 66 in 2002, and 139 versus 69 in 2003. The number of firms having negative total exposure has decreased after 2000. The reason might be a floating exchange rate regime started to be applied after February 2001. The comparisons of export sales ratio for each sample year show that there is no difference between firms with negative exposure and firms with positive exposure. The same results are valid for firms in the first and the fourth quartile. This result implies that export sales are not a determinant for the balance sheet total exposure of Turkish industrial firms.

We observe statistically significant differences in profitability measured by net income and earnings before interest (both of them are scaled by total assets) between firms with negative total exposure and firms with positive total exposure. In each sample year, except 2003 when real value of TL has appreciated, firms with positive exposure are more profitable then firms with negative exposure. This is also true for the comparison of firms in the first and the fourth quartile determined based on total exposure. This result indicates that firms with more foreign currency denominated debts with regard to foreign currency denominated assets are hurt by the depreciation of real value of TL. On the other hand, high profitable position of firms with positive total exposure in year 2000 cannot be related with the exchange rate changes because we see overvalued TL in this year. Therefore, we think that high profitability may be related to very high interest rates occurred in November 2000 with an economic crisis.

Table 4
Comparisons of Balance Sheet Exposures Based on Indebtedness, Affiliation with Holdings and Banks

	Year 2000						Year 2001					
	Mean	Median	Mean	Median	F Stat.	Chi.Sq.	Mean	Median	Mean	Median	F Stat.	Chi.Sq.
	T. Debt ≤ 0.58 (N=96)		T. Debt> 0.58 (N=97)				T. Debt≤0.62 (N=100)		T. Debt>0.62 (N=100)			
Total Exposure	-0.10	-0.10	-0.34	-0.28	(24.6)***	[24.5]***	-0.03	-0.02	-0.40	-0.36	(54.2)***	[49.8]***
Debt Exposure	0.11	0.08	0.34	0.28	(26.7)***	[23.1]***	0.13	0.07	0.39	0.34	(31.8)***	[23.0]***
Export Sales Ratio	0.20	0.13	0.27	0.17	(3.92)**	[1.02]	0.27	0.26	0.31	0.22	(0.94)	[0.24]
	Bank (N=63)		Non-Bank (N=130)				Bank (N=65)		Non-Bank (N=135)			
Total Exposure	-0.17	-0.16	-0.25	-0.18	(1.96)	[1.31]	-0.18	-0.13	-0.24	-0.16	(1.19)	[0.09]
Debt Exposure	0.20	0.17	0.24	0.15	(0.91)	[0.04]	0.23	0.14	0.28	0.18	(0.88)	[0.09]
	Holding (N=118)		Non-Holding (N=75)				Holding (N=122)		Non-Holding (N=78)			
Total Exposure	-0.25	-0.18	-0.19	-0.16	(1.50)	[0.64]	-0.26	-0.17	-0.17	-0.14	(2.54)	[0.77]
Debt Exposure	0.25	0.17	0.19	0.12	(1.55)	[2.50]	0.31	0.21	0.21	0.13	(3.94)**	[0.77]
	Year 2002						**Year 2003**					
	T. Debt ≤ 0.57(N=100)		T. Debt> 0.57(N=100)				T. Debt≤0.50 (N=100)		T. Debt>0.50 (N=100)			
Total Exposure	0.00	-0.00	-0.45	-0.30	(38.8)***	[40.5]***	-0.01	0.00	-0.29	-0.20	(24.2)***	[37.1]***
Debt Exposure	0.09	0.06	0.48	0.29	(32.5)***	[37.1]***	0.09	0.04	0.33	0.24	(31.4)***	[24.8]***
Export Sales Ratio	0.28	0.22	0.28	0.18	(0.01)	[0.39]	0.26	0.21	0.26	0.18	(0.00)	[0.24]
	Bank (N=70)		Non-Bank (N=138)				Bank (N=70)		Non-Bank (N=138)			
Total Exposure	-0.14	-0.13	-0.27	-0.14	(2.49)	[0.12]	-0.12	-0.08	-0.16	-0.10	(0.40)	[0.43]
Debt Exposure	0.21	0.18	0.32	0.13	(2.05)	[0.93]	0.18	0.15	0.22	0.12	(0.48)	[0.43]
	Holding (N=127)		Non-Holding (N=81)				Holding (N=127)		Non-Holding (N=81)			
Total Exposure	-0.24	-0.15	-0.22	-0.10	(0.05)	[1.47]	-0.17	-0.11	-0.11	-0.05	(0.83)	[0.61]
Debt Exposure	0.31	0.18	0.26	0.11	(0.45)	[3.85]**	0.23	0.15	0.17	0.09	(1.70)	[0.92]

