Firm Productivity, Exchange Rate Movements, Sources of Finance and Export Orientation

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Abstract

We investigate the level and volatility effects of real exchange rates on productivity growth of manufacturing firms with heterogeneous access to debt, and domestic and foreign equity markets in Turkey. We find that while volatility affects productivity growth negatively, having access to foreign or domestic equity, or debt markets does not alleviate these effects. Furthermore, foreign or publicly traded companies do not appear to perform significantly better than the rest. We detect, however, that productivity is positively related to credit market access. Additionally, we find that while export-oriented firms react positively to currency appreciations, they are hurt more from volatility.

Keywords: Productivity growth, Exchange rate volatility, Sources of finance, Capital structure, Export orientation

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1 Introduction

Understanding the sources of exchange rate volatility and its impacts on the economy has been a pressing issue for researchers following the breakdown of Bretton Woods system. As a result the economic impacts of the level and volatility of exchange rate movements have been explored extensively using a variety of theoretical and empirical methods.[1] However, we know little about how changes in the level and volatility of exchange rates affect productivity. Despite a significant amount of research generated on the effects of exchange rate movements on investment, growth and export performance of firms, research on firm level productivity has been limited. In fact, to our knowledge only Aghion et al. (2009) provide empirical evidence that exchange rate uncertainty can negatively affect productivity growth. Furthermore, the productivity effects of heterogenous access to external finance under exchange rate shocks also remain an unexplored field of research. The lack of research is quite surprising given that despite the substantial increases in financial openness and international capital flows across countries, firms' access to debt and equity markets, both foreign and domestic, is distributed quite unevenly, creating significant competitive asymmetries in those markets.

In this study, building on the heterogeneous firm literature, we empirically examine the impact of the level and the volatility of real exchange rate on firm level productivity growth, conditional on firms' access to domestic and foreign equity markets, debt finance, and foreign goods markets. To carry out our investigation we exclusively focus on firm level data collected from Turkey, which went through two severe financial crises over the period of investigation yet still managed to grow faster than many other emerging as well as European economies. At a time when many developed and developing economies are grappling with the devastating goods and asset market effects of the 2008-2009 global financial crisis as well as the ongoing European sovereign debt crisis, we argue that we can gain valuable insights from the Turkish experience to understand the impacts of exchange rate shocks on productivity growth when firms have heterogenous access to debt and equity markets as well as export markets.

To carry out our investigation, we utilize a unique panel dataset which includes the top 1,000

private manufacturing sector firms from Turkey. The data set covers the 1993-2005 period. Over the period of investigation, thanks to domestic and external financial liberalization that started in 1989, private firms' access to domestic and external equity markets as well as to bank finance increased substantially in Turkey. However, at the same time, this period is also characterized by high levels of economic risk, exchange rate uncertainty and limited financial sector deepening. In particular, despite a substantial increase in FDI and portfolio inflows (reaching a total of $96 and $55 billion during 1990-2009, respectively) and foreign bank presence (which, in 2011, accounted for more than 40% of the sector), a major fault line that continues to limit firms' growth performance in Turkey is the lack of external finance. While private credit (from the banking sector and other financial institutions) to the private sector has increased substantially over the period of investigation (reaching 20% in 2005 and 33% in 2009 up from less than 17% of GDP in 1993), it is still significantly below the OECD average. As a result, private firms face strict credit constraints and are often forced to finance investments from internal sources or short-term borrowing. For example, the average share of short-term debt in total debt of the top 500 manufacturing firms was around 71% during 1992-2005 (the ratio stayed at around 69% during 2006-2010). Consequently, more than half of manufacturing firms in Turkey report that they face external financing difficulties (ICI, 2011). Furthermore, Turkey is an emerging market with a long history of dollarization, which makes exchange rate volatility a significant source of risk for businesses.[2] In 2011, 60% (52%) of large (medium) size industrial firms depended on foreign currency credits for more than 70% of their external borrowing (ICI, 2011). On the other hand, the period under analysis was also of a success story for export oriented manufacturing firms that succeeded in raising the share of manufactured goods in total exports from 84% in 1993 to 94% in 2005 (and 94% in 2011) (CBRT, 2012).

Additionally, our dataset has several unique features. To start with, all private firms in the dataset are among the top 1,000 manufacturing firms, generating approximately 28% of the total manufacturing value added in GDP and half of the total manufactured goods exports of Turkey over the period of investigation. Secondly, the dataset provides us with *time variant* information

on firms' access to domestic and foreign equity, and to credit markets, with considerable variation across firms. For example, the share of firm level foreign equity participation ranges from zero to 100%, with an overall average of 15%. Likewise, the external debt to assets ratio (i.e. leverage) ranges between 8% and 68%, with an average of 44%. Last but not the least, 29% of the firms have access to the domestic equity market. The sample firms also display substantial heterogeneity in terms of their access to foreign goods markets with the share of exports in output ranging between 0% and 69.3% with an average of 23%. Therefore, we have the ability to control for firm heterogeneity based on access to domestic and foreign capital, and debt finance, as well as export orientation.

To study firms' productivity growth, we implement a dynamic model adopted from the standard empirical growth literature as in Levine et al. (2000) and Aghion et al. (2009), and use the GMM dynamic panel data estimator developed by Arellano and Bond (1991). The empirical results from our investigation show that real exchange rate volatility has a significantly negative effect on productivity growth. Yet, we do not find any evidence that having access to foreign or domestic equity markets, or to debt markets alleviates the adverse impact of exchange rate volatility on productivity at the margin. Having said this, however, we also find that the joint economic effect of exchange rate uncertainty is significantly lower for firms with access to foreign equity while being significantly higher for firms with access to domestic equity market. Interestingly, we observe that the negative productivity effect of exchange rate volatility is stronger for export-oriented firms. Furthermore, we report that the productivity of companies that are foreign owned or publicly traded is generally similar to that of the rest of the firms in our sample. On the other hand, supporting the findings of Aghion et al. (2009), we find that firm productivity improves with increasing external debt finance. When we scrutinize the level effects of exchange rate movements, we observe that a real exchange rate appreciation leads to improvements in productivity of export-oriented firms, while the opposite is true for inward-oriented firms. The robustness of these findings is confirmed by a rich battery of sensitivity checks including those for measurement error, entry/exit bias, threshold effects, and firm tenure.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature on the level and volatility effects of exchange rates on firm productivity. Section 3 introduces the empirical model, and describes the data. Section 4 presents the empirical results, and section 5 concludes.

2 Literature Review

The theoretical research has shown that exchange rate uncertainty can work its effects on firms through multiple channels : a) by changing the relative costs of production (and relative competitiveness) with both creative and destructive growth effects (Burgess and Knetter, 1998; Gourinchas, 1999; Arize et al., 2000, Sauer and Bohara, 2001; Klein et al., 2003; Kandilov and Leblebicioglu, 2011); b) by reducing the degree of credit availability from the banking system (Bernanke and Gertler, 1990)[3]; c) by damaging firm balance sheets and net worth (Bernanke and Gertler, 1990; Braun and Larrain, 2005); and d) through its interactions with other key variables, such as aggregate growth, causing uncertainty effects to magnify (Ramey and Ramey, 1995; Aghion et al., 2009). The growth effects of exchange rate uncertainty, however, ultimately depend on firm characteristics. In view of the capital market imperfections and high exchange rate uncertainty faced by developing countries, having access to better internal and/or external finance through debt and equity markets can allow a significant competitive edge for private sector firms. For example, firms with access to foreign equity can deal with exchange rate shocks and market volatility more effectively than others due to having better access to international goods and capital markets, larger pool of internal finance through the parent company, and better risk management, know-how and experience, and higher labor and total factor productivity (Mitton, 2006; Desai et al., 2008; Arnold and Javorcik, 2009; Yasar and Paul, 2009; Demir (2013)). A similar argument can be made for firms with access to the domestic equity market and bank finance (Demir, 2013). Likewise, the levels of export orientation, import dependence, size, productivity, and profitability also determine the nature of firm response to exchange rate shocks (Gourinchas, 1999; Arize et al., 2000; Campa and Goldberg, 2001; Klein et al., 2003; Demir, 2010, 2013).

The idea that uncertainty can affect firm behavior indirectly through other variables has been

considered by researchers that examine the fixed investment behavior of firms (Leahy and Whited, 1995; Aizenman and Marion, 1999; Bloom et al., 2007; Bloom, 2009; Kandilov and Leblebicioglu, 2011). Aghion et al. (2009), however, is the only study (we are aware of) that explored how exchange rate uncertainty affects productivity growth conditional on changes in credit depth. Using macro data from 83 countries, they show that exchange rate volatility reduces aggregate productivity growth more severely in countries with weaker financial sector development. The basic mechanism that leads to this result is that if borrowing is based on firms' current earnings, which deteriorate due to exchange rate shocks, the very same firms will not be able to invest in innovative technologies, leading to adverse productivity growth effects. However, the importance of firm heterogeneity generated by differential access to domestic or foreign financial markets (for debt and equity) has been left unexplored.

The differential effects of exchange rate movements on firm behavior across publicly traded *versus* non-traded firms are also not explored sufficiently in previous research. Mitton (2006), for example, using static panel data techniques with 1,141 publicly traded firms in 28 emerging markets (with the number of firms ranging between 2 and 136 per country) explores the effects of stock market liberalization on firm performance and finds that firms with access to foreign capital grow faster and enjoy higher investment and profitability rates. Similarly, using Bureau of Economic Analysis data on U.S. multinationals and Worldscope data on publicly traded emerging country firms, and employing a static panel data analysis, Desai et al. (2008) find that US multinationals grow faster in the aftermath of sharp depreciations. In this literature, Chong and Gradstein (2009), and Demir (2010, 2013) are the only studies we are aware of that examine the effects of uncertainty on firm growth using a sample that includes non-publicly-traded firms. Using the World Bank's World Business Environment survey with firm level cross section data from 80 countries, Chong and Gradstein (2009) find that economic policy uncertainty significantly reduces firm growth. Likewise, using a panel data on the largest 1,000 manufacturing firms in Turkey, Demir (2010) shows that exchange rate uncertainty has a significant negative effect on firm growth. Subsequently, Demir (2013) presents evidence that having access to foreign and domestic equity markets, as well as debt

markets reduce negative effects of exchange rate shocks on firm growth. Yet, both Demir (2010) and Demir (2013) are silent about the productivity effects of exchange rate shocks under imperfect capital markets.

