Growth under Exchange Rate Volatility: Does Access to Foreign or Domestic Equity Markets Matter?

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Abstract

Employing a matched employer-employee dataset, this paper explores the effects of exchange rate volatility on the growth performances of domestic versus foreign, and publicly traded versus non-traded private manufacturing firms in a major developing country, Turkey. The empirical results using dynamic panel data estimation techniques and comprehensive robustness tests suggest that exchange rate volatility has a significant growth reducing effect on manufacturing firms. However, having access to foreign, and to a lesser degree, domestic equity markets is found to reduce these negative effects at significant levels. These findings continue to hold after controlling for firm heterogeneity due to differences in export orientation, external indebtedness, profitability, productivity, size, industrial characteristics, and time-variant institutional changes.

Keywords: Growth; Foreign Direct Investment; Capital Structure; Exchange Rate Volatility, Manufacturing Sector

JEL Classification Codes: F23; F31; G15; G31; G32

Introduction

The macro and microeconomic effects of exchange rate volatility have long been a major concern in development economics. The primary purpose of the Gold Standard of the 19th and early 20th centuries and the ensuing Bretton Woods system, as well as the Exchange Rate Mechanism under the European Monetary System of the 1990s was to ensure exchange rate stability. In fact, the Article 1 of Articles of Agreement of the International Monetary Fund (IMF) continues to single out the promotion of "exchange stability" as one of its primary objectives. Nevertheless, increasing financial liberalization and capital market integration after the collapse of the Bretton Woods system in 1973 exposed both developed and developing countries to large swings in exchange rates.

In a majority of empirical studies, increasing exchange rate uncertainty is found to have economically and statistically significant profitability, investment, growth, and to some degree, trade reducing effects (Pindyck and Solimano, 1993; Ramey and Ramey, 1995; Aizenman and Marion, 1999; Bleaney and Greenaway, 2001; Grier and Smallwood, 2007). Nevertheless, the research on firm growth effects of exchange rate uncertainty has been much limited with an exclusive focus on publicly traded firms located mostly in developed countries despite substantial structural differences between developed and developing countries, and between publicly traded and non-traded firms. The lack of research on developing country experiences is especially surprising given that developing countries face higher levels of exchange rate uncertainty with stronger negative welfare effects than developed countries (Pallage and Robe, 2003). The exclusive focus on the publicly traded firms is also striking because of the structural differences between publicly traded and non-traded firms, and the low market capitalization rates in developing countries that limit sample sizes substantially. Furthermore, there has also been no research exploring differences between domestic and foreign firms in their growth responses to exchange rate uncertainty despite a radical increase in foreign direct investment (FDI) inflows to developing countries, reaching $735 billion (or 43% of global flows) by 2008 from $35 billion in 1990 (or 17% of global flows). In fact, the FDI inflows accounted for 36% of total gross fixed capital formation (GFCF) in developing countries in 2008, nine times more than their 1990 level of 4% (UNCTAD, 2011). The

increasing participation of foreign firms in production and capital formation in developing countries is expected to have major growth effects given that they are generally found to be more productive, profitable, and have better access to global and domestic capital markets. As a result they may help mitigate the contractionary effects of exchange rate shocks and currency crises in developing countries. Yet, there has been little empirical work analyzing the growth effects of exchange rate uncertainty on foreign vis-à-vis domestic firms.

Building on the heterogeneous firm literature, the current study contributes to the existing research on growth effects of exchange rate uncertainty under capital market imperfections by addressing four issues that were previously unaccounted for. First, it separates firms based on their (time-variant) degrees of access to foreign equity. Second, it separates firms based on their access to the domestic stock market. Third, it focuses on a major developing country, Turkey. Fourth, instead of using country or industry level aggregates, it controls for firm heterogeneity based on export orientation, external indebtedness, size, industrial characteristics, and productivity and profitability rates.

The Turkish case is interesting because it entails four important features. First, Turkey liberalized its capital account in 1989, much earlier than other developing countries, and adopted a very open foreign investment regime, leading to substantial FDI inflows since then.[1] Second, as an emerging economy, Turkey has faced high levels of economic instability for the last two decades including significant exchange rate volatility and two severe currency-cum-banking crises in 1994 and 2001. Third, despite comprehensive liberalization programs and a substantial foreign bank presence, the financial sector in Turkey has remained highly underdeveloped. As a result, domestic private firms, both large and small, face strict credit constraints and are forced to finance capital investments mostly from internal sources or short-term borrowing (denominated heavily in foreign currencies), exposing them to exchange rate uncertainty. Looking at the cost of borrowing, for example, the annual average real interest rate reached

[1] During 1990-2009, Turkey received over $95 billion FDI inflows, whose share in GFCF increased from less than 2% in 1990 to 16% in 2007 and 14% in 2008 (UNCTAD, 2011).

11% during 1993-2005, which is the period under consideration in this paper. Likewise, during the same period the real private credit (from the banking sector and other financial institutions) to the private sector (as a share of real GDP) was on average a bare 16%.[2] Money markets in private securities were also quite underdeveloped with the share of private securities in secondary market transactions being below 15% during 1996-2005 (CBRT, 2011). The average stock market capitalization rate as a share of GDP was only 21.6% during 1995-2001 and 25.2% during 2002-2007 (World Bank, 2011). As a result, it is no surprise that the average share of short-term debt in total debt of top 500 manufacturing firms was found to be 71% during 1993-2005 (and was still around 68% in 2010). Furthermore, as late as 2010 more than 60% (44%) of large (small) firms depended on foreign currency credits for more than 70% of their total borrowing needs (ICI, 2011). On average, the non-financial firms accounted for more than 62% of total private external debt during 1993-2005. Fourth, Turkey provides us with a unique firm level panel dataset, which includes 585 private manufacturing firms with over 4,800 firm year observations, accounting for 28% of total manufacturing value added during 1993-2005. In addition to balance sheet and income statement information, the dataset includes time series information on the capital structure of firms such as the level of foreign ownership, and access to the domestic equity market.

The empirical analysis using dynamic panel estimation techniques and comprehensive robustness tests suggest that exchange rate uncertainty has a significantly negative effect on private firm growth. However, having access to foreign capital is found to overcome this negative effect at economically and statistically significant levels. According to point estimates, a one standard deviation increase in exchange rate volatility reduces firm growth by around 4 percentage points among domestic firms. In contrast, having access to foreign equity either reduces this negative effect by around 40% or, depending on the level of foreign ownership, reverses it fully and leads to an around 3 percentage point increase in growth. Supporting this finding, we also find that firms with access to domestic stock market perform

[2] Even during the boom years of 2002-2007, deposit bank private credit to non-financial firms was startlingly low with an average annual growth rate of -5% (CBRT, 2011).

significantly better than non-traded firms under exchange rate shocks. We confirmed these results during currency crises episodes as well. Furthermore, we find that the negative growth effect of exchange rate volatility is significantly lower for firms with higher export orientation and with better access to external credit markets.

The paper is organized as follows: the next section provides a brief overview of the literature on uncertainty and growth relationship. The third section introduces the empirical analysis including the data, methodology and estimation issues. The fourth and fifth sections present the empirical results and robustness analysis, and the final section concludes the paper.

1. Literature review

Exchange rate volatility can affect investment and growth through multiple channels though, theoretically speaking, the sign of the relationship is ambiguous depending on the underlying assumptions (Aiginger, 1987; Dixit and Pindyck, 1994; Caballero and Pindyck, 1996; and the collection of articles in Aizenman and Pinto, 2005). In contrast, a rich body of empirical research points out an unambiguously negative effect of uncertainty on investment, employment, and growth (Federer, 1993; Pindyck and Solimano, 1993; Aizenman and Marion, 1999; Serven, 2003; Rosenberg, 2004; Aghion et al., 2009; Chong and Gradstein, 2009). Accordingly, exchange rate volatility works its effects through: a) changing the relative costs of production with both creative and destructive growth effects (Burgess and Knetter, 1998; Gourinchas, 1999; Klein et al., 2003); b) reducing the degree of credit availability from the banking system (Bernanke and Gertler, 1990)[3] with contractionary effects on employment (Sharpe, 1994; Nickell and Nicolitsas, 1999) and investment (Fazzari et al., 1988); c) decreasing aggregate growth and productivity growth especially in countries where financial development is low (Ramey and Ramey, 1995; Aghion et al., 2009); d) increasing inflation uncertainty, which is found to reduce employment

[3] Under credit shocks, high share of short term financing (as in developing countries) can also put substantial constraints on firms (Chang and Velasco, 2000). Besides, banking crises in emerging markets are often accompanied by currency crises (Beck et al., 2003).

