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Exports, Real Exchange Rates and External Exposures: Empirical Evidence from Turkish Manufacturing Firms

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Exports, Real Exchange Rates and External Exposures: Empirical Evidence from Turkish Manufacturing Firms

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Abstract

Turkish manufacturing firms are highly exposed to foreign currency (FX) denominated costs in the forms of liability dollarization and high imported input content in domestic production. This might limit the competitiveness effects of currency depreciation on exports. We attempt to uncover the relationship between the real exchange rates and exports of manufacturing firms in Turkey by taking account FX exposures and various firm characteristics. We use a large panel of manufactıring firms to carry out an empirical analysis for the period 2002-2010. We document that a real depreciation of the Turkish lira has a positive impact on export volumes and its impact is muted for manufacturing firms operating in sectors that use imported inputs intensively. That is, the cost of production channel seems to be effective in export performance of firms. In addition, we estimate that exports are less sensitive to real exhange rates for firms having moderate or low FX debt-to-export ratios (naturally hedged) and those are large and mature. Contrary to macro evidence, firm level findings suggest that a depreciation of Turkish lira seems to favor the external competitiveness of firms in general while for naturally hedged, large, mature, and high import intensity firms, the sensitivity is estimated to be smaller.

Keywords: exports, real exchange rates, currency mismatch, firm characteristics
JEL Classification: F23, F31, G15, G31, G32

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I. Introduction

With the availability of firm-level evidence, the dynamics of exporting activity has been a major area of interest among empirical researchers following Bernard and Jensen (1999). This line of research has demonstrated the presence of substantial productivity differences among establishments in similar industries which are strongly correlated with the establishments' export status (Bernard and Jensen, 1999, Baldwin and Gu, 2003). These findings contributed to the development of the new-new trade theory with the seminal paper of Melitz (2003). In this setting individual firms are subject to sunk costs such as cost of acquiring local information, establishing a local distribution network, and modifying goods to adjust the local market tastes. In the presence of these entry costs, only relatively more productive firms are able to export and productivity appears as an important determinant for firms to engage in exporting activity.

These sunk costs of exporting can be perceived as a form of investment and need to be financed (Bernard et al., 2003; Bernard and Jensen, 2004; Campa, 2004; Helpman et al., 2004; Roberts and Tybout, 1997; Roberts et al., 1997 and Tybout, 2003). Empirical literature has documented that financially strong firms are more likely to enter the export markets since their financial positions affect their investment and spending decisions associated with sunk costs (Greenaway et al. 2007). This literature opened a line of empirical research testing the role of financial constraints in firms' intensive and extensive margins of trade by using rich micro datasets mostly available for developed economies (see, for example, Forlani, 2010; Minetti and Zue, 2011 for Italy; Gorg and Spailara (2014), for the UK, Bellone et al. 2010 for France). Further research in this field has stressed the role of financial health in generating an additional source of heterogeneity that could possibly account for differences in exporting behavior across firms. In this framework, financial constraints can create a disconnection between productivity and exporting such that productivity can be major determinant of the export decision only if the firm has a sufficient access to external finance (Berman and Hericourt, 2010; Liu and Li, 2015).

The empirical trade literature has so far paid little attention to the possible effects of FX exposures (or FX denominated cost items including debt) on financial positions of firms in examining the impact of exchange rates on exporting behavior. Under perfect capital markets, a firm's financial position is irrelevant to its decisions on production and investment activities (Modigliani and Miller, 1958). However, in imperfect financial markets, informational asymmetries create a wedge between internal and external finance (Bernanke and Gertler, 1995). Therefore, the extent of the changes in activities of firms as a result of external shocks depends very much on how these activities are financed. That is, the activities of firms with limited internal funds or financially constrained firms are more sensitive to retained earnings or cash flows as empirically documented by Fazzari et al.(1988).

Consequently, for firms with large foreign exchange denominated debt (a form of external finance), a shock to capital inflows or sudden stops may lead to a rise in exchange rate volatility and have strong implications for their financial positions thus their real activities (Calvo and Reinhart, 2002; Calvo *et al*., 2004). The potential effects of these shocks are amplified, particularly in the case of "currency mismatch" when firm's debt is largely in the form of FX and its income and assets are mostly denominated in domestic currency. Particularly in the context of developing countries, this is an important area of research as exchange rates are more volatile, hedging instruments are not widely used, and domestic production is highly dependent on foreign exchange denominated cost items.

In a simple framework, a real depreciation of domestic currency (a decline in the real exchange rate index) may affect firms' exports through three channels. First channel is the rise in the foreign demand for exports as a result of a decrease in the FX value of the exported goods. In this way, a firm will gain competitive advantage in international markets, and a margin is created both for an increase in the quantity and the local currency denominated unit price of the exported goods. The second channel exhibits itself through imported and FX indexed domestic inputs. Accordingly, currency depreciation will increase production costs of companies that rely heavily on these inputs. In this study, we particularly pay attention to the fact that the domestic production of manufacturing firms is highly exposed to FX denominated costs. Therefore, the competitiveness impact of a real depreciation of domestic currency might be muted by these counter-acting cost items. That is, an exchange rate policy intending to reduce external imbalances might not be fully effective as noted by Campa and Goldberg (1997) and Greenaway et al. (2010). Finally, the third channel is that, after currency depreciation, firms that are indebted in terms of FX, lose their competitive advantage in the international markets through balance sheet effects due to the increase in the book value of their debts. Especially those firms that have currency mismatch in their liabilities and assets are impacted by exchange rate volatility negatively through balance sheets and production cost channels. Under such circumstances, the depreciation of the local currency reduces the net worth of the firm, restricts the availability of export financing and causes a loss of competitive advantage.

This paper builds on the literature focusing on the effects of exchange rate variations on firm-specific performance measures (exports, growth, productivity, survival) by taking into account the role of financial constraints. We particularly incorporate foreign exchange denominated costs (foreign exchange denominated debt and imported inputs) into the analysis to control firm-level currency mismatch. That is, we estimate exchange rate elasticity of exports by allowing heterogeneity among firms by using data for the period 2002-2010 when flexible exchange rate regime was effective in Turkey.

The analysis done, referencing the related literature, involves empirical tests that use firm specific variables such as the liability dollarization ratio, labor productivity, real sales, leverage ratio, collateral ratio; industry based variables such as industry-specific real

exchange rates and imported inputs intensity as well as macro variables that reflect domestic and foreign demand and macro volatility. In this context, we intent to control how exchange rate elasticity of exports react to firms heterogeneity in terms of imported inputs intensity, liability dollarization, degree of currency mismatch, size, and age.

Our findings suggest that a real depreciation of the Turkish lira has a positive impact on exports of firms. This positive impact is muted for manufacturing firms operating in sectors that use imported inputs intensively. Similarly, exports of firms with moderate or low FX debt-exports ratios, so called "naturally-hedged", are less sensitive to real exchange rates as expected. In addition, estimations show that the exports of medium, small, and young firm groups are generally more sensitive to the real exchange rate while the exports of mature and large firms are estimated to be less sensitive. In short, firm level findings suggest that a depreciation of Turkish lira favor the external competitiveness of firms in general while the sensitivity is estimated to be smaller for naturally hedged, large, mature and high import intensity firms.

The rest of the paper is organized as follows. Section II reviews the existing literature. Section III presents economic developments and FX exposure structure in Turkey. Section IV describes the firm-level data and other data sources. Section V contains the empirical analysis of the links between export patterns and exchange rates considering various firms characteristics. Section VI concludes.

II. Literature Review

The empirical trade literature has remained fairly limited to the impact of foreign exchange exposures or FX debt on financial positions of firms in examining the impact of exchange rates on exporting behavior. Although a number of studies focused on emerging market countries using firm-level data investigate the impact of debt dollarization on investment (Bleakley and Cowan, 2008; Carranza et al., 2003), sales and employment (Alp and Yalçın, 2015), with the exception of Cheung and Sengupta (2013), none of them incorporates foreign exchange denominated debt to explore exchange rate and export link. Cheung and Sengupta (2013), using a sample of Indian firms, document a negative effect of currency appreciation and currency volatility on Indian firms' exports-to-sales ratio while the impact of firm-level determinants on financial constraints such as FX debt or collateral do not appear to have a significant effect on firms' exports-to-sales ratios. At a macro level, using quarterly data for 27 developed and developing countries, Berman and Berthou (2009) finds that the impact of currency depreciation on exports is negative in a given country if firms heavily borrow in FX.[1] Manova (2015) based on a heterogeneous-firm model with cross-

[1] On the theoretical side, Chaney (2016) in a Melitz (2003) type heterogeneous firm framework, assuming that firms finance the costs for entering foreign markets using cash flows from domestic sale, stresses the positive impact of exchange rate appreciation on alleviating liquidity constraints by increasing the value of domestic assets owned by potential exporters. As a result firms that could not enter foreign markets because of liquidity constraints, start to export as the value of their assets has appreciated.

country differences in financial development and cross-industry variation in financial vulnerability, demonstrates that weak financial institutions lead to fewer destination markets, reduced export product variety, and lower aggregate trade volumes and these distortions are amplified in financially vulnerable sectors.

Our paper is also related to the firm-level studies examining the impact of exchange rates on firm-level performance measures with an emphasis on financial constraints. Gezici et. al. (2016) find evidence that less financially constrained firms are more likely to start exporting in Turkish manufacturing. Çağlayan and Demir (2014) and Demir (2013), using a panel of Turkish firms, document that when they have access to foreign or domestic equity, or debt markets, the negative impacts of exchange rate volatility on firms' growth is muted. On the other hand, the negative impact of exchange rate volatility on firms' productivity growth is not decreased. Hericourt and Poncet (2015), using a panel of Chinese firms show that firms' decision to start exporting and the exported value decrease for destinations with higher exchange rate volatility and this effect is increased for financially vulnerable firms. In these studies, foreign exchange denominated costs or the level of imported inputs have not been considered.[2]

None of the studies mentioned addresses the role of foreign exchange denominated costs or imported inputs. In this study, in addition to foreign exchange denominated debt, we also take into consideration sectoral level imported input use. A depreciation of the real exchange rate results in cheaper exported goods and services, but also makes the imported input expensive creating a cost disadvantage (for example, see Campa and Goldberg, 1997, for the US, UK, Canada and Japan; Hummels et al., 2001, for several OECD countries, Greenaway et al. 2010 for UK). Ahmed et al. (2015) find evidence that the elasticity of exports to the real exchange rate has been declining mainly due to the intensification of vertical integration the in global value chain which increases the usage of imported inputs all around the world. In this context, Turkish industrial production which is highly dependent on imported inputs represents an ideal natural experiment for testing the muting effects of currency depreciations on exports due to growing imports bill.

In this paper, we also contribute to the literature investigating the relative irresponsiveness of exports to exchange rate movements at the aggregate level, a phenomenon referred as exchange rate disconnect puzzle. Heterogeneous responses of export volumes to exchange rates depending on firms' characteristics may partly explain the weak impact of exchange rate movements on aggregate exports. Micro level empirical investigation has potential to

[2] In Hericourt and Poncet (2015) financial constraints or vulnerability has been measured using standard measures such as share of capital expenditures not financed with cash flows from operations as in Rajan and Zingales (1998) or the ratio of intangible assets to fixed assets as in Braun (2003), and the share of R&D spending in total sales (R&D) as in Manova (2015). These are good proxies for ranking industries in all countries. In Cağlayan and Demir (2014) and Demir (2013) firm-specific variable reflecting firms' access to domestic and foreign equity and debt markets has been considered as an indicator of financial development.

reconcile conflicting macro and micro evidence (see, e.g., Dekle et al., 2009) in explaining the relative insensitivity of exports to exchange rates.
For the Turkish case, the micro evidence on the impact of exchange rate variations on firm-level exports is almost not present. The impact of real exchange rate variations on exports has been studied extensively using aggregate level data at macro or industry level (Aydın et al. 2004, 2007; Bozok et al. 2015; Çulha and Kalafatacılar; 2014; Berument et al., 2014; Neyaptı et al., 2007). These studies often fail to report strong impact of real exchange rate depreciations on exports, mainly attributed to high import content in the production (Aydın et al., 2007), the destination specific differences (Culha and Kalafatacılar, 2014), and product or sectoral variations (Berument et al., 2014; Coşar, 2002). Nazlioglu (2013) and Dinçer and Kandil (2011) stresses that growth in importing countries is a key determinant of sectoral export growth.