The results of the other profitability measure, which is the ratio of operating profits to total assets, also show that firms with positive exchange rate exposure gain advantages in their operations. However, the evidence is not as strong as the other profitability variables. One could think that these firms may have more export sales, so that depreciation of the value of TL increases their revenues from export sales. However, we have already shown that there is no statistically significant difference in export sales between the two groups. On the other hand, it is very likely that cost of firms with negative total exposure depend on imported materials. We use two market based performance variables. One of them is Tobin's q, which is also used to measure firm value, and the other is average monthly stock returns in a particular year. We observe that Tobin's q of firms with positive total exposure is higher than that of firms with negative exposure in years 2000 and 2002. This difference is statistically significant for comparison of firms in the first and the forth quartiles in only year 2000. We have very similar results for average monthly stock returns. These results do not present strong evidence to conclude whether foreign exchange rate risk is priced in Turkish stock market. However, this issue is the not main concern for our study. We study on an indirect effect of exchange rate risk on the firm value.

Table 5
Comparisons of Some Financial Characteristics based on Total Balance Sheet Exposure

Year 2000	Total Sample			Total Exposure < 0			Total Exposure > 0				
	N	Mean	Median	N	Mean	Median	N	Mean	Median	F Test	Chi-Sq.
Export Sales Ratio	193	0.23	0.15	158	0.24	0.15	35	0.21	0.15	(0.44)	[0.01]
Net Income / Assets	193	0.02	0.04	158	0.00	0.03	35	0.09	0.10	(7.89)***	[6.03]***
Earnings Before Int. / Assets	193	0.12	0.14	158	0.11	0.13	35	0.16	0.20	(4.28)**	[4.34]**
Operating Income / Assets	193	0.07	0.08	158	0.07	0.08	35	0.09	0.07	(0.56)	[0.28]
Tobin's Q	193	1.68	1.38	158	1.53	1.31	35	2.34	1.78	(18.1)***	[6.03]***
Average Monthly Returns	161	0.44	-0.50	136	0.06	-1.05	25	2.52	1.66	(3.54*	[5.86]**

	1st Quartile (N=49)		2nd Quartile (N=47)		3rd Quartile (N=48)		4th Quartile (N=49)			Q1 vs Q4	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median		F Test	Chi-Sq.
Export Sales Ratio	0.31	0.20	0.21	0.16	0.23	0.12	0.18	0.10		(7.09)***	[2.30]
Net Income / Assets	-0.08	0.00	0.03	0.03	0.03	0.04	0.09	0.09		(15.2)***	[11.7]***
Earnings Before Int. / Assets	0.08	0.11	0.12	0.14	0.12	0.13	0.17	0.18		(7.14)***	[11.6]***
Operating Income / Assets	0.05	0.06	0.07	0.09	0.08	0.08	0.09	0.08		(1.84)	[0.36]
Tobin's Q	1.49	1.14	1.65	1.41	1.34	1.29	2.22	1.78		(8.06)***	[11.7]***
Average Monthly Returns	0.38	-1.38	-0.35	-1.11	-0.04	-0.54	2.00	1.25		(0.91)	[4.52]**