(Seyfried and Ewing, 2001), and growth (Grier and Grier, 2006); e) raising interest rates (UNCTAD, 2006) with negative growth effects (Nickell and Nicolitsas, 1999); f) damaging firm balance sheets and net worth (Bernanke and Gertler, 1990; Braun and Larrain, 2005); and g) discouraging international trade by raising transaction risk (Grier and Smallwood, 2007).

In view of these transmission channels, the growth effects of exchange rate uncertainty ultimately depend on firm and country characteristics. For example, in the presence of financing constraints firms that have access to domestic and/or foreign capital markets can deal with unexpected exchange rate shocks better than others. Similarly, the level 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). Regarding country specific factors, Gupta et al. (2007) find that currency crises are more likely to have contractionary effects in emerging markets than in developed or other developing countries. In general, exchange rate uncertainty is expected to have more depressing growth effects in developing countries because of the following vulnerabilities in these markets: a) Low levels of financial market deepening and the lack of hedging instruments; b) the presence of original sin and dollarization with strong balance sheet effects; c) higher levels of openness, and the invoicing of exports in hard currencies; d) higher levels of exchange rate pass-through; and e) higher levels of exchange rate, capital flow, consumption, and growth volatility.

Nevertheless, despite the heterogeneity in firm and country specific factors, few studies addressed them in empirical research. First, there is limited research looking into the effects of firm access to foreign equity. In theory, exchange rate expectations affect the future cash flow and profit expectations of foreign firms and influence their entry and expansion decisions. According to option-pricing models, for example, increasing exchange rate uncertainty deters foreign firms' investment and growth as they postpone their entry or expansion decisions (Campa, 1993). Aizenman (2003) using a model of vertically integrated multinational firms argues that increasing macroeconomic volatility in emerging markets reduces foreign firms' employment as they switch production to less volatile markets. Conversely, increasing exchange rate uncertainty may increase foreign firms' entry and growth as risk-averse foreign

firms substitute foreign production for exports (Cushman, 1985; Goldberg and Kolstad, 1995). Even under risk-neutrality, firms may choose to increase their foreign investments or to divert home investments to foreign locations due to increasing profitability of foreign plants (Sung and Lapan, 2000).[4] In addition, firms with access to foreign equity can deal with exchange rate shocks and market volatility more effectively thanks to their better access to international goods and capital markets, larger supply of internal finance through parent company, and better risk management, know-how, experience, and productivity (Mitton, 2006; Desai and Foley, 2007; Arnold and Javorcik, 2009; Yasar and Paul, 2009). Besides, workers employed by foreign multinationals are reported to have higher skills and productivity (Navaretti et al. 2003; Almeida, 2007; Huttunen, 2007, Yasar and Paul, 2009). As a result, foreign firms may display lower short-run sensitivity to volatility by keeping worker turnover low to prevent the spillover of their technology and know-how to local competitors (Hamermesh, 1993; Fosturi et al., 2001).

Empirically speaking, Cushman (1985), using data on FDI flows from the U.S. to five industrialized countries, and Goldberg and Kolstad (1995), using the U.S. bilateral FDI flows with three industrialized countries, find that increasing exchange rate risk significantly increases FDI flows. Accordingly, multinationals substitute foreign capital for decreasing exports in response to increasing risk. Likewise, Aguiar and Gopinath (2005) find that foreign firms significantly increased their acquisitions in East Asia during 1996-1998 currency crisis period. In contrast, Campa (1993) finds that exchange rate uncertainty significantly reduces foreign investment from 35 countries into the U.S. On the other hand, Gorg and Wakelin (2002) fail to find any statistically significant and economically robust effect of exchange rate volatility on either US outward or inward FDI to and from 12 developed countries.

The differences between publicly traded and non-traded firms are also neglected in the current literature with a disproportionate weight given to publicly traded firms. In this literature, Mitton (2006) using static panel data techniques with 1,141 publicly traded firms in 28 emerging markets (with the

[4] Russ (2007), however, argue that a multinational firm's response to exchange rate volatility depend on the nature of the exchange rate shock, that is whether it results from home or host country factors.

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. (2007) find that US multinationals grow faster in the aftermath of sharp depreciations. Chong and Gradstein (2009), however, is the only research we are aware of that looks into the effects of uncertainty on firm growth using a sample that includes publicly non-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 (as perceived by the respondent firms) significantly reduces firm growth.

2. Empirical analysis

2.1 Benchmark model

In order to explore whether domestic and foreign firms respond differently to exchange rate uncertainty, we begin our empirical analysis by adopting the following benchmark dynamic model (for a discussion, see Hamermesh, 1993; Fabbri et al., 2003; Navaretti et al., 2003; Rosenberg, 2004; Desai et al., 2008):

$$Growth_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 S_t + \alpha_3 Volatility_t + \alpha_4 Foreign_{i,t} + \alpha_5 Volatility_t * Foreign_{i,t} + \alpha_6 X_{i,j,t} + \varepsilon_{i,t} \quad (1)$$

where $i=1,\ldots, n$, $j= 1,\ldots, k$, and $t=1993,\ldots, 2005$ respectively refer to the firm, industry, and time series elements of the data, and ε_{it} is the error term. All firm and industry level variables are deflated using the domestic manufacturing sector price index.

Growth is measured by the logarithmic growth rate of the number of employees of firm *i* at time *t*. Lagged dependent variable measures the persistency and adjustment speed of labor demand. We used employment growth to proxy firm growth given that a firm's production and expansion decisions are a function of both labor and capital, and the long term growth of a firm can be measured using either of these two variables. As we lack data on physical capital, we choose employment growth as our main variable.

S is the annual average logarithmic growth rate of effective real exchange rate (an increase is a real appreciation) to control for the level effects as opposed to volatility. Appreciating real exchange rate can reduce firm growth through decreasing export competitiveness, increasing import competition, or balance sheet effects (Gupta et al., 2007; Desai et al., 2008). Alternatively, a currency appreciation may increase firm growth thanks to falling cost of imported intermediate and capital goods, or lower wage demands because of lower expected domestic prices.

Volatility is the exchange rate volatility variable measured by the annual average conditional variance from a GARCH (1, 1) process. The empirical literature offers a number of competing approaches for the construction of volatility measure such as the standard deviation of the series. However, this proxy gives rise to substantial serial correlation in the summary measure. Furthermore, theoretically speaking, uncertainty is caused by unpredictable innovations to the variable of interest, while sample variation includes predictable innovations from past behavior as well.[5] Therefore, to be able to separate the predictable from the unpredictable exchange rate shocks and to capture the volatility clustering often found in exchange rate series; we adopted a GARCH model to generate the uncertainty measure. Given that the firm data are annual, we constructed the uncertainty proxy incorporating monthly variations in exchange rate up to a year. We used monthly exchange rates instead of short term alternatives such as daily rates for measuring volatility assuming that daily fluctuations are less relevant for manufacturing firms' long term investment and employment decisions. However, as a robustness check we also experimented with two alternative proxies measured by: a) the annual standard deviation of monthly percentage changes in effective real exchange rate, and b) two-digit industry level bilateral real exchange rates. Based on our earlier discussion, we expect a negative relationship between *Volatility* and *Growth*.

[5] From here on, we will refer to uncertainty and volatility interchangeably. For a discussion of different volatility and uncertainty measures, see Serven (1998) and Wolf (2005).

Foreign is the percentage share of foreign ownership in a firm's total equity.[6] In addition to the continuous measure, we also employed a second variable to control for foreign ownership, $Foreign^{10}$, which is a dummy variable set equal to one when 10% or more of the equity is foreign owned. It is possible that the effect of foreign ownership on firm growth is not linear and becomes noticeable only when the equity share passes a certain threshold. Below this level, foreign portfolio investors may be inattentive to the long term growth of the firm or to the effects of exchange rate shocks. It is also possible that portfolio investors may be more sensitive to short term exchange rate fluctuations, causing them to liquidate their investments prematurely with negative effects on firm growth. In that case, a dummy variable approach might be more appropriate. In the robustness analysis, we also experimented with several other thresholds, including 25%, 50%, 75% and 100%. We expect a negative relationship between foreign ownership and employment growth if, as suggested by previous studies, foreign firms are more capital intensive and more productive than domestic firms. However, if the majority of foreign firms are vertical FDI, and are located in Turkey for lower labor costs then we may find a positive relationship.

*Volatility*Foreign* is an interaction variable capturing the effect of *Volatility* on foreign owned firms. Given better access to domestic and foreign capital markets, better risk and financial management and portfolio diversification, and better planning and organization, foreign firms are expected to be less vulnerable to exchange rate uncertainty. However, given the portfolio allocation decision they face in multiple countries, increasing uncertainty may also slow down foreign firm growth more.

X is a vector of standard firm and industry specific control variables including the following:

Sales is the logarithmic growth rate of net annual sales of firm *i* at time *t*, and controls firm specific demand and supply shocks.[7]

[6] To be exact, it is *log(1+percentage share of foreign ownership in equity)*. Regressions without logs yielded similar results, which are available from authors upon request.