There are several studies investigating exporting behavior using firm-level data, but one of them investigates firm-level exports' sensitivity to real exchange rates. Amongst the firm-level studies, Demirhan (2015) using CBRT Company Accounts Database documented the superiority of exporting firms in terms of productivity, profitability, and size compared to non-exporters explained by self-selection and learning-by-exporting hypotheses. Using the same database, Aldan and Günay (2008), investigate the effect of entering into export market on firm-level productivity and employment documenting that larger and more productive firms self select into export market and starting to export further increases labor productivity and employment. Akarım (2013) investigates the impact of financial contraints using a dataset of manufacturing firms whose stocks are traded in Istanbul Stock Exchange (ISE) and find no significant relations between financial factors and the probability of exporting.

III. A Short Evaluation on Foreign Exchange Exposures in Turkey

High current account deficit (or low domestic savings) has been a major obstacle for achieving high and sustainable growth in Turkey. Heavy dependence on imported inputs and foreign savings raises the sensitivity of the economic activity and prices to fluctuations in capital flows and international commodity prices. In this environment, exchange rates appear to be one of the key variables reflecting the conditions of the economy. In addition to unfavorable external position of the economy mentioned above, relatively high and unstable inflation rates were one of the underlying factors behind volatile exchange rates putting economic agents in a position where their pricing and investment decisions are more complicated.

To overcome the uncertainty due to unstable macro environment and volatility in exchange rates and international risk appetite, economic agents in Turkey tend to hold large amounts of FX liabilities and assets and they adopted a widespread FX indexed domestic pricing behavior especially during 1990s. In other words, economic transactions were highly

dollarized. Although there has been a decline in both liability and asset dollarization in 2000s as a consequence of improvement in underlying fundamentals, dollarization and FX indexed pricing have gained momentum again in recent years.

Before going into details of the empirical model, we will present several factors, which have affected the sensitivity of the Turkish economy to the exchange rates through increasing its FX exposure. Firstly, Turkish economy was transformed in a way that it has started to use more imported inputs in the production activity especially in 2000s. Secondly, in addition to growing import bill, fixed investments were largely financed by growing capital inflows which not only supported Turkish lira especially before the great recession in 2008, but also increased the fragility of the real sector to external shocks. Lastly, although there has been a decline in the extent of liability dollarization, the FX indexed pricing in the domestic economy has not lost its importance (Hülagü and Yalçın, 2014). We provide brief discussions on the first two factors below, respectively.

Turkish economy is characterized by a large trade deficit which is triggering the boom and bust cycles in the economy. Although various initiations were taken to encourage exports and reduce the reliance on imported inputs in the production, they failed to stop the widening the external gap. In fact, trade deficit has deteriorated further in recent years resulting from increasing trend in imports which have grown rapidly due to the increasing imported input content of domestic production especially after 2001 (Figure 1 and 2). Intermediate goods imports which has been always larger than exports of goods, reached as much as 22 percent of GDP in 2014. Insufficient domestic production in parallel to the strong economic performance during post-2001 crisis period was one of the major reasons of this increasing trend (Saygılı et al., 2010).

During this period, the finance costs and the price of capital goods went down, capital inflows accelerated and the Turkish lira appreciated significantly. Firms tended to allocate more resources to capital intensive production activities such as automotive, machinery and equipment, basic metal, metal products etc. which relied relatively more on imported intermediate and capital (machinery and equipment) inputs. The unavailability of domestic production, the need for high quality and uninterrupted supply to ensure technology transfer, and the possibility of cheaper supply due to domestic currency appreciation and competitive prices in the trading partners (e.g. China) were other major factors contributing to the increasing trend in imported inputs.

Turkish financial system do not produce sufficient Turkish lira denominated resources with reasonably long maturity to finance financially constrained domestic agents. The most important reasons for this are the relatively low domestic financial savings mostly characterized by short maturity structure. Banks are the primary financial institutions and have to borrow from abroad in order to extend credits with longer maturity. These credits are provided mostly in terms of FX in order to avoid the currency risk. On the other hand,

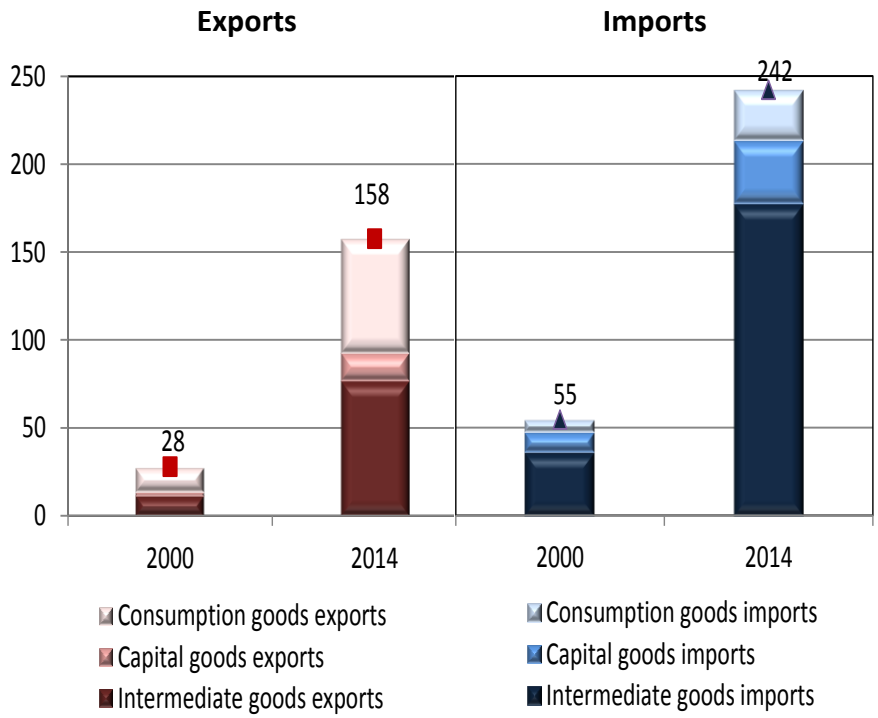
non-financial firms also borrow heavily from abroad directly. In other words, the growing imports bill and investments are largely financed by FX denominated debt. As a result, the FX liabilities of non-financial firms reached to 35 percent of GDP in 2014 from 14 percent in 2002 and short net FX position[3] of these firms have increased from 3 percent of GDP to 22 percent in the same period (Figure 3). The net FX short position of non-financial firms in Turkey surpassed 180 billion US dollars recently.

The liability dollarization ratio, calculated as the share of FX debt in total debt, of non-financial firms in Turkey can be interpreted as high when compared internationally as well. According to IMF (2015, p.42), Turkey has the third highest FX-denominated debt to GDP ratio as of 2014 after Chile and Poland. Based on firm level data, during the post-2001 crisis period, liability dollarization ratio, decreased from 85 percent in 2001 to 65 percent in 2010 in parallel to the declining inflation, structural reforms, and the newly adopted flexible exchange rate system (Alp and Yalçın, 2015). Short-term liability dollarization ratio has been on a declining trend as well. From 76 percent in 1996, it decreased to 50 percent in 2001, and with the positive impact of the reduced uncertainty during the post-2001 period it further shrank to 25 percent in 2010. Despite the improvements in the maturity structure and the decreased share of FX-denominated debt, liability dollarization ratio of Turkey is still high. This situation increases the fragility of non-financial companies to external shocks such that in the case of a sudden stop foreign funding remains limited and credit to the real sector freezes. However, in spite of risk involved in FX debt, they undermine the extent of financial constraints and contribute to the enhancement of domestic economic activity in an environment where domestic financial system fail to produce enough domestic currency denominated funds mainly due to low domestic savings and short maturity of financial savings. Note that although there has been a decline in the extent of liability dollarization, the FX indexed pricing in the domestic economy has not lost its importance. FX-indexed pricing behavior prevailing in the domestic sector in some sectors has a positive impact on lowering currency risk (Hülagü and Yalçın, 2014).

In addition to imported inputs, it is also important to note that financial expenditures in terms of FX is an important cost item for non-financial firms particularly in times of currency depreciations as FX denominated debt in terms of the domestic currency increases. Figure 4 shows that net profit margins of firms with poor natural hedging (risky firms) melt down significantly when Turkish lira depreciated sharply during the post-2008 financial crisis period. On the other hand, firms that are able to match the currency composition of their debt with their income streams, so called low-risk firms, seem to be affected from currency depreciations to a lesser extent.

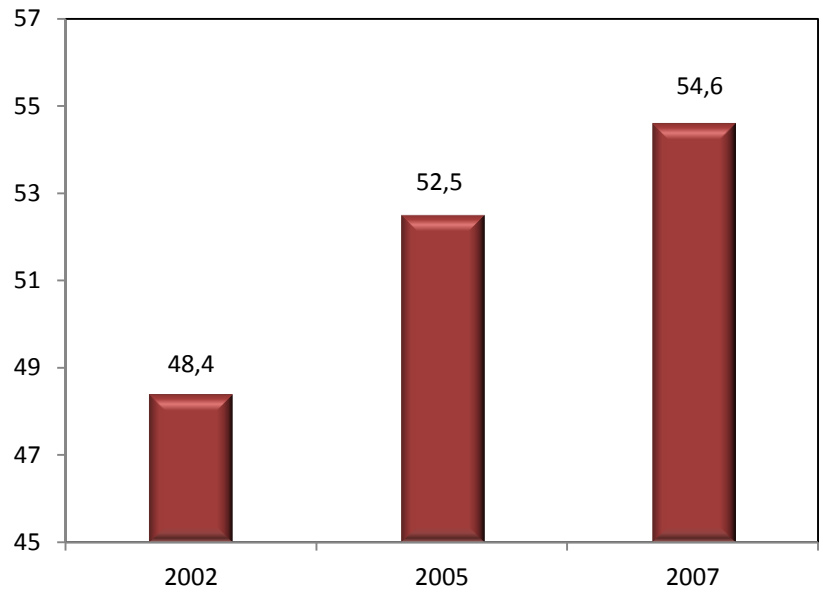
[3] Net FX deficit is calculated as FX denominated assets minus FX denominated liabilities.

Figure 1: Exports and Imports in 2000-2014 (in billion US dollar)



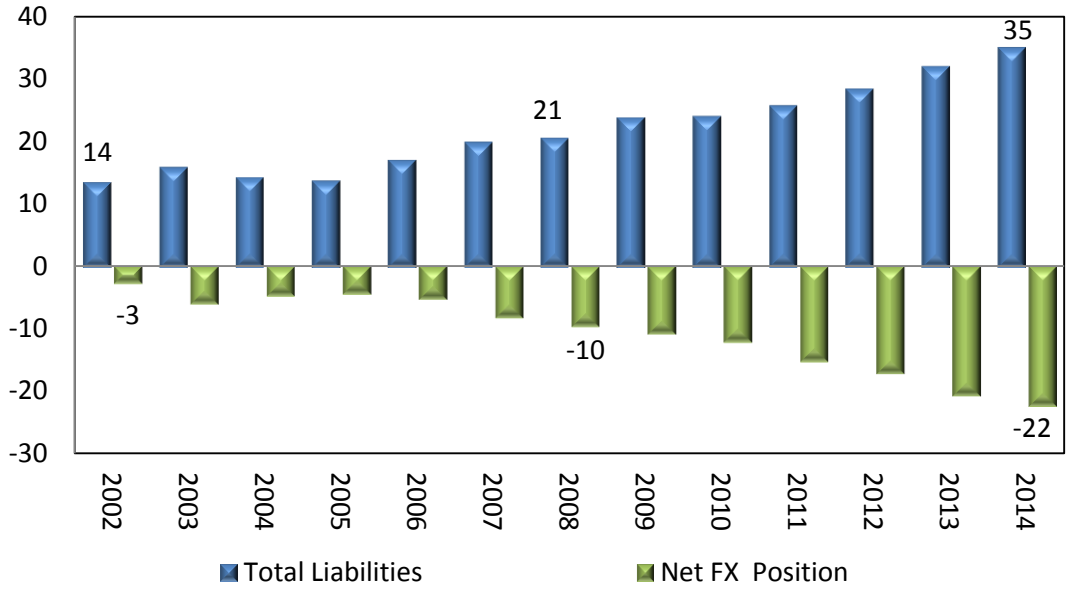
Source: TURKSTAT

Figure 2: The Share of Imported Intermediate Inputs in Total Cost of Production (Percent)



Source: Saygılı, Cihan, Yalçın and Hamsici (2010)

