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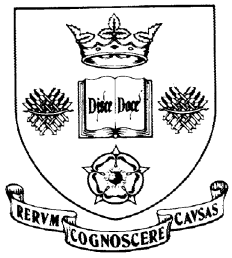

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Firm productivity, exchange rate movements, sources of finance and export orientation

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

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Abstract

We investigate the level and volatility effects of exchange rates on the productivity growth of manufacturing firms with heterogenous access to debt, and domestic and foreign equity markets in Turkey. We find that while exchange rate volatility affects productivity growth negatively, having access to foreign or domestic equity, or debt markets does not alleviate these effects. Furthermore, foreign owned or publicly traded companies do not appear to perform significantly better than the rest. We detect, however, that firm productivity is positively related to having access to external credit. Additionally, we find that while export (inward) oriented firms are affected less (more) by exchange rate appreciations, they are more (less) sensitive to exchange rate volatility.

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

JEL Classification Numbers: F23; F31; F43; G31; G32; L6

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 the 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), using country and industry level data, provide empirical evidence that exchange rate uncertainty can affect long term productivity growth. They show that productivity growth in countries with lower levels of financial development is more sensitive to exchange rate uncertainty than in those countries with higher levels of financial development.

In this study, building on the heterogeneous firm literature, we empirically examine the impact of the level and the volatility of the real exchange rate on firm level productivity growth, conditional on firms' access to domestic and foreign equity markets, and to debt finance. In our investigation, we also account for several additional sources of firm heterogeneity including export orientation. To carry out our investigation, we utilize a unique panel of the top 1,000 private manufacturing sector firms from a major emerging market, Turkey, covering the 1993-2005 period. Over the period of investigation, due to domestic and external financial liberalization, private firms' access to domestic and external equity markets as well as to bank finance increased substantially. 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 the substantial increases in FDI and portfolio inflows (reaching \$97 and \$56 billion during 1990-2009, respectively), and foreign bank presence (which now accounts 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 real private credit (from the banking sector and other financial institutions) to the private sector (as a share of real GDP) has increased substantially over the period of investigation (reaching 26% in 2007), it is still below the OECD average of 160%. As a result, private firms face strict credit constraints and are often forced to finance investments mostly from internal sources or short-term borrowing.[2]

We argue that, considering the persistent credit market imperfections and lack of capital market development in developing countries, we can gain valuable insights from the Turkish experience to understand the impact of the level and volatility of exchange rates on productivity growth under heterogenous access to debt and equity markets. In addition, the dataset we employ has some unique features. To start with, all firms in the dataset are among the top 1,000 private 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 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. 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, size and industry effects).

To study firms' productivity growth, we implement a dynamic model adopted from the standard empirical growth models of 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 margins. 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. 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 the 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 several avenues : a) by changing the relative costs of production with both creative and destructive growth effects (Burgess and Knetter, 1998; Gourinchas, 1999; Klein et al., 2003); 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 covariance with the other key variables, which causes uncertainty effects to magnify or reduce firms' cost and demand side risks (Koren and Szeidl, 2003).

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 better access to international goods and capital markets, larger supply of internal finance through the parent company, and better risk management, know-how and experience, and productivity (Mitton, 2006; Desai et al., 2008; Arnold and Javorcik, 2009; Yasar and Paul, 2009). A similar argument can be made for firms with access to the domestic equity market and bank finance. Likewise, the levels of export orientation, leverage, import dependence, size, productivity, and profitability also determine the nature of firm response to exchange rate shocks (Klein et al., 2003).

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 (Koren and Szeidl, 2003). Aghion et al. (2009), however, is the only study (we are aware of) that explored how exchange rate uncertainty affects productivity growth based 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, because of the limitations of macroeconomic data, the importance of firm heterogeneity generated by differential access to domestic or foreign financial markets (for debt and equity) has not been explored.

The differential effects of exchange rate movements on firm behavior across publicly traded *versus* non-traded firms are also neglected in this literature, with a disproportionate weight given to publicly traded firms. 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 BEA data on US 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) is the only work we are aware of that looks into 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, they find that economic policy uncertainty significantly reduces firm growth.