[7] Given the derived demand nature of employment, we used GMM type instruments for sales growth.

Size is the natural log of real total assets of firm *i* at time *t*. If increasing size leads to diseconomies of scale, the size-growth relationship can be negative. Also, since larger firms have higher sunk costs, firm size may be a proxy for the degree of investment irreversibility (Rosenberg, 2004). As a result, larger firms may be more sensitive to increasing uncertainty. Alternatively, scale and scope economies and entry barriers may favor large firms' growth over small ones. Besides, firms' access to external credit may be a positive function of their size and thereby affect their future growth. Gibrat's law, on the other hand, suggests that firms' growth is independent of its size.

Industry is the annual logarithmic growth rate of two-digit manufacturing industry real output, controlling for industry-wide demand and supply shocks (a list of industries is in the appendix). Exchange rate volatility is expected to have smaller negative effects in those industries where firms have pricing power and less import dependent, and production is less labor intensive (Campa and Goldberg, 2001).

Wages is the annual logarithmic growth rate of real wages in two-digit manufacturing industries.[8]

2.2 Domestic equity market access

Previous empirical research suggests that publicly traded firms enjoy easier access to external finance, have better governance and risk management, and are more productive and profitable than non-traded firms. However, they may also be more exposed to market fluctuations and face higher shareholder pressure, which increase their sensitivity to uncertainty. Therefore, we expect exchange rate shocks to have different growth effects on firms with access to the domestic equity market. To test this hypothesis, we extend the benchmark specification (1) as follows:

$$Growth_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 S_t + \alpha_3 Volatility_t + \alpha_4 Foreign_{i,t} + \alpha_5 Volatility_t * Foreign_{i,t} + \beta_1 ISE_{i,t} + \beta_2 Volatility_t * ISE_{i,t} + \alpha_6 X_{i,j,t} + \varepsilon_{i,t} \quad (2)$$

[8] Here we instrumented *Wages* with the one-period lagged values to control for any contemporaneous effect of exchange rate uncertainty on employment through higher wages, and also for the reverse causality from labor demand (Andersen and Sorensen, 1988).

In Eq. (2) *ISE* is a dummy variable set equal to one if firm *i* is traded in Istanbul Stock Exchange market in year *t*. We expect publicly traded firms to have higher growth in capital accumulation, but not necessarily in employment if they are also more efficient, productive, or capital intensive in production.

*Volatility*ISE* is an interaction variable of *Volatility* and *ISE*. Having better access to domestic equity market is expected to reduce the negative effect of exchange rate shocks. However, given the higher responsiveness of firms' valuation to market fluctuations, publicly traded firms may be harder hit by such shocks. Depending on which effect is dominant β_2 might be positive or negative.

2.3 Export orientation

In empirical literature export oriented firms are generally found to be more productive and capital intensive, larger, faster growing, more competitive, and have better access to international markets than non-exporting firms (Bernard and Jensen, 1999). Some explanations for these differences include scale effects as market size expands, learning by exporting that may increase factor productivity, higher competition due to output tradability, or that there is a self-selection process where more efficient firms simply tend to export more (Tybout, 2003). Comparing sample firms in the dataset, the average output share of exports is not significantly different between domestic and foreign firms with mean (median) values of 28% (22%) and 29% (22%), respectively. To control for export orientation, we expand equation (1) as follows[9]:

$$Growth_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 S_t + \alpha_3 Volatility_t + \alpha_4 Foreign_{i,t} + \alpha_5 Volatility_t * Foreign_{i,t}$$
$$+ \phi_1 Exports_{i,t-1} + \phi_2 S_t * Exports_{i,t-1} + \phi_3 Volatility_t * Exports_{i,t-1} + \alpha_6 X_{i,j,t} + \varepsilon_{i,t} \quad (3)$$

Exports is the natural log of one plus the percentage share of exports in total output of firm *i* at time *t-1*. Due to the endogeneity problem between export performance, and exchange rate fluctuations, we use one-period lagged values here.

[9] Extending equation (3) to include the stock market variables as in eq. (2) yields similar results. Unreported regression results are available from the author.

*S*Exports* controls for the exchange rate level effects on export oriented firms. Depending on demand and supply elasticities as well as imported input dependence, firms with higher export shares are expected to grow faster after currency depreciations.

*Volatility*Exports* that is an interaction variable between *Volatility* and *Exports*. Assuming that firms involved in foreign trade have better knowledge and access to foreign financial markets, they may utilize hedging instruments that are not available to domestic firms. Also, exporting firms may be able to shield themselves better from domestic goods market disturbances caused by volatility. Yet, given the lack of local hedging instruments and the fact that manufactured good exporting developing countries are price takers in international markets with the transactions being invoiced in few hard currencies, exporting firms may be more exposed to exchange rate volatility.

2.4 Access to external credit

In eq. (4) we differentiated firms based on their level of external indebtedness. Increasing financial leverage (i.e. external debt to total assets ratio) reflects firms' access to external finance and therefore can have a positive effect on growth. Yet, increasing indebtedness may also make new borrowing more difficult and can slow down growth (Lang et al., 1996). Among the sample firms, firms with access to foreign equity have a leverage ratio of 58% as opposed to 60% for domestic firms.

$$Growth_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 S_t + \alpha_3 Volatility_t + \alpha_4 Foreign_{i,t} + \alpha_5 Volatility_t * Foreign_{i,t} + \gamma_1 Leverage_{i,t-1} + \gamma_2 S_t * Leverage_{i,t-1} + \gamma_3 Volatility_t * Leverage_{i,t-1} + \alpha_6 X_{i,j,t} + \varepsilon_{i,t} \quad (4)$$

Leverage is the natural log of one plus the leverage ratio of firm *i* at time *t-1*. The lagged value of *Leverage* is used to avoid any endogeneity or reverse causality problem.

*S*Leverage* is an interaction variable controlling for the effects of exchange rate fluctuations on firms at different levels of external indebtedness. In the presence of balance sheet effects, currency depreciations can hurt those firms with higher levels of liability dollarization more.

*Volatility*Leverage* is an interaction term of *Volatility* and *Leverage*. Exchange rate volatility can affect firms differently depending on the level of their external indebtedness: First, firms that are exposed

to currency mismatch problem will suffer from fluctuations in the domestic currency value of external liabilities. Second, firms with maturity mismatch problem will suffer from fluctuations in short term interest rates as the monetary authority intervenes to curtail excess volatility, or as the risk premium on external borrowing increases. And third, as the risk premium increases, rising cost of external borrowing will hurt those firms with higher leverage ratios and external finance dependence more through decreasing supply and increasing cost of external finance (Braun and Larrain, 2005).

3.3 The data

In the empirical analysis we utilize an unbalanced firm-level panel dataset compiled from the annual surveys of the Istanbul Chamber of Industry (ICI) on the largest 500 private manufacturing firms in Turkey. The second largest 500 manufacturing firm surveys, and the Istanbul Stock Exchange (ISE) database are also utilized to complete some of the missing observations. Given that the foreign ownership share data in the surveys are available only after 1993, we limited our analysis to the 1993-2005 period, during which time Turkey received more than 90% of its post-1980 total FDI inflows. The panel, apart from being one of the most comprehensive firm level datasets from developing countries, also has the advantage that unlike the surveys from statistical institutes, it is a matched employer/employee dataset with the names of the firms included. Furthermore, given the topic at hand, the dataset provides us with information on the firm level percentage share of foreign ownership in each year. Considering that other firm level data sources classify foreign firms only based on a benchmark level and is generally time-invariant, this is a considerable advantage. Last, but not the least, unlike most other datasets (such as Amadeus or Worldscope), our sample firms, both domestic and foreign, are *not* limited with only those that are publicly traded. This advantage allows us to directly explore any differential growth effects of domestic and foreign capital market access under exchange rate shocks.

One shortcoming of the dataset, however, is that it includes only the largest surviving firms. It is possible that exiting firms and small and medium sized firms might have had stronger reactions to exchange rate uncertainty than these survivors. This would bias our results against finding any significant effect of uncertainty on firm growth, and as such finding a significant effect among the survivors will

strengthen our conclusions. To limit this bias we expanded our initial sample using the second largest 500 manufacturing firm dataset from ICI as well as the ISE balance sheet data on publicly traded firms.

All data are checked for errors and obviously misrecorded observations are discarded. In the regression analysis, we further excluded those firms with only one year of data, and those extreme outlier observations whose absolute value of logarithmic change of employment and sales exceeded 1.00. This resulted in a marginal reduction in sample size corresponding to less than 1.5% of total observations. After this restriction, we have 585 firms in 21 manufacturing sectors (based on two-digit ISIC codes) with 4,832 observations. On average, firms in the sample jointly accounted for 28% of total manufacturing value added in GDP, and 50% of total manufactured goods exports of Turkey during 1993-2005.