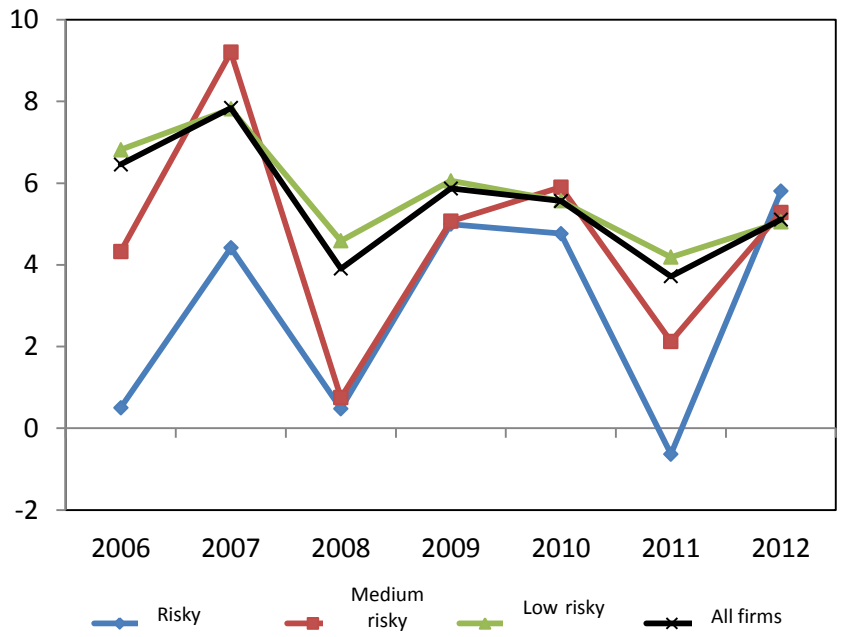
Figure 3: FX Liabilities and Net FX Position of Non-Financial Firms in Turkey (As percent of GDP)



Source: Central Bank of Turkey

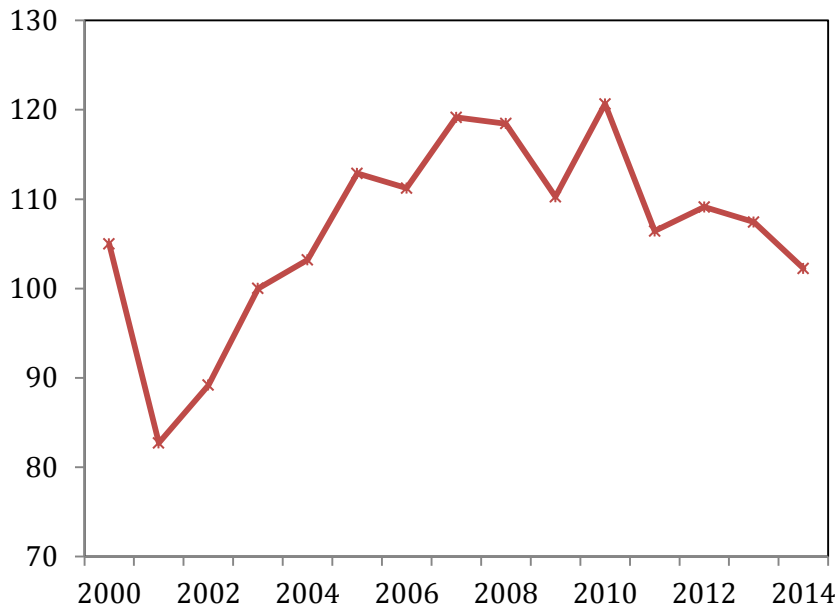
Any change in the pace of capital inflows and the price of international commodity prices has strong implications for the real exchange rates and thus domestic economy. The Turkish lira has usually exhibited a very volatile pattern over the time given heavy reliance on foreign capital and imported inputs. The Turkish lira has appreciated significantly when capital inflows speeded up in 2000s while it has depreciated during the great recession and afterwards (Figure 5). Given the volatility in the exchange rate and economy's strong reliance on imported inputs, empirical evidence for Turkey documents very strong exchange rate and import price pass through to domestic prices as well (Kara and Öğünç; 2008; 2012). Although there has been a decline in recent years in the exchange rate pass through, it is still large in international standards. Consequently, the export performance has been also affected by strong exchange rate and import price pass-through to domestic prices prevailing in the Turkish economy, which deteriorates firms' relative competitiveness in external markets.

Figure 4: Profit Margins of Non-financial Firms (Percent)



Source: Hülagü and Yalçın (2014)

Figure 5: CPI Based Real Exchange Rates



Source: CBRT

IV. Data and Variables

IV.1. Database

The firm level data used in this study is based on two sources: i) The Central Bank of the Republic of Turkey (CBRT) Company Accounts and ii) Risk Center Database of Banks' Association of Turkey. The CBRT Company Accounts Database is the most comprehensive database regarding financial data of non-financial firms in Turkey. It includes information on balance sheet and income statement items, economic activity classified according to industry or sector, establishment date, number of employees, provinces operated in, and the legal status. Risk Center Database provides information on firm-level foreign and local currency denominated debts and their maturities. We merge two datasets by using firm identifiers, which enables us to incorporate information from balance sheet, income statements, and FX denominated debts items into the same analysis.

One of the drawbacks of the CBRT data is that it does not meet sampling standards as it covers mainly large firms. The database also covers only the participating firms those submit their financial statements regularly to the commercial banks. Any firm whose data of last three years is not available is kept out of the analysis. However, firms included in the dataset are of great weight in total activities, which renders the representative power of this analysis high. The dataset also includes substantial portion of small and medium-sized enterprises in addition to large firms (about two third of the sample) operating in Turkey. About half of the firms in the dataset operate in the manufacturing industry and these firms cover a significant portion of aggregate economic activity. Based on 2010 data, these firms hold about 77 percent of manufacturing sales, over 95 percent of manufacturing exports and about half of manufacturing FX-denominated debts. Firms in the database account for 35 percent of total manufacturing employment.

IV.2. Variables of Interest

We use various firm specific, sectoral and macro variables in our analysis. As often used in the literature we utilize logarithms of real sales and logarithms of labor productivity (the ratio real sales to employment) to control for firms' size and productivity, respectively. To control financial conditions, following variables are used in the analysis: (i) leverage ratio, defined as the firm's ratio of total liabilities to total assets, (ii) collateral ratio, defined as real tangible assets over total assets to control capital intensity of firms and (iii) liability dollarization ratio, defined as the ratio of FX liabilities to total liabilities. The first two indicators have been extensively used in the literature dealing with financial constraints and all these variables reveals the degree of the firms' financial health (see Greenaway et al., 2007).

Foreign currency liabilities is a central variable when examining the impact of exchange rate variations on firm-level exports particularly in the context of developing countries as most of

them suffer from high liability dollarization (IMF, 2015). This situation is often referred as "original sin", following Eichengreen et al. (2005) measuring the inability of an economy to borrow internationally in its own currency. In this situation, "currency mismatch" creates a potential source of vulnerability if firm's debt is in the form of FX while the income and assets are mostly denominated in domestic currency. Therefore when evaluating the risks associated with liability dollarization of companies, FX revenues (if any FX denominated revenue exists) should also be considered. Since there is no available data that reflecting the overall FX exposure of Turkish companies' balance sheets, liability dollarization is analysed by taking into account the export revenues of companies. In other words, export revenues are considered as a "natural hedge" for companies that has FX denominated cash loans. If the liability dollarization of a company is high whereas its export revenue is low (or no export revenue), then the financial fragility of those kinds of companies are considered as high due to currency mismatch. In order to measure the degree of currency mismatch, we adopt Echeverry et al. (2003) methodology. Accordingly, we identify each firm as belonging to one of the three zones in the foreign debt-exports space: hell, heaven, and hedge. Firms are classifed as hedged if the magnitude of their exports is similar to the magnitude of their foreign denominated liabilities. We construct our measure for currency mismatch by taking the ratio of foreign exchange denominated debt to exports and set upper and lower bound as FX Debt =0.15 Exports and FX Debt =3.2 Exports, representing the upper and lower 25th percentile of the distribution.[4] On the hand hand, beyond the currency mismatch, having access to FX-denominated debt at reasonably longer maturity may relax financially constraints domestic agents and may support economic activity.

At sectoral level, we construct export-weighted real effective exchange rates. The trade weights of each industry are constructed using the methodology described in Goldberg (2004). The trade shares are averaged (within an industry) across the pre-sample time period (1996-2000), therefore the variation in exchange rate over time comes only from changes in the real exchange rate changes and not from fluctuations in partners' trade shares.[5] A rise in this index represents an appreciation of the domestic currency. Figure 6 shows time varying patterns of industry specific exchange rate index for the period 2000-2010. The index both includes periods of appreciation and depreciation. Further details on the construction of this index can be found in the Appendix 1.

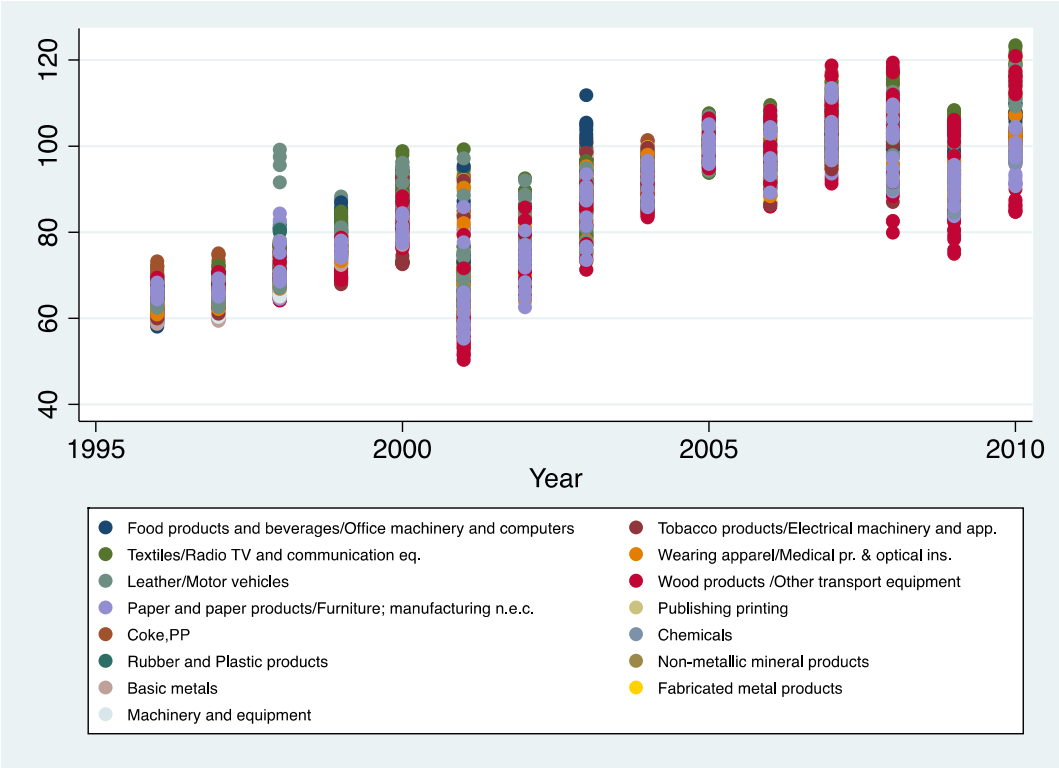
At macro level, we use domestic GDP with constant prices to reflect domestic demand that may be considered a substitute for external markets. For the external demand, we used the weighted average of OECD countries' GDPs (constant prices), where bilateral trade flows as

[4] Echeverry et al. (2003) set the upper and lower bounds of the hedge area as Liability Dollarization (FX to Total Debt) =(3/2)Export to Sales Ratio (EXPS) and LD=(2/3) EXPS, respectively. For the period of 1992 to 2003 using Turkish sectoral data on nonfinancial sectors, in Kesriyeli et al. (2011), the lower and upper bounds of the hedge area are set as LD=(1/2)EXPS and LD=EXPS respectively.

[5] We conduct robustness checks using time varying weights and weights calculated based on 2000-2010 average trade shares. The findings do not exhibit significant variation.

shares in total trade of Turkey are used as weights and data are from IMF. In addition, we use Chicago Board of Exchange (CBOE) Volatility Index (VIX index) as measure of macro volatility.[6]

Figure 6: Industry Specific Exchange Rate Index



Source: TURKSTAT, IMF International Financial Statistics

To mitigate the impact of outliers on the regression results, we drop 0.1 percentile of firms both ends of the distributions of labor productivity, leverage ratio and collateral ratio. We also excluded companies that have missing values and that possess inconsistent values. Subsequently, we end up with about 24 thousand firm-year observations consisting of 4227 firms belonging to 22 manufacturing industries over the period 2002-2010. We deflate all the nominal values using the sectoral-level producer price indices (PPI) obtained from the Turkish Statistical Institute.