We contribute to this debate by exploiting a detailed firm level data set, which makes it possible to control for the role of firms' access to external finance (foreign or domestic equity, and debt markets), export orientation, size and industrial characteristics while examining the impact of exchange rate uncertainty on productivity. We also hope that our results will help shed some light on why recent research, such as Levchenko et al. (2009), fail to detect any effect of financial liberalization either on industry level productivity or on long term industry growth.

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 two sets of uncertainty measures based 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 an alternative proxy measured by the standard deviation of the first difference of the logarithm of the monthly real exchange rate. We estimate all our 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. 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, satisfying the orthogonality conditions, and that there is no evidence of the presence of second-order serial correlation in the residuals.

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 several 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:

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

where i and t denote firm and year, $\Delta(y_{it})$ is the log difference of real output (from production) per worker and σ_t is the 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, which controls for the level effects on productivity (an increase is a real appreciation). $Foreign$ captures the percentage share of foreign ownership in firm's total equity;[5] 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).[6] Firm specific effects and the error term are denoted by f_i and ϵ_{it}, respectively. All firm and industry variables are deflated by the domestic manufacturing sector price index.

In the empirical implementation, we follow two different methods to control for foreign ownership. In our first set of regressions, we use the share of foreign equity in total equity as a continuous measure. In our next 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 several other possibilities setting up thresholds 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 (ISE).

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.[7] In contrast, the effect of a real exchange rate appreciation on productivity ($\beta_3 \lesseqgtr 0$) is ambiguous. On the one hand exchange rate appreciation decreases firms' export competitiveness and increases import competition. Moreover it is also possible that, due to the balance sheet effects, exchange rate appreciation can deteriorate the investment prospects of a firm that has heavily borrowed in foreign currency. 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; and 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.

The coefficients of $Foreign$ and ISE are expected to take positive signs (β_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, public firms are expected to have higher productivity in comparison to non-public 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

We next augment our basic specification by differentiating firms based on their access to financial markets, measured by both debt and equity (foreign and domestic) markets. Hence, in equation (2) we extend the benchmark model with several interactions to gauge the overall effect of exchange rate volatility through financial depth:

$$\begin{aligned}\Delta(y_{i,t}) = \alpha + \beta_1 y_{i,t-1} + \beta_2 \sigma_{t-1} + \beta_3 S_{t-1} + \beta_4 Foreign_{i,t-1} + \beta_5 ISE_{i,t-1} \\ + \phi(\sigma_{t-1} \times Access_{i,t-1}) + \beta_6 Exports_{i,t-1} + \beta_7 Size_{t-1} + \beta_8 Industry_{i,t} + f_i + \epsilon_{i,t}\end{aligned} \tag{2}$$

In model (2), *Access* represents a vector of variables, which reflects firms' access to domestic and foreign equity, and debt markets. The interaction between *Access* and exchange rate volatility (σ) allows us to explore if the impact of exchange rate uncertainty on firm productivity varies with firms' ability to access domestic and foreign equity capital as well as external debt finance. Second, inspecting the coefficients of the interaction terms, we can evaluate the differential effects of the source of firm finance (and capital structure) on productivity growth. Thus we can determine whether firms with access to domestic equity, foreign equity, and debt finance perform differently in the face of exchange rate shocks. Therefore, if *Access* were to make a difference, some or all of the coefficients associated with interaction terms should be significant.

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 firm level productivity growth. Aghion et al. (2009) 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 in the long term. Given this argument, one may expect that the interaction coefficients between exchange rate uncertainty and foreign capital ownership, stock market access, and leverage (ϕ) 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 [8]:

$$\begin{aligned}\Delta(y_{i,t}) &= \alpha + \beta_1 y_{i,t-1} + \beta_2 \sigma_{t-1} + \beta_3 S_{t-1} + \beta_4 Foreign_{i,t-1} + \beta_5 ISE_{i,t-1} \\ &+ \phi(\sigma_{t-1} \times Access_{i,t-1}) + \beta_6 Exports_{i,t-1} + \psi_1(S_{t-1} \times Exports_{i,t-1}) \\ &+ \psi_2(\sigma_{t-1} \times Exports_{i,t-1}) + \beta_7 Size_{t-1} + \beta_8 Industry_{i,t} + f_i + \epsilon_{i,t}\end{aligned} \tag{3}$$

As discussed earlier, the level effects ($\psi_1 \lessgtr 0$) of real exchange rate movements on export-oriented firms is ambiguous. In contrast, the coefficient of the interaction term between exchange rate uncertainty and exports is expected to be negative ($\psi_2 < 0$).[9]

3.2 Data

Our investigation uses a detailed hand-collected firm-level panel dataset. The data are compiled using the annual surveys of the Istanbul Chamber of Industry on the first and second largest 500 private 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.[10] Considering that other firm level data sources 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 firms.[11] 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, allowing us to test the effect of debt finance on growth, as well as exports, sales, size, and employment.

