



# Exchange rate exposure at the firm and industry levels: Evidence from Turkey



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## ABSTRACT

The purpose of this study is to examine industry-weighted exchange rate exposure at the firm and industry level for Turkish plants. We use an unbalanced panel of plant-level data for manufacturing firms in Turkey during the years of 2002 and 2010 in seven industries. The results indicate that macro indicators seem to be a more significant influence on the exchange rate exposure. Moreover, industry-weighted openness is the most important factor to determine the exchange rate exposure for Turkish firms. We also find that the direction of exposure varies at the industry level.

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## 1. Introduction

Financial liberalization and the implementation of more flexible exchange rate regimes have created significant variation and uncertainty in exchange rates in both developed and developing countries. Exchange rate movements have become an essential feature of the international economic environment, particularly as a result of globalization. Nieh and Wang (2005) have argued that these changes require adjustments in firms' costs and benefits as well as increasing exchange rate exposure to enterprises and financial institutions.

The exchange rate sensitivity affects the firm value since firms' future cash flow would be adjusted according to the fluctuations in foreign exchange rates. For instance, while the value of an exporting firm is more likely to decrease based upon the appreciation of domestic currency, the value of an importing firm tends to increase. Exchange rates can impact stock prices not only for exporting firms but also for domestic firms since they may import a part of their inputs and compete with foreign firms in the domestic market. Early theoretical studies such as Heckerman (1972), Ethier (1973), Shapiro (1975) and Hodder (1982) recognize the importance of exchange rate risk on firms, and develop different determinants of exchange rate exposure. However, empirical findings of the exchange rate effect on firms and its implications have not been as powerful or reliable as expected based on theoretical predictions (Williamson, 2001).<sup>1</sup>

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<sup>1</sup> Most of the empirical studies show a statistically insignificant link between exchange rate change and firm's value. See, e.g., Jorion (1990), Bodnar and Gentry (1993), and Khoo (1994).

According to seminal studies by Dumas (1978) and Adler and Dumas (1980), economic exposure to exchange rate fluctuations can be examined by the regression coefficient of the real value of the firm on exchange rate across states of nature.<sup>2</sup> Many researchers study determinants of exposure at firm, industry or national level.<sup>3</sup> Jorion (1990) shows a statistically insignificant link between foreign sales and exposure for U.S. multinationals. Bartov and Bodnar (1994) also find no correlation between stock prices and exchange rate exposure for US companies.<sup>4</sup> However, Choi and Prasad (1995) report a significant exchange rate exposure for 15% of the nonfinancial firms and 10% of the industry portfolios in the U.S. He and Ng (1998) state that only about 25% of 171 Japanese multinational corporations have major exchange rate exposure. Griffin and Stulz (2001) find that weekly exchange rate shocks have a negligible impact on the performance of industries for six industrialized countries.<sup>5</sup> Dominguez and Tesar (2006) show that exposure is correlated with international status, foreign sales, size, trade and competitiveness at the industry level. A study by Muller and Verschoor (2009) reports that trade and service industries are more sensitive to exchange rate conditions for U.S. multinationals.

<sup>2</sup> See, e.g., Jorion (1990) for detailed discussion.

<sup>3</sup> According to Chue and Cook (2008), one needs to distinguish between the direct effects of exchange rate variability on firm value, and the effects of other macroeconomic shocks to measure exposure at national level.

<sup>4</sup> Bartov and Bodnar (1994) point out that the link between exchange rate changes and firm's stock returns was "mispricing". They conclude that the stock market did not instantly response to exchange rate changes.

<sup>5</sup> Bodnar and Gentry (1993) find that the industries with significant exposures are 23%, 21%, and 25% for the U.S., Canada and Japan respectively. Prasad and Rajan (1995) also show that the industries with significant exposures are 15%, 4%, and 6% for the U.S., Japan and the U.K. respectively.