We categorize firms into small, medium, and large according to their employment levels. Firms below 50 average employees during the period are grouped as small firms, firms between 50 and 250 average employees are labeled as medium-sized firms and the rest of firms with more than 250 employees are considered as large firms. We also define young firms as belonging to the lowest 25 percentile of the age distribution, and mature firms as

[6] We use various measures of exchange rate volatility namely the conditional variances of GARCH (1.1) for macro and sectoral real exchange rates, average annual standard deviation of percentage change in monthly real effective exchange rates at macro and sectoral levels. Unfortunately, the estimated coefficients for these alternative volatility measures are not significant and stable in terms of signs. Therefore, following the referee's suggestion, we use VIX index as volatility measure in our analysis.

those belonging to the highest 25th percentile. In addition, we classify firms according to their export shares. We call exporting firms as low exporters, high exporters and medium exporters if their average export shares are in the lowest the 25 percentile, the highest 25 and those between 25-75 percentile.

Table 1 provides the basic descriptive statistics of the variables used in the empirical analysis. We provide statistics across different categories based on size, age, the degree of currency mismatch and export shares and imported input intensity. When we compare young vs mature firms, small vs. large firms, we find consistent results concerning labor productivity and sales (Table 1-a and 1-b). Accordingly, larger and mature firms tend to be more productive and have higher sales.

With regard to currency mismatch categorization, firms under the hell category tend have lower export shares, higher real sales, and liability dollarization and leverage ratios. They also hold higher tangible assets (Table 1-c). These firms are highly dollarized and are mostly selling in the domestic market evidenced by considerable lower export shares. Firms in the heaven region, are relatively smaller in terms of both employment and real sales, have lower dollarization and leverage ratios. In terms of exporting, they in general export more than firms in the hell region but still considerable lower than firms in the hedged area. Firms in the hedged region have high export shares and they are slightly older than their counterparts in the heaven and hell regions.

According to Table 1-d, consistent with the empirical literature exporters on average have higher employment and labor productivity than non-exporters (see, for example, Bernard and Jensen, 1999 , for the US; and Greenaway and Kneller, 2004 , for the UK). Firms operating in sectors that use lower imported inputs have higher dollarization rate, export shares, employment, and lower productivity. On the other hand, there is no significant variation in collateral ratios, leverage ratios, real sales, and real export values between firms operating in sectors which have low and high-imported input intensities (Table 1-e).

We further present the distribution of the export share and dollarization rate in the three zones of the foreign debt-exports space in Figure 7 (Panel a-c). It appears that firms belonging to the hedge region both export and carry substantial amount of FX debt. The descriptive analysis reflects that companies in hedged region possess both high export share and liability dollarization ratios. Firms in heaven have an export share distribution skewed to the left ranging between 0 and 1, while the distribution of the dollarization ratio suggest that they tend to not carry foreign exchange denominated debt as their counterparts in hell and hedged regions. Firms in the hell region are characterized by low export shares and high dollarization rates.

Table 1-a: Descriptive Statistics - Size Categorization

	N	Mean	Median	Sd	Min	Max
Log of Labour Productivity						
Small	5755	11.6	11.51	1.0	5	17.0
Medium	12126	11.63	11.54	0.9	7	18.6
Large	6164	11.74	11.61	0.9	7	19.3
Total	24045	11.65	11.55	0.9	5	19.3
Log of Real sales						
Small	5755	15.12	15.13	1.1	8	19.6
Medium	12126	16.5	16.49	1.0	11	23.6
Large	6164	18.19	18.06	1.2	12	23.8
Total	24045	16.6	16.55	1.5	8	23.8
Log of Real Exports						
Small	5755	12.78	13.05	2.1	0	18.6
Medium	12126	14.31	14.7	2.1	1	23.2
Large	6164	16.27	16.61	2.2	3	22.0
Total	24045	14.45	14.74	2.5	0	23.2
Export Share (Exports/ Total sales)						
Small	5755	0.27	0.17	0.3	0	1.0
Medium	12126	0.3	0.22	0.3	0	1.0
Large	6164	0.35	0.3	0.3	0	1.0
Total	24045	0.31	0.22	0.3	0	1.0
Employment						
Small	5755	32.17	33.6	11.5	3	49.9
Medium	12126	124.74	114.33	54.5	50	248.6
Large	6164	751.23	458.6	1075.9	249	17482.1
Total	24045	263.18	117.27	617.9	3	17482.1
Age						
Small	5733	21.11	19	8.9	3	110.0
Medium	12068	24.16	22	10.7	3	134.0
Large	6146	28.27	26	12.5	4	122.0
Total	23947	24.48	22	11.1	3	134.0
Dollarization Ratio						
Small	5755	0.38	0.17	0.4	0	1.0
Medium	12126	0.52	0.65	0.4	0	1.0
Large	6164	0.61	0.81	0.4	0	1.0
Total	24045	0.51	0.64	0.4	0	1.0
Leverage Ratio						
Small	5755	0.6	0.61	0.3	0	3.2
Medium	12126	0.58	0.59	0.3	0	5.1
Large	6164	0.54	0.53	0.3	0	3.4
Total	24045	0.57	0.58	0.3	0	5.1
Collateral Ratio						
Small	5755	0.25	0.2	0.2	0	1.0
Medium	12126	0.28	0.26	0.2	0	1.0
Large	6164	0.32	0.3	0.2	0	1.0
Total	24045	0.28	0.26	0.2	0	1.0

Table 1-b: Statistics - Age Categorization

	N	Mean	Median	Sd	Min	Max
Log of Labour Productivity						
Young	6979	11.58	11.48	0.92	4.74	19
Medium age	11144	11.6	11.49	0.95	7.93	17
Mature	5824	11.83	11.75	0.93	6.94	19
Total	23947	11.65	11.55	0.94	4.74	19
Log of Real sales						
Young	6979	16.22	16.23	1.42	8.18	21
Medium age	11144	16.52	16.48	1.47	8.35	24
Mature	5824	17.23	17.13	1.64	10.25	24
Total	23947	16.61	16.56	1.54	8.18	24
Log of Real Exports						
Young	6979	13.93	14.24	2.34	0.22	20
Medium age	11144	14.43	14.75	2.44	1.1	22
Mature	5824	15.11	15.34	2.49	1.47	23
Total	23947	14.45	14.74	2.46	0.22	23
Export Share (Exports/ Total sales)						
Young	6979	0.3	0.2	0.28	0	1
Medium age	11144	0.33	0.24	0.28	0	1
Mature	5824	0.28	0.21	0.24	0	1
Total	23947	0.31	0.22	0.27	0	1
Employment						
Young	6979	168.64	85	294.54	3	4105
Medium age	11144	222.68	109.43	361.86	4.42	4527
Mature	5824	455.16	187.5	1081.68	5.25	17482
Total	23947	263.47	117.27	618.92	3	17482
Age						
Young	6979	13.65	14	2.90	3	17
Medium age	11144	23.27	23	3.65	17.08	30
Mature	5824	39.79	37	9.59	30.18	134
Total	23947	24.48	22	11.08	3	134
Dollarization Ratio						
Young	6979	0.51	0.63	0.41	0	1
Medium age	11144	0.52	0.65	0.41	0	1
Mature	5824	0.5	0.62	0.42	0	1
Total	23947	0.51	0.64	0.41	0	1
Leverage Ratio						
Young	6979	0.61	0.63	0.24	0.01	5
Medium age	11144	0.57	0.57	0.25	0	5
Mature	5824	0.54	0.52	0.29	0	4
Total	23947	0.57	0.58	0.26	0	5
Collateral Ratio						
Young	6979	0.28	0.25	0.19	0	1
Medium age	11144	0.28	0.25	0.18	0	1
Mature	5824	0.3	0.27	0.18	0	1
Total	23947	0.28	0.26	0.18	0	1

Table 1-c: Descriptive Statistics - Mismatch Categorization

	N	Mean	Median	Sd	Min	Max
Log of Labour Productivity						
Hell	5863	11.71	11.62	0.94	4.74	16.93
Hedged	13561	11.69	11.57	0.94	7.06	19.29
Heaven	4621	11.47	11.40	0.93	8.21	16.17
Total	24045	11.65	11.55	0.94	4.74	19.29
Log of Real sales						
Hell	5863	16.79	16.77	1.42	8.18	22.62
Hedged	13561	16.74	16.67	1.53	10.63	23.60
Heaven	4621	15.97	15.87	1.56	8.35	23.82
Total	24045	16.60	16.55	1.54	8.18	23.82
Log of Real Exports						
Hell	5863	13.37	13.59	2.56	1.10	21.88
Hedged	13561	15.24	15.37	2.03	1.32	23.24
Heaven	4621	13.48	13.68	2.62	0.22	22.00
Total	24045	14.45	14.74	2.46	0.22	23.24
Export Share (Exports/ Total sales)						
Hell	5863	0.14	0.08	0.16	0.00	0.99
Hedged	13561	0.40	0.34	0.27	0.00	1.00
Heaven	4621	0.26	0.14	0.29	0.00	0.99
Total	24045	0.31	0.22	0.27	0.00	1.00
Employment						
Hell	5863	252.30	135.43	413.57	4.67	5555.80
Hedged	13561	283.67	127.85	537.08	3.17	7967.27
Heaven	4621	216.86	65.92	958.89	3.00	17482.13
Total	24045	263.18	117.27	617.85	3.00	17482.13
Age						
Hell	5830	23.67	22.00	10.83	3.00	122.00
Hedged	13521	24.96	23.00	11.06	4.00	93.00
Heaven	4596	24.12	22.00	11.39	3.00	134.00
Total	23947	24.48	22.00	11.08	3.00	134.00
Dollarization Ratio						
Hell	5863	0.63	0.80	0.37	0.00	1.00
Hedged	13561	0.60	0.76	0.38	0.00	1.00
Heaven	4621	0.09	0.00	0.24	0.00	1.00
Total	24045	0.51	0.64	0.41	0.00	1.00
Leverage Ratio						
Hell	5863	0.61	0.60	0.28	0.00	3.39
Hedged	13561	0.58	0.59	0.25	0.00	5.13
Heaven	4621	0.51	0.50	0.28	0.00	3.83
Total	24045	0.57	0.58	0.26	0.00	5.13
Collateral Ratio						
Hell	5863	0.33	0.30	0.20	0.00	0.97
Hedged	13561	0.27	0.25	0.18	0.00	0.99
Heaven	4621	0.26	0.22	0.18	0.00	0.98
Total	24045	0.28	0.26	0.18	0.00	0.99

Table 1-d: Descriptive Statistics - Exporter Categorization

	N	Mean	Median	Sd	Min	Max
Log of Labour Productivity						
Non-exporter	2934	11.46	11.45	1.14	5.03	16.86
Low - Exporter	2014	11.78	11.74	0.98	7.75	16.64
Med. - Exporter	14236	11.68	11.58	0.93	4.74	16.93
High - Exporter	7795	11.56	11.44	0.94	6.84	19.29
Log of Real sales						
Non-exporter	2934	14.96	15.00	1.63	5.25	20.46
Low - Exporter	2014	16.45	16.39	1.57	12.19	22.41
Med. - Exporter	14236	16.6	16.55	1.56	8.18	23.82
High - Exporter	7795	16.64	16.59	1.51	10.2	23.6
Employment						
Non-exporter	2934	64.07	28	164.64	0.86	1852
Low - Exporter	2014	221	77	729	3	10726
Med. - Exporter	14236	250	113	659	3	17482
High - Exporter	7795	299	141	495	5	5245
Age						
Non-exporter	2906	21.43	18	10.24	5	77
Low - Exporter	2002	23	21	11	4	134
Med. - Exporter	14173	25	23	11	3	122
High - Exporter	7772	24	22	10	3	110
Dollarization Ratio						
Non-exporter	2934	0.09	0	0.25	0	1
Low - Exporter	2014	0.28	0	0.38	0	1
Med. - Exporter	14236	0.46	0.5	0.4	0	1
High - Exporter	7795	0.66	0.86	0.38	0	1
Leverage Ratio						
Non-exporter	2934	0.59	0.6	0.3	0	3.81
Low - Exporter	2014	0.54	0.54	0.25	0.01	1.92
Med. - Exporter	14236	0.57	0.57	0.27	0	4.67
High - Exporter	7795	0.59	0.6	0.25	0	5.13
Collateral Ratio						
Non-exporter	2934	0.28	0.24	0.21	0	0.99
Low - Exporter	2014	0.3	0.28	0.19	0	0.97
Med. - Exporter	14236	0.28	0.26	0.18	0	0.97
High - Exporter	7795	0.28	0.25	0.19	0	0.99