Year 2001	Total Sample			Total Exposure < 0			Total Exposure > 0				
	N	Mean	Median	N	Mean	Median	N	Mean	Median	F Test	Chi-Sq.
Export Sales Ratio	200	0.29	0.22	144	0.30	0.22	56	0.28	0.28	(0.15)	[0.98]
Net Income / Assets	200	-0.07	0.00	144	-0.13	-0.04	56	0.07	0.09	(16.7)***	[35.6]***
Earnings Before Int. / Assets	200	0.21	0.22	144	0.20	0.18	56	0.26	0.27	(6.65)***	[9.87]***
Operating Income / Assets	200	0.12	0.11	144	0.11	0.10	56	0.14	0.16	(1.41)	[2.47]
Tobin's Q	200	1.69	1.41	144	1.66	1.38	56	1.76	1.48	(0.52)	[0.89]
Average Monthly Returns	193	6.91	6.24	139	6.85	6.05	54	7.08	6.61	(0.10)	[2.70]*

	1st Quartile (N=50)		2nd Quartile (N=50)		3rd Quartile (N=50)		4th Quartile (N=50)			Q1 vs Q4	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median		F Test	Chi-Sq.
Export Sales Ratio	0.28	0.18	0.31	0.21	0.27	0.22	0.31	0.31		(0.33)	[3.96]**
Net Income / Assets	-0.30	-0.18	-0.06	-0.01	0.01	0.02	0.06	0.09		(26.1)***	[57.2]***
Earnings Before Int. / Assets	0.16	0.14	0.21	0.20	0.21	0.24	0.27	0.28		(10.6)***	[12.8]***
Operating Income / Assets	0.07	0.07	0.14	0.12	0.12	0.10	0.14	0.17		(5.24)***	[5.70]***
Tobin's Q	1.80	1.53	1.45	1.33	1.68	1.32	1.81	1.54		(0.00)	[0.01]
Average Monthly Returns	6.90	6.35	5.63	5.05	7.71	6.38	7.46	7.49		(0.42)	[0.25]

Table 5 (Continued)
Comparisons of Some Financial Characteristics based on Total Balance Sheet Exposure

Year 2002	Total Sample			Total Exposure < 0			Total Exposure > 0				
	N	Mean	Median	N	Mean	Median	N	Mean	Median	F Test	Chi-Sq.
Export Sales Ratio	208	0.28	0.21	142	0.28	0.18	66	0.28	0.29	(0.01)	[1.53]
Net Income / Assets	208	0.00	0.04	142	-0.04	0.02	66	0.08	0.08	(15.8)***	[16.3]***
Earnings Before Int. / Assets	208	0.16	0.15	142	0.15	0.15	66	0.19	0.18	(1.80)	[1.41]
Operating Income / Assets	208	0.10	0.09	142	0.09	0.08	66	0.12	0.10	(3.39)*	[1.41]
Tobin's Q	208	1.58	1.16	142	1.38	1.10	66	2.02	1.26	(3.37)*	[3.18]*
Average Monthly Returns	199	1.01	0.71	137	1.06	0.64	62	0.89	0.86	(0.08)	[0.12]

	1st Quartile (N=52)		2nd Quartile (N=52)		3rd Quartile (N=52)		4th Quartile (N=52)			Q1 vs Q4	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median		F Test	Chi-Sq.
Export Sales Ratio	0.31	0.18	0.28	0.20	0.21	0.13	0.32	0.35		(0.10)	[1.90]
Net Income / Assets	-0.13	-0.01	-0.02	0.02	0.04	0.05	0.10	0.10		(37.3)***	[29.1]***
Earnings Before Int. / Assets	0.16	0.14	0.11	0.14	0.18	0.17	0.20	0.21		(0.40)	[2.16]
Operating Income / Assets	0.06	0.08	0.08	0.08	0.10	0.10	0.13	0.13		(8.45)***	[5.08]***
Tobin's Q	1.70	1.29	1.19	1.08	1.21	1.04	2.24	1.31		(0.73)	[0.09]
Average Monthly Returns	0.48	-0.03	1.20	0.80	1.51	1.42	0.83	0.72		(0.24)	[0.65]