Our study also contributes to the debate on the growth effects of financial openness. While Levchenko et al. (2009), for example, fail to detect any significant effect on industry level productivity or long term growth, Bekaert et al. (2011) report a positive effect of financial openness on total factor productivity (TFP) growth through its positive role in stock market and banking sector development. Bekaert et al. (2011) suggest that the net effect remains positive even in the face of global or regional banking crises. Likewise, Kose et al. (2009) argue that FDI and portfolio inflows have a significantly positive effect on TFP growth, while the opposite is the case for external debt liabilities, especially in countries with weaker financial sector development. On the other hand, Eichengreen et al. (2011) find that industrial growth enhancing effects of financial openness disappears during financial crises and is generally limited only to countries with well-developed financial systems. We contribute to this debate by exploring the role of capital structure in productivity growth under exchange rate shocks and capital market imperfections.

3 Empirical Analysis

We employ a standard empirical specification borrowed from the growth literature to examine the impact of the first and the second moments of the effective real exchange rate on firm level productivity growth. To carry out the analysis, we use three sets of uncertainty measures built on the monthly effective real exchange rates from the Central Bank of Turkey online dataset. Our benchmark results are based on an uncertainty measure derived from a GARCH (1,1) model. Then, as a robustness check, we repeat the analysis using two alternative proxies measured by the standard deviation of the first difference of the logarithm of the monthly real exchange rate, and the GARCH method applied to a bilateral two-digit industry level real exchange rate series. We estimate all models using the GMM dynamic panel data estimator developed in Arellano and Bond (1991) to allow for endogeneity, state dependence, and simultaneity bias. We report robust two-step standard

errors proposed by Windmeijer (2005) to correct for the downward bias in standard errors.[4]

As suggested by Arellano and Bond (1991), we use two tests to check the validity of the instrument selection, which determine the consistency of our results.[5] The first is the *J-statistics* of Hansen, which is an over-identifying restrictions test for the instruments. And the second one is the Arellano and Bond (1991) test for autocorrelation to examine the presence of serial correlation in the error terms. In our context the first-order serial correlation is expected to be present, but the residuals should not exhibit second-order serial correlation if the instruments are strictly exogenous. These tests indicate that the instruments used are appropriate, satisfy the orthogonality conditions, and that there is no evidence of the presence of second-order serial correlation.

3.1 Methodology

To quantify the impact of exchange rate movements on firm productivity growth, we introduce both the level and volatility of the real exchange rate along with lagged firm productivity and other firm-specific factors as explanatory variables. Our benchmark specification is in the spirit of Levine et al. (2000) and Aghion et al. (2009) and takes the following form:

$$\begin{aligned}\Delta(y_{i,t}) = \alpha + \beta_1 y_{i,t-1} + \beta_2 \sigma_{t-1} + \beta_3 S_{t-1} + \beta_4 Foreign_{i,t-1} + \beta_5 ISE_{i,t-1} \\ + \beta_6 Exports_{i,t-1} + \beta_7 Size_{i,t-1} + \beta_8 Industry_{j,t} + f_i + \epsilon_{i,t}\end{aligned} \tag{1}$$

where i and t denote firm and year, $\Delta(y_{it})$ is the log difference of real output (from production) per worker,[6] and σ_t is the annual average real exchange rate volatility. The annual real exchange rate S_t is calculated by taking the 12-month average of the logarithmic growth rate of the real effective exchange rate and controls for the level effects on productivity (an increase is a real appreciation). The effective real exchange rate index is based on trade weights of Turkey's 36 main trading partners and is adopted from the Turkish Central Bank database. $Foreign$ captures the percentage share of foreign ownership in a firm's total equity;[7] ISE is a dummy variable that identifies publicly traded *versus* non-traded firms; and $Exports$ is the log of (one plus) the percentage share of exports in output. $Size$ is the log of real total assets of the firm, and $Industry$ is the two-digit manufacturing

industry output growth (from the Turkish Statistical Institute).[8] Firm specific effects and the error term are denoted by f_i and ϵ_{it}, respectively. In order to limit the reverse causality problem we use lagged values on the right hand side of equation (1) with the exception of industry level variable. All firm and industry variables are deflated by the domestic manufacturing sector price index. In all our specifications we use cross-section invariant level and volatility of real exchange rates. As such, our approach is not expected to cause any bias in estimation as long as the cross-section-invariant variables are sufficient to capture all year effects, which also saves on the degrees of freedom as we do not estimate year effects separately. Furthermore, the specification tests suggest that the model is well specified.[9]

In the empirical implementation, we follow two different methods to control for foreign ownership. In the first set of regressions, we use the share of foreign equity in total equity as a continuous measure. In the second set of regressions, we proxy foreign participation in the capital structure of the firm using a dummy variable, $Foreign$[10], which is set equal to 1 when 10% or more of the equity is owned by foreign investors. We take the 10% ownership as a critical level, below which foreign (portfolio) investors may not be too concerned about the long term productivity of the firm or the impact of any adverse exchange rate shocks. It is possible that the effect of foreign ownership is not linear but subject to threshold effects so that foreign equity participation makes a difference only above a certain level. This will also be true if the investors are solely interested in short-run profits. Hence, we can avoid such cases where investors quickly liquidate their equity or write-off their losses if firms experience adverse internal or external shocks. In robustness checks, we also experiment with alternative threshold levels set at 25%, 50%, 75% and 100% to study the importance of foreign capital. Firm access to domestic equity market is captured by the ISE dummy which is set to 1 if the shares of a company are traded on the Istanbul Stock Exchange.

In equation (1), based on the neoclassical theory of competition, we expect the coefficient of lagged productivity variable to take a negative value ($\beta_1 < 0$) showing the catching-up process by less productive firms. Our key variable of interest, the exchange rate uncertainty, is expected to have a negative impact on productivity ($\beta_2 < 0$) based on the idea that uncertainty hinders firms'

ability to invest in new technologies, which could help the firm innovate and stay competitive in the market.[10] In contrast, the effect of a real exchange rate appreciation on productivity is ambiguous ($\beta_3 \lessgtr 0$). On the one hand exchange rate appreciation decreases firms' export competitiveness and increases import competition. These factors—cheap imports, declining exports, and a possible deterioration in product quality due to lack of investment—in turn render the firm less productive as demand for its products declines (see Gupta et al. 2007; Desai et al. 2008). On the other hand, a currency appreciation may increase firm growth, due to falling cost of imported intermediate and capital goods, or lower wage demands because of lower expected domestic prices. It is also possible that, through balance sheet effects, exchange rate appreciation can improve the investment prospects of a firm that has heavily borrowed in foreign currency.

The coefficients of $Foreign$ and ISE are expected to take positive signs ($\beta_5,\ \beta_6 > 0$). In particular, one may expect that firm productivity should improve as foreign ownership increases if foreign investors bring along better production technologies, better management and know-how, and easier access to internal and external sources of finance. Similarly, on average, publicly traded firms are expected to have higher productivity in comparison to non-publicly traded firms if they are more efficient and capital-intensive, and have better external finance access. As discussed extensively in the literature, we also expect export-oriented firms to have higher productivity growth reflected by a positive β_6 because of channels including self selection and learning by exporting (Park et al. 2010). *Size* and *Industry* are introduced as standard control variables.

3.1.1 Extending the basic model

In equation (2) we augment our basic specification by differentiating firms based on their access to debt and equity (foreign and domestic) markets to gauge the overall effect of exchange rate volatility through financial depth:

$$\begin{aligned}\Delta(y_{i,t}) = \alpha + \beta_1 y_{i,t-1} + \beta_2 \sigma_{t-1} + \beta_3 S_{t-1} + \beta_4 Access_{i,t-1} + \phi(\sigma_{t-1} \times Access_{i,t-1}) \\ + \beta_5 Exports_{i,t-1} + \beta_6 Size_{i,t-1} + \beta_7 Industry_{j,t} + f_i + \epsilon_{i,t}\end{aligned} \tag{2}$$

In model (2), *Access* represents a vector of variables, which reflects firms' access to domestic and foreign equity (*Foreign* and ISE as in Eq.1) and debt (*Leverage*) markets. The interaction between *Access* and exchange rate volatility (σ) allows us to determine if the impact of exchange rate uncertainty on firm productivity varies with firms' ability to access domestic and foreign equity capital as well as debt finance. Second, inspecting the coefficients of the interaction terms, we can explore any heterogenous effects of the source of firm finance (and capital structure) on productivity growth.

However, *a priori*, it is not clear whether the interaction terms between *Access* and exchange rate uncertainty can mitigate the (expected) negative impact of exchange rate uncertainty on productivity growth. Aghion et al. (2009) and Bond et al. (2010) argue that the effects of exchange rate shocks amplify if the economy is not financially developed. They suggest that if the borrowing capacity of a firm is related to its current earnings and if wages cannot be adjusted as the exchange rate fluctuates, then in response to exchange rate fluctuations the firm's ability to borrow will be affected, rendering it unable to invest and innovate. Therefore, one may expect that the interaction coefficients (ϕ) between exchange rate uncertainty and foreign capital ownership, stock market access, and leverage will be positive, mitigating the direct effects of exchange rate uncertainty on firm productivity.

Finally, in equation (3) we turn to study the differences in productivity growth based on firms' export orientation under exchange rate shocks by augmenting equation (2) with uncertainty-export interactions[11]:

$$\begin{aligned}\Delta(y_{i,t}) &= \alpha + \beta_1 y_{i,t-1} + \beta_2 \sigma_{t-1} + \beta_3 S_{t-1} + \beta_4 Access_{i,t-1} + \phi(\sigma_{t-1} \times Access_{i,t-1}) \\ &+ \beta_5 Exports_{i,t-1} + \psi_1(S_{t-1} \times Exports_{i,t-1}) + \psi_2(\sigma_{t-1} \times Exports_{i,t-1}) \\ &+ \beta_6 Size_{i,t-1} + \beta_7 Industry_{j,t} + f_i + \epsilon_{i,t}\end{aligned} \tag{3}$$

As discussed earlier, the level effects of real exchange rate movements on export-oriented firms is ambiguous ($\psi_1 \lessgtr 0$). Likewise, the same is true for the sign of coefficient on the interaction term between exchange rate uncertainty and exports ($\psi_2 \lessgtr 0$). On the one hand, while it is shown

that firms with higher openness are subject to higher output volatility (i.e. Arize et al., 2000; Caglayan et al., 2012 and Kandilov and Leblebicioglu, 2011), they may also have better know-how and expertise in hedging their risks. As a result, they may be able to shield themselves better from such shocks (Demir, 2013).