One shortcoming of the dataset is that it only includes the surviving firms and does not provide information on firms that exit from the first 1,000 list. 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 acquired or developed the means to survive such negative shocks. To test the robustness of our results to non-random entry and exit bias, we also run our models on a balanced sub-sample. The results based on the balanced sample provide strong support for our findings based on the full sample.

Prior to estimating our models we apply a number of sample selection criteria. 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. We also eliminate those firms with less than three consecutive years from the sample as 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.[12] Overall, the number of firms in a given year ranges from 358 (71 foreign (at the 10% threshold level) and 287 domestic firms) 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. This is expected as the Turkish economy went through deep recessions due to the 1994 and 2001 financial crises followed by rapid expansions. During these extreme cases, the value of the currency fluctuated widely, depreciating sharply

first, and then appreciating slowly to its earlier levels.

Insert Table 1 Here

Table 1 also shows that the average sales-to-assets ratio is around 18%, similar to the levels observed among firms in developed countries. Foreign ownership ranges between zero and 100% of firm capital, and is on average around 15% of the sample at the 10% threshold level (without this limit 28% of firms in the sample have foreign equity participation). Approximately 29% of the firms are publicly traded. The average export-to-sales ratio is around 23%, yet for some firms this ratio is as high as 70% of total sales. We also see that the mean leverage at 44% is above that of firms in developed economies. In our sample, firm leverage ranges from 8% to almost 70% of total assets and can help us understand the dynamics of firm entry and exit during periods of financial crises.[13] 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.

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.[14] Using logarithmic monthly real exchange rate series, we implement both the GARCH and the standard deviation approach to generate a measure of uncertainty.[15] Once we obtain the measures from either method, we annualize the monthly measures to match the frequency of the panel data.[16] 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 model given in 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.[17] 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 during periods of high volatility. 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).[18] Column 1 also shows that real exchange rate appreciations have a significantly negative impact on productiv-

ity, suggesting that on average the negative effects or 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.[19] 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 (both economically and statistically) lower for these firms than domestic firms. In fact, foreign-owned firms on average face 20% lower volatility exposure compared to domestic firms.[20] 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 US, 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 bring forth 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.[21] 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 use 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.

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. 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.[22] That is, while exchange rate appreciation has a negative impact on the 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.[23] This implies that the net effect of uncertainty on export-oriented firms is higher that that of home market-oriented firms. This finding is consistent with 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., 2010). Here, using firm level data, we present first hand evidence that exchange rate uncertainty not only has a negative impact on productivity but also that the negative effect is stronger for export-oriented firms. These results are consistent across different specifications.[24]

4.1 Robustness Tests

To check the robustness of our findings, we carried out a rich battery of sensitivity tests. First, to test for measurement error and the sensitivity of the findings to our choice of volatility measure, we replace the GARCH-based measure of uncertainty with

a standard deviation-based uncertainty measure and present the results in Table 4. Here the uncertainty measure is defined as the annual standard deviation of the first difference of the logarithm of the monthly real exchange rate. As in the benchmark Table 2, to capture the presence of foreign ownership, the first four models of this table use the continuous foreign ownership variable whereas the remaining models use $Foreign$[10]. We report only the results for the broadest model that we have presented in the previous two tables including the impact of leverage.[25]

Insert Table 4 Here

Overall, the results from the standard deviation based volatility measure do not significantly differ from our earlier findings. We confirm that real exchange rate volatility has an economically and statistically significant negative effect on productivity growth: the joint significance of the uncertainty effect is always significant at 1% 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. Similarly, 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 32% lower for these firms compared to domestic firms. In contrast, publicly traded firms face around a 34% higher productivity reduction than non-public domestic firms.