Year 2003	Total Sample			Total Exposure < 0			Total Exposure > 0				
	N	Mean	Median	N	Mean	Median	N	Mean	Median	F Test	Chi-Sq.
Export Sales Ratio	208	0.26	0.18	139	0.26	0.16	69	0.27	0.24	(0.02)	[2.33]
Net Income / Assets	208	-0.02	0.05	139	0.05	0.04	69	-0.14	0.05	(1.86)	[0.54]
Earnings Before Int. / Assets	208	0.10	0.08	139	0.10	0.09	69	0.10	0.08	(0.01)	[0.02]
Operating Income / Assets	208	0.04	0.04	139	0.03	0.04	69	0.06	0.06	(3.39)*	[1.75]
Tobin's Q	208	0.66	0.51	139	0.70	0.61	69	0.60	0.33	(0.32)	[23.5]***
Average Monthly Returns	201	1.73	1.31	135	1.85	1.26	66	1.47	1.54	(0.70)	[0.90]

	1st Quartile (N=52)		2nd Quartile (N=52)		3rd Quartile (N=52)		4th Quartile (N=52)			Q1 vs Q4	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median		F Test	Chi-Sq.
Export Sales Ratio	0.28	0.19	0.26	0.16	0.24	0.14	0.27	0.24		(0.04)	[0.15]
Net Income / Assets	0.07	0.05	0.03	0.04	0.04	0.04	-0.21	0.05		(1.20)	[0.01]
Earnings Before Int. / Assets	0.13	0.09	0.08	0.08	0.09	0.08	0.09	0.08		(2.17)	[0.61]
Operating Income / Assets	0.02	0.04	0.04	0.03	0.06	0.05	0.05	0.06		(1.72)	[1.37]
Tobin's Q	0.99	0.76	0.56	0.53	0.42	0.43	0.69	0.34		(0.89)	[29.9]***
Average Monthly Returns	2.09	1.98	0.92	0.77	2.40	1.63	1.53	1.58		(1.10)	[0.49]

4.2. Endogeneity of Investment and Firm Value

In this section, we examine the possibility of investment and firm value is endogenous. McConnel and Muscarella (1985) show that investment positively affects firm value. On the other hand, Fazzari et al. (1988) and Kaplan and Zingales (1997) use firm value measured by Tobin's q as determinant of investment level. These two different approaches suggest that investment and firm value might be interdependent. In fact, Cho (1998) find that investment affects firm value in his study that examines the possibility that investment and firm value are endogenously determined with the interdependency of the ownership structure.

To test the endogeneity issue, we perform OLS regressions on investment and also on firm value for each sample year separately. We also reply the same kind of analysis with taking averages of each variable in the whole sample period. In this analysis, we required firms to have all data items in each sample year. Therefore, the sample size decreases. Hausman test is the estimated coefficient of residuals obtained from firm value (investment) equation on investment (firm value). The results presented in Table 6 show that Tobin's Q has significant and positive effect on firm value in each sample year, except in 2003. We observe the same results with average values, which are reported in the last two columns of the table, in the whole period. Investment affects Tobin's Q positively in 2000, 2002, and in the whole period, but the effect is not statistically significant for years 2001 and 2003. Hausman test results present significant coefficients in all cases. This test result indicates that investment and firm value are interdependent. Therefore, we use Tobin's Q as a determinant of investment in the fixed effect panel data regression analysis presented in the next section.