3.2 Data

Our investigation uses a detailed firm-level panel dataset based on the annual surveys of the Istanbul Chamber of Industry on the first and second largest 500 manufacturing firms (based on sales) in Turkey. We also utilize the Istanbul Stock Exchange (ISE) database to construct the final dataset. The data start in 1993 when information on foreign equity participation became available in the surveys and end in 2005.[12] Considering that most other firm level datasets classify foreign ownership as time-invariant, based on a benchmark level, this is a considerable advantage. Furthermore, our sample contains both publicly traded and non-traded private firms.[13] Hence, we can explore if exchange rate shocks affect firm productivity differently depending on firms' access to domestic or foreign equity capital. The dataset also provides leverage ratios and export levels, allowing us to test the effect of debt finance and export orientation on growth.

One shortcoming of the dataset is that it only includes the largest surviving firms and does not provide information on firms that exit from the top 1,000 list.[14] This survivorship, however, would bias our estimations *against* observing any significant effects of exchange rate uncertainty as the sample includes only the most successful firms, which must have developed the means to survive such negative shocks. To test the robustness of our results to non-random entry and exit bias, we also repeat our regressions on a balanced sub-sample. A second issue with the dataset is that it includes the largest private manufacturing firms in Turkey and these firms, unlike small and medium sized firms, may have privileged access to debt and equity markets. However, there is indeed significant firm heterogeneity in the sample regarding firms' access to debt and equity markets, as shown in Table 1.

Insert Table 1 Here

Prior to estimating our models we apply a number of sample selection criteria. First, we include only private firms with no public sector ownership. Second, in order to control for the potential influence of outliers, we drop the upper and lower one percentile of the variables, and also exclude those observations where the leverage ratio is more than 1. Third, we eliminate those firms with less than three consecutive years from the sample since we use lagged observations as instruments. After all screening, we have 568 private manufacturing firms from 21 manufacturing industries including 15-32, 34-36, according to ISIC revision 3 code D.[15] Overall, the number of firms in a given year ranges from 358 (71 foreign and 287 domestic firms (at the 10% threshold level)) to 506 (123 foreign and 383 domestic) firms. Table 1 provides the basic descriptive statistics of the sample used in the empirical estimation. The mean labor productivity growth (Δy) is small and negative yet with a high standard deviation. Figure 1, which plots the productivity distribution of firms in the sample, suggests that even though our sample contains the largest and most successful manufacturing firms in Turkey, there are a large number of relatively less productive firms, with almost half of the observations displaying negative productivity growth. Secondly, the TFP dispersion is high with the 10^{th} percentile of δy (y) being -0.285 (17.069) as opposed to 0.275 (18.942) at the 90^{th} percentile. Third, the autocorrelation coefficient for the level of productivity is significantly high at 0.781 across t and $t-1$.

Insert Figure 1 Here

As shown in Table 1, the share of firm level foreign equity participation ranges from zero to 100% of firm capital, with a standard deviation of 29.8%, and an average of 14.9%. Furthermore, around 28% of firms in the sample have foreign equity participation. We also observe a steady increase in average foreign ownership, rising from 11% in 1993 to 16% in 2005. Likewise, 29% of the firms have access to the domestic equity market, i.e. publicly traded, at any point during the period under investigation (with a standard deviation of 45.2%). Regarding credit market access, the level of access to external debt measured by the leverage ratio ranges between 9% and 97%, with a standard deviation of 20% and an average of 56%. The high level of external indebtedness may also help explain entry and exit dynamics under exchange rate shocks and financial crisis in

Turkey.[16] The sample firms also display substantial heterogeneity in terms of their access to foreign goods markets with the share of exports in output ranging between 0% and 100%, with a standard deviation of 26% and a mean of 28%. Overall, 94% of the firms have reported positive exports, and for 85% of the firms the export ratio was more than 10% of total output. The table also shows that the average sales growth and profitability rates are 2% and 10% per annum, respectively, while some firms experience both extremes of the spectrum. Moreover, the average number of employment per firm, which is 761 is quite high reflecting the size of these firms.

Comparing *Foreign* vs. *Domestic* firms, and *Publicly Traded* vs. *Publicly NonTraded* firms, we find similar results as previous studies. Accordingly, foreign firms appear to have significantly higher level and growth rate of productivity, profitability and leverage ratios than domestic firms. They are also larger in size. Regarding export orientation, however, we do not detect any significant differences between foreign and domestic firms, suggesting that vertical and horizontal FDI are evenly distributed among foreign firms in the sample. Comparing publicly traded and non traded firms, while public firms appear to have significantly higher productivity levels, their growth rates are not significantly different from non-traded firms. They, however, are larger in size, have higher export and external debt ratios.Furthermore, while foreign firms appear to have higher sales growth than domestic firms, pubblicly traded firms have significantly lower sales growth than non-traded firms.[17]

3.3 Computing real exchange rate uncertainty

To carry out our investigation, we need a proxy that captures the volatility of the exchange rate series. In the literature, different methodologies are used to construct measures of exchange rate uncertainty. The two most commonly employed measures of risk are the GARCH methodology, which mimics the volatility clustering often found in high-frequency financial series, and the standard deviation of the series over a window.[18] Using logarithmic monthly real exchange rate series, we implement both the GARCH and the standard deviation approach to generate a measure of uncertainty.[19] Once we obtain the measures from either method, we annualize the monthly measures

to match the frequency of the panel data.[20] We present our main results based on our measure of uncertainty generated from a GARCH (1,1) model. However, we also employ the uncertainty proxy obtained from the standard deviation of the first difference of the logarithm of the monthly real exchange rate to check the robustness of our results. From here on, we refer to uncertainty and volatility interchangeably.

4 Empirical Results

We begin our investigation by exploring the effects of the level and volatility of the real exchange rate on firms' productivity growth, as shown in equation (1). Then, we estimate the augmented models based on equation (2). The results from these two sets of regressions are provided in Table 2. The first 4 columns of the table present results with the continuous foreign ownership measure while the last two columns use a dummy variable, $Foreign^{10}$, which is set to 1 if foreign equity share is 10% or more of total equity.

Insert Table 2 Here

In Table 2, we see that lagged productivity has a large negative and significant coefficient for all models, implying that less productive firms catch up quickly with their more productive counterparts. We also find that exchange rate uncertainty has a highly significant and negative impact on firm productivity across all specifications.[21] The investment literature has shown that uncertainty adversely affects firm investment behavior. Hence, the negative coefficient may imply that firms do not invest in productivity-enhancing technologies or practices when volatility increases. The coefficient estimates imply that a one standard deviation increase in volatility (0.002) reduces productivity growth in the range of 3.5 to 4.8 percentage points (the impact factor).[22] Column 1 also shows that real exchange rate appreciations have a significantly negative impact on productivity, suggesting that on average the negative effects of currency appreciations outweigh the positive effects discussed in Section 3. In terms of the size of the economic effect, we find that a one percentage point real exchange rate appreciation leads to around a 0.2 percentage point decline in

productivity growth. In addition, we find that an increase in export share of output leads to higher productivity growth.

The two remaining variables of interest are $Foreign$ and ISE, capturing the information that the firm has access to foreign and domestic equity markets, respectively.[23] Table 2 shows that the coefficient of foreign ownership is negative and significant for all models implying that the productivity growth of firms with foreign equity ownership is less than that of domestic firms. This finding (which is robust across all regressions and robustness tests) suggests that among the largest and most successful manufacturing firms, productivity growth of foreign-owned firms is slower than that of domestic firms. Furthermore, we do not detect any significant differences in productivity growth between publicly traded *versus* non-publicly traded firms. Lastly, the standard control variables, $Size$ and $Industry$, appear with the expected signs showing that larger firms grow slower (possibly due to dis-economies of scale) and firm growth is positively related with industry level growth.

The second column of Table 2 presents results based on equation (2), which augments the first model with exchange rate and $Foreign$ and ISE interactions. These interactions allow us to test whether the impact of exchange rate uncertainty on productivity varies depending on firm access to foreign equity and domestic stock markets. The estimation results suggest that having access to foreign equity does not matter much as the interaction term takes a positive yet insignificant coefficient. Nevertheless, firms with access to foreign equity are found to perform better than domestic firms under exchange rate shocks. Even though the marginal effect of foreign ownership is found to be positive but insignificant, the net effect of volatility is significantly lower (both economically and statistically) for these firms than domestic firms. In fact, foreign-owned firms on average face 20% lower volatility exposure compared to domestic firms.[24] The impact factor for foreign firms (with continuous, 10% and 25% levels) of one standard deviation in volatility is found to be in the range of 2.4–3.4 percentage points, which is significantly lower than that of domestic firms.

Second, having access to domestic equity markets does not appear to have a significant effect on the negative productivity impact of exchange rate uncertainty either. Nevertheless, the impact factors, which range between 4.8 and 5.3 percentage points, are significantly higher for publicly traded firms than non-traded firms. The net effect of volatility is found to be around 40% higher for these firms than non-foreign/non-public domestic firms. Compared to foreign firms, the impact factor is around 77% higher for publicly traded firms. One explanation, as discussed in the recent literature, might be that publicly traded firms are more likely to be short-termist in their investment decisions and may over react to economic uncertainty. In contrast, foreign firms, and publicly non-traded domestic firms may be more long-termist as they are not subject to the same degree of market pressure in the short run. Miles (2002) points out a significant rise in emerging market stock returns volatility after financial liberalization. Comin and Philippon (2005) and Comin and Mulani (2006) also report a significant rise in employment, sales and equity return volatility among publicly traded firms in the U.S., OECD and Asia after financial deregulation. Moreover, following Aghion and Stein (2008), it is possible that lower growth among publicly traded firms after exchange rate shocks might be due to the fact that they focus more on cost cutting than long term growth. Accordingly, if the stock market values firms' short-term profitability performance more highly, then firms may direct their efforts to short-term "window dressing" measures rather than long term growth of the firm.