Next, in Table 5 we repeat the benchmark regressions using a balanced panel to control for non-random entry and exit bias. It is possible that the results may differ for those firms that managed to stay in the sample for the entire time period under consideration, and for which the data are complete. The results in Table 5, 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.[26] However, due to positive and significant marginal effects, we find that firms with access to foreign equity are significantly much less sensitive to exchange rate volatility. In fact, the net effect is more than 56% lower for firms with foreign equity than for domestic firms.[27] Furthermore, the net (joint) effect of foreign ownership becomes insignificant with alternating signs as opposed to a significantly negative sign in the full sample. With regard to the effect of having access to the 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 20% 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.

Insert Table 5 Here

Third, in Table 6 we examine the robustness of our results by setting the foreign threshold values at 50%, 75%, and 100% to test whether firms with higher foreign ownership 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.[28] 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 a significantly positive interaction effect between foreign ownership and exchange rate volatility. Accordingly, the impact factor for these firms is a positive 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 data.[29] The effects of access to the debt and domestic equity markets are similar to our earlier observations. Last, as before, 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 6 Here

Fourth, in Table 7 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 7 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 7 Here

Last but not the least, we carried out additional robustness checks controlling for different leverage ratio and export orientation interactions among domestic and foreign firms, and publicly traded vs. non-traded firms. We also repeated all robustness tests above for balanced 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 hand-collected firm level panel dataset from the top 1,000 private manufacturing firms in Turkey for the period of 1993–2005. During this period the sample firms generated approximately 28% of total manufacturing value added in GDP and half of the total manufactured goods exports of Turkey. The data series offer information on domestic *versus* foreign ownership, stock market access, as well as external indebtedness.

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. This result, which is 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 severely than inward oriented firms.

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 Turkish central bank aims to keep the value of Turkish Lira stable while allowing its value to appreciate over time to encourage capital inflows, 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, this study shows that real exchange rate appreciations and real exchange rate volatility have significantly negative effects on firm productivity. Given these findings, exchange rate uncertainty is likely to have an adverse impact on aggregate output and long run growth in developing countries. As a result, we argue that exchange rate stability and avoidance of misalignments should be in the objective function of central banks and economy ministries in developing countries.

Notes

[1]See, for instance, Pindyck and Solimano, (1993), Ramey and Ramey, (1995), Aizenman and Marion, (1999), Bleaney and Greenaway (2001), and Grier and Smallwood (2007).

[2]The average share of short-term debt in total debt of the top 500 manufacturing firms was around 71% during 1992-2005.

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

[4]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.

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

[6]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).

[7]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), and Baum et al. (2010).

[8]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 10%, 25%

or more 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.

[9]For a discussion, among others, see Caglayan et al. (2010), Arize et al. (2000), and the references therein on the effects of exchange rate volatility on trade flows of emerging economies.

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

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

[12]Firms included in the sample have no partial government ownership.

[13]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 see Arteta and Hale, 2008).

[14]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.

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

[16]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.

[17]In each table we also 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.

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

[19]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.

[20]We found this by taking the average percentage difference in the impact factors between foreign firms (measured by continuous, 10% and 25% thresholds) and domestic firms under different specifications.

[21]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)).

[22]One can also argue that the gains in productivity is due to the decreasing cost of imported intermediary goods.

[23]Note that the joint uncertainty effect is significant at more than 1% level in all specifications.

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

[25]Results under other specifications are very similar and available upon request.

[26]Except in column (6), the joint effect is always significant at 1% or higher. In column (6), the uncertainty effect becomes insignificant for foreign firms due to a significantly positive interaction term.

[27]We note that the difference was around 20% in the unbalanced panel.

[28]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.

[29]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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Table 1: Descriptive Statistics

Variable	Obs	Mean	Median	Std.Dev	Min	Max
Δy	3918	-0.004	-0.006	0.248	-1.070	0.995
$Sales/Assets$	3918	18.012	18.010	0.723	16.286	20.121
σ	3918	0.002	0.001	0.002	0.000	0.005
S	3918	0.014	0.044	0.100	-0.215	0.169
$Foreign$	3918	0.149	0.000	0.298	0.000	1.000
$\sigma \times Foreign$	3918	0.112	0.000	0.216	0.000	0.693
ISE	3918	0.287	0.000	0.452	0.000	1.000
$Exports$	3918	0.230	0.199	0.194	0.000	0.693
$Log(Size)$	3918	24.144	24.099	0.852	22.225	26.493
$Leverage$	3918	0.438	0.452	0.134	0.084	0.676
$Industry$	3918	0.057	0.073	0.141	-0.974	1.023
$SalesGrowth$	3918	0.021	0.024	0.241	-1.795	1.284
$Profitability$	3879	0.103	0.070	0.163	-0.710	1.220
$Rerstd$	3918	0.030	0.017	0.024	0.009	0.083