4.3. Effects of Balance Sheet Exposure and Real Exchange Movements on Investment and Firm Value

We present the summary statistics of variables that were not examined in Table 5 before discussing the regression analysis. According to the summary results in Table 7, mean and median values of investment and liquidity are decreasing after economic crisis year, 2001. On the other hand, the mean (median) value of leverage rises in 2001 and then follows a decreasing trend. The mean and median values of size in each sample year are close to each other.

Table 6

Endogeneity for Effect of Balance Sheet Exchange Rate Exposure on Investment, and for Effect of Investment on Firm Value (2000-2003)

This table presents results for OLS regression analysis where the dependent variables are the investment level of the firm and Tobin's Q for each sample year to test that investment and firm value are endogenous. Investment level is the ratio of tangible assets bought at time *t* to lagged tangible assets multiplied by the annual nominal inflation rate at time *t*. Tobin's Q ratio is the market value of equity plus short-term liabilities plus long-term liabilities at time *t* scaled by lagged assets multiplied by the annual inflation rate for time *t*. Hausman test is the estimated coefficient of residuals obtained from firm value (investment) equation on investment (firm value).

	YEAR 2000		YEAR 2001		YEAR 2002		YEAR 2003		2001-2003	
Variables	**Invest.**	**T Q**	**Invest.**	**T Q**	**Invest.**	**T Q**	**Invest.**	**T Q**	**Invest.**	**T Q**
	Eq. (1)	Eq. (2)	Eq. (1)	Eq. (2)	Eq. (1)	Eq. (2)	Eq. (1)	Eq. (2)	Eq. (1)	Eq. (2)
Constant	1.60	1.08	-0.16	-1.51	14.26	5.15	0.93	1.07	0.02	0.49
	(2.32)**	(1.26)	(-0.69)	(-0.63)	(3.91)***	(1.30)	(3.72)***	(2.85)***	(0.14)	(0.76)
Total Exposure	-0.03		-0.003		0.04		-0.004		-0.01	
	(-2.35)**		(-1.71)*		(2.66)***		(-1.40)		(-6.32)***	
Short-term Exposure										
Investment		0.29		0.80		0.24		-0.16		0.67
		(2.11)**		(1.11)		(3.74)***		(1.60)		(2.58)**
Tobin's Q	0.08		0.01		0.23		-0.09		0.06	
	(1.89)*		(2.19)**		(3.38)***		(-1.68)*		(3.01)***	
Export Sales Ratio	0.01		-0.03		3.72		-0.05		0.0002	
	(0.05)		(-0.80)		(4.47)***		(-0.56)		(0.00)	
Liquidity	0.01	0.02	0.002	-0.004	-0.01	-0.004	0.003	0.02	0.01	-0.0001
	(1.12)	(2.84)***	(1.82)*	(-0.45)	(-1.43)	(-0.57)	(1.41)	(2.84)***	(7.99)***	(-0.06)
Size	-0.09	0.05	0.02	0.17	-0.92	-0.20	-0.04	-0.002	0.01	0.04
	(-2.13)**	(0.59)	(1.68)*	(1.14)	(-4.3)***	(-0.86)	(-3.0)***	(-1.32)	(0.62)	(1.10)
Leverage		-0.01		0.05		-0.002		-0.001		0.002
		(-0.84)		(5.21)***		(-0.34)		(-0.15)		(0.93)
HAUSMAN TEST	(0.08)**	(0.27)**	(0.01)*	(1.25)*	(0.23)***	(0.25)***	(-0.09)*	(0.17)*	(0.31)*	(0.06)*
# of Observations	186	186	194	194	204	204	201	201	186	186
Adj. R Square	0.08	0.05	0.02	0.15	0.22	0.06	0.07	0.10	0.30	0.04
F Statistics	4.19***	3.24***	1.91*	9.27***	12.4***	4.41***	3.82***	6.84***	16.4***	2.80**