The third and fourth columns allows us to examine the role of external credit in firm productivity. Consistent with our prediction, we find that external finance availability contributes positively to productivity: the joint significance of leverage and the interaction term between leverage and uncertainty is always positive at the 10% level or better. According to point estimates, an increase in the leverage ratio from the 25th percentile (0.42) to the 75th percentile (0.74) would increase productivity growth by around 0.07 to 0.1 percentage points.[25] Furthermore, we find that exchange rate uncertainty does not affect highly leveraged firms significantly different from others, as shown by the insignificant interaction coefficient between leverage and uncertainty. Finally, the last two columns present results using a dummy variable to capture the presence of foreign ownership in

firm equity (at the 10% threshold level). Overall, results from this set of models are similar to those reported earlier in columns 3 and 4. However, it is noteworthy to point out that although the coefficient on foreign ownership is still negative, it is smaller in comparison to earlier results.[26]

In Table 3 we extend the basic model to explore the level and volatility effects of real exchange rate movements on export-oriented firms. Consistent with the previous research we find that export-oriented firms enjoy significantly higher productivity growth than non-exporting firms (Alvarez and Lopez, 2005). Furthermore, we observe that real exchange rate appreciation leads to an improvement in productivity as captured by the positive and significant coefficient on the export-exchange rate interaction. This can be explained by the fact that export-oriented firms need to improve their productivity to be able to stay competitive when the real exchange rate appreciates.[27] That is, while exchange rate appreciation has a negative impact on home market oriented firms, export oriented firms take measures to improve their productivity to remain competitive in their export markets. The post-2001 period in Turkey provides some support to this argument as real manufactured good exports increased at around 10% a year during 2002–2009 despite the continuous appreciation of the real exchange rate reaching around 5% a year. In 2005, for example, the domestic currency (TL) appreciated by 8% in real terms while real manufactures exports increased by 10%.

Insert Table 3 Here

When we turn to investigate the effects of exchange rate uncertainty on productivity of export oriented firms, we observe that the uncertainty-export interaction takes a significantly negative sign.[28] This implies that the net effect of uncertainty on export-oriented firms' productivity is higher than that of domestic market-oriented firms. This finding is consistent with the previous research, which shows that exchange rate uncertainty has a significant and generally negative impact on trade flows (Arize et al., 2000; Sauer and Bohara, 2001; Baum and Caglayan, 2010; and Caglayan et al., 2012). These results are consistent across different specifications.[29]

4.1 Robustness Tests

In this section we present results obtained from a battery of sensitivity tests to check the robustness of our findings. To guard against measurement errors and to test for the sensitivity of findings to the exchange rate uncertainty measure, in Tables 4 and 5 we repeat our benchmark regressions using two alternative proxies estimated by: a) the annual standard deviation of the first difference of the logarithm of the monthly effective real exchange rate, and b) two-digit industry level bilateral real exchange rates. Unlike the uncertainty measure employed in the paper so far, the standard deviation based volatility variable captures both predictable and unpredictable components of exchange rate fluctuations, and therefore is better be defined as volatility than uncertainty. Regarding the second method, in comparison to aggregate real exchange rate variable, industry level series allow a more refined analysis of the effects of real exchange rate shocks, which may not be uniformly distributed across different industries. Furthermore, the weight of each industry with trading partners is different and as such can affect the impact of the level and volatility of real exchange rates. However, because there are no continuous price indexes for Turkey and its main trading partners for the period analyzed we had to use bilateral, rather than multilateral, real exchange rate series with respect to the US dollar only. Besides, (based on the ADF test) we have found that the bilateral industry level real exchange rate series is non-stationarity. Hence, we first difference the logarithm of the series to render them stationarity. As a consequence, unlike in the case of the aggregate measure, this approach allows us to use 20 bilateral monthly real exchange rate series to construct an uncertainty measure based on the GARCH (1, 1) methodology.[30] The average correlation between the logarithmic growth rate of this newly created variable and the aggregate effective real exchange rate series is 0.72, and ranges between 0.39 - 0.88 per industry.

Table 4 presents the regression results using the standard deviation based uncertainty measure. As in Table 2, to capture the presence of foreign ownership, the first four columns of this table present results using the continuous foreign ownership variable whereas the remaining four columns use $Foreign^{10}$, which is a dummy variable set to 1 when 10% or more of the equity is owned by foreign investors.[31] Overall, the results from the standard deviation based volatility measure do

not significantly differ from our earlier findings. We confirm that exchange rate volatility has an economically and statistically significant negative effect on productivity growth: the joint significance is always significant at the 1% level or higher. Accordingly, a one standard deviation increase in volatility (2.5%) reduces growth by around 3.2 to 4.4 percentage points. The point estimates are very similar to those obtained when we use the GARCH-based uncertainty. Likewise, the effects of foreign ownership and stock market access are very similar. Even though the marginal effect of foreign ownership is positive but insignificant, the net effect of volatility (using continuous, 10% and 25% thresholds) is around 22% lower for these firms compared to domestic firms. In contrast, publicly traded firms face around 34% higher productivity reduction than non-public domestic firms.[32]

Insert Table 4 Here

Table 5 is constructed similar to Table 4 except that the level and volatility of exchange rates are obtained from the two-digit bilateral industry level real exchange rate series. The results confirm our earlier findings from Tables 2 - 4 showing a significantly negative effect of exchange rate uncertainty on productivity growth. Accordingly, a one standard deviation increase in uncertainty (0.003) is expected to reduce productivity growth in the range of 1 - 4 percentage points. The coefficient estimates regarding the foreign ownership and stock market interactions are also quite similar to those from before. In fact, the marginal effect of foreign ownership under exchange rate uncertainty has now become significantly positive and much stronger than before, causing a downward adjustment in the joint impact factor due to the larger interaction impact of the foreign ownership variable. The net effect of uncertainty is now around 65% lower for foreign firms while it is around 25% higher for publicly traded firms.[33] We note, however, that these results are based on a more limited definition of real exchange rate series which use only bilateral series and with fewer observations due to data availability.[34]

Insert Table 5 Here

Next, in Table 6 we repeat the benchmark regressions using a balanced panel to control for

non-random entry and exit. It is possible that the results may differ for those firms that managed to stay in the sample for the full time period, and for which the data are complete. The results in Table 6, which are based on the balanced dataset are very similar to our earlier observations. Real exchange rate uncertainty continues to have a significant and negative effect on productivity growth with almost identical impact factors as before.[35] However, due to positive and significant marginal effects, we find that firms with access to foreign equity are significantly less sensitive to exchange rate volatility. In fact, the net effect is around 54% lower for firms with foreign equity than for domestic firms.[36] Furthermore, the net (joint) effect of foreign ownership becomes insignificant with alternating signs as opposed to a significantly negative sign in the full sample. On the effect of having access to domestic equity market, the results are very similar to our earlier findings. The stock market access variable (ISE) appears with insignificant and alternating coefficients. The interaction effect with volatility, on the other hand, is negative yet insignificant. The net effect of exchange rate volatility, however, is significantly negative and around 21% higher than that of domestic non-traded firms. In contrast, we find strong evidence that firms with more than 10% foreign ownership that managed to stay in the list for the full time period performed significantly better than others, so that the net effect of exchange rate volatility became insignificant. Furthermore, we no longer observe the productivity growth premium observed among export oriented firms and higher leveraged firms. The significantly positive productivity growth effect of exchange rate appreciations also disappear here. Yet, we continue to find a significantly negative growth effect of exchange rate volatility on export oriented firms.

Insert Table 6 Here

In Table 7 we examine the robustness of our results to the foreign ownership threshold levels set at 50%, 75%, and 100% to test whether firms with higher foreign equity shares behave differently from others. Once again, this set of results are similar to our earlier observations and robust to the choice of threshold level.[37] Overall, we fail to find any significant difference in productivity growth between domestic and foreign owned firms with 50% or higher foreign ownership. However, unlike previous results, we find that the joint effect of exchange rate uncertainty becomes *insignificant* once

we include firms with 75% or higher level of foreign equity ownership. On the other hand, for other firms the joint uncertainty effect continuous to be significant at the 1% level. In the (unreported) balanced panel for firms with 100% foreign ownership, we also find that foreign ownership has a positive and significant effect on productivity growth, due to the significantly positive interaction effect between foreign ownership and exchange rate volatility. Accordingly, the impact factor for these firms is around 0.12. Furthermore, we fail to find any significantly negative effect of exchange rate volatility on firms which hold 10% or more foreign equity in the balanced panel.[38] The effects of access to the debt and domestic equity markets are similar to our earlier observations. Last, while export-oriented firms are found to have higher productivity than the inward-oriented firms, they are also more exposed to exchange rate uncertainty.

Insert Table 7 Here

In Table 8 we explore whether the length of the duration of foreign ownership makes a difference in our results. Perhaps, there is a time lag for foreign firms to reach their full potential in a foreign market. To scrutinize the tenure effect, we generate a dummy variable set to 1 if foreign equity ownership has at least two-year ($Foreign^{10} \geq 2$) or three-year ($Foreign^{10} \geq 3$) tenure at the standard 10% threshold level. Results from this set, as presented in Table 8 are similar to our previous observations. That is while we find a significantly negative uncertainty effect (joint significance) on productivity, no significance difference among firms is detected based on their access to domestic or foreign equity markets. Likewise, similar to our earlier findings, *Leverage* is found to be positive and significant.

Insert Table 8 Here

We also check for the presence of any structural break. Hence, we repeat our benchmark regressions in Tables 2 and 3 by limiting the analysis to the post 2001 crisis period. The (unreported) regression results were very similar to those reported before and are available upon request. When using the industry specific exchange rates as in Table 5, in separate regressions we have also introduced a year specific control variable that is the International Country Risk Guide country risk

index of Political Risk services. This variable controls both year specific shocks and also the institutional quality/risk in the country. It is a 12-month average composite index reflecting corruption, investment profile, law and order, bureaucratic quality, government stability, socioeconomic conditions, internal conflict, external conflict, military in politics, religion in politics, ethnic tensions, and democratic accountability. The (unreported) regression results were similar to those reported before. We also carried out further robustness checks controlling for possible differences between domestic and foreign firms, and between publicly traded and non-traded firms based on their leverage ratios under exchange rate shocks. Last but not least, we repeated all robustness tests above for balanced sub-samples as well. In all cases the (unreported) results were very similar.