<Insert Table 1 Here>

The number of firms with foreign equity participation ranges between 74 (in 1994) and 131 (in 2001 and 2002), and they account for 27% of total observations. Similarly, the number of firms with access to domestic equity market ranges between 84 (in 1994) and 137 (in 2001), and they account for 29% of the observations. Of the sample firms, the average foreign equity ownership rate is 15%, and of those firms with access to foreign equity, the ownership rate is more than or equal to 10% of total equity 89% of the time (Table 1). Firms with foreign ownership are responsible for 29% of employment, and 40% of sales and 43% of exports in the sample. Publicly traded firms, on the other hand, account for 34% of total employment, 39% of sales, and 38% of exports.

Based on both average and median size of employment, total assets and sales, foreign firms are significantly larger than domestic firms. Likewise, at both mean and median levels foreign firms are significantly more profitable and productive than domestic firms. Moreover, foreign firms appear to be significantly (at 1%) less indebted than domestic firms with a mean (median) leverage ratio of 57.9% (55%) for the former as opposed to 60.4% (58.3%) for the latter. Looking at export orientation, however, we do not observe any significant differences between domestic and foreign firms. The mean (median) export share in output is 28.8% (22%) for foreign firms and 27.8% (22%) for domestic firms. We also do

not detect any significant differences between foreign and domestic firms in terms of average growth rates in employment or sales.

Turning to publicly traded firms in Table 1, we find that they are larger than non-traded firms in terms of mean and median size of employment, total assets and sales. They are also more productive and profitable, and have lower leverage ratios measured at both mean and median levels. Publicly traded firms are, however, less export oriented with their export shares in output standing at a mean (median) level of 24.6% (19%) as opposed to 29.6% (23%) for non-traded firms. Furthermore, publicly traded firms appear to have lower mean and median levels of growth in employment and sales.

4. Results

First, in Table 2 we report estimation results based on equation 1 using a fixed effects method clustered at the firm level, and a feasible GLS method assuming heteroskedastic error structure and panel specific autocorrelation. In equation 1 the lagged dependent variable is endogenous to the fixed effects in the error term, giving rise to the well-known dynamic panel bias making OLS and making fixed effects estimators inconsistent. Moreover, we still need to deal with parameter endogeneity and simultaneity. The fixed effects and GLS methods ignore these issues altogether. In order to tackle these issues, in the remainder of the paper we employed the augmented Generalized Method of Moments (GMM) dynamic panel data (DPD) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) that estimates a system of equations in the first differences and levels. Using this method it is possible to control for any possible parameter endogeneity and simultaneity bias as well as to correct for the correlation between the lagged dependent variable and firm specific effects and the error term. To limit the problem of having "too many instruments" (Roodman, 2009), we employed the *t-s* for $2 \leq s \leq 3$ dated variables as instruments.[10] We computed robust two-step standard errors by the Windmeijer finite-sample correction

[10] The DPD estimates are obtained using the xtabond2 command in Stata 10.1 written by David Roodman. The stationarity of all variables are confirmed using the panel unit root tests of Im et al. (2003). Repeating the analysis

method. The validity of the instrument set is tested by the Hansen test of overidentifying restrictions while the presence of serial correlation is tested by a second order serial correlation test.

As expected and consistent with the previous studies on the topic, the results presented in Table 2 using the fixed effects and GLS methods suggest a significant level of dynamic adjustment with the lagged dependent variable being significant at more than 1% level. Moreover, we find that exchange rate volatility has an economically and statistically significant negative effect on firm growth. Accordingly, a one standard deviation increase in *Volatility* reduces firm growth in the range of 0.2 – 1.2 percentage points for domestic firms, and 0.2 – 1.0 percentage points for foreign firms. Furthermore, even though the point estimates for the marginal effects of foreign or domestic equity market access are less precise, the impact factors suggest that firms with access to domestic or foreign equity are significantly less sensitive to exchange rate volatility.

In Table 3 we present regression results based on equation (1) using the system GMM method, taking into account the dynamic adjustment and state dependence, as well as possible parameter endogeneity and simultaneity among the regressors. Columns (1) – (3) show results using the continuous foreign ownership variable, and (4) – (6) repeats the same using the 10% foreign ownership threshold dummy. In all specifications we find that exchange rate volatility has an economically and statistically firm growth reducing effect. However, we also find that this negative effect is either significantly reduced or reversed for firms with access to foreign equity. Focusing on columns (1) and (4) we see that one standard deviation (0.0016) increase in uncertainty (i.e. the impact factor) reduces employment growth of domestic firms by 3.9 – 4.2 percentage points. In contrast, access to foreign capital is found to reduce this negative effect by 40% leading to an impact factor of (-2.3) (column 1). Moreover, when foreign ownership is more than 10% of total equity (column 4), the impact of one-standard deviation increase in exchange rate volatility becomes positive for these firms with a point estimate of 3.2 percentage points.

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using one-step estimation yielded similar results. We identified *Sales* as endogenous in the instrument selection, and instrumented *S, Volatility, Foreign,* and their interaction variables with their first lags.

This finding (supported by the robustness tests at higher thresholds) also suggests that the negative effect of volatility is decreasing in the rate of foreign ownership.

Based on equation (2) in columns (2) – (3) and (5) – (6) of Table 3 we control for having access to the domestic equity market. While all our previous results continue to hold, we also discover that firms with access to domestic equity market are significantly less exposed to exchange rate volatility. Comparing publicly traded and non-traded domestic firms, we find that the negative impact factor drops from around (-4.7) to around (-1.9) – (-2.5) percentage points. Likewise, the impact factors for foreign firms that have access to domestic equity market increases either from (-3.3) to (-0.5) (and becomes statistically insignificant) or from (2.2) to (4.5). As such, the results provide support to the argument that having access to foreign and domestic capital markets significantly reduces the negative effects of exchange rate shocks, though significantly more so for the former.

Looking at the performance of foreign and publicly traded firms in columns (1) – (6), we find that they display lower employment growth than others possibly reflecting higher efficiency and capital intensity of these firms. Moreover, output growth is found to be a robust and significant predictor of firm growth. We also find that the labor demand adjustment is quite fast with annual employment changes accounting for 95% of the desired adjustment. Other control variables, including firm size, two-digit manufacturing industry output growth, and two-digit manufacturing industry wage growth are found with the expected signs yet at statistically insignificant levels. Last but not the least, exchange rate appreciation is found to have a positive but statistically insignificant effect on growth.

4.1 Export orientation and access to external credit

In Table 4 columns (1) – (4) we differentiated firms according to their export orientation as in equation (3). We confirm previous results from Table 3 showing a significantly negative growth effect of exchange rate volatility, which decreases significantly for firms with access to foreign equity. Furthermore, we find that export oriented firms are significantly less vulnerable to volatility suggesting better exchange risk management. Comparing firms at the 10^{th} and 90^{th} percentile of the distribution based

on export shares (that are 0% and 67%)[11], we find that the negative impact factor significantly decreases as export share increases. Looking at its direct effect, we find that similar to the effects of having access to foreign and domestic equity markets firms with higher export orientation display lower employment growth, possibly reflecting increasing productivity, capital intensity and competitive pressures.

<Insert Table 4 Here>

Next, based on equation (4) we separated firms according to their level of external indebtedness in columns (5) – (8) of Table 4. The results provide strong support to our previous findings on the effects of volatility and having access to foreign equity, with almost identical economic and statistical significance levels. Moreover, while we find that firms with higher leverage grow significantly slower, they are less vulnerable to exchange rate shocks. According to point estimates, the impact factor for domestic firms is (-0.5) at the 90th percentile level of indebtedness (88%) as opposed to (-5.8) at the 10th percentile level (29%).[12] For foreign firms, the impact factor increases from 0.9 at the 10th percentile to 6.5 at the 90th percentile level.

5. Robustness analysis

5.1 Controlling for profitability and productivity differences, and industrial outliers

As discussed earlier, foreign, and publicly traded firms have higher profitability and productivity rates then the rest (Table 1). Perhaps, the significantly better performances of these firms under exchange rate shocks simply reflect their better profitability and productivity rates. Thus, in columns (1) – (4) of Table 5 we check whether it is firm level differences in profitability and productivity, rather than (domestic and foreign) capital market access that matter for growth. We expect both foreign ownership, and access to domestic capital markets to affect firm profitability and productivity. Previous studies show that foreign

[11] The impact factors are based on the 10th and 90th percentile (1+log) levels of $Exports_{t-1}$ corresponding to 0.000 and 0.513.