Table 1-e: Descriptive Statistics – Imported Input Intensity (III)

	N	Mean	Median	Sd	Min	Max
Log of Labour Productivity						
High III	9485	11.74	11.64	0.96	6.94	19.29
Low III	14560	11.59	11.5	0.93	4.74	16.34
Log of Real sales						
High III	9485	16.64	16.54	1.66	8.35	23.82
Low III	14560	16.58	16.56	1.46	8.18	22.41
Employment						
High III	9485	247.58	109.43	551.77	3	6796
Low III	14560	273.35	125	657.14	3	17482
Age						
High III	9464	25.42	24	11.04	3	110
Low III	14483	23.87	22	11.07	3	134
Dollarization Ratio						
High III	9485	0.46	0.49	0.4	0	1
Low III	14560	0.54	0.72	0.41	0	1
Leverage Ratio						
High III	9485	0.56	0.57	0.25	0	3.5
Low III	14560	0.58	0.58	0.27	0	5.13
Collateral Ratio						
High III	9485	0.28	0.26	0.18	0	0.97
Low III	14560	0.28	0.26	0.19	0	0.99

V. Model and Estimation Results

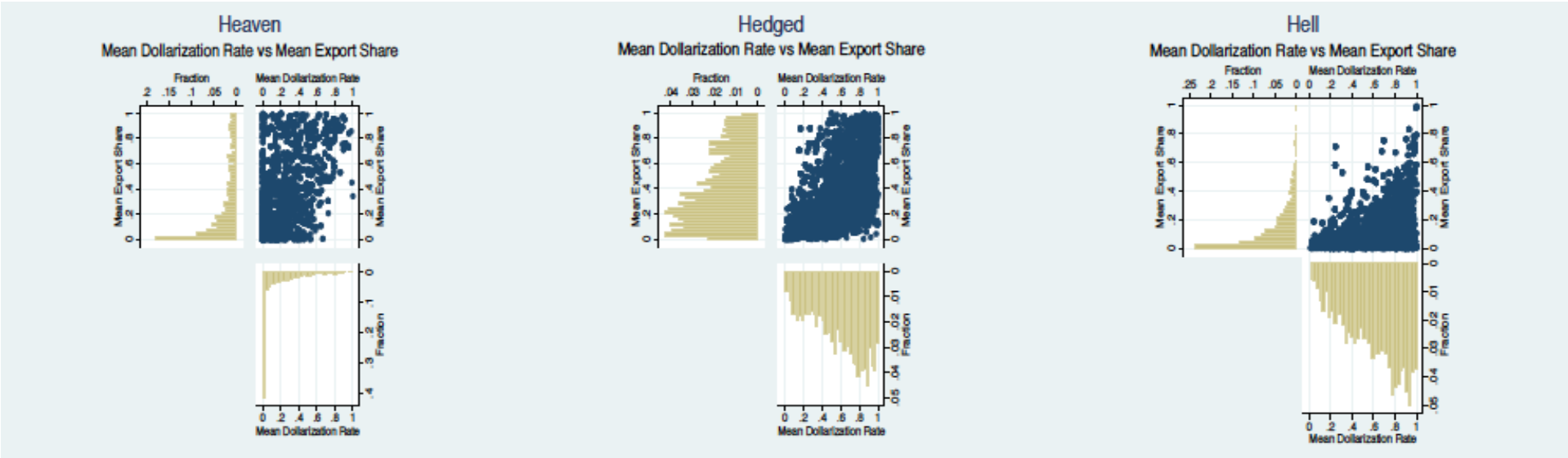
In our empirical specifications described below, we test the relative importance of different above-mentioned channels through which exchange rate variations may affect exports. These channels are often classified as competitiveness, the cost of production and the balance sheets. We start empirical tests with baseline specification and then extent the empirical model by introducing interaction terms representing firm characteristics.

V.1. Baseline Specification

We construct an econometric model to investigate the determinants of export volume of manufacturing firms (intensive margin).[7] Our baseline model is standard where the logarithm of firm level export volumes are explained by sectoral logarithm (log) of real exchange rates (both level and change), *VIX* index as a measure of macro volatility, domestic output and foreign demand as well as firm specific variables. That is, we utilize variables that allow us to control for macro, sectoral, and firm level dynamics. More specifically, we use the following baseline specification to quantify the impact of exchange rate movements on firm level exports.

[7] Although firms in the sample carry out a significant portion of economic activity, firms' responses are on voluntary basis therefore our data is not convenient for testing extensive margin of trade.

Figure 7: Mean Dollarization Ratio vs. Export Ratio



(a) (b) (c)

$$\ln(X_{it}) = \alpha_1 \ln(RER_{jt}) + \alpha_2 VOL_t + \alpha_3 Z_{it} + \alpha_7 ln(GDP_t^D) + \alpha_8 ln(GDP_t^F) + \tau\mu_i + \varepsilon_{it} \qquad (1)$$

where i indexes firms, t shows time (years), j is the industry to which firm i belongs to, X_{it} is firm level real exports, RER_{jt} stands for industry-specific pre-period trade weighted real exchange rate (a rise in this index represents a real appreciation of the domestic currency), VOL_t is time varying *VIX* index, Z_{it} is a vector of firm-specific variables including labor productivity, log of real sales, liability dollarization ratio (the ratio of FX denominated debt to total debt), collateral ratio leverage ratio, $ln(GDP_t^D)$ and $ln(GDP_t^F)$ are logs of domestic income and export weighted foreign income, respectively, μ_i shows non-time-varying firm-specific idiosyncrasies and ε_{it} is the error term of the regression.

We start our analysis firstly by employing fixed effect regressions. Estimation results for the baseline specification using fixed effects are presented in Table 2. For the sake of robustness, we report alternative specifications using the levels and changes in logs of real exchange rates and labor productivity. Under fixed effects model, we also report the findings with and without firm size variable (the log of sales, *lrsale*) to show the potential multicollinearity and to stress the need for a better estimation technique. Consequently, we report our findings based on eight alternative specifications.

Our estimation results from fixed effects model which does not include firm size suggest that real appreciation of Turkish lira (a rise in log of RER_{jt} or change in the log of RER_{jt}) has a negative and significant impact on the log of real exports in most specifications. The coefficient of the change in log of real exchange rate is estimated to be smaller in absolute term than the coefficients of the log of real exchange rate. That is, a ten percent (or percentage point for the change) rise in real exchange rates (appreciation) reduces export volume over 6 percent (or about 4 percent) in specifications where size variable is not used as regressor. Consistent with the literature, the coefficients of both the log level of labor productivity (LP_{it}) and the change in the log level are estimated to be positive and significant when the size variable is not included as an explanatory variable. That is, more productive labor usage would support the competiveness of the firm in the export markets and contribute to the export performance.

We estimate that coefficients of liability dollarization ratio ($Dolratio_{it}$) are positive and significant and verify that having access to foreign finance supports exports performance. These coefficients are estimated to be smaller when the size variable is included as regressor. The coefficients of collateral ratio ($Collateral_{it}$) are estimated to be negative and significant and they are smaller in absolute term when the size variable is included. We document generally negative coefficients for the leverage ratio ($Leverage_{it}$) and they are significant only when size variable is included. We estimate negative and significant coefficients for the export-weighted logarithms of foreign income ($ln\, GDP_t^F$) when size variable is included while they appear insignificant (and mostly positive) when it is not included. On the other hand, the coefficients of the logarithms of domestic income

($\ln GDP_t^D$) are generally positive and significant only when size variable is used as regressor. Lastly, contrary to expectations, the coefficients of *VIX* index as measure of volatility are estimated to be mostly positive and significant when size variable is used as regressor.

Estimation results change significantly when the size variable is added as explanatory variable. For example, the coefficients of the change in real exchange rate are estimated to be smaller and insignificant, the coefficients of labor productivity become negative when the size variable is introduced as explanatory variable and coefficients of volatility and foreign income are not in line with the expectations. This may suggest that fixed effects model fails to control the potential endogeneity and dynamic aspects; therefore it is not a good candidate for estimation. Findings from fixed effects model also show that the log of real sales is an important variable statistically. That is, the coefficient of determination of the regression (R^2) increases from 2-6 percent to 21 percent when it is included as regressor. The firm size is not only important statistically but also theoretically in explaining exports (Bernard and Jensen, 1995, 1999; Wagner, 2001; Greenaway and Kneller; 2004) Findings seem to be more consistent with theory when the size variable is included as regressor.

In order to cope with these issues in the remainder of our analysis we use a dynamic panel framework where difference GMM estimations are carried out. The difference GMM estimation introduces the lag(s) of dependent variable to control for potential dynamic effects and uses the lags of dependent and explanatory variables as instruments to tackle potential endogeneity problem. Estimation results for the baseline specification using GMM are presented in Table 3 across four alternative specifications.

We use the first lag of dependent variable as a regressor to control for the inertia in real exports and use its third lag as instrument variable in all GMM regressions. In addition, we treat liability dollarization ratio, labor productivity (change and its level), and log of real sales as endogenous variables given their endogenous relationships with employment and real sales and we use their up to three lagged values as the GMM-type instruments. Similarly, depending on specification used macro variables and sectoral real exchange rates (change and its level) are employed as standard differenced instruments. We report the Sargan test of over-identification to test for the validity of our instruments. Estimations results are from the one-step GMM procedure while the Sargan and autocorrelation tests, which are obtained from the two-step procedure.[8] Second order autocorrelation tests (arm2) do not reject the hypothesis of no serial correlation in the error terms for almost all regressions. Similarly, the Sargan tests do not reject the hypothesis of the validity of over-identifying restrictions almost in all regressions suggesting that instruments are valid.

[8] We use two-step results because only for a homoskedastic error term the Sargan test has an asymptotic chi-squared distribution. Arellano and Bond (1991) show that the one-step Sargan test overrejects in the presence of heteroskedasticity. As an alternative, we perform the Sargan test after the two-step estimator.

Table 2: Baseline Specification: Estimation Results for Fixed Effects Model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ln(RER_{jt})$	-0.623***	-0.370**	-0.721***	-0.293*	-	-	-	-
	(0.184)	(0.168)	(0.194)	(0.174)				
$\Delta(ln(RER_{jt}))$	-	-	-	-	-0.358***	-0.0145	-0.437***	-0.0245
					(0.126)	(0.115)	(0.130)	(0.117)
$ln(LP_{it})$	0.495***	-0.0617***	-	-	0.494***	-0.0616***	-	-
	(0.0171)	(0.0180)			(0.0171)	(0.0180)		
$\Delta(ln(LP_{it}))$	-	-	0.214***	-0.0137	-	-	0.213***	-0.0137
			(0.0155)	(0.0143)			(0.0155)	(0.0143)
$ln(lrsale_{it})$	-	1.168***	-	1.153***	-	1.169***	-	1.154***
		(0.0187)		(0.0177)		(0.0187)		(0.0177)
$Dolratio_{it}$	0.430***	0.255***	0.443***	0.259***	0.426***	0.252***	0.440***	0.257***
	(0.0302)	(0.0277)	(0.0323)	(0.0292)	(0.0301)	(0.0277)	(0.0323)	(0.0292)
$Collateral_{it}$	-0.443***	-0.285***	-0.617***	-0.252***	-0.460***	-0.289***	-0.634***	-0.254***
	(0.0813)	(0.0743)	(0.0862)	(0.0778)	(0.0813)	(0.0744)	(0.0863)	(0.0779)
$Leverage_{it}$	0.00703	-0.113**	-0.0272	-0.111**	0.0163	-0.111**	-0.0160	-0.110**
	(0.0514)	(0.0471)	(0.0540)	(0.0486)	(0.0515)	(0.0471)	(0.0540)	(0.0486)
$ln(GDP_t^F)$	-0.0700	-3.132**	1.167	-3.023**	0.668	-2.896**	2.144	-2.797**
	(1.452)	(1.328)	(1.486)	(1.339)	(1.453)	(1.330)	(1.487)	(1.340)
$ln(GDP_t^D)$	0.970	1.676**	0.348	1.552**	-0.0109	1.243*	-0.844	1.192*
	(0.784)	(0.717)	(0.805)	(0.725)	(0.761)	(0.696)	(0.780)	(0.703)
VIX_t	-0.00134	0.00941***	-0.00243	0.00879***	-0.00252	0.00946***	-0.00418	0.00871***
	(0.00261)	(0.00239)	(0.00268)	(0.00242)	(0.00265)	(0.00243)	(0.00274)	(0.00247)
Constant	0.724	-6.564***	8.132***	-6.501***	5.530***	-4.481***	13.74***	-4.848***
	(2.011)	(1.842)	(2.067)	(1.873)	(1.805)	(1.658)	(1.860)	(1.698)
Observations	24,045	24,045	22,162	22,162	24,045	24,045	22,162	22,162
Number of firms	4,227	4,227	4,151	4,151	4,227	4,227	4,151	4,151
R-squared	0.056	0.212	0.026	0.212	0.056	0.211	0.026	0.211

Standard errors in parentheses, *** <0.01, ** p<0.05, * p<0.1

Findings from difference GMM estimation are generally in line with those from fixed effects estimations with some important differences. The GMM estimation enables us to test the inertia in exports or its dynamic aspect. The coefficients of lag dependent variable are estimated to be positive and statistically significant across all specifications suggesting that real export variable has an inertia and its coefficient is estimated around 0.25, i.e. a ten percent rise in the previous year's exports adds about 2.5 percent to current real exports.