5 Conclusion

In this paper we investigate the impact of exchange rate uncertainty and currency appreciations on firm level productivity growth. We implement our analysis using a detailed firm level panel dataset from the top 1,000 manufacturing firms in Turkey for the period 1993–2005. During this period the sample firms generated around 28% of total manufacturing value added in GDP and half of the total manufactured goods exports of Turkey. The most striking finding of this study is that exchange rate uncertainty has an economically and statistically significant negative effect on firm productivity. Moreover, neither foreign or domestic equity market access, nor the availability of external credit seem to reduce the negative productivity growth effects of exchange rate shocks on the margins. Nevertheless, we also find that the joint economic effect of exchange rate uncertainty is significantly lower for firms with access to foreign equity while being significantly higher for firms with access to domestic equity market. Our findings, which are robust to various sensitivity tests, may also help explain why recent empirical studies fail to find any significant productivity effects of financial liberalization (Levchenko et al. 2009). Furthermore, we find that exchange rate uncertainty hurts the productivity growth of export-oriented firms significantly more than others.

In addition, our empirical analysis shows that real exchange rate appreciations have a significantly negative productivity growth effect. Yet, export-oriented firms are found to be more resilient

and shown to improve their productivity in the face of real exchange rate appreciations. It is likely that, as the domestic currency appreciates, the only possibility for export-oriented firms to stay competitive is to improve productivity. In this environment, the productivity of inward-oriented firms declines as they are priced out of the domestic market due to increasing import competition and decreasing investment in productivity enhancing technologies.

Overall, in this study we show that real exchange rate appreciations and real exchange rate volatility have significant negative effects on firm productivity in Turkey, a major emerging economy. Given these findings, exchange rate uncertainty is likely to have an adverse impact on aggregate output and long run growth and therefore we suggest that exchange rate stability and avoidance of misalignments may need to be included in the objective function of central banks and economy ministries. We should point out that findings are based on the (sales based) largest top 1,000 manufacturing firms and that their responses to exchange rate shocks may not be representative for the case of small and medium sized firms. Furthermore, these firms are also the most successful survivors as they managed to stay in the top 1,000 firms list. Therefore, our results may be biased downwards since we do not observe those firms that dropped off the top-1000 list over time. As a consequence, the overall impact of exchange rate movements may be more severe than what we report here.

Notes

[1]See, for instance, Pindyck and Solimano (1993), Ramey and Ramey (1995), Aizenman and Marion (1999), Gourinchas (1999), Arize et al. (2000), Bleaney and Greenaway (2001), Eichengreen et al. (2011), Kandilov and Leblebicioglu (2011).

[2]Echoing this point, Rahmi Koc, the chairman of Koc Holding, which is the largest conglomerate in Turkey was recently quoted saying "Exchange rate fluctuations have always affected us very much. I lost sleep both when the dollar appreciated and when the dollar depreciated" (Uras, 2011).

[3]In addition, Arteta and Hale (2008) show that foreign credit to domestically owned firms in emerging markets fall significantly during sovereign debt crises.

[4]We have employed the first difference rather than the system GMM method given the complications we have encountered in the estimation stage, particularly with regard to the instrument choice. We should note that the additional instruments used in the level equation for system estimation requires that variations in instruments are uncorrelated with the fixed effects. That is firms sampled are in a kind of steady-state, in the sense that deviations from long-term values, controlling for covariates, are not systematically related to fixed effects (Roodman, 2009: 128).

[5]We use only the most recent possible lags of the variables as instruments to limit the problem of 'too many instruments', which reduces the power of the Hansen test (Roodman, 2009). The estimates are obtained using the xtabond2 command in Stata 10.1. We identify foreign ownership share, access to stock market, size, and corresponding interaction variables as endogenous in the instrument selection. Export decision and foreign investment do not appear to have any link in the sample as the simple correlation coefficient between these variables is below 2%. For this, please also refer to footnote 11.

[6]We use labor productivity as our key variable of interest here, similar to OECD (2001), among others. However, firms' reaction to exchange rate shocks might be different due to firm heterogeneity in labor and capital intensity, and as such, the use of multi-factor productivity for a robustness check might be needed. However, our data set lacks information on physical capital stocks of firms, which prevents us from estimating capital or multifactor productivity. Furthermore, for most of the period analyzed, Turkey did not require inflation accounting for firm balance sheets and income statements, despite annual inflation rates approaching 100%. This causes a significant bias in

capital stock estimates, and capital or multi-factor productivity estimates of Turkish firm, as the capital stock values of newer firms and all firms subsequent capital acquisitions are higher valued than the older ones.

[7]More precisely, *Foreign* is set equal to the log of one plus the percentage share of foreign equity.

[8]Exchange rate volatility may have smaller negative effects in those sectors where firms have pricing power, less import dependent, and production is less labor intensive (Campa and Goldberg, 2001).

[9]This methodology has been used by several researchers to examine effects of macroeconomic variables including level and volatility effects of exchange rates under panel data context. For instance see Acemoglu et al. (2003) who also implement a similar strategy.

[10]There is extensive literature on adverse effects of uncertainty on investment. See, for instance, Leahy and Whited (1995), Aizenman and Marion (1999), Bloom et al. (2007), Bloom (2009), Baum et al. (2010), and Kandilov and Leblebicioglu (2011). Also, using a structural model applied to Compustat firms in the US, Bloom (2009) show that rising uncertainty causes a temporary drop in productivity growth as firms pause their investment and hiring.

[11]We also conduct robustness tests by estimating two separate models after dividing the sample into two groups based on export-orientation using alternative definitions where export oriented firms are defined as those with, on average, more than 0%, 10%, 25%, or 50% of the output exported. This approach, however, not only requires an export classification of firms' export orientation (which is time invariant) but also limits our ability to explore the effect of changes in export orientation on productivity. Nevertheless, the (unreported) regression results were similar to those from equation (3) and are available from the authors upon request.

[12]During this period Turkey received more than 90% of its post-1980 total FDI inflows.

[13]Around 25% and 28% of firms in the dataset are publicly traded, and have foreign equity ownership, respectively.

[14]There is a possibility that regional heterogeneity in the sample may cause a bias in estimation results. However, we should note that while an overwhelming majority of firms in the sample are headquartered in Istanbul, most firms in the sample have multiple plants across Turkey. Since we have firm level but not plant level data, it is not possible to calculate the percentage distribution of each plant and region in total output.

[15]In the dataset while no single industry represents more than 20% of the sample, there is a high variation in sectoral representation, with industry shares of observations ranging from less than 0.2% (ISIC 35) to 20% (ISIC 17). When a firm operates in multiple industries we chose the biggest industrial concentration based on sales as the main industry.

[16]The interbank interest rates, for example, jumped as high as 7,000% during the 2001 crisis. Once the credit flow from the banking sector fell due to increased uncertainty and weaknesses in the banking sector as well as firm-level balance-sheet effects, highly indebted firms had no other choice but declare bankruptcy. The high share of short term debt (71% for top 500 manufacturing firms during 1992-2007) also accelerated this process. For a related discussion of such transmission channels see Arteta and Hale (2008).

[17]For space limitations we do not report the summary statistics for sales, and employment for foreign, domestic, publicly-traded and non-traded firms separately. An online appendix provide these and other additional summary statistics.

[18]See for instance, Aizenman (1999) and Driver et al. (2005) who use the ARCH approach, while Ghosal and Loungani (2000) and Aghion et al. (2009) use the standard deviation method.

[19]We checked the series for unit root and rejected its presence using the ADF test.

[20]We used monthly real exchange rates (using relative producer prices) instead of short term alternatives such as daily rates for measuring volatility assuming that daily fluctuations are less relevant for manufacturing firms' annual productivity growth.

[21]In each table we report the joint significance of the effect of uncertainty on productivity growth using the impact factors. In Table 2 the joint effect is always significant. Individual impact factors for firms with access to foreign and domestic equity, external debt, and export markets are not reported for space limitations but are available from authors upon request.

[22]At the mean values of foreign ownership share (0.111), exports (0.229) and leverage (0.438).

[23]Having the ability to access foreign and domestic equity does not necessarily mean that firms raise funds from these sources. Nevertheless, foreign or public ownership may signal the quality of the firm.

[24]This figure is obtained by taking the average percentage difference in the impact factors between foreign firms (measured by continuous, 10% and 25% thresholds) and domestic firms under identical specifications based on results in columns (1)-(4).

[25]Given that the leverage ratio is in natural log, we found this by [ln(0.74)-ln(42)]*leverage point estimate (at the mean value of uncertainty (0.0015)).

[26]We should also note that our results do not appear to be driven by the pro-cyclical nature of capital flows and credit generation in emerging markets. The simple correlation coefficients between the exchange rate volatility measure, and foreign equity participation, stock market listing, and leverage ratio are (0.02), (-0.01), and (-0.006), all statistically insignificant at conventional levels, respectively.

[27]The gains in productivity may also be due to the decreasing cost of imported intermediate and capital goods (Demir, 2013).

[28]Note that the joint uncertainty effect is significant at the 1% level or better in all specifications.

[29]As discussed in footnote 8, we have also divided the sample into two groups based on export orientation. These regression results, which are available upon request, confirm the above findings.

[30]To construct the series one must overcome several problems. First, there are no continuous industry level price indices in Turkey for the period analyzed. There are four separate industry level indexes with different base years and product compositions classified using different methods and product aggregation. In addition, the tobacco industry has been dropped from the sample as there are no comparable private sector price series. This has led to the removal of eight firms. On the trading partner side, i.e. the U.S., we have encountered similar problems with regard to the producer price index. At the end we used hybrid series composed of different producer price indexes for Turkey and the US at two-digit industry level. Further details on measurement issues are available from the authors upon request.

[31]Results under other specifications as in table 2 and 3 are very similar and available upon request.

[32]These figures are based on results in columns (1)-(8) as well as unreported regression estimations obtained for the 25% foreign ownership threshold.