[12] The impact factors are based on the 10th and 90th percentile (1+log) levels of $Leverage_{t-1}$ corresponding to 0.253 and 0.630.

firms and stock market listed firms are more profitable and productive. Therefore we introduced the profitability and productivity rates in a lagged form to avoid reverse causality and parameter endogeneity problems. The profitability rate is defined as net profits before taxes divided by the end of last period total assets. We excluded outliers by dropping those observations where the absolute value of profitability rate exceeded one. Similarly, the productivity rate is defined as output per worker in natural logs and we excluded outliers below and above the 1st and 99th percentiles.

<Insert Table 5 Here>

We find that more profitable and productive firms do indeed grow faster than the rest. Regarding our key variables of interest, the results confirm our previous findings showing a significantly negative effect of exchange rate uncertainty, and a significantly positive interaction effect of having access to foreign equity (which is again found to be increasing in the level of foreign participation), and domestic stock market. After controlling for profitability and productivity differences in columns (1) – (4), we find that the impact factors for domestic firms are in the range of (-1.3) – (-2.1) for publicly traded, and (-3.7) – (-4.2) for non-traded firms. Likewise, among foreign firms we find that the impact factor is in the range of (-0.2) – (5.4) for publicly traded, and (-2.6) – (3.2) for non-traded firms.

Next, in columns (5) – (6), we excluded those manufacturing industries in the sample that had no foreign firms, which are ISIC 19, 30, and 35. After this restriction, we still continue to find almost identical results to those before.

5.2 Controlling for alternative volatility measures

One possible bias affecting our previous results might be our proxy for measuring exchange rate volatility. Therefore we repeat our benchmark regressions of equation (1) and (2) using three different measures of exchange rate shocks in Table 6: i) A standard deviation based volatility variable measured by the annual standard deviation of monthly percentage changes in effective real exchange rate series. ii) A two-digit industry level real exchange rate measure. Compared to aggregate real exchange rate series, industry level real exchange rates are arguably a more preferable since they enable a more refined analysis of the effects of real exchange rate shocks, which are not necessarily uniform across different

industries. In addition, each industry's trade weights with trading partners are different, which can affect the level and variation of real exchange rates. However, because of lack of continuous price indexes during the period analyzed for Turkey's major trading partners, instead of multilateral series as in the benchmark results, we had to calculate bilateral real exchange rate series with respect to US dollar. Moreover, due to the non-stationarity of industry level real exchange rate series (found using the ADF test) we used first differencing on log-levels, which removed the non-stationarity in all series. Therefore, unlike the aggregate level measure, the final uncertainty measure here is based on monthly growth rates of real exchange rate series. At the end, we developed 21 monthly bilateral real exchange rate series, which are used to create the uncertainty measure a la the GARCH (1, 1) methodology.[13] The average cross correlation between growth rates of the industry level and the effective real exchange rate series is 0.72, and is in the range of 0.39 – 0.88. (iii) Finally, we also use two currency crises episodes to explore differences in firms' growth rates under exchange rate shocks.

<Insert Table 6 Here>

Columns (1) – (4) in Table 6 show regression results using the standard deviation based volatility measure. We confirm our previous findings in terms of the sign, and economic and statistical significance of key variables of interest. In particular, we find that exchange rate volatility has a significantly negative effect on firm growth, and this effect is significantly lower for firms with access to foreign equity, and domestic stock market. Accordingly, the impact factors are in the range of (-1.1) – (-1.2) at significant

[13] However, note that even in this case there were multiple issues to be tackled with. First, there are no continuous industry level price indexes in Turkey for the period analyzed. There are four different industry level series with different base years and product compositions classified using different classification systems and product aggregation in each industry. In addition, because of lack of comparable private sector price series, we had to drop the tobacco industry from the dataset leading to a loss of eight firms in the sample. There are similar problems regarding the US producer price index as well. 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 of measurement issues are available from the authors upon request.

levels for domestic firms, and (-0.9) – (0.3) at insignificant levels for foreign firms. Furthermore, the significantly negative effect for domestic firms becomes insignificant once they have access to the stock market.

Next, columns (5) – (8) present results using the two-digit industry level real exchange rate series. Again, the results confirm our previous findings. Briefly, we continue to find that exchange rate volatility has a significantly negative effect on firm growth. Moreover, having access to foreign capital, and to a lesser degree, domestic equity market helps protect firms from negative growth effects at significant levels. In terms of economic significance, the impact factors are also quite similar to those from Table 3. Regarding the sign and significance of other control variables, including the dynamic effects, the results are again very similar to those before. Moreover, we continue to find that the positive effect of access to foreign capital is increasing in the level of foreign equity participation.

<Insert Table 7 Here>

As a third robustness check on the volatility measure, we also compare the growth differences of foreign versus domestic, as well as publicly traded versus non-traded firms during currency crises. Turkey had two serious currency-cum-banking crises in 1994 and 2001 that led to a 39% devaluation on April 6, 1994, and a 40% devaluation on February 23, 2001. In both cases, the currency crisis was accompanied by a banking crisis leading to three and eighteen bank failures (whose deposit market shares were 7% and 22%), respectively. We can use these two episodes for a natural experiment in comparing firm growth in the face of an extreme exchange rate and credit market shock (the cost of borrowing reached four-digit numbers in the aftermath of each of these crises). Thus, we modify equations (1) and (2), and introduce a crisis dummy taking the value of one for 1994 and 2001, and zero otherwise. To isolate the crisis effects, we dropped the exchange rate volatility and the rate of depreciation variables and instead introduced a time dummy for each year except the crises periods. The year dummies also work as an additional sensitivity test on time variant country fixed effects. The regression results in Table 7 suggest that foreign firms perform significantly better than domestic firms during financial crises. Likewise, we find that firms with stock market access perform significantly better than non-traded firms.

5.3 Controlling for institutional changes and year fixed effects

Turkey went through significant structural institutional changes during the period of 1990s and early 2000s. To control for such country wide changes in institutional development we introduced *ICRG* (International Country Risk Guide) as a control variable, which is an institutional quality index constructed by Political Risk Services and ranges between 0 and 100, the latter representing the best institutional development. 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. Columns (1) – (4) in Table 8 present regression results including *ICRG* as a control variable. We find that while institutional development has a positive and significant effect on firm growth, all our previous variables of interest (including access to foreign and domestic equity) continue to show the same sign and significance.

<Insert Table 8 Here>

Next, to test whether our previous results are driven by the excess exchange rate volatility in 1994 and 2001 that mark the dates of financial-cum-currency crises with excessive exchange rate volatility, we repeat our benchmark regressions in Table 3 after excluding these years. Columns (5) – (8) in Table 8 display regressions results with this adjustment, where we continue to find almost identical results to those in Table 3.

5.4 Controlling for threshold effects

One possible bias affecting our findings might be the 10% threshold level of foreign ownership that we used. As argued by Mansfield and Romeo (1980) transfer of technology may be greater in fully owned foreign firms facilitating higher productivity or better work force restructuring. The (unreported) regression results with 25%, 50%, 75% and 100% ownership threshold levels were similar to those reported.

Throughout all regressions discussed above in Tables 3 – 8, the Hansen test and AR(2) test confirm that the instrument selection is appropriate, satisfying the orthogonality conditions, and that there

is no evidence of second-order serial autocorrelation in the residuals. We also note that the number of instruments is always significantly less than the number of cross-section units.

6. Conclusion

The findings of this study extend the existing research on the growth effects of exchange rate shocks in developing countries. Our empirical analysis suggests that exchange rate volatility has an economically and statistically significant negative effect on firm growth. However, having access to foreign or, to a lesser degree, domestic equity markets is found to reduce this negative effect at significant levels. We have also found some evidence that the positive effect of foreign ownership is increasing in the rate of foreign equity participation. Comparatively speaking, the results suggest that firms with access to foreign equity outperform domestic firms, with or without access to domestic equity markets. In addition, we find that firms with better access to external credit, and foreign goods markets perform better under exchange rate shocks. These empirical results continue to hold after controlling for measurement bias in the exchange rate volatility measure, institutional changes, time fixed effects, and other sources of firm heterogeneity such as, profitability, productivity, size, and industrial characteristics. Better portfolio and risk management, and easier access to internal and external financing sources appear to contribute significantly to the higher growth performance of foreign firms under exchange rate shocks. Overall, the empirical findings in this research highlight the importance of having access to foreign and domestic capital markets in stabilizing growth and reducing contractionary pressures under exchange rate shocks.

The current study also opens some new venues for future research such as the distributional impacts of exchange rate shocks and currency crises on domestic and foreign firms, and on the long run portfolio allocation decisions of foreign firms. Does the superior performance of foreign firms cause a crowding out or crowding in of domestic firms? What is the extent to which foreign firms help mitigate the contractionary effects of exchange rate shocks on the overall economy? In addition, both the growth responses of small and medium sized firms to exchange rate shocks as well as the exact channels through which foreign firms manage to control exchange rate shocks remain to be explored in future research.