Early empirical studies on exchange rate exposure have provided weak statistical evidence. Hence, recent studies focus more on methodological and technical issues. *Bodnar and Wong (2003)* point out that variation in period raises firm-level exposures, if empirical strategy controls for macroeconomic and market-wide capital market effects. *Dominguez and Tesar (2001a)* argue that a country-level exchange rate is not suitable for estimating firm-level parameter in an empirical model.<sup>6</sup> They also use the capital market model to measure exchange rate exposure.<sup>7</sup> On the other hand, *Martin and Mauer (2003, 2005)* employ cash-flow approach to determine the sensitivity of cash flows to exchange rate variation. *Chue and Cook (2008)* employ an instrumental variable method to define the total exposure of a firm to exchange rate movements.

A limited number of studies document the exchange rate exposure for developing markets at the firm or industry level. *Mørck et al. (2000)* find that stock prices in developing economies are more synchronized with those in developed economies over time. *Kho and Stulz (2000)* show that currency depreciation has a negative impact on banking sector in Indonesia and the Philippines. *Kiyamaz (2003)* shows that Turkish firms are highly exposed to foreign exchange risks during the period of 1991–1998. *Dominguez and Tesar (2006)* provide evidence that the majority of Thai firms have a negative exposure to local currency depreciation. *Chue and Cook (2008)* study foreign exchange exposure for 15 emerging markets at country and firm-level. They show that only 4.9% of the firms were significantly exposed to foreign exchange risk. Studies examining exchange rate exposure for developing countries generally conclude that small numbers of firms are exposed to exchange rate exposure.<sup>8</sup>

In this study, we address the several potential problems that might affect the empirical design. First, the majority of exposure studies in the literature employ trade-weighted exchange rate that derived from national volume of exports and imports figures with foreign countries. However, national figures neither fit nor represent the characteristics of individual firms or industries. We use industry-weighted exchange rate indices that prevail biased results of this note.<sup>9</sup> Second, firms reflect different characteristics in a country. *Hutson and O'Driscoll (2010)* state that industries are influenced differentially by exchange rate sensitivity. Therefore, the components of this exposure should differ across industries and sizes. If some industries have more foreign operations relative to other industries, they may have more exchange rate sensitivity. Similarly, exposure may vary with firm size. *Bodnar and Wong (2003)* and *He and Ng (1998)* find evidence that large firms have more exposure than small firms in the U.S. and Japan. We examine exchange rate exposure and its determinants for firms by controlling industry affiliation and firm size. Third, the different results regarding the determinants of the exposure relation highlight the need for a methodical comparison of exchange rate exposure in terms of firm-specific factors and macroeconomic indicators.<sup>10</sup> We believe that firm-specific factors and macroeconomic indicators may explain substantial amounts of the variation on exposure.<sup>11</sup> In this study, the empirical strategy is conducted using firm-specific and macroeconomic variables on exposure. Fourth, openness is one of the key factors that might influence exchange rate

exposure. *Hutson and Stevenson (2010)*, and *Hutson and O'Driscoll (2010)* use trade-weighted exports and imports as a proxy for openness. However, as noted by *De Jong et al. (2006)*, using a trade-weighted openness may contain aggregation problem. Unlike previous studies, in this paper we calculate industry-weighted openness for each industry to prevent aggregation problem in trade openness figures.