[33]As in Table 4, these figures are based on results in columns (1)-(8) as well as unreported regression estimations which uses the 25% foreign ownership threshold.

[34]When repeating regressions with industry level clustering, or separately running them at industry level, we encountered cases where the AR(2) test and Hansen test results failed. However, since this is a firm level rather than plant level dataset we should note that firms in the sample may

operate in more than one industry at the same time, causing noise and possible bias in industry level estimates. These results are available from authors upon request.

[35]Except in columns (7) and (8), the joint effect is always significant at 1% or higher. In columns (7) and (8), the uncertainty effect becomes insignificant for foreign firms due to the interaction term.

[36]These figures are based on results in columns (1)-(8) as well as unreported regression estimations using the 25% foreign ownership threshold based on specification in column (5). We note that the difference was around 20% in the unbalanced panel.

[37]We also experimented using a quasi continuous variable by interacting the continuous foreign ownership variable with the threshold dummies. The (unreported) results are very similar. The (unreported) results with the 25% threshold level were also very similar and are available upon request.

[38]We should note that the use of balanced dataset leads to a substantial decline in sample size. Also, the share of observations with 100% foreign ownership drops from 6.4% to 4.5% of the sample.

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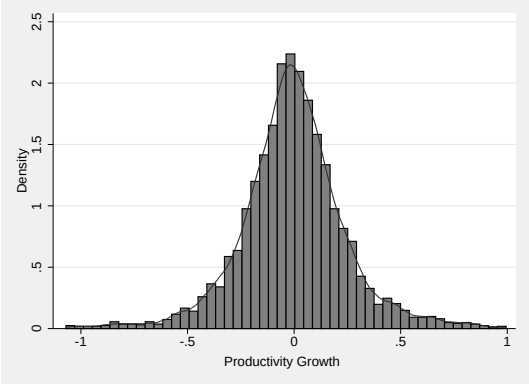

Figure 1: Firms' Productivity Distribution

Notes: Productivity distribution of firms, defined as logarithmic growth rate of real output per worker.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Median	Std.Dev	Min	Max
Δy	3,918	-0.004	-0.006	0.248	-1.070	0.995
$Foreign$	951	0.009*	0.001	0.244	-1.049	0.961
$Domestic$	2,967	-0.008	-0.010	0.250	-1.070	0.995
$Public$	1,125	-0.004	0.003	0.221	-1.020	0.807
$NonPublic$	2,793	-0.004	-0.011	0.259	-1.070	0.995
y	3,918	18.012	18.010	0.723	16.286	20.121
$Foreign$	951	18.253***	18.290	0.592	16.378	20.121
$Domestic$	2,967	17.935	17.879	0.745	16.286	20.082
$Public$	1,125	18.078***	18.121	0.672	16.405	20.043
$NonPublic$	2,793	17.986	17.959	0.742	16.286	20.121
$Log(Size)$	3,918	24.144	24.099	0.852	22.225	26.493
$Foreign$	951	24.290***	24.275	0.906	22.251	26.457
$Domestic$	2,967	24.097	24.060	0.829	22.225	26.493
$Public$	1,125	24.451***	24.485	0.814	22.251	26.464
$NonPublic$	2,793	24.020	23.953	0.835	22.225	26.493
$Exports$	3,918	0.283	0.220	0.261	0.000	1.000
$Foreign$	951	0.275	0.200	0.269	0.000	1.000
$Domestic$	2,967	0.285	0.230	0.258	0.000	1.000
$Public$	1,125	0.244***	0.190	0.222	0.000	0.950
$NonPublic$	2,793	0.298	0.240	0.275	0.000	1.000
$Leverage$	3,918	0.564	0.572	0.204	0.087	0.966
$Foreign$	951	0.552**	0.545	0.205	0.091	0.963
$Domestic$	2,967	0.568	0.578	0.204	0.087	0.966
$Public$	1,125	0.514***	0.516	0.194	0.089	0.966
$NonPublic$	2,793	0.584	0.593	0.205	0.087	0.966
$Profitability$	3,879	0.103	0.070	0.163	-0.710	1.220
$Foreign$	937	0.141***	0.113	0.186	-0.616	0.989
$Domestic$	2,942	0.091	0.060	0.153	-0.710	1.220
$Public$	1,123	0.108	0.087	0.174	-0.710	0.962
$NonPublic$	2,756	0.100	0.064	0.158	-0.572	1.220
$SalesGrowth$	3,918	0.021	0.024	0.241	-1.795	1.284
$Employment$	3,918	761	551	681	34	5,447
σ	3,918	0.002	0.001	0.002	0.000	0.005
S	3,918	0.014	0.044	0.100	-0.215	0.169
$Rerstd$	3,918	0.030	0.017	0.024	0.009	0.083
$\sigma_{industry}$	3,367	0.002	0.001	0.003	0.0002	0.028
$S_{industry}$	3,367	-0.002	-0.024	0.131	-0.476	0.458
$Foreign$	3,918	0.149	0.000	0.298	0.000	1.000
$\sigma \times Foreign$	3,918	0.112	0.000	0.216	0.000	0.693
ISE	3,918	0.287	0.000	0.452	0.000	1.000
$Industry$	3,918	0.057	0.073	0.141	-0.974	1.023

Notes: $Foreign$, $Domestic$, $Public$ and $NonPublic$ refer to foreign firms with 10% or more of equity, Domestic firms, Publicly traded, and non-traded firms, respectively. (***), (**), (*) refer to significance at 1, 5 and 10 percent levels, respectively, based on the t-test of equality of means between foreign vs. domestic, and publicly traded vs. non-traded firms. Growth rates are in log differences. y is the natural log of firm level productivity (defined as real output per worker), $Size$ is real total assets, $Exports$ is the share of exports in total sales, $Leverage$ is the debt to total assets ratio, $Profitability$ is the net profits before taxes to (end of last period) total assets ratio, $SalesGrowth$ is the real net sales growth, $Employment$ is the number of workers employed, σ is the GARCH-based exchange rate uncertainty, S is the annual growth rate of real effective exchange rate, $Rerstd$ is the average annual standard deviation of percentage change in monthly real exchange rate, $\sigma_{industry}$ is the GARCH-based two-digit industry level bilateral real exchange rate uncertainty, $S_{industry}$ is the annual growth rate of two-digit industry level bilateral real exchange rate, $Foreign$ is the percentage share of foreign ownership, ISE is a dummy variable taking 1 for stock market listed firms, $Industry$ is the output growth in two-digit manufacturing industries.

Table 2: Exchange rate uncertainty (GARCH) and Productivity Growth

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.746***	-0.751***	-0.819***	-0.836***	-0.779***	-0.793***
	(0.097)	(0.097)	(0.096)	(0.097)	(0.096)	(0.096)
σ_{t-1}	-21.44***	-20.24***	-22.82***	-12.31	-24.82***	-19.40*
	(3.939)	(4.691)	(4.618)	(9.734)	(4.588)	(10.09)
S_{t-1}	-0.199***	-0.205***	-0.236***	-0.240***	-0.242***	-0.243***
	(0.0546)	(0.0544)	(0.0555)	(0.0558)	(0.0548)	(0.0552)
$Foreign_{t-1}$	-1.382**	-1.411**	-1.357**	-1.357**		
	(0.563)	(0.579)	(0.616)	(0.612)		
$\sigma_{t-1} * Foreign_{t-1}$		9.658	14.47	14.16		
		(13.51)	(13.39)	(13.47)		
$Foreign^{10}_{t-1}$					-0.500***	-0.507***
					(0.178)	(0.180)
$\sigma_{t-1} * Foreign^{10}_{t-1}$					8.917	7.666
					(6.636)	(6.259)
ISE_{t-1}	-0.052	-0.048	-0.094	-0.099	-0.055	-0.064
	(0.150)	(0.151)	(0.172)	(0.175)	(0.168)	(0.171)
$\sigma_{t-1} * ISE_{t-1}$		-9.242	-8.196	-8.844	-9.692	-9.410
		(6.375)	(6.733)	(6.900)	(6.802)	(7.122)
$Leverage_{t-1}$			0.122*	0.159**	0.164**	0.183**
			(0.072)	(0.077)	(0.073)	(0.082)
$\sigma_{t-1} * Leverage_{t-1}$				-22.24		-10.94
				(18.09)		(18.62)
$Exports_{t-1}$	0.220**	0.212**	0.193*	0.194*	0.183	0.187*
	(0.096)	(0.096)	(0.107)	(0.105)	(0.112)	(0.110)
$Size_{t-1}$	-0.158***	-0.156***	-0.136***	-0.137***	-0.169***	-0.171***
	(0.044)	(0.044)	(0.043)	(0.044)	(0.04)	(0.042)
$Industry_{t-1}$	0.191***	0.194***	0.182***	0.180***	0.188***	0.183***
	(0.046)	(0.046)	(0.047)	(0.047)	(0.046)	(0.046)
Impact factor	-0.035***	-0.047***	-0.048***	-0.048***	-0.042***	-0.043***
Observations	4,222	4,222	3,918	3,918	3,918	3,918
# of firms	568	568	555	555	555	555
# of instruments	120	120	121	122	121	122
AR(1)	0.000	0.000	0.001	0.002	0.000	0.001
AR(2)	0.282	0.292	0.412	0.476	0.351	0.395
Hansen	0.335	0.366	0.137	0.103	0.12	0.091

Notes: Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**), (*) refer to significance at 1, 5 and 10 percent levels respectively. σ is real exchange rate volatility; S is the annual growth rate of real effective exchange rate; $Foreign$ is the log of one plus the percentage share of foreign equity; $Foreign^{10}$ is a dummy variable taking 1 for firms with 10% or higher foreign ownership at time t; ISE is a dummy variable taking 1 for stock market listed firms; $Leverage$ is the log of debt to assets ratio; $Exports$ is the log of one plus the share of exports in total sales; $Size$ is the log of real total assets; $Industry$ is the output growth in two-digit manufacturing industries. All regressions include an (unreported) constant variable. Impact factor is the joint effect of one standard deviation increase in uncertainty on productivity growth at the mean values of *Foreign*, *Leverage*, and when *ISE* is one. Hansen is the Hansen tests of over-identifying restrictions, AR(1) and AR(2) are AR(1) and AR(2) tests. P-values are given for all test statistics.