Table 7
Summary Statistics

	2000 (N=193)		2001 (N=200)		2002 (N=208)		2003 (N=208)	
Investment	0.066	0.040	0.085	0.037	0.053	0.032	0.034	0.014
Size	17.447	17.419	17.827	17.815	18.063	18.059	18.203	18.212
Liquidity	0.138	0.180	0.082	0.149	0.071	0.168	0.075	0.170
Leverage	0.602	0.581	0.684	0.622	0.688	0.566	0.654	0.503

Table 8 reports the results for regression models with fixed effect panel data analysis.[3] In the models where investment level is the dependent variable, we examine the effects of three different balance sheet exposure measures. Total exposure in the models titled as "Investment (1)", short-term exposure in "Investment (2)" and debt exposure in "Investment (3)" are used as independent variables. The variable of "Exposure x RER" represents the interaction effect of balance sheet exposure and real exchange rate movements on investment. Each investment column has two different models; therefore there are six equations related with investment. In all Eq. (1), we use all control variables except Tobin's Q. Since we show that firm value and investment are endogenous we also use Tobin's Q as another explanatory variable of investment in all Eg. (2).

We observe that the estimated coefficients of "exposure" in each investment equation are positive and statistically significant at 1 percent level. This result implies that firms with less negative or positive balance sheet exchange exposures increase their investment level. On the other hand, the estimated coefficients of the interaction variable of exposure with the percentage change in real exchange rate are negative and significant at 1 percent level. This result shows that Turkish industrial firms are affected by exchange rate movements differently according to their balance sheet exchange rate exposures. Negative coefficient of the interaction variable indicates that investment level decreases if the firms have negative (positive) balance sheet exposure and the change in real exchange rate index is negative (positive). This evidence is consistent with our expectation that the firms with negative exposure invest less when change in real value of TL is negative. The reason behind this finding is that the depreciation of the value of TL deteriorates the net worth of the firms whose fraction of foreign currency denominated debts is larger than that of foreign currency denominated assets. Moreover, the firms that have positive balance sheet exposure invest also less when TL appreciates because the TL value of foreign currency denominated assets decreases.

[3] We have already identified the endogeneity problem in the previous section. We are aware that the empirical model (fixed effects) that we employ may lead to inconsistent estimators as explanatory variables are going to be dependent on the disturbance term in the case of endogeneity. The endogeneity problem may be captured through using alternative estimation methods using a simultaneous equation framework like Two Stage Least Square (2SLS) or GMM. Unfortunately, the results using a simultaneous equation framework seem partially dependent on model specification. The different models may create different results. Therefore, we prefer to use fixed effect panel data analysis.

In all Eq. (2) in which investment is the dependent variable, Tobin's Q has positive and significant (at 1 percent level) estimated coefficient. This evidence indicates that firm value determines investment. However, the effect of interaction variables between exposure and change reel exchange rate is still significant. Other control variables have statistically significant estimated coefficients. Investment level of the firms increases with export sales and decreases with liquidity and size. These results are the same in all investment equations. The estimated coefficients of year dummies that control the impact of the economic turbulences in specific years are negative and statistically significant. The most negative sign belongs to year 2001, showing that the Turkish economy has witnessed a credit crunch that brought about sharply decline financial and real activity in 2001.

Tobin's q equation measures the effect of investment on the firm value. The estimated coefficients of the variable investment are positive and significant as expected in two equations. The value of firms increases with the level of investment. Among the control variables, size has the negative and significant coefficient. Our sample does not detect any significant effects of liquidity and debt level on the firm value. We observe that the values of the firms are higher in 2002 and 2003. The estimated coefficients of these two time dummies are positive and statistically significant.