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Appendix

1. 2-Digit manufacturing industry classification (ISIC revision 3 code D)

15 - Manufacture of food products and beverages

16 - Manufacture of tobacco products

17 - Manufacture of textiles

18 - Manufacture of wearing apparel; dressing and dyeing of fur

19 - Tanning and dressing of leather; manufacture of luggage, handbags, harness and footwear

20 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials

21 - Manufacture of paper and paper products

22 - Publishing, printing and reproduction of recorded media

23 - Manufacture of coke, refined petroleum products and nuclear fuel

24 - Manufacture of chemicals and chemical products

25 - Manufacture of rubber and plastics products

26 - Manufacture of other non-metallic mineral products

27 - Manufacture of basic metals

28 - Manufacture of fabricated metal products, except machinery and equipment

29 - Manufacture of machinery and equipment n.e.c.

30 - Manufacture of office, accounting and computing machinery

31 - Manufacture of electrical machinery and apparatus n.e.c.

32 - Manufacture of radio, television and communication equipment and apparatus

34 - Manufacture of motor vehicles, trailers and semi-trailers

35 - Manufacture of other transport equipment

36 - Manufacture of furniture; manufacturing n.e.c.

Table 1: Summary statistics

	Volatility	*S*	*Foreign*	*Public*	S_2	$Volatility_2$	$Volatility_3$	*ICRG*	*Industry*	*Wages*
Mean	0.001	0.023	0.148	0.294	-0.002	0.033	0.002	58.974	0.050	-0.024
Median	0.001	0.057	0.000	0.000	-0.024	0.020	0.001	58.333	0.060	-0.003
Std.Dev	0.002	0.099	0.298	0.456	0.131	0.025	0.003	5.797	0.143	0.107
Max	0.005	0.169	1.000	1.000	0.458	0.083	0.028	69.333	1.023	0.798
Min	0.000	-0.215	0.000	0.000	-0.476	0.009	0.000	48.583	-0.974	-0.361
			Employment					*Employment growth*		
	Total	Foreign	Domestic	Public	Non-Public	Total	Foreign	Domestic	Public	Non-Public
Mean	782	855	754	905	730	0.014	0.012	0.015	-0.006	0.023
Median	541	567	533	597	527	0.007	0.005	0.008	-0.002	0.016
Std.Dev	798	907	751	1,002	689	0.190	0.170	0.197	0.169	0.198
Max	8,945	7,964	8,945	8,945	5,447	0.999	0.977	0.999	0.834	0.999
Min	0	37	0	0	12	-0.963	-0.768	-0.963	-0.963	-0.962
			Sales growth					*(log) Size*		
	Total	Foreign	Domestic	Public	Non-Public	Total	Foreign	Domestic	Public	Non-Public
Mean	0.009	0.008	0.009	-0.013	0.018	24.164	24.371	24.087	24.480	24.033
Median	0.017	0.021	0.015	-0.001	0.023	24.115	24.311	24.065	24.482	23.970
Std.Dev	0.248	0.246	0.248	0.237	0.251	0.921	1.009	0.873	0.948	0.876
Max	0.998	0.998	0.966	0.998	0.966	27.472	27.420	27.472	27.472	26.989
Min	-0.997	-0.991	-0.997	-0.991	-0.997	21.402	21.796	21.402	21.759	21.402
			Exports					*Leverage*		
	Total	Foreign	Domestic	Public	Non-Public	Total	Foreign	Domestic	Public	Non-Public
Mean	0.281	0.288	0.278	0.246	0.296	0.597	0.579	0.604	0.567	0.609
Median	0.220	0.220	0.220	0.190	0.230	0.576	0.555	0.583	0.528	0.598
Std.Dev	0.262	0.271	0.258	0.226	0.274	0.315	0.282	0.326	0.400	0.271
Max	1.000	1.000	1.000	1.000	1.000	5.259	3.674	5.259	5.259	3.077
Min	0.000	0.000	0.000	0.000	0.000	0.016	0.055	0.016	0.032	0.016
			Profitability					*(log) Productivity*		
	Total	Foreign	Domestic	Public	Non-Public	Total	Foreign	Domestic	Public	Non-Public
Mean	0.096	0.122	0.087	0.111	0.090	17.989	18.195	17.912	18.071	17.954
Median	0.067	0.094	0.059	0.090	0.057	17.982	18.243	17.852	18.117	17.920
Std.Dev	0.174	0.189	0.168	0.185	0.169	0.734	0.618	0.759	0.691	0.749
Max	0.989	0.989	0.966	0.962	0.989	20.077	20.035	20.077	20.043	20.077
Min	-0.945	-0.662	-0.945	-0.714	-0.945	16.269	16.378	16.269	16.294	16.269

Notes: *Volatility* is real exchange rate volatility estimated using the GARCH (1,1) method; *S* is the annual growth rate of real effective exchange rate; *Foreign* is the percentage share of foreign equity; *Public* is a dummy variable taking 1 for Istanbul Stock Exchange market listed firms; $Volatility_2$ refers to the exchange rate volatility measured by the annual standard deviation of monthly percentage changes in effective real exchange rate; S_2 and $Volatility_3$ refer to the real exchange rate level and volatility (using GARCH (1,1) methodology) measured by two-digit industry level bilateral real exchange rate series; *ICRG* refers to International Country Risk Guide institutional quality index; *Industry* is the output growth in two-digit manufacturing industries; *Wages* is two-digit manufacturing sector real wage growth; *Employment* is total level of employment; *Sales* growth is annual real net sales growth; *Size* is the (log) real total assets; *Exports* is the percentage share of exports in sales, *Leverage* is debt to assets ratio; *Profitability* is the net profits before taxes to (end of last period) total assets ratio, *Productivity* is real output per worker.

Table 2: Firm growth and exchange rate uncertainty: Preliminary results

	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effects			GLS		
Growth$_{t-1}$	-0.068***	-0.068***	-0.068***	0.089***	0.088***	0.077***
	(0.020)	(0.020)	(0.020)	(0.004)	(0.004)	(0.004)
Volatility	-7.575**	-7.511**	-7.621**	-1.926***	-1.494***	-2.150***
	(3.207)	(3.141)	(3.382)	(0.374)	(0.400)	(0.573)
S	0.002	-0.001	0.001	0.086***	0.090***	0.085***
	(0.039)	(0.039)	(0.039)	(0.006)	(0.006)	(0.008)
Foreign	-0.019			-0.014***		
	(0.026)			(0.003)		
*Volatility*Foreign*	7.492			3.798**		
	(7.492)			(1.554)		
Foreign[10]		0.016	0.016		-0.003	-0.006***
		(0.021)	(0.021)		(0.003)	(0.002)
Volatility Foreign*[10]		3.702	3.723		0.521	1.235
		(4.084)	(4.085)		(0.986)	(1.024)
ISE			-0.012			-0.025***
			(0.019)			(0.002)
*Volatility*ISE*			0.570			1.538
			(3.321)			(1.215)
Sales	0.171***	0.171***	0.171***	0.217***	0.215***	0.214***
	(0.016)	(0.016)	(0.016)	(0.001)	(0.001)	(0.001)
Size	0.041***	0.041***	0.042***	0.002***	0.002***	0.005***
	(0.009)	(0.009)	(0.009)	(0.001)	(0.001)	(0.001)
Industry	0.124***	0.124***	0.123***	0.102***	0.100***	0.096***
	(0.024)	(0.024)	(0.024)	(0.005)	(0.005)	(0.004)
Wages	-0.032	-0.033	-0.033	-0.005	-0.007	-0.001
	(0.046)	(0.045)	(0.045)	(0.005)	(0.005)	(0.005)
Constant	-0.971***	-0.981***	-0.987***	-0.045**	-0.048***	-0.111***
	(0.214)	(0.213)	(0.214)	(0.018)	(0.018)	(0.021)
Observations	4,832	4,832	4,832	4,818	4,818	4,818
R-squared	0.101	0.101	0.101			
Number of firms	585	585	585	571	571	571
Impact factors						
Domestic	-1.205**	-1.195**		-0.306***	-0.238***	
Publicly traded			-1.121*			-0.097
Non-traded			-1.212**			-0.342***
Foreign	-1.029**	-0.606		-0.217***	-0.155	
Publicly traded			-0.529			0.099
Non-traded			-0.620			-0.146

Notes: Fixed effects and GLS refer to fixed effects and feasible GLS estimation results. Unless otherwise stated, all growth rates are measured by logarithmic differences. (***), (**), (*) refer to significance at 1, 5 and 10 percent levels respectively. *Volatility* 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 in firm i at time t; $Foreign^{10}$ 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 Istanbul Stock Exchange market listed firms; *Size* is the log of real total assets; *Industry* is the output growth in two-digit manufacturing industries, *Wages* is two-digit manufacturing sector real wage growth; *Sales* is annual real net sales growth; *Stock Market* is a dummy variable taking 1 for stock market listed firms at time *t*. *Impact factor* is the impact of one-standard deviation increase in *Volatility* on *Growth*. *Domestic Publicly Traded* (*Non-Traded*) and *Foreign Publicly Traded* (*Non-Traded*) refer to domestically and foreign owned publicly traded (non-traded) firms, respectively.