Table 3: Uncertainty-Export interactions and Productivity Growth

	(1)	(2)	(3)	(4)
y_{t-1}	-0.752***	-0.751***	-0.700***	-0.694***
	(0.103)	(0.105)	(0.104)	(0.104)
σ_{t-1}	-12.41**	-10.83	-15.12**	-19.20*
	(6.154)	(9.874)	(5.938)	(10.20)
S_{t-1}	-0.373***	-0.372***	-0.417***	-0.414***
	(0.091)	(0.091)	(0.084)	(0.083)
$Foreign_{t-1}$	-1.290**	-1.262**		
	(0.586)	(0.582)		
$\sigma_{t-1} * Foreign_{t-1}$	17.08	17.03		
	(13.37)	(13.40)		
$Foreign^{10}_{t-1}$			-0.485***	-0.479***
			(0.180)	(0.179)
$\sigma_{t-1} * Foreign^{10}_{t-1}$			9.211	9.320
			(7.058)	(6.882)
ISE_{t-1}	-0.057	-0.063	-0.035	-0.042
	(0.158)	(0.159)	(0.158)	(0.158)
$\sigma_{t-1} * ISE_{t-1}$	-7.156	-7.099	-8.625	-7.828
	(6.436)	(6.601)	(6.598)	(6.832)
$Leverage_{t-1}$	0.131*	0.137*	0.163**	0.150*
	(0.072)	(0.076)	(0.073)	(0.079)
$\sigma_{t-1} * Leverage_{t-1}$		-2.958		9.466
		(18.48)		(19.65)
$Exports_{t-1}$	0.311**	0.314***	0.298**	0.302**
	(0.122)	(0.121)	(0.124)	(0.125)
$S_{t-1} * Exports_{t-1}$	0.587*	0.583*	0.745***	0.743***
	(0.312)	(0.312)	(0.274)	(0.273)
$\sigma_{t-1} * Exports_{t-1}$	-55.97***	-57.10***	-53.55***	-55.92***
	(21.35)	(21.77)	(20.37)	(20.85)
$Size_{t-1}$	-0.149***	-0.149***	-0.180***	-0.178***
	(0.043)	(0.043)	(0.043)	(0.043)
$Industry_{t-1}$	0.180***	0.178***	0.191***	0.190***
	(0.046)	(0.046)	(0.046)	(0.046)
Impact factor	-0.05***	-0.05***	-0.044***	-0.043***
Observations	3,918	3,918	3,918	3,918
# of firms	555	555	555	555
# of instruments	123	124	123	124
AR(1)	0.001	0.001	0.000	0.000
AR(2)	0.401	0.397	0.335	0.322
Hansen	0.239	0.229	0.200	0.201

Notes: For variable definitions, refer to Table 2.

Table 4: Robustness Checks: Controlling for Uncertainty Measure-1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	-0.791***	-0.805***	-0.736***	-0.737***	-0.753***	-0.764***	-0.687***	-0.685***
	(0.094)	(0.095)	(0.102)	(0.103)	(0.094)	(0.095)	(0.102)	(0.102)
σ_{t-1}	-1.365***	-0.615	-0.771**	-0.609	-1.476***	-1.072*	-0.907***	-1.105*
	(0.270)	(0.596)	(0.355)	(0.602)	(0.268)	(0.619)	(0.349)	(0.620)
S_{t-1}	-0.167***	-0.174***	-0.339***	-0.341***	-0.166***	-0.168***	-0.370***	-0.368***
	(0.047)	(0.047)	(0.078)	(0.079)	(0.047)	(0.047)	(0.074)	(0.074)
$Foreign_{t-1}$	-1.227**	-1.234**	-1.188**	-1.173**				
	(0.617)	(0.615)	(0.586)	(0.585)				
$\sigma_{t-1} * Foreign_{t-1}$	0.862	0.856	1.012	1.004				
	(0.851)	(0.853)	(0.853)	(0.854)				
$Foreign^{10}_{t-1}$					-0.479***	-0.487***	-0.467***	-0.464***
					(0.178)	(0.180)	(0.178)	(0.178)
$\sigma_{t-1} * Foreign^{10}_{t-1}$					0.555	0.454	0.557	0.556
					(0.402)	(0.378)	(0.430)	(0.416)
ISE_{t-1}	-0.110	-0.112	-0.071	-0.075	-0.071	-0.079	-0.050	-0.057
	(0.172)	(0.174)	(0.156)	(0.157)	(0.167)	(0.171)	(0.156)	(0.157)
$\sigma_{t-1} * ISE_{t-1}$	-0.472	-0.526	-0.398	-0.405	-0.546	-0.541	-0.467	-0.432
	(0.405)	(0.411)	(0.389)	(0.396)	(0.413)	(0.429)	(0.401)	(0.412)
$Leverage_{t-1}$	0.120*	0.181**	0.126*	0.140*	0.155**	0.187**	0.152**	0.136
	(0.071)	(0.082)	(0.071)	(0.082)	(0.072)	(0.089)	(0.072)	(0.087)
$\sigma_{t-1} * Leverage_{t-1}$		-1.628		-0.358		-0.821		0.472
		(1.167)		(1.189)		(1.195)		(1.246)
$Exports_{t-1}$	0.198*	0.201*	0.325***	0.327***	0.191*	0.198*	0.317**	0.322**
	(0.104)	(0.103)	(0.125)	(0.125)	(0.109)	(0.108)	(0.128)	(0.129)
$S_{t-1} * Exports_{t-1}$			0.761***	0.763***			0.898***	0.899***
			(0.274)	(0.274)			(0.247)	(0.247)
$\sigma_{t-1} * Exports_{t-1}$			-3.082**	-3.076**			-2.981**	-3.090**
			(1.222)	(1.251)			(1.176)	(1.211)
$Size_{t-1}$	-0.132***	-0.136***	-0.144***	-0.145***	-0.163***	-0.166***	-0.172***	-0.170***
	(0.042)	(0.043)	(0.042)	(0.043)	(0.040)	(0.042)	(0.042)	(0.043)
$Industry_{t-1}$	0.185***	0.183***	0.180***	0.179***	0.191***	0.187***	0.192***	0.191***
	(0.047)	(0.047)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)
Impact factor	-0.044***	-0.044***	-0.044***	-0.044***	-0.037***	-0.038***	-0.038***	-0.037***
Observations	3,918	3,918	3,918	3,918	3,918	3,918	3,918	3,918
# of firms	555	555	555	555	555	555	555	555
# of instruments	121	122	123	124	121	122	123	124
AR(1)	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.33	0.375	0.367	0.371	0.282	0.316	0.314	0.312
Hansen	0.236	0.200	0.304	0.297	0.205	0.168	0.251	0.249

Notes: σ is the average annual standard deviation of percentage change in monthly real exchange rate. For other variables, refer to Table 2.

Table 5: Robustness Checks: Controlling for Uncertainty Measure-2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	-0.955***	-0.933***	-0.966***	-0.944***	-0.847***	-0.814***	-0.854***	-0.830***
	(0.095)	(0.096)	(0.100)	(0.101)	(0.097)	(0.095)	(0.100)	(0.101)
σ_{t-1}	-10.33***	-31.86**	-13.91***	-38.03***	-10.93***	-39.38**	-14.57***	-47.88***
	(3.646)	(13.30)	(4.496)	(14.35)	(4.029)	(15.79)	(4.830)	(18.03)
S_{t-1}	-0.142***	-0.142***	-0.292***	-0.303***	-0.141***	-0.140***	-0.312***	-0.340***
	(0.046)	(0.046)	(0.081)	(0.084)	(0.046)	(0.045)	(0.078)	(0.081)
$Foreign_{t-1}$	-0.194	-0.163	-0.146	-0.101				
	(0.555)	(0.518)	(0.603)	(0.555)				
$\sigma_{t-1} * Foreign_{t-1}$	19.63**	22.72**	17.39*	20.53*				
	(8.216)	(9.740)	(9.128)	(10.51)				
$Foreign^{10}_{t-1}$					-0.244	-0.225	-0.256	-0.234
					(0.182)	(0.162)	(0.182)	(0.166)
$\sigma_{t-1} * Foreign^{10}_{t-1}$					11.34**	14.87***	10.98**	14.03***
					(4.581)	(5.170)	(4.776)	(5.005)
ISE_{t-1}	-0.247	-0.213	-0.247	-0.227	-0.132	-0.107	-0.159	-0.145
	(0.192)	(0.184)	(0.196)	(0.193)	(0.201)	(0.191)	(0.192)	(0.186)
$\sigma_{t-1} * ISE_{t-1}$	-3.933	-3.886	-2.748	-2.764	-3.244	-2.324	-1.770	-0.795
	(4.425)	(4.640)	(4.356)	(4.588)	(4.272)	(4.678)	(4.197)	(4.587)
$Leverage_{t-1}$	0.008	-0.095	-0.011	-0.117	-0.033	-0.161	-0.024	-0.164
	(0.163)	(0.172)	(0.164)	(0.176)	(0.167)	(0.182)	(0.169)	(0.181)
$\sigma_{t-1} * Leverage_{t-1}$		45.23*		50.61**		57.84**		64.95**
		(23.97)		(24.21)		(28.10)		(29.37)
$Exports_{t-1}$	0.029	0.032	0.006	0.008	0.032	0.055	0.019	0.036
	(0.123)	(0.121)	(0.133)	(0.132)	(0.130)	(0.130)	(0.136)	(0.137)
$S_{t-1} * Exports_{t-1}$			0.635***	0.681***			0.746***	0.860***
			(0.244)	(0.256)			(0.249)	(0.265)
$\sigma_{t-1} * Exports_{t-1}$			12.40	12.89			10.78	17.03
			(9.493)	(10.45)			(9.789)	(12.20)
$Size_{t-1}$	-0.083*	-0.095**	-0.086*	-0.098**	-0.101**	-0.110**	-0.105**	-0.114**
	(0.047)	(0.046)	(0.047)	(0.047)	(0.049)	(0.048)	(0.049)	(0.048)
$Industry_{t-1}$	0.129***	0.123***	0.128***	0.122***	0.136***	0.139***	0.134***	0.138***
	(0.044)	(0.042)	(0.044)	(0.043)	(0.047)	(0.047)	(0.047)	(0.047)
Impact factor	-0.039***	-0.043***	-0.038***	-0.043***	-0.01	-0.01	-0.01	-0.01
Observations	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367
# of firms	534	534	534	534	534	534	534	534
# of instruments	159	160	161	162	159	160	161	162
AR(1)	0.039	0.023	0.064	0.041	0.003	0.001	0.006	0.003
AR(2)	0.650	0.835	0.492	0.665	0.883	0.711	0.921	0.924
Hansen	0.153	0.243	0.131	0.214	0.071	0.114	0.073	0.122

Notes: σ is the two-digit industry level bilateral real exchange rate uncertainty, and S_{t-1} is the logarithmic difference of the two-digit industry level bilateral real exchange rate. For other variables, refer to Table 2.