As an open economy, Turkey has experienced remarkable phases of growth over the last nine years. In 2010, Turkish trade to GDP ratio was 40.5%. Turkey underwent a substantial financial reform after the crisis in February 2001. A new program was designed to adapt floating exchange rate regime after years of managed/pegged exchange rate regime with tight fiscal policy and implement structural reforms. The observable transformations in the Turkish Economy have also encouraged foreign trade. Turkish exports reached USD 114 billion by the end of 2010, up from USD 36 billion in 2002. On the other hand, imports increased USD 51 billion to USD 177 billion during the same period. Due to growing economy, the Turkish stock market, Istanbul Stock Exchange (ISE), is one of the fastest emerging security exchange corporations in the World and is not under heavy regulations. The market capitalization value of ISE increased from \$33.96 billion to \$306.62 billion during 2002–2010.<sup>12</sup> In addition, exchange rate exposure is one of the important external risks at plant level. Turkish firms have been using hedge instruments in the organized market since 2005. According to the annual reports of Turkish Derivatives Exchange Market, annual derivatives trading volume for currency (U.S. dollar and EUR) increased by 1.7 billion U.S. dollar to 31.9 billion U.S. dollar during the period of 2005 to 2010. In the same period, annual currency trading volume increased by 4.6 billion U.S. dollar to 7.4 billion U.S. dollar and this indicates that derivatives/spot market rate increased from % 0.38 to % 431.<sup>13</sup> This ratio shows the firms' engaging in currency derivatives to cover their exchange rate risk. *Geczy et al. (1997)* and *Allayannis and Ofek (2001)* point out that large firms are more likely to use currency trading and derivatives. In this note, we find that large firms tend to be less exposed to exchange rate exposure than small and medium firms.<sup>14</sup>

This note investigates exchange rate exposure and its determinants for Turkish plants during the period from 2002 to 2010. The estimation is conducted using panel data technique to measure the role of firm-specific factors and macro indicators on exposure. The results show that macro-specific factors seem to be a more significant influence on the exchange rate exposure. Moreover, industry-based trade openness is the most important factor to determine exchange rate exposure for Turkish firms. We also find that the direction of exposure varies at the industry level.

The reminder of the paper is as follows. *Section 2* discusses data. *Section 3* presents empirical methodology. *Section 4* shows the empirical results and *Section 5* presents robustness checks. Finally, *Section 6* provides conclusion.

## 2. Data

The present study uses plant-level manufacturing data obtained from Bureau van Dijk's Orbis database during the period of 2002 through 2010.<sup>15</sup> The total sample consists of 173 manufacturing and services firms listed on the Istanbul Stock Exchange (ISE).<sup>16</sup> The selected firms are 48% of all firms in the ISE. Based on firms' affiliation, the following industry sub-samples are constructed: food, wood, chemicals, metal-machinery, non-metals, textiles and services. They are also

<sup>6</sup> Such as "basket" or trade-weighted exchange rates.

<sup>7</sup> *Dominguez and Tesar (2001b, 2006)* use the same model.

<sup>8</sup> See *Abdalla and Murinde (1997)*, *Kho and Stulz (2000)*, *Parsley and Popper (2006)* and *Lin (2011)*.

<sup>9</sup> Using firm-specific exchange rate is more appropriate than industry-weighted exchange rate. However, the availability of data is limited to use firm-specific exchange rate for Turkish plants.

<sup>10</sup> A few studies in the empirical exposure literature have primarily focused on both the impact of firm-specific factors and macroeconomic indicators to explain determinants of exchange rate exposure. See, e.g., *Dominguez and Tesar (2006)*, *Chue and Cook (2008)*, *Hutson and Stevenson (2010)*, and *Hutson and O'Driscoll (2010)*.

<sup>11</sup> *He and Ng (1998)*, *Muller and Verschoor (2006)*, *Choi and Jiang (2009)* and *Aggarwal and Harper (2010)* use only firm-specific variables to show exchange rate exposure. On the other hand, *Bredin and Hyde (2011)* and *Entorf et al. (2011)* explore the exchange rate exposure at national level.

<sup>12</sup> Source: <http://databank.worldbank.org/>.

<sup>13</sup> Source for annual currency trading volume: The Association of Capital Market Intermediary Institutions of Turkey, <http://www.tspakb.org.tr/eng/>.

<sup>14</sup> This finding is consistent with the result of *Bodnar and Wong (2003)* and *Dominguez and Tesar (2006)*.

<sup>15</sup> This database contains comprehensive financial information on companies worldwide. Source: <https://orbis2.bvdep.com/>.

<sup>16</sup> These firms are selected based on firm-level data availability.

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