Table 3: Firm growth, exchange rate uncertainty and access to equity markets: Benchmark GMM results

	(1)	(2)	(3)	(4)	(5)	(6)
Growth$_{t-1}$	0.048*	0.047*	0.048**	0.050**	0.049**	0.051**
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Volatility	-24.589***	-24.47***	-29.54***	-26.176***	-25.81***	-29.91***
	(7.075)	(7.037)	(8.056)	(6.797)	(6.810)	(7.700)
S	0.042	0.039	0.039	0.033	0.033	0.032
	(0.058)	(0.057)	(0.057)	(0.057)	(0.056)	(0.056)
Foreign	-0.112***	-0.115***	-0.110***			
	(0.041)	(0.041)	(0.041)			
*Volatility*Foreign*	66.439**	64.76**	61.27**			
	(27.46)	(27.30)	(27.37)			
Foreign[10]				-0.083***	-0.082***	-0.078***
				(0.026)	(0.026)	(0.026)
Volatility Foreign*[10]				48.12***	45.91***	43.72***
				(16.06)	(16.03)	(16.14)
ISE		-0.028***	-0.054***		-0.028***	-0.049***
		(0.007)	(0.011)		(0.007)	(0.009)
*Volatility*ISE*			17.39***			14.41**
			(6.181)			(6.169)
Sales	0.225***	0.222***	0.233***	0.224***	0.223***	0.230***
	(0.079)	(0.078)	(0.079)	(0.079)	(0.078)	(0.079)
Size	0.004	0.008*	0.007*	0.004	0.008*	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Industry	0.052	0.055	0.049	0.058	0.059	0.054
	(0.054)	(0.054)	(0.055)	(0.054)	(0.054)	(0.055)
Wages	-0.060	-0.060	-0.054	-0.049	-0.051	-0.045
	(0.082)	(0.083)	(0.084)	(0.082)	(0.083)	(0.084)
Constant	-0.058	-0.130	-0.114	-0.057	-0.128	-0.116
	(0.096)	(0.102)	(0.103)	(0.096)	(0.102)	(0.104)
Observations	4,831	4,831	4,831	4,831	4,831	4,831
Number of firms	585	585	585	585	585	585
Number of instruments	66	67	68	66	67	68
AR(1) test	0	0	0	0	0	0
AR(2) test	0.604	0.630	0.568	0.603	0.617	0.573
Hansen test	0.812	0.808	0.823	0.801	0.787	0.794
Impact factors						
Domestic	-3.911***	-3.892***		-4.163***	-4.105***	
Publicly traded			-1.932**			-2.465***
Non-traded			-4.698***			-4.757***
Foreign	-2.349***	-2.370		3.490*	3.196	
Publicly traded			-0.491			4.488***
Non-traded			-3.258***			2.196

Notes: Two-step system GMM results using Windmeijer finite-sample correction. *Hansen* is Hansen tests of over-identifying restrictions, *m1* and *m2* are standard AR(1) and AR(2) tests, and. All test statistics are given by their p-values. For other variable definitions see Table 2.

Table 4: Sensitivity checks: Export orientation and leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L.Growth	0.043*	0.043*	0.045*	0.045*	0.044*	0.054**	0.046*	0.056**
	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Volatility	-26.98***	-29.45***	-28.35***	-33.49***	-23.14***	-58.55	-24.66***	-62.40*
	(7.210)	(11.16)	(6.906)	(10.94)	(7.065)	(36.84)	(6.804)	(37.20)
S	0.019	-0.236***	0.012	-0.248***	0.053	-0.185	0.044	-0.202
	(0.059)	(0.091)	(0.057)	(0.091)	(0.058)	(0.268)	(0.057)	(0.268)
Foreign	-0.113***	-0.098**			-0.108***	-0.099**		
	(0.042)	(0.043)			(0.041)	(0.041)		
*Volatility*Foreign*	66.53**	55.62*			63.81**	58.61**		
	(27.86)	(28.89)			(27.31)	(27.43)		
Foreign[10]			-0.082***	-0.078***			-0.081***	-0.078**
			(0.026)	(0.026)			(0.026)	(0.027)
*Volatility*Foreign*[10]			46.61***	43.30***			46.51***	44.59**
			(16.01)	(16.56)			(15.95)	(16.42)
$Exports_{t-1}$	0.014	-0.088*	0.014	-0.097**				
	(0.017)	(0.046)	(0.017)	(0.045)				
$S^* Exports_{t-1}$		1.217***		1.213***				
		(0.317)		(0.319)				
$Volatility^* Exports_{t-1}$		46.15*		51.79**				
		(25.47)		(25.44)				
$Leverage_{t-1}$					-0.039*	-0.208*	-0.041**	-0.217**
					(0.021)	(0.109)	(0.021)	(0.111)
$Volatility^* Leverage_{t-1}$						88.09		92.59
						(70.70)		(71.70)
$S^* Leverage_{t-1}$						0.572		0.585
						(0.492)		(0.494)
Firm & Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,764	4,764	4,764	4,764	4,814	4,814	4,814	4,814
Number of firms	585	585	585	585	585	585	585	585
Number of instruments	67	69	67	69	67	69	67	69
AR(1) test	0	0	0	0	0	0	0	0
AR(2) test	0.641	0.508	0.634	0.536	0.606	0.653	0.609	0.676
Hansen test	0.815	0.726	0.806	0.732	0.837	0.698	0.823	0.679
Impact factors								
Domestic	-4.291***		-4.509***		-3.680***		-3.922***	
10th		-4.684***		-5.327***		-5.774*		-6.206**
90th		-0.920		-1.102		-0.483		-0.645
Foreign	-2.726***		2.904		-2.180***		3.475*	
10th		-3.377**		1.560		-4.396		0.886
90th		0.388		5.785**		0.895		6.447**

Notes: *Exports* refer to logarithm of one plus the percentage share of exports in sales; *Leverage* is the logarithm of one plus the external debt to assets ratio. *Firm and Industry Controls* include *Size*, *Industry* and *Wages* as in previous tables. For other variable definitions, refer to Table 2 and 3.

Table 5: Sensitivity checks: Controlling for profitability and productivity differences

	(1)	(2)	(3)	(4)	(5)	(6)
	Profitability		Productivity		Excl. ISIC 19, 30, 35	
Growth$_{t-1}$	0.036	0.038	0.029	0.029	0.047*	0.049**
	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Volatility	-23.00***	-24.86***	-25.55***	-26.67***	-29.31***	-29.83***
	(8.055)	(7.567)	(7.635)	(7.301)	(8.051)	(7.676)
S	0.072	0.060	0.053	0.045	0.038	0.031
	(0.056)	(0.055)	(0.055)	(0.054)	(0.057)	(0.057)
Foreign	-0.092**		-0.150***		-0.108***	
	(0.042)		(0.036)		(0.042)	
*Volatility*Foreign*	43.88		65.73***		59.77**	
	(27.90)		(24.25)		(27.40)	
Foreign[10]		-0.072***		-0.110***		-0.078***
		(0.026)		(0.024)		(0.026)
Volatility Foreign*[10]		35.82**		47.05***		43.27***
		(15.99)		(14.71)		(16.22)
ISE	-0.057***	-0.054***	-0.062***	-0.055***	-0.052***	-0.048***
	(0.01)	(0.010)	(0.012)	(0.012)	(0.011)	(0.01)
*Volatility*ISE*	15.03**	13.37**	16.02***	13.48**	16.72***	13.76**
	(6.001)	(5.905)	(5.976)	(5.905)	(6.117)	(6.081)
Profitability$_{t-1}$	0.128***	0.126***				
	(0.022)	(0.021)				
Productivity$_{t-1}$			0.074***	0.074***		
			(0.009)	(0.009)		
Firm & Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,762	4,762	4,765	4,765	4,814	4,814
Number of firms	585	585	582	582	583	583
Number of instruments	69	69	69	69	68	68
AR(1) test	0	0	0	0	0	0
AR(2) test	0.584	0.607	0.839	0.833	0.586	0.594
Hansen test	0.949	0.944	0.658	0.631	0.802	0.779
Impact factors						
Domestic						
Publicly traded	-1.267	-1.827*	-1.516*	-2.098**	-2.003**	-2.556***
Non-traded	-3.658***	-3.954***	-4.064***	-4.242***	-4.662***	-4.744***
Foreign						
Publicly traded	-0.235	3.869*	0.029	5.384***	-0.597	4.326**
Non-traded	-2.626***	1.742	-2.519***	3.241	-3.256***	1.979

Notes: *Profitability* refers net profits before taxes at time *t* divided by total assets at time *t-1* in natural log; and *Productivity* refers to real output per worker in natural log. For other variable definitions see Table 2 and 3.

