Exchange Rate Volatility and Employment Growth in Developing Countries: Evidence from Turkey

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2010

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Published in *World Development* 38(8): 1127-1140, 2010.

ABSTRACT

Employing a unique panel of 691 private firms that accounted for 26% of total value-added in manufacturing in Turkey, the paper explores the impacts of exchange rate volatility on employment growth during the period of 1983 - 2005. The empirical analysis using a variety of specifications, estimation techniques, and robustness tests suggests that exchange rate volatility has a statistically and economically significant employment growth reducing effect on manufacturing firms. Using point estimates, the results suggest that for an average firm a one standard deviation increase in real exchange rate volatility reduces employment growth in the range of 1.4 - 2.1 percentage points.

JEL Classification Codes: F31, E24, L6

Keywords: Exchange Rate Volatility, Employment Growth, Manufacturing Firms, South Eastern Europe, Turkey

ACKNOWLEDGMENTS: I thank Hassan Aly, Güzin Erlat, Jeffrey B. Nugent, Jaime Ros, session participants at the ASSA 2008 meetings in New Orleans, and at the International Economics Association 2008 meeting in Istanbul, and the three anonymous referees of the journal for their constructive comments and suggestions. For financial support, I would like to thank the Office of the Vice President for Research, the Research Council, and the College of Arts and Sciences at the University of Oklahoma. The usual disclaimer applies.

1. INTRODUCTION

Increasing capital market integration following the collapse of the Bretton Woods system and the accompanying financial liberalization wave of 1980s and early 90s exposed both developed and developing countries to large swings in exchange rates. As a result, the effects of exchange rate volatility on investment and growth have increasingly become of particular interest for both researchers and policy makers. In a majority of empirical studies, increasing uncertainty and volatility in exchange rates are found to have economically and statistically significant profitability, investment, growth, and, in some, trade reducing effects in both developed and developing countries (Kenen and Rodrik, 1986; Thursby and Thursby, 1987; Pindyck and Solimano, 1993; Ramey and Ramey, 1995; Serven, 1998; Aizenman and Marion, 1999; Bleaney and Greenaway, 2001; UNCTAD, 2006; Demir, 2009a, 2009b, 2009c). In contrast, the theoretical and empirical research on the employment effects of exchange rate volatility has been much limited with an exclusive focus on developed countries. This lack of research on developing country experiences is especially surprising given that they face higher levels of growth (Mobarak, 2005), consumption (Kose et al., 2003), and capital flow (Gabriele et al., 2000) volatility with significantly costlier welfare effects than developed countries (Pallage and Robe, 2003).

Therefore, the present research expects to fill an important gap in the literature not only by focusing on the direct employment effects of exchange rate volatility in a major emerging market, Turkey, that faced significant levels of economic instability for the last two decades including two-digit real interest rates and high levels of exchange rate and inflation volatility, but also by employing a unique firm level panel dataset. Accordingly, we utilize a comprehensive dataset including firm level data on the largest 500 private manufacturing firms that accounted

for the 26% of total value added in manufacturing in Turkey between 1983 and 2005. The use of three dimensional data including time, firm and industry characteristics not only allows us to explore the direct effects of macro volatility on employment creation at the firm level but also helps uncover more informative and robust results after controlling for firm-level size, value-added, and demand effects. Likewise, the time series dimension of the data permits a detailed analysis of the adjustment process to changes in exchange rate volatility.

Regarding the selection of Turkey, the choice was not random. Briefly, Turkey has not only been among the forerunners of trade and financial liberalization among developing countries starting from early 1980s, but also faced the negative effects of financial liberalization first hand through two major financial crises in 1994 and 2000-2001. During this period, the standard deviation of real GDP growth has steadily increased from 3.5 in 1980-89 to 5.2 in 1990-1999, and to 6.1 in 2000-2005. Moreover, the coefficient of variation of annual real short-term capital inflows has increased three-folds from 1982-1989 to 1990-2005.[1] Private firms, on the other hand, have faced strict credit rationing and been forced to finance their investments mostly from internal sources and short-term borrowing. As of 2005, the share of short-term debt in total debt of top 500 manufacturing firms was around 70% that made them more vulnerable to changes in expectations and macro fundamentals. Furthermore, there was little improvement in the industrial and manufacturing sector performance after liberalization. Accordingly, the share of manufacturing value added in GDP stagnated at around 21% during 1982-1989 and 1990-2000 before beginning a steady decline, reaching as low as 16% in 2008, which is the lowest level since 1975. In contrast, the export performance of manufacturing sectors has been a textbook example of the wonders of outward oriented export model, reaching 95% of total exports in 2008 from a bare 27% in 1980. Yet, its employment share in total non-agricultural

employment stagnated at round 27-28% throughout the 1980s and 1990s and started to decline during the 2000s reaching 25% in 2007. This contrasting transformation also makes it an interesting case study to explore the effects of exchange rate volatility on manufacturing sector employment performance.