5. Conclusion

We test the hypothesis that a combined effect of fluctuating real exchange rates with net foreign currency position of Turkish firms affect their investment decisions and then investment affects the firm value. We claim that balance sheet exchange rate exposure of Turkish firms is a better measure to examine the effects of exchange rate fluctuations than classification of firms based on their international activities. The combined effect is detected as being negative on investment level of Turkish industrial firms. Investment amount at time t scaled by the total amount of tangible assets at time t-1 decreases for the firms with negative (positive) balance sheet exchange rate exposure when the change in the real value of TL is negative (positive). This evidence is true when we control the effect of firm value on investment. Moreover, the relationship between firm value and investment is positive. Our findings contribute to the limited existing body of literature regarding foreign currency exposure of Turkish firms and other emerging markets. We believe that our results are complimentary to Kiymaz's study that shows that monthly stock returns of Turkish firms that are either exporter or importer are affected negatively only by exchange rate changes.

Table 8

Effects of Balance Sheet Exchange Rate Exposure and Real Exchange Movements on Investment, and Effect of Investment on Firm Value (2000-2003)

The table presents results for fixed effect panel data analyses where the dependent variables are the investment level of the firm and Tobin's Q. Investment level is the ratio of tangible assets bought at time *t* to lagged tangible assets multiplied by the annual nominal inflation rate at time *t*. Tobin's Q ratio is the market value of equity plus short-term liabilities plus long-term liabilities at time *t* scaled by lagged assets multiplied by the annual inflation rate for time *t*. We use three different balance sheet exposure measures; total exposure is used in the model of Investment (1), short-term exposure is used in the model of Investment (2), and debt exposure is the independent variable in the model of Investment (3). Interaction variable is created by multiplying balance sheet exposure with annual change in real exchange rate index. Control variables are Export sales, liquidity measured by the difference between current assets and short-term liabilities. These two variables are also scaled by tangible assets at time *t-1* multiplied by the annual nominal inflation rate at time *t*. Leverage controls the firm's debt level.

Variables	**Investment (1)**		**Investment (2)**		**Investment (3)**		**Tobin's Q**	
	Eq. (1)	Eq. (2)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (4)	Eq. (1)	Eq. (2)
Exposure	0.04	0.04	0.04	0.04	-0.04	-0.04		
	(5.78)***	(5.18)***	(5.73)***	(5.11)***	(-5.25)***	(-4.62)***		
Exposure x RER	-0.06	-0.05	-0.06	-0.05	0.06	0.05		
	(-3.21)***	(-2.13)**	(-3.18)***	(-2.14)**	(2.79)***	(1.98)**		
Investment							0.14	0.14
							(3.09)***	(2.93)***
Tobin's Q		0.08		0.08		0.08		
		(2.13)**		(2.13)**		(2.13)**		
Export Sales Ratio	1.09	0.93	1.10	0.94	1.37	1.22		
	(2.56)**	(2.17)**	(-2.58)***	(-2.18)***	(3.22)***	(2.85)***		
Liquidity	-0.49	-0.01	-0.48	-0.01	-0.49	-0.001		-0.01
	(-1.71)*	(-0.96)	(-1.68)*	(-0.89)	(-1.72)*	(-0.11)		(-0.04)
Size	-3.38	-3.19	-3.37	-3.18	-3.58	-3.36	-1.62	-1.80
	(-12.29)***	(-11.2)***	(-12.26)***	(-11.14)***	(-12.25)***	(-11.10)***	(-5.13)***	(-4.81)***
Leverage								0.0001
								(0.88)
Year 2001	-3.15	-3.05	-3.14	-3.03	-3.37	-3.37	-0.01	-0.20
	(-8.76)***	(-8.48)***	(-8.73)***	(-10.67)***	(-8.97)***	(-8.97)***	(-0.02)	(-0.43)
Year 2002	-1.41	-1.35	-1.41	-1.35	-1.46	-1.46	0.73	0.64
	(-5.47)***	(-5.32)***	(-5.47)***	(-5.31)***	(-5.58)***	(-5.58)***	(2.52)**	(2.06)**
Year 2003	-0.78	-0.76	-0.79	-0.77	-0.83	-0.83	0.76	0.70
	(-3.24)***	(-3.17)***	(-3.26)***	(-3.18)***	(-3.41)***	(-3.41)***	(2.81)***	(2.49)**
# of Observations	783	780	783	780	783	780	784	782
R Square	0.62	0.63	0.62	0.63	0.62	0.62	0.54	0.55
F Statistics	4.59***	3.77***	4.59***	3.76***	4.54***	3.82***	3.37***	3.38***

References

Adler, M. and Dumas, B. 1984. Exposure to Currency Risks: Definition and Measurement. *Financial Management* 13: 41-50.