Estimation results suggest that real appreciation of domestic currency (a rise in $\Delta ln(RER_{jt})$) has a negative impact on exports. That is, a ten percentage point rise in real exchange rates (appreciation) reduces export volume by around 3 percent. Contrary to coefficients in fixed effect model, the coefficients of the real exchange rate do not change significantly when the log of RER_{jt} is used instead of the change in the log of RER_{jt}. In other words, the real exchange rate elasticity of exports is estimated to be around 3 percent in all specifications of the baseline model.

We estimate that firm size has positive impact on exports. The coefficients of *lrsale* are significant and larger than unity in specifications where the log of labor productivity is used as regressors. This suggests that firms' exports increase faster than their total sales as sales rise. This finding is consistent with literature, exporting activity incurs a sunk-cost and this cost is less important for larger firms thus they are expected to enter the export markets more easily. We use the log of labor productivity as explanatory variables as the literature suggests. As described under findings of fixed effects models, the coefficients of this variable are estimated to be positive and significant in the specification without *lrsale*. When *lrsale* is introduced coefficients turns to be insignificant. Under difference GMM, we get similar results. In order to address the potential multi-collinearity between *lrsale* and *llabprod* we report the findings with both level and change in log of labor productivity. We estimate positive and significant coefficients for change in log of labor productivity (*dllabprod*) suggesting that a ten percentage point rise in labor productivity lead to a rise in export around 3-5 percent. These results are in line with the empirical evidence and theoretical predictions documenting that more productive firms tend to export more than less productive firms (Melitz, 2003).

Liability dollarization ratio is used to control for several factors: (i) access to foreign finance which is evidently to be cheap and mutes financial constraints, (ii) an instrument of hedging mechanism (iii) the extent of FX-denominated liability exposure or currency mismatch. The first two channels may suggest a positive coefficient for this variable while the last channel suggests a negative coefficient especially when domestic currency depreciates to a large extent. Cheap FX-denominated debt with better terms compared to domestic currency denominated debt is apparently supportive for exports. However, one may expect a potential endogeneity between foreign exchange loans and exports as a firm starting to export is more likely to have access to these loans. This deserves further research and we do not go into detail in this paper.[9] The estimation results usually suggest a

[9] Until mid-2009, only firms that have FX revenues could borrow in FX. Therefore, we believed that the assumption that having access to FX loans supports exports is reasonable one.

positive and significant association between liability dollarization ratio and export volume. The last channel as an element of production cost and balance sheet effects, suggests that large share of FX debt may not be supportive for exports in case of currency depreciation. We will test these channels in the next section.

We use the leverage ratio and collateral ratio as explanatory variables in order to control the financial health or capital of firms. Estimations suggest no statistically significant link between leverage ratio and exports. We estimate often insignificant coefficients for collateral ratio except in one specification (Table 3 in column 3) where we have negative and significant coefficient, implying that as the share of tangible assets rises, firm's exports declines. Data shows that exports of firms in the lowest 25 percentile in terms of collateral ratio grew faster than exports of firms in the 75 percentile. Contrary to this findings, empirical literature document that industries with more tangible assets enjoy easier access to outside capital because firms can pledge more collateral (Braun, 2003; Claessens and Laeven, 2003; Manova,2015). Literature also documents that export starters have a significant ex-ante financial advantage, compared to non-exporters (Bellone et al. 2010; Muuls, 2012). That is, firm capital is more vital for the new exporter starters. However, even though better financial health has been associated with increasing export market participation (the extensive margin of trade) it does not necessarily increases intensive margin (Berman and Hericourt, 2010; Muuls, 2008) which is in line with the existence of large sunk costs which have to be paid to access the export market for the first time. Manova (2013) and Hur et al. (2006) find that in economies with higher levels of financial development, exports of vulnerable industries with fewer tangible assets grow faster. Therefore our finding on the impact of tangibility on intensive margin do not contradict fully with the empirical findings given the fact that recent improvement in conditions of accessing to credits by Turkish exporters and new incentives supporting exports might have increased the export performance of firms with lower collateral ratios.

For the macro variables, we use time varying *VIX* index as a regressor. In line with expectation and contrary to findings in fixed effect estimations, coefficients of this variable are estimated to be negative and significant in specifications where the log change of labor productivity while they are mostly negative and significant in the extended model estimations. In addition, we use $ln(GDP_t^F)$ to control for foreign demand and we estimate positive as expected but not always significant coefficients for this variable. We also use domestic demand, $ln(GDP_t^D)$, to control for potential substitution between domestic sales and exports. We estimate negative and significant coefficients for this variable, implying a substitution between domestic sales and exports. Anecdotal evidence for Turkish manufacturing suggests that firms substitute exports for domestic sales in the periods of weak domestic activity. This evidence is supported by Şahinbeyoğlu and Ulaşan (1999) that estimate a negative association between exports and domestic income. Parallel with our findings, empirical studies carried out for EU countries suggest a strong substitution between domestic sales and exports in the short run especially when domestic demand is weak (Bobeica, Esteves, Rua and Staehr, 2015), and economies are highly diversified in exporting or activities are less concentrated (Esteves and Prades, 2016).

Table 3: Baseline Specification: Estimations with Difference GMM Model

	(1)	(2)	(3)	(4)
$lrexp_{i,t-1}$	0.198***	0.254***	0.230***	0.254***
	(0.0328)	(0.0387)	(0.0346)	(0.0374)
$ln(RER_{jt})$	-0.319**	-0.276*	-	-
	(0.154)	(0.164)		
$\Delta(ln(RER_{jt}))$	-	-	-0.340***	-0.230***
			(0.0714)	(0.0733)
$ln(LP_{it})$	0.160	-	-0.202	-
	(0.163)		(0.186)	
$\Delta(ln(LP_{it}))$	-	0.530***	-	0.338**
		(0.135)		(0.152)
$ln(lrsale_{it})$	1.088***	0.824***	1.117***	0.878***
	(0.127)	(0.148)	(0.130)	(0.142)
$Dolratio_{it}$	0.424**	0.323	0.525***	0.412**
	(0.189)	(0.215)	(0.193)	(0.208)
$Collateral_{it}$	-1.026	0.361	-2.155**	-0.501
	(0.973)	(1.251)	(1.021)	(1.219)
$Leverage_{it}$	0.218	0.739	0.260	0.584
	(0.502)	(0.650)	(0.517)	(0.630)
$ln(GDP_t^F)$	1.489	3.735***	0.501	2.360
	(1.160)	(1.414)	(1.222)	(1.450)
$ln(GDP_t^D)$	-1.488**	-2.620***	-1.294**	-2.173***
	(0.608)	(0.722)	(0.607)	(0.710)
VIX_t	-0.004	-0.007**	-0.003	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
Constant	2.918	9.579***	7.618***	9.304***
	(2.701)	(2.853)	(2.887)	(2.700)
Observations	20,969	20,908	20,969	20,908
Number of firms	3,855	3,847	3,855	3,847
Sargan (P-value)	0.0172	0.553	0.399	0.670
arm2 (p-value)	0.0704	0.954	0.313	0.672
arm1 (p-value)	0	0	0	0

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

V.2. The Extended Specification

We extend the baseline specification by introducing dummy variables interacted with industry-specific real exchange rate (both level and change) to examine the sensitivity of exports to sectoral real exchange rates across various firm characteristics.[10]. We construct dummy variables reflecting the imported input intensity, the degree of liability of dollarization, the degree of currency mismatch, the firm size, and the firm age. We interact these dummy variables with the real exchange rate to test how the sensitivity of real exports to the real exchange rate alters across these characteristics. The model that includes the interaction terms mentioned above (the

[10] In our analysis we consider both the level of trade-weighted real exchange rate and its change from year t - 1 to year t. In our estimation tables we do not report findings where the change in log of labor productivity is used as a regressor for the sake of avoiding duplications.

extended specification) is given in equation (2) below and is estimated by using the difference GMM estimation technique.

$$\ln(X_{it}) = \alpha_1 \Delta\ln(RER_{jt}) + \alpha_2 VOL_t + \alpha_3 Z_{it} + \alpha_7 \ln(GDP_t^D) + \alpha_8 \ln(GDP_t^F) + \alpha_9(FCD \times \Delta\ln(RER_{jt})) + \tau\mu_i + \varepsilon_{it} \quad (2)$$

where *FCD* is a dummy variable reflecting firm characteristics and sets equal to "1" for firms that have specific characteristics mentioned above and "0" otherwise. We report and discuss findings concerning these interaction terms and provide details on how these dummies are constructed under the relevant sub-sections below, respectively.

V.2.1 Imported Inputs

Campa and Goldberg (1997) and Greenaway, Kneller and Zhang (2010) find evidence that the impact of real exchange rate on exports is muted to some extent by the usage of imported intermediate inputs in the domestic production. We follow similar path to test the impact of real exchange rate on firm level export volume in Turkey. Evidence suggests that domestic manufacturing production is highly exposed to imported inputs in Turkey. Saygılı et al (2010) estimated that about 55 percent of total intermediate inputs are made up of imported inputs and it has been rising over the period of our study. In addition, there is widespread foreign exchange denominated pricing in domestic economy including in housing, manufacturing, tourism sectors and especially commodities. For example, rents in shopping centers, commodity prices in manufacturing are often in terms of FX. Therefore, due to high content of FX-denominated cost in domestic activity, the exchange rate pass through to CPI inflation is estimated to be very high compared to other countries. Based on this background, the competitive impact of currency depreciation on export volume in Turkey might be muted by the degree of foreign exchange exposures through the cost of production channel.

We construct a dummy variable based on sectoral imported inputs intensity following Saygılı et al. (2010) which reports sectoral imported input intensity ratio based on 2002 Input-Output Table. We define the sector in which firms are classified as high imported input intensity if this ratio is larger than 0.29 (IM_j is equal to "1", otherwise it is "0") which is the median ratio of the imported input intensities for two digit manufacturing industries in our analysis. In this context, the first dummy variable is based on sectoral imported inputs intensity. We test the cost of production channel by using the interaction term between the real exchange rate variable and imported intensity dummy (IM_j) as regressor. We expect the coefficient of interaction terms between the sectoral exchange rate variable and the imported input intensity dummy to be positive. That is, the exports of manufacturing firms with high imported inputs in their production are expected to be less sensitive to real exchange rate (the sum of interaction term and the log real exchange rate is smaller in absolute term). In other words, a depreciation of the domestic currency is expected to raise production costs of companies that rely on imported inputs or FX denominated inputs and thus reduce the sensitivity of exports to the real exchange rate.

Table 4 provides the estimation results in which interaction terms of the level and change the log of real exchange rate with IM_j are used as explanatory variable, respectively. In line with expectations, estimations show that the coefficients of these interaction terms are positive but it is statistically significant only for the interaction term with the log of real exchange rate. This suggests that exports of firms belonging to sectors with high imported inputs intensity are less sensitive to level real exchange rate. That is, imported inputs as an item of production cost may mute the impact of the competitiveness channel of the real exchange rate, i.e. the sums of coefficients of interaction terms and real exchange rate variables are smaller in absolute value. Moreover, the estimated coefficients of other variables are generally in line with those in the baseline model.