The empirical results using a fixed effects (and a dynamic GMM) method and various specifications and robustness tests suggest that exchange rate volatility has a statistically (at less than 1% level) and economically significant employment growth reducing effect on manufacturing firms in Turkey. In terms of economic impact, our point estimates suggest that for an average firm a one standard deviation increase in real exchange rate volatility reduces employment growth in the range of 1.4 – 2.1 percentage points that is a considerable magnitude given that the average employment growth has been 1.7% among the sample firms during the period analyzed.

The paper is organized as follows: the next section provides a brief overview of the literature on the volatility and employment relationship. The third section introduces the key hypothesis together with data, methodology and estimation issues. The fourth and fifth sections present the empirical results and robustness tests, and the final section concludes the paper.

2. LITERATURE REVIEW

Exchange rate volatility can affect investment and employment decisions of firms through multiple channels though, theoretically speaking, the sign of the relationship is ambiguous. The theoretical research on the sign of investment-uncertainty relationship gives opposing results depending on assumptions regarding production technology and irreversibility problem (for a discussion see Aiginger, 1987; Dixit and Pindyck, 1994; Caballero and Pindyck, 1996; and the collection of articles in Aizenman and Pinto, 2005). In contrast, the overwhelming majority of

empirical research suggests an unambiguously direct and negative link from uncertainty and volatility to investment. First, increasing volatility can reduce the total supply of credits available from the banking system (Bernanke and Gertler, 1990). The empirical evidence shows that in markets with capital market imperfections, financial constraints significantly affect firm level fluctuations in employment (Sharpe, 1994), inventories (Kashyap et al. 1994), investment (Fazzari et al., 1988), sales, and short-term borrowing (Gertler and Gilchrist, 1994; Bernanke et al., 1996). In addition, Braun and Larrain (2005) show that the negative effect of recessions on industrial growth is increasing with the degree of external finance dependence and financial frictions. Second, increasing exchange rate volatility causes higher interest rates through rising risk premium, and more restrictive monetary policy, both to continue attracting capital inflows (in the presence of current account deficits) and to fight against inflation (UNCTAD, 2006). Consequently, increasing interest costs negatively affects employment (Nickell and Nicolitsas, 1999).

In addition, exchange rate volatility can directly affect firms' employment decisions through its effects on sales, profits, and investment risk and planning (Federer, 1993; Pindyck and Solimano, 1993; Aizenman and Marion, 1999; Demir, 2009a, 2009b, 2009c). It can also: a) raise inflation uncertainty (UNCTAD, 2006) that is shown to reduce employment (Seyfried and Ewing, 2001) and growth (Grier and Grier, 2006); b) encourage short term financial investments at the expense of long term fixed investments by real sector firms (UNCTAD, 2006; Demir, 2009a, 2009b); c) damage firms' balance sheets and reduce their net worth (especially when firms suffer from currency and maturity mismatch problems) that limit the amount of credit they can get, aggravating the initial shock (Bernanke and Gertler, 1990; Krugman, 1999; Braun and Larrain, 2005); d) reduce economic growth with negative effects on employment (Pindyck and

Solimano, 1993; Ramey and Ramey, 1995); e) discourage international trade (assuming risk-averse investors) by raising the risk in international transactions (Kenen and Rodrik, 1986; Thursby and Thursby, 1987; Qian and Varangis 1994). The negative effect is expected to be more pronounced when the exports are invoiced in the importers' currency, as is the case for most developing countries (Qian and Varangis, 1994; also see Grier and Smallwood, 2007). Thus, both export oriented and imported input dependent firms would be expected to suffer more from exchange rate uncertainty. There might also be additional transmission channels such as the contemporaneous effect of exchange rate uncertainty on employment through higher wages. Accordingly, uncertainty in labor demand (caused by exchange rate uncertainty) may cause unions to add a risk premium to their wage demands and lead to higher unemployment (Andersen and Sorensen, 1988; Belke and Kaas, 2004). In a parallel strain of this literature, Belke and Goecke (2004) also formalize the employment decisions of a risk-neutral firm in the presence of sunk hiring and firing costs, and revenue uncertainty resulting from exchange rate volatility (in which case the effect of uncertainty becomes indeterminate depending on the history of the system).