Table 6: Sensitivity checks: Controlling for alternative volatility measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RERSTD				Industry level volatility			
Growth$_{t-1}$	0.056**	0.056**	0.051**	0.057**	0.051*	0.053*	0.056**	0.058**
	(0.025)	(0.025)	(0.025)	(0.025)	(0.027)	(0.027)	(0.026)	(0.026)
Volatility	-0.455*	-0.488**	-1.165*	-0.549**	-10.72**	-14.01**	-25.57***	-28.85***
	(0.235)	(0.236)	(0.670)	(0.259)	(4.783)	(5.529)	(7.171)	(7.646)
S	0.171***	0.169***	0.149**	0.165***	-0.017	-0.014	0.101**	0.089**
	(0.054)	(0.053)	(0.061)	(0.054)	(0.057)	(0.058)	(0.041)	(0.041)
Foreign	-0.033**		-0.067		-0.045*		-0.091***	
	(0.015)		(0.103)		(0.026)		(0.028)	
*Volatility*Foreign*	0.765*		1.458		17.99		38.94***	
	(0.401)		(3.040)		(11.11)		(12.70)	
Foreign^{10}		-0.025**		-0.027***		-0.043**		-0.075***
		(0.009)		(0.009)		(0.019)		(0.019)
*Volatility*Foreign*^{10}		0.615**		0.631***		17.18**		31.61***
		(0.240)		(0.241)		(8.040)		(8.528)
ISE			-0.047***	-0.031***			-0.059***	-0.057***
			(0.015)	(0.009)			(0.010)	(0.011)
*Volatility*ISE*			0.671*	0.190			18.66***	17.48***
			(0.354)	(0.233)			(5.595)	(6.211)
Sales	0.268***	0.267***	0.306***	0.262***	0.220**	0.222**	0.308***	0.299***
	(0.085)	(0.084)	(0.087)	(0.083)	(0.088)	(0.087)	(0.096)	(0.095)
Size	0.005	0.005	0.007	0.008*	0.005	0.004	0.005	0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Industry	0.018	0.020	0.003	0.026	0.0512	0.049	-0.052	-0.043
	(0.049)	(0.049)	(0.058)	(0.049)	(0.063)	(0.063)	(0.079)	(0.079)
Wages	-0.123	-0.121	-0.169*	-0.119	0.035	0.023	-0.063	-0.064
	(0.102)	(0.101)	(0.087)	(0.102)	(0.085)	(0.086)	(0.089)	(0.089)
Constant	-0.107	-0.106	-0.114	-0.167	-0.091	-0.071	-0.057	-0.033
	(0.095)	(0.095)	(0.105)	(0.103)	(0.102)	(0.104)	(0.120)	(0.124)
Observations	4,832	4,832	4,831	4,832	4,792	4,792	4,792	4,792
Number of firms	585	585	585	585	579	579	579	579
Number of instruments	66	66	68	68	66	66	68	68
AR(1) test	0	0	0	0	0	0	0	0
AR(2) test	0.396	0.391	0.359	0.403	0.598	0.614	0.455	0.489
Hansen test	0.774	0.771	0.738	0.760	0.442	0.431	0.691	0.639
Impact factors								
Domestic	-1.144*	-1.227**			-3.318**	-4.336**		
Publicly traded			-1.243	-0.903			-2.139*	-3.520**
Non-traded			-2.929*	-1.380**			-7.913***	-8.928***
Foreign	-0.858	0.318			-2.495**	0.979		
Publicly traded			-0.701	0.684			1.038	6.263***
Non-traded			-2.388***	0.207			-6.132***	0.854

Notes: *RERSTD* refers to the exchange rate volatility measured by the annual standard deviation of monthly percentage changes in effective real exchange rate. *Industry level volatility* refers to the real exchange rate level and volatility measured by two-digit industry level bilateral real exchange rate series.

Table 7: Sensitivity checks: Firm growth during currency crises

	(1)	(2)	(3)	(4)
Growth$_{t-1}$	0.047*	0.048*	0.047*	0.048*
	(0.025)	(0.025)	(0.025)	(0.025)
Crises	-0.068***	-0.075***	-0.065***	-0.071***
	(0.019)	(0.022)	(0.020)	(0.022)
Foreign	-0.021**	-0.027***		
	(0.009)	(0.009)		
*Crises*Foreign*	0.073**	0.076**		
	(0.032)	(0.032)		
Foreign[10]			-0.011*	-0.013**
			(0.007)	(0.006)
*Crises*Foreign*[10]			0.034**	0.035**
			(0.017)	(0.017)
ISE		-0.034***		-0.032***
		(0.007)		(0.007)
*Crises*ISE*		0.025		0.020
		(0.016)		(0.016)
Firm & Industry Controls	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Observations	4,832	4,832	4,832	4,832
Number of firms	585	585	585	585
Number of instruments	74	76	74	78
AR(1) test	0	0	0	0
AR(2) test	0.677	0.649	0.679	0.639
Hansen test	0.833	0.841	0.832	0.882
Impact factors				
Domestic	-6.555***		-6.265***	
Publicly traded		-4.948**		-4.980**
Non-traded		-7.263***		-6.882***
Foreign	-5.550***		-3.005	
Publicly traded		-3.874		-1.569
Non-traded		-6.219***		-3.543

Notes: *Crises* is a dummy variable taking the value of one for 1994 and 2001. All regressions include unreported firm and industry controls as in previous regressions and year dummies. For other variable definitions see Table 2 and 3.

Table 8: Sensitivity checks: Controlling for institutional changes and year fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	*ICRG				Exclude crisis years of 1994 and 2001			
Growth$_{t-1}$	0.041*	0.043*	0.044*	0.045*	0.045*	0.047*	0.048*	0.049**
	(0.024)	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)
Volatility	-33.94***	-38.55***	-30.82***	-34.87***	-26.07***	-30.79***	-27.90***	-31.27***
	(7.671)	(8.666)	(7.108)	(8.075)	(7.332)	(8.361)	(7.167)	(8.076)
S	-0.017	-0.016	-0.007	-0.007	0.047	0.045	0.038	0.037
	(0.061)	(0.060)	(0.059)	(0.059)	(0.058)	(0.057)	(0.057)	(0.057)
Foreign	-0.130***	-0.122***			-0.111***	-0.108***		
	(0.042)	(0.042)			(0.039)	(0.039)		
*Volatility*Foreign*	79.52***	69.73**			74.11**	67.94**		
	(27.94)	(28.19)			(29.50)	(29.56)		
Foreign[10]			-0.074***	-0.069***			-0.082***	-0.077***
			(0.026)	(0.026)			(0.026)	(0.026)
*Volatility*Foreign*[10]			42.69***	37.68**			54.84***	49.90***
			(15.84)	(16.08)			(18.17)	(18.32)
ISE		-0.059***		-0.052***		-0.052***		-0.047***
		(0.009)		(0.009)		(0.010)		(0.009)
*Volatility*ISE*		20.07***		15.87***		17.69***		14.07**
		(5.733)		(5.708)		(6.576)		(6.526)
ICRG$_{t-1}$	0.003***	0.003**	0.003**	0.003**				
	(0.001)	(0.001)	(0.001)	(0.001)				
Firm & Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,831	4,831	4,831	4,831	4,521	4,521	4,521	4,521
Number of firms	585	585	585	585	575	575	575	575
Number of instruments	67	69	67	69	66	68	66	68
AR(1) test	0	0	0	0	0	0	0	0
AR(2) test	0.827	0.733	0.734	0.679	0.636	0.582	0.639	0.596
Hansen test	0.901	0.893	0.887	0.873	0.847	0.847	0.832	0.816
Impact factors								
Domestic	-5.398***		-4.902***		-4.146***		-4.437***	
Publicly traded		-2.940***		-3.022***		-2.085**		-2.736***
Non-traded		-6.131***		-5.546***		-4.897***		-4.973***
Foreign	-3.528***		1.888		-2.405***		4.285*	
Publicly traded		-1.300		2.971		-0.487		5.200**
Non-traded		-4.492***		0.446		-3.300***		2.962

Notes: *ICRG* refers to International Country Risk Guide institutional quality index. *Exclude crisis years of 1994 and 2001* refers to regression results after excluding the years 1994 and 2001. All regressions include unreported firm and industry controls as in previous regressions.