Table 4: Extended Specification with Imported Inputs: Estimations with Difference GMM Model

	(1)	(2)
$lrexp_{i,t-1}$	0.252***	0.253***
	(0.0386)	(0.0375)
$ln(RER_{jt})$	-0.392**	-
	(0.185)	
$\Delta(ln(RER_{jt}))$	-	-0.270***
		(0.104)
$ln(RER_{jt})*IM_j$	0.344*	-
	(0.202)	
$\Delta(ln(RER_{jt}))*IM_j$	-	0.0989
		(0.147)
$\Delta(ln(LP_{it}))$	0.531***	0.330**
	(0.135)	(0.158)
$ln(lrsale_{it})$	0.829***	0.882***
	(0.147)	(0.143)
$Dolratio_{it}$	0.297	0.410**
	(0.215)	(0.208)
$Collateral_{it}$	0.317	-0.530
	(1.245)	(1.218)
$Leverage_{it}$	0.717	0.577
	(0.648)	(0.628)
$ln(GDP_t^F)$	3.664***	2.305
	(1.406)	(1.457)
$ln(GDP_t^D)$	-2.598***	-2.145***
	(0.720)	(0.714)
VIX_t	-0.007**	-0.006**
	(0.003)	(0.003)
Constant	9.571***	9.204***
	(2.854)	(2.722)
Observations	20,908	20,908
Number of firms	3,847	3,847
Sargan (P-value)	0.534	0.666
arm2 (p-value)	0.955	0.670
arm1 (p-value)	0	0

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

V.2.2 Liability Dollarization

In the analysis, we also control for foreign exchange exposures in the form of foreign exchange liabilities, which is an important cost item in terms of FX especially during large currency depreciations. On the other hand, foreign exchange liabilities are instruments in muting financial constraints and thus supporting economic activity of manufacturing sector in Turkey (Alp and Yalçın, 2015). After 2001 crisis, liability dollarization ratio in Turkey decreased from 85 percent in 2001 to 65 percent in 2010 in parallel to the declining inflation rate, structural reforms, and the newly adopted flexible exchange rate system. Although the average liability dollarization ratio of non-financial firms in Turkey (the ratio of FX liabilities to total liabilities) has been declined following the crisis, it is well above that of firms in peer countries (Özmen and Yalçın, 2007; Hülagü and Yalçın, 2014, IMF 2015).

It would be informative to know how exports of firms with different degree of dollarization ratios are affected by exchange rate fluctuations. The empirical findings document mixed evidence on the impact of balance sheet effects on firm or aggregate level performance measures. If firms have net foreign exchange debt on their balance sheets, real exchange rate depreciations may negatively affect the level of exports through raising financial expenditure and reducing the net worth of firms (currency mismatch), the balance sheet channel. On the other hand, if firms are able to match their foreign exchange debts with their FX-denominated revenues or assets, the impact of exchange rate depreciation may be muted. In order to assess the balance sheet effect, we construct three different dummies reflecting the degree of liability dollarization for the possibility of nonlinear relation between exports and dollarization ratio and its interaction with real exchange rates. For robustness checks, we alternatively construct interaction terms using continuous dollarization ratio.

We construct three firm-specific dummies based on the period average of liability dollarization ratios. The first dummy ($LDOLD_i$) is equal to "1" if firms' period average dollarization ratios are in the lower 25 percentile of the distribution and "0" otherwise. The second dummy ($HDOLD_i$) is equal to "1" if firms' period average dollarization ratios are in the upper 25 percentile of the distribution and "0" otherwise. A positive coefficient for the interaction term with high dollarization dummy ($HDOLD_i$) may imply that the depreciation of the real exchange rate might have negative impact on exports due to currency mismatch binding through production cost and balance sheets channels. On the other hand, a negative coefficient may imply that these channels may not be binding and competitiveness channel dominates. That is, high dollarization supports economic activity including exports through muting financial constraints as forwarded by Alp and Yalçın (2015).

We estimate the model given in equation (2). In this case interaction terms are constructed based on liability dollarization dummies instead of import intensity dummy. The findings are reported in Table 5. We estimate mostly positive but insignificant coefficients for the interaction terms in the specifications where the log of real exchange rates are used as regressor for high and low dollarization firms. We compare the absolute size of the sums of coefficients of the log of real exchange rate and respective interaction terms in the first and the third columns, and in the second and forth columns. We find that exports by firms with high dollarization ratios are slightly more

sensitive to the exchange rate than exports by firms with low dollarization. This result is somewhat different from Cheung and Sengupta (2013) which report insignificant effects of FX debt on firms' exports-to-sales ratios. The insignificant relationship between FX debt and exports does not seem surprising as India is a country where liability dollarization is fairly limited.

Our findings hardly supports the idea that liability dollarization may reduce the sensitivity of exports to the real exchange rates and thus mute the competitiveness channel of the currency depreciation as estimated coefficients for the interaction terms are not statistically significant. Although our results supports the idea that the ability to borrow in FX may increase exporting activity through muting financial constraints, the insignificant coefficients reported for interaction terms blurs the picture. The liability dollarization per se is not a good proxy for currency mismatch as we are only considering firm-level measure for foreign exchange denominated debts without taking into account firm-level foreign exchange denominated assets. To deepen our analysis further, we will introduce a firm-level proxy for currency mismatch in the next section below.

V.2.3 Currency Mismatch: Firms in Hell, Heaven or Hedged Regions

We extend our analysis by introducing a better firm-level proxy for currency mismatch, calculated by taking the period averages of the ratio of FX-denominated debt to exports ($MISMATCH_i$). The numerator represents liabilities while the denominator represents revenues thus larger $MISMATCH_i$ implies higher degree of currency mismatch. Although the ideal way of calculating a proxy for the currency mismatch is to consider also FX-denominated assets and FX indexed domestic sales, due to lack of data we use only exports in the denominator of the ratio. We think this proxy is biased upward as the denominator may be larger than the actual export figures. We use the period average of $MISMATCH_i$ and classify firms into three groups and named them "heaven", "hedged" and "hell" inspired by Echeverry et al. (2003). The first group is reflected by a dummy that represents firms in the lower 25 percentile of average $MISMATCH_i$, "heaven". The second group is made up of firms in the upper 25 percentile of average $MISMATCH_i$, "hell". The last group represents the rest of the firms, "hedged". We use interaction terms of these three dummies with levels and change in log real exchange rate and run regression for the model given in equation (2).

We expect the export sensitivity of hedged firms to the real exchange rate be small, that is, the coefficient of the interaction term of hedged firms is expected to be positive. We expect an insignificant coefficient for the interaction term for the firms belonging to the heaven region as the mismatch is not a problem for these firms and thus the impact through cost of production and balance sheets channels are muted. However, it is not straightforward to guess the expected sign of the coefficient for interaction term for the firms belonging to the hell region. Counteracting channels may determine the sign of this coefficient. A depreciation of the domestic currency may hit the firms' overall economic activity negatively including exports through cost of production and balance sheet channels when currency mismatch exists to a great extent. Therefore, we may expect a positive sign for the coefficient of the interaction term. On the contrary, we may expect a negative sign for the coefficient of the interaction term when the competitiveness channel dominates.

Table 5: Extended Specification with Liability Dollarization Degree: Estimations with Difference GMM Model

	(1)	(2)	(3)	(4)
$lrexp_{i,t-1}$	0.259***	0.253***	0.251***	0.253***
	(0.039)	(0.037)	(0.040)	(0.037)
$ln(RER_{jt})$	-0.334*	-	-0.301*	-
	(0.179)		(0.166)	
$\Delta(ln(RER_{jt}))$	-	-0.180**	-	-0.249***
		(0.077)		(0.078)
$ln(RER_{jt})*HDOLD_i$	0.153	-	-	-
	(0.183)			
$\Delta(ln(RER_{jt}))*HDOLD_i$	-	-0.179	-	-
		(0.146)		
$ln(RER_{jt})*LDOLD_i$	-		0.328	-
			(0.296)	
$\Delta(ln(RER_{jt}))*LDOLD_i$	-	-	-	0.131
				(0.207)
$\Delta(ln(LP_{it}))$	0.548***	0.288*	0.508***	0.314**
	(0.138)	(0.170)	(0.134)	(0.153)
$ln(lrsale_{it})$	0.819***	0.889***	0.836***	0.885***
	(0.148)	(0.143)	(0.147)	(0.143)
$Dolratio_{it}$	0.366*	0.373*	0.243	0.404**
	(0.222)	(0.204)	(0.202)	(0.202)
$Collateral_{it}$	0.380	-0.434	0.503	-0.508
	(1.259)	(1.205)	(1.250)	(1.210)
$Leverage_{it}$	0.754	0.635	0.805	0.588
	(0.654)	(0.623)	(0.655)	(0.619)
$ln(GDP_t^F)$	3.798***	2.260	3.686***	2.292
	(1.424)	(1.455)	(1.417)	(1.454)
$ln(GDP_t^D)$	-2.648***	-2.116***	-2.594***	-2.138***
	(0.727)	(0.713)	(0.722)	(0.711)
VIX_t	-0.007**	-0.006**	-0.007**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
Constant	9.619***	8.945***	9.277***	9.139***
	(2.870)	(2.725)	(2.826)	(2.675)
Observations	20,908	20,908	20,908	20,908
Number of firms	3,847	3,847	3,847	3,847
Sargan (P-value)	0.594	0.647	0.379	0.609
arm2 (p-value)	0.902	0.625	0.753	0.456
arm1 (p-value)	0	0	0	0

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Findings from estimations are often in line with these expectations. We estimate insignificant coefficients for the interaction terms with heaven firms dummy (Table 6). That is, the exports of these firms are unlikely to be sensitive to real exchange rates. On the other side of the distribution, however, we estimate significant and negative signs for the interaction terms of firms in the hell region. In this case, firms seem to be more sensitive to the real exchange rate fluctuations. This finding is interesting as it suggests that exports of firms with high currency mismatch are more sensitive to the change in real exchange rate thus a depreciation of domestic currency is favorable for the exports of these firms. Contrary to our expectation, the cost of production and the balance sheets channels seem to be not binding when domestic currency depreciates implying that competitiveness channel dominates. This finding supports the idea that firms with high FX debt

relative to their exports are somehow able to sustain their export performance with a depreciation of the domestic currency. We discover that these firms seem to be largely domestic oriented (14 percent export share, compared to 40 and 26 percent for firms in the hedged and heaven regions, respectively) and they have relatively lower imported inputs which may be a potential explanation for the strong sensitivity of their exports to the real exchange rates.

Table 6: Extended Specification with Natural Hedge Position: Estimations with Difference GMM Model

	(1)	(2)	(3)	(4)	(5)	(6)
$lrexp_{i,t-1}$	0.256***	0.253***	0.273***	0.260***	0.272***	0.261***
	(0.0392)	(0.0374)	(0.0386)	(0.0380)	(0.0381)	(0.0374)
$ln(RER_{jt})$	-0.274	-	-0.680***		-0.0747	-
	(0.167)		(0.201)		(0.173)	
$\Delta(ln(RER_{jt}))$	-	-0.245***	-	-0.450***	-	-0.107
		(0.0799)		(0.101)		(0.0846)
$ln(RER_{jt})*HEAVEN_i$	0.00248	-	-	-	-	-
	(0.231)					
$\Delta ln(RER_{jt})*HEAVEN_i$	-	0.0742	-	-	-	-
		(0.164)				
$ln(RER_{jt})*HEDGED_i$	-	-	0.639***	-	-	-
			(0.185)			
$\Delta ln(RER_{jt})*HEDGED_i$	-	-	-	0.384***	-	-
				(0.132)		
$ln(RER_{jt})*HELL_i$	-	-	-	-	-0.845***	-
					(0.234)	
$\Delta ln(RER_{jt})*HELL_i$	-	-	-	-	-	-0.552***
						(0.156)
$\Delta(ln(LP_{it}))$	0.526***	0.326**	0.556***	0.417***	0.518***	0.345**
	(0.135)	(0.153)	(0.136)	(0.161)	(0.136)	(0.153)
$ln(lrsale_{it})$	0.824***	0.883***	0.812***	0.854***	0.837***	0.872***
	(0.149)	(0.143)	(0.149)	(0.144)	(0.150)	(0.143)
$Dolratio_{it}$	0.297	0.415**	0.386*	0.446**	0.209	0.408**
	(0.209)	(0.204)	(0.221)	(0.211)	(0.210)	(0.208)
$Collateral_{it}$	0.468	-0.548	0.353	-0.523	0.548	-0.528
	(1.258)	(1.214)	(1.269)	(1.236)	(1.273)	(1.221)
$Leverage_{it}$	0.803	0.557	0.779	0.546	0.841	0.558
	(0.659)	(0.624)	(0.656)	(0.639)	(0.663)	(0.631)
$ln(GDP_t^F)$	3.765***	2.313	3.872***	2.579*	3.793***	2.418*
	(1.422)	(1.452)	(1.427)	(1.471)	(1.428)	(1.453)
$ln(GDP_t^D)$	-2.632***	-2.152***	-2.692***	-2.290***	-2.675***	-2.211***
	(0.725)	(0.710)	(0.729)	(0.721)	(0.726)	(0.711)
VIX_t	-0.007**	-0.007**	-0.008**	-0.006**	-0.008**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	9.493***	9.252***	9.751***	9.908***	9.380***	9.476***
	(2.850)	(2.688)	(2.890)	(2.750)	(2.863)	(2.710)
Observations	20,908	20,908	20,908	20,908	20,908	20,908
Number of firms	3,847	3,847	3,847	3,847	3,847	3,847
Sargan (P-value)	0.538	0.670	0.575	0.676	0.362	0.679
arm2 (p-value)	0.969	0.645	0.846	0.752	0.988	0.592
arm1 (p-value)	0	0	0	0	0	0

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We estimate a positive and significant coefficient for the interaction terms with hedged firms dummy. These firms, by definition, may be treated as candidates for naturally hedged ones whose activities including exports are expected to be less sensitive to the variations in the real exchange rate. This suggests that the sensitivity of the exports to real exchange rate is muted, i.e. the cost of production channel limits the impact of competitiveness channel to some extent. These results are in line with findings in Bleakley and Cowan (2008), and confirm that firms tend to match the currency composition of their liabilities with their ex-ante sensitivity of revenues to the real exchange rate.