Bartov, E. and Bodnar, G.M. 1994. Firm Valuation, Earnings Expectations, and the Exchange Rate Exposure Effect. *Journal of Finance* 44(5): 1755-1785.

Benavente, J.M., Johnson, C.A. and Morandé, F.G. 2003. Debt Composition and Balance Sheet Effects of Exchange Rate Depreciations: A Firm Level Analysis for Chile. *Emerging Markets Review* 4: 397-416.

Bonomo, M., Martins, B. and Pinto, R. 2003. Debt Composition and Exchange Rate Balance Sheet Effect in Brazil: A Firm Level Analysis. *Emerging Markets Review* 4: 368-396.

Carranza, L.J., Cayo, J.M. and Galdón-Sánchez, J.E. 2003. Exchange Rate Volatility and Economic Performance in Peru: A Firm Level Analysis. *Emerging Markets Review* 4: 472-496.

Cho, M.H. 1998. Ownership Structure, Investment, and the Corporate Value: An Empirical Analysis. *Journal of Financial Economics* 47:103-121.

Choi, J.J. and Prasad, A.M. 1995. Exchange Risk Sensitivity and its Determinants: A Firm and Industry Analysis of U.S. Multinationals. *Financial Management* 24(3): 77-88.

Doukas, J., Hall, P.H. and Lang, L.H.P. 1999. The Pricing of Currency Risk in Japan. *Journal of Banking and Finance* 23: 1-20.

Fazzari, S.M., Hubbard R.G. and Petersen B.C. 1988. Financing Constraints and Corporate Investment. *Brooking Papers on Economic Activity* 1: 141-195.

Forbes, K. 2002. How Do Large Depreciations Affect Firm Performance?. *NBER Working Paper* 9095.

Harvey, C. and Hopper, A. 1999. The Asian Bet. In Harwood, A., Litan, R.E. and Pomerleano, M. (eds.), *The Crisis in Emerging Financial Markets*. Brookings Institution Press: 29-115.

Jorion, P., 1990. The Exchange Rate Exposure of U.S. Multinationals. *Journal of Business* 63(3): 331-345.

_____ 1991. The Pricing of Exchange Rate Risk in Stock Market. *Journal of Financial and Quantitative Analysis* September: 363-376.

Kaplan, S.N. and Zingales L. 1997. Do investment-Cash Flow Sensitivities Provide Useful measures of Financing Constraints. *Quarterly Journal of Economics* 112: 169-215.

Kiymaz, H. 2003. Estimation of Foreign Exchange Exposure: An Emerging Market Application. *Journal of Multinational Financial Management* 13: 71-84.

McConnell, J. and Muscarella C. 1985. Corporate Capital Expenditure Decisions and the Market Value of the Firm. *Journal of Financial Economics* 14: 399-422.

Pratap, S., Lobato, I. and Somuano, A. 2003. Debt Composition and Balance Sheet Effects of Exchange Rate Volatility in Mexico: A Firm Level Analysis. *Emerging Markets Review* 4: 450-471.

Rajan, R. and Zingales L. 1995. What Do We Know About Capital Structure? Some Evidence from International Data. *Journal of Finance* 50 (5): 1421-1460.

Wooldridge, J. 2000. *Introductory Econometrics: A Modern Approach,* South-Western College Publishing: Thomson Learning.