In all above cases, the extent to which the employment decisions of firms are subject to the irreversibility problem is conditional on the degree of labor market flexibility. Firms may respond to increasing uncertainty and volatility by cutting employment, labor hours or wages depending on the nature of the shock, cost of firing/hiring and other labor market rigidities, and the contract structure of labor force (Hammermesh, 1993; Campa and Goldberg, 2001; Belke and Setzer, 2003).[2] They may also start increasing the use of subcontractors for activities that they used to perform themselves.

Nevertheless, most empirical work on the employment effects of macroeconomic volatility only focuses on developed country markets. In these studies, employment fluctuations are found to be significantly related to RER movements and volatility in high income OECD and the European Union countries (Burgess and Knetter, 1998; Gourinchas, 1998, 1999; Goldberg et al., 1999; Campa and Goldberg, 2001; Belke and Gros, 2002; Belke and Setzer, 2003; Klein et al., 2003). In contrast, there is limited research on the employment effects of RER volatility in developing countries. Regarding fluctuations in levels, Frenkel and Ros (2006) find a significantly negative effect of real exchange rate appreciations on employment growth in 17 Latin American countries. Likewise, Ribeiro et al. (2004) find a significantly negative effect of RER appreciation on employment creation in manufacturing sectors in Brazil. Furthermore, Galindo et al. (2006) show that RER depreciations have negative employment effects in industries with high liability dollarization. None of these studies, however, focus directly on the employment effects of exchange rate *volatility* in developing countries.

The lack of research is surprising given that exchange rate volatility is expected to have more depressing employment effects in developing countries because of: a) low levels of financial market development and high share of short term liabilities, b) lack of developed futures markets and other hedging instruments[3], c) the presence of original sin and dollarization that makes firms' balance sheets (including external indebtedness and valuation) more exposed to changes in exchange rates, d) higher levels of openness in these markets, and invoicing of exports in major foreign currencies, e) higher levels of exchange rate pass-through, f) higher exchange rate and inflation uncertainty, and higher country risk, g) more pro-cyclical fiscal spending, h) higher levels of capital flow, consumption, and growth volatility.

Therefore, in our empirical approach the main focus of attention is on the employment effects of exchange rate volatility, but not on the sources of this volatility itself. This, however, does not mean that we downplay the importance of other sources of volatility[4], or distinguish the exchange rate volatility as a purely exogenous variable. Following the extensive theoretical and empirical research on small open economies, we treat the exchange rate both as a relative price and a shock absorber, which is consequently determined by (among others) demand and supply shocks, macroeconomic fundamentals, investor and household expectations (especially when the currency substitution is high as in Turkey), self-fulfilling prophecies, herd behavior and contagion, speculation, political risks, capital flows, world interest rates, level of foreign exchange reserves, degree of openness (both current and capital accounts), share of government consumption in GDP, etc.

3. EMPIRICAL ANALYSIS

(a) The econometric model

In analyzing the effects of exchange rate volatility on employment growth in manufacturing firms, we use a general reduced form of a labor demand specification derived from a Cobb-Douglas production function (see Hamermesh, 1993)[5]:

$$l_{it} = \alpha_0 + \alpha_1 FXV_t + \alpha_2 RER_t + \alpha_3 Assets_{it} + \alpha_4 ValueAdded_{it} + \alpha_5 Industry_{jt} + \alpha_6 Wage_{t-1} + \alpha_7 GDP_{t-1} + \alpha_8 V_{it} + d_i + \varepsilon_{it} \quad (1)$$

where $i=1,\ldots, n$ and $t=1983, \ldots, 2005$ respectively refer to the cross section and time series elements of the data. Here d_i is firm fixed effects controlling for unobserved firm heterogeneity, and ε_{it} is the error term.[6] All firm and industry level variables are deflated using the manufacturing sector price index. We used the fixed effects estimation method to correct for parameter endogeneity resulting from unobserved firm fixed effects and attrition bias due to non-

random exit.[7] The regressions are estimated using robust variances and the clustering method to adjust standard errors for intra-group correlation.[8]