Table 7 Extended Specification with Size: Estimations with Difference GMM Model

	(1)	(2)	(3)	(4)	(5)	(6)
$lrexp_{i,t-1}$	0.265***	0.254***	0.255***	0.253***	0.259***	0.254***
	(0.0398)	(0.0376)	(0.0388)	(0.0375)	(0.0392)	(0.0373)
$ln(RER_{jt})$	-0.449**	-	-0.127	-	-0.219	-
	(0.179)		(0.183)		(0.170)	
$\Delta(ln(RER_{jt}))$	-	-0.260***	-	-0.132	-	-0.268***
		(0.0825)		(0.0968)		(0.0802)
$ln(RER_{jt})*LARGE_i$	0.576***	-	-	-	-	-
	(0.203)					
$\Delta(ln(RER_{jt}))*LARGE_i$	-	0.111	-	-	-	-
		(0.139)				
$ln(RER_{jt})*MED_i$	-	-	-0.300*	-	-	-
			(0.175)			
$\Delta(ln(RER_{jt}))*MED_i$	-	-	-	-0.194	-	-
				(0.123)		
$ln(RER_{jt})*SMALL_i$	-	-	-	-	-0.281	-
					(0.226)	
$\Delta(ln(RER_{jt}))*SMALL_i$	-	-	-	-	-	0.170
						(0.155)
$\Delta(ln(LP_{it}))$	0.558***	0.354**	0.530***	0.340**	0.545***	0.315**
	(0.138)	(0.154)	(0.135)	(0.152)	(0.137)	(0.153)
$ln(lrsale_{it})$	0.824***	0.877***	0.826***	0.880***	0.820***	0.882***
	(0.149)	(0.143)	(0.148)	(0.143)	(0.149)	(0.142)
$Dolratio_{it}$	0.321	0.417**	0.322	0.425**	0.323	0.403*
	(0.217)	(0.211)	(0.215)	(0.209)	(0.216)	(0.208)
$Collateral_{it}$	0.541	-0.522	0.385	-0.574	0.444	-0.460
	(1.278)	(1.238)	(1.252)	(1.227)	(1.264)	(1.216)
$Leverage_{it}$	0.840	0.560	0.752	0.547	0.785	0.613
	(0.666)	(0.640)	(0.652)	(0.634)	(0.658)	(0.627)
$ln(GDP_t^F)$	3.862***	2.392*	3.735***	2.322	3.814***	2.310
	(1.437)	(1.452)	(1.415)	(1.451)	(1.428)	(1.447)
$ln(GDP_t^D)$	-2.689***	-2.194***	-2.619***	-2.157***	-2.662***	-2.143***
	(0.734)	(0.710)	(0.723)	(0.710)	(0.729)	(0.708)
VIX_t	-0.007**	-0.006**	-0.007**	-0.006**	-0.007**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	9.546***	9.410***	9.527***	9.327***	9.648***	9.107***
	(2.882)	(2.719)	(2.855)	(2.701)	(2.870)	(2.702)
Observations	20,908	20,908	20,908	20,908	20,908	20,908
Number of firms	3,847	3,847	3,847	3,847	3,847	3,847
Sargan (P-value)	0.609	0.657	0.563	0.665	0.579	0.676
arm2 (p-value)	0.821	0.705	0.947	0.668	0.900	0.624
arm1 (p-value)	0	0	0	0	0	0

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

V.2.4 Size and Age

We interact firm size and age dummy variables with the change and level of log of real exchange rate and report regression results in Table 7 and Table 8, respectively. We expect to estimate a positive signs for the coefficients of interaction terms with large and old dummies and negative signs for small, medium, and young dummies. The latter group of firms is expected to be financially constrained and is not mature enough both in terms of size and age to manage the currency mismatch which makes their exports sensitive to the real exchange rate fluctuations. Estimations results are generally in line with expectations. We estimate generally positive and only significant coefficients for the interaction terms with log of real exchange rate for large and old dummies while generally negative and only significant coefficients for the interaction term with log of real exchange rate for medium and young dummies. The coefficient of interaction terms with small dummy is estimated to be generally insignificant. In short, estimations show that the exports of large and old groups are generally less sensitive to the real exchange rate.

Table 8: Extended Specification with Age: Estimations with Difference GMM Model

	(1)	(2)	(3)	(4)
$lrexp_{i,t-1}$	0.257***	0.253***	0.257***	0.251***
	(0.0389)	(0.0375)	(0.0387)	(0.0373)
$ln(RER_{jt})$	-0.407**		-0.191	
	(0.177)		(0.169)	
$D(ln(RER_{jt}))$		-0.272***		-0.189**
		(0.0876)		(0.0808)
$ln(RER_{jt})*OLD_i$	0.411**			
	(0.189)			
$Dln(RER_{jt})*OLD_i$		0.144		
		(0.133)		
$ln(RER_{jt})*YOUNG_i$			-0.449	
			(0.217)	
$Dln(RER_{jt})*YOUNG_i$				-0.202
				(0.153)
$D(ln(LP_{it}))$	0.533***	0.344**	0.531***	0.341**
	(0.135)	(0.152)	(0.135)	(0.153)
$ln(lrsale_{it})$	0.823***	0.878***	0.831***	0.876***
	(0.148)	(0.143)	(0.148)	(0.143)
$Dolratio_{it}$	0.310	0.417**	0.314	0.435**
	(0.215)	(0.209)	(0.215)	(0.207)
$Collateral_{it}$	0.414	-0.549	0.365	-0.646
	(1.255)	(1.228)	(1.251)	(1.209)
$Leverage_{it}$	0.802	0.563	0.795	0.531
	(0.655)	(0.632)	(0.650)	(0.626)
log_GDP_Partners	3.758***	2.369	3.722***	2.377
	(1.418)	(1.450)	(1.417)	(1.453)
log_GDP	-2.618***	-2.181***	-2.602***	-2.190***
	(0.724)	(0.710)	(0.724)	(0.712)
VIX_t	-0.007**	-0.006**	-0.007**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
Constant	9.487***	9.390***	9.422***	9.553***
	(2.857)	(2.702)	(2.864)	(2.714)
Observations	20,908	20,908	20,908	20,908
Number of id	3,847	3,847	3,847	3,847
Sargan (P-value)	0.575	0.664	0.578	0.651
arm2 (p-value)	0.946	0.675	0.950	0.646
arm1 (p-value)	0	0	0	0

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

VI. Conclusion

Empirical studies that use macro data often fail to find a relationship between real exchange rate and manufacturing exports in Turkey. This finding may be justified with a large content of costs in the forms of foreign exchange including extensive imported inputs and high liability dollarization. In other words, foreign exchange denominated cost items are made up of a significant portion of manufacturing production. Given the cost structure of domestic manufacturing production, the competitive impact of the exchange rate depreciation may be balanced or muted by the cost of production and the balance sheets channels. In this study we use large panel of manufacturing firms to investigate the impact of the variations in exchange rate on exports for the period 2002-2010. We attempt to uncover the relationship between the real exchange rates and exports of manufacturing firms in Turkey by taking account FX exposures and various firm characteristics. Our main contribution is to strike attention to the role of FX exposures and currency mismatch in examining export performance of firms operating in manufacturing industry.

We document that a real depreciation of the Turkish lira has a positive impact on exports and this impact is muted for manufacturing firms operating in sectors that use imported inputs intensively. That is, the cost of production channel seems to be effective in export performance of firms. We also find that exports of firms with moderate FX debt-to-export ratios, so called "naturally hedged firms", are less sensitive to real exchange rates as expected. That is, our findings suggest that degree of currency mismatch appears an important determinant for firm level exports in addition to other commonly used firm specific financial health measures in the literature. Our estimations also show that the exports of medium, small, and young firm groups are generally more sensitive to the real exchange rates while the exports of mature and large firms are estimated to be less sensitive. Contrary to macro evidence, firm level findings suggest that a depreciation of Turkish lira seems to favor the external competitiveness of firms in general while for naturally hedged, large, mature and high import intensity firms, the sensitivity is estimated to be smaller.

These findings are consistent with fact that small and medium sized-young firms in Turkey are more concerned with the level of the exchange rate than large-mature firms which are somehow naturally hedged and hold a large amount of FX debt with longer maturity. The latter group of firms expects lower volatility rather than the level for the exchange rate. Similarly, the former group of firms that uses Turkish lira denominated financing intensively is concerned with high domestic interest rate which creates a financing burden for them.

Liability dollarization in itself is an anomaly for an economy, which may threaten the financial stability. Turkish manufacturing firms are highly dollarized in terms of their liabilities, which may lead to a currency mismatch and thus potentially deteriorate their financial positions in case of large depreciations. However, as also documented by Alp and Yalçın (2015), having access to foreign exchange funds with longer maturity undermines the extent of financial constraints and thus support firms' activity. That is, a strong association is estimated among liability dollarization ratio, and sales, employment and exports of firms. In addition, we estimate that the competitiveness channel dominates the negative outcomes of balance sheet and the cost of production channels in case of currency depreciation for firms, which experience currency mismatch. This finding suggests

that the corporate sector has potential to deal with the negative impact of depreciation of the domestic currency.

The data used in this study is confined with balance sheets and income statements of firms. There is extensive foreign exchange indexed pricing in Turkey, which has important implications for the impact of real exchange rate depreciation on firms activity and their financial positions. To better measure the extent of currency mismatch and assess the impact of exchange rate on export, foreign exchange indexed pricing and foreign exchange denominated assets of firms should be incorporated into the analysis. This is a starting point for future research.

Appendix 1: Industry Specific Exchange Rates

We construct industry-specific trade-weighted real exchange rate to exploit time-series variation in the industry-level currency movements to identify the effect of exchange rates on the exports.

We build the industry specific real exchange rate using the following steps. First we normalized the bilateral nominal exhange rates denominated in local currency (increase meaning an depreciation of Turkish Lira) for each country using 2005 as the base year. For price index, we use aggregate consumer price index of the partner country. We construct industry specific weights based on the sum of exports for each industrys' 30 largest trading partners for a given period. Due to the lack of consistency in the data availability we drop several countries. Consequently, across the two digit manufacturing industries, the number of trading partners varies between 27-30 constituiting %75-90 percent of total exports depending on the industry.

We follow Goldberg (2004) to calculate three real exchange rate measures by industry using i) time varying weights, ii) pre-period weights (1996-1999), and period average weights (2002-2010). In this framework, we construct industry specific exchange rates by using the trade-weights of each industry's trading partners in exports and corresponding bilateral real exchange rates. Export weighted industry-specific real exchange rate (based on pre-period, t1-t2, weights) is calculated as:

$$rer_{jt} = \sum_{k=1}^{30} w_{jk}^{t1-t2} rer_{kt}$$

where

$$w_{jk}^{t1-t2} = \left(\frac{1}{t2 - t1 + 1}\right) \times \left(\sum_{t=t1}^{t2} X_{jkt} \Big/ \sum_{k=1}^{n} X_{jkt}\right)$$

j represent industry, k repsents trading partner, and t is time. For pre-period weights t1 stands for the year 1996 and t2 stands for the year 1999. $\mathrm{rer_{kt}}$ is the bilateral real exchange rate of trading partner k at time t. $\mathrm{w_{jkt}}$ is the corresponding weight based on export value, $\mathrm{X_{jkt}}$, of the trading partner k in sector j.

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