Table 6: Robustness Checks: Controlling for Entry-Exit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
y_{t-1}	-0.626***	-0.657***	-0.664***	-0.670***	-0.643***	-0.674***	-0.697***	-0.691***
	(0.075)	(0.078)	(0.078)	(0.079)	(0.078)	(0.088)	(0.091)	(0.091)
σ_{t-1}	-23.25***	-25.01***	-26.09***	-24.91	-6.634	-22.94***	-26.87	-14.13
	(5.308)	(6.482)	(6.070)	(15.87)	(16.15)	(4.963)	(17.02)	(16.92)
S_{t-1}	-0.217***	-0.215***	-0.204***	-0.205***	-0.155	-0.202***	-0.195***	-0.124
	(0.078)	(0.079)	(0.078)	(0.077)	(0.142)	(0.076)	(0.074)	(0.145)
$Foreign_{t-1}$	-0.047	-0.058	0.030	0.075	0.131			
	(0.394)	(0.398)	(0.402)	(0.406)	(0.405)			
$\sigma_{t-1} * Foreign_{t-1}$		39.04*	42.44*	41.11*	36.11			
		(21.17)	(22.23)	(22.06)	(23.24)			
$Foreign^{10}_{t-1}$						-0.169	-0.157	-0.156
						(0.117)	(0.119)	(0.106)
$\sigma_{t-1} * Foreign^{10}_{t-1}$							24.22**	19.00**
							(9.667)	(9.356)
ISE_{t-1}	-0.061	-0.065	-0.0004	-0.010	-0.008	-0.087	0.067	0.119
	(0.162)	(0.162)	(0.173)	(0.173)	(0.167)	(0.170)	(0.190)	(0.189)
$\sigma_{t-1} * ISE_{t-1}$		-5.773	-6.523	-6.489	-6.050		-4.978	-2.394
		(8.544)	(8.270)	(8.325)	(8.359)		(8.908)	(9.160)
$Leverage_{t-1}$			0.159	0.152	0.150		0.168	0.163
			(0.097)	(0.102)	(0.105)		(0.106)	(0.112)
$\sigma_{t-1} * Leverage_{t-1}$				-2.771	6.673		1.217	17.11
				(33.05)	(36.13)		(33.06)	(35.78)
$Exports_{t-1}$	0.187	0.158	0.135	0.123	0.358**	0.198	0.118	0.305*
	(0.148)	(0.144)	(0.143)	(0.142)	(0.155)	(0.147)	(0.150)	(0.161)
$S_{t-1} * Exports_{t-1}$					-0.218			-0.232
					(0.424)			(0.420)
$\sigma_{t-1} * Exports_{t-1}$					-100.5***			-92.59***
					(29.19)			(30.19)
$Size_{t-1}$	-0.067	-0.076	-0.087*	-0.084*	-0.085*	-0.068	-0.076*	-0.078*
	(0.047)	(0.047)	(0.045)	(0.045)	(0.049)	(0.051)	(0.045)	(0.047)
$Industry_{t-1}$	0.277***	0.264***	0.268***	0.270***	0.252***	0.259***	0.249***	0.245***
	(0.064)	(0.063)	(0.064)	(0.065)	(0.061)	(0.063)	(0.063)	(0.058)
Impact factor	-0.038***	-0.043***	-0.045***	-0.045***	-0.047***	-0.038***	-0.013	-0.019
Observations	1,439	1,439	1,438	1,438	1,438	1,439	1,438	1,438
# of firms	131	131	131	131	131	131	131	131
# of instruments	120	120	121	122	124	120	122	124
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.352	0.305	0.332	0.324	0.422	0.227	0.249	0.306
Hansen	0.608	0.645	0.694	0.702	0.623	0.756	0.822	0.854

Notes: The sample is a balanced sub-sample.

Table 7: Robustness Checks: Controlling for Ownership Thresholds

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.948***	-0.943***	-0.990***	-0.986***	-0.878***	-0.881***
	(0.121)	(0.121)	(0.125)	(0.128)	(0.108)	(0.110)
σ_{t-1}	-11.29*	-13.39	-12.51**	-11.25	-12.03*	-11.51
	(6.007)	(9.578)	(6.039)	(9.277)	(6.261)	(10.12)
S_{t-1}	-0.279***	-0.278***	-0.293***	-0.295***	-0.320***	-0.322***
	(0.092)	(0.092)	(0.095)	(0.096)	(0.096)	(0.096)
$Foreign^{50}_{t-1}$	-0.139	-0.143				
	(0.229)	(0.228)				
$\sigma_{t-1} * Foreign^{50}_{t-1}$	8.425	8.738				
	(9.044)	(9.051)				
$Foreign^{75}_{t-1}$			-0.213	-0.214		
			(0.148)	(0.147)		
$\sigma_{t-1} * Foreign^{75}_{t-1}$			12.88	13.33		
			(12.03)	(12.00)		
$Foreign^{100}_{t-1}$					-0.119	-0.122
					(0.337)	(0.332)
$\sigma_{t-1} * Foreign^{100}_{t-1}$					25.42	25.24
					(17.06)	(16.73)
ISE_{t-1}	-0.392	-0.400	-0.348	-0.346	-0.454	-0.450
	(0.344)	(0.339)	(0.322)	(0.318)	(0.347)	(0.344)
$\sigma_{t-1} * ISE_{t-1}$	-5.370	-5.044	-5.377	-5.633	-6.230	-6.226
	(6.368)	(6.519)	(6.134)	(6.232)	(6.128)	(6.292)
$Leverage_{t-1}$	0.143*	0.136*	0.156**	0.160**	0.127	0.130
	(0.078)	(0.083)	(0.075)	(0.079)	(0.078)	(0.083)
$\sigma_{t-1} * Leverage_{t-1}$		4.930		-2.738		-1.313
		(18.17)		(17.24)		(18.00)
$Exports_{t-1}$	0.157	0.160	0.142	0.143	0.151	0.151
	(0.136)	(0.137)	(0.130)	(0.131)	(0.132)	(0.132)
$S_{t-1} * Exports_{t-1}$	0.308	0.309	0.232	0.241	0.361	0.353
	(0.312)	(0.312)	(0.291)	(0.293)	(0.329)	(0.328)
$\sigma_{t-1} * Exports_{t-1}$	-49.83**	-51.10**	-48.79**	-48.61**	-52.72**	-52.72**
	(21.41)	(21.99)	(22.50)	(22.94)	(20.69)	(21.00)
$Size_{t-1}$	-0.150***	-0.151***	-0.156***	-0.156***	-0.168***	-0.167***
	(0.053)	(0.053)	(0.054)	(0.054)	(0.049)	(0.050)
$Industry_{t-1}$	0.139***	0.139***	0.122**	0.122**	0.155***	0.153***
	(0.046)	(0.046)	(0.055)	(0.055)	(0.049)	(0.048)
Impact factor	-0.032**	-0.032*	-0.027	-0.026	-0.008	-0.009
Observations	3,918	3,918	3,918	3,918	3,918	3,918
# of firms	555	555	555	555	555	555
# of instruments	104	105	104	105	103	104
AR(1)	0.099	0.094	0.213	0.214	0.014	0.017
AR(2)	0.708	0.734	0.590	0.608	0.844	0.860
Hansen	0.112	0.113	0.186	0.188	0.152	0.155

Notes: $Foreign^{50}$, $Foreign^{75}$, and $Foreign^{100}$ are dummy variables taking 1 for firms at the 50%, 75%, and 100% foreign ownership thresholds, respectively. For other variable definitions, refer to Tables 2 and 3.

Table 8: Robustness Checks: Controlling for Foreign Tenure

	(1)	(2)
y_{t-1}	-0.787***	-0.864***
	(0.130)	(0.133)
σ_{t-1}	-13.11	-20.27**
	(9.902)	(9.780)
S_{t-1}	-0.345***	-0.320***
	(0.092)	(0.089)
$(Foreign^{10} > 2)_{t-1}$	-0.021	
	(0.149)	
$(\sigma_{t-1} * Foreign^{10} > 2)_{t-1}$	7.426	
	(7.493)	
$(Foreign^{10} > 3)_{t-1}$		-0.262*
		(0.150)
$(\sigma_{t-1} * Foreign^{10} > 3)_{t-1}$		4.383
		(7.176)
ISE_{t-1}	-0.460	-0.314
	(0.329)	(0.303)
$\sigma_{t-1} * ISE_{t-1}$	-5.029	-4.050
	(6.310)	(6.143)
$Leverage_{t-1}$	0.153*	0.144*
	(0.089)	(0.083)
$\sigma_{t-1} * Leverage_{t-1}$	4.176	12.370
	(18.08)	(18.23)
$Exports_{t-1}$	0.148	0.217
	(0.136)	(0.136)
$S_{t-1} * Exports_{t-1}$	0.536*	0.415
	(0.320)	(0.329)
$\sigma_{t-1} * Exports_{t-1}$	-55.53**	-52.97**
	(22.50)	(22.97)
$Size_{t-1}$	-0.155***	-0.158***
	(0.052)	(0.053)
$Industry_{t-1}$	0.155***	0.161***
	(0.045)	(0.049)
Impact factor	-0.035***	-0.044***
Observations	3,918	3,918
# of firms	555	555
# of instruments	87	84
AR(1)	0.007	0.051
AR(2)	0.495	0.868
Hansen	0.073	0.110

Notes: $Foreign^{10} > 2$ ($Foreign^{10} > 3$) refers to a dummy variable equal to one when firms with 10% or more foreign equity were present both this year and last year (and the previous year).