Notes: Growth rates are in log differences. y is the natural log of firm level productivity (defined as real output per worker), $Sales/Assets$ is net sales to assets ratio, σ is the GARCH-based exchange rate uncertainty, S is the annual growth rate of real effective exchange rate, $Foreign$ is the percentage share of foreign ownership, ISE is a dummy variable taking 1 for stock market listed firms, $Exports$ is the share of exports in total sales, $Size$ is real total assets, $Leverage$ is the debt to total assets ratio. $Industry$ is the output growth in two-digit manufacturing industries, $SalesGrowth$ is the real net sales growth, $Profitability$ is the net profits before taxes to (end of last period) total assets ratio, $Rerstd$ is the average annual standard deviation of percentage change in monthly real exchange rate.

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)		
$\sigma * Foreign_{t-1}$		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)	(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 Table2.

Table 5: Robustness Checks: Controlling for Entry-Exit

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-1}	-0.626***	-0.657***	-0.664***	-0.670***	-0.674***	-0.697***
	(0.075)	(0.078)	(0.078)	(0.079)	(0.088)	(0.091)
σ_{t-1}	-23.25***	-25.01***	-26.09***	-24.91	-22.94***	-26.87
	(5.308)	(6.482)	(6.070)	(15.87)	(4.963)	(17.02)
S_{t-1}	-0.217***	-0.215***	-0.204***	-0.205***	-0.202***	-0.195***
	(0.078)	(0.079)	(0.078)	(0.077)	(0.076)	(0.074)
$Foreign_{t-1}$	-0.047	-0.058	0.030	0.075		
	(0.394)	(0.398)	(0.402)	(0.406)		
$\sigma_{t-1} * Foreign_{t-1}$		39.04*	42.44*	41.11*		
		(21.17)	(22.23)	(22.06)		
$Foreign^{10}_{t-1}$					-0.169	-0.157
					(0.117)	(0.119)
$\sigma_{t-1} * Foreign^{10}_{t-1}$						24.22**
						(9.667)
ISE_{t-1}	-0.061	-0.065	-0.0004	-0.010	-0.087	0.067
	(0.162)	(0.162)	(0.173)	(0.173)	(0.170)	(0.190)
$\sigma_{t-1} * ISE_{t-1}$		-5.773	-6.523	-6.489		-4.978
		(8.544)	(8.270)	(8.325)		(8.908)
$Leverage_{t-1}$			0.159	0.152		0.168
			(0.097)	(0.102)		(0.106)
$\sigma_{t-1} * Leverage_{t-1}$				-2.771		1.217
				(33.05)		(33.06)
$Exports_{t-1}$	0.187	0.158	0.135	0.123	0.198	0.118
	(0.148)	(0.144)	(0.143)	(0.142)	(0.147)	(0.150)
$Size_{t-1}$	-0.067	-0.076	-0.087*	-0.084*	-0.068	-0.076*
	(0.047)	(0.047)	(0.045)	(0.045)	(0.051)	(0.045)
$Industry_{t-1}$	0.277***	0.264***	0.268***	0.270***	0.259***	0.249***
	(0.064)	(0.063)	(0.064)	(0.065)	(0.063)	(0.063)
Impact factor	-0.038***	-0.043***	-0.045***	-0.045***	-0.038***	-0.013
Observations	1,439	1,439	1,438	1,438	1,439	1,438
# of firms	131	131	131	131	131	131
# of instruments	120	120	121	122	120	122
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.352	0.305	0.332	0.324	0.227	0.249
Hansen	0.608	0.645	0.694	0.702	0.756	0.822

Notes: The sample is a balanced sub-sample.

Table 6: 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 7: 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)
$(\sigma * Foreign^{10} > 3)_{t-1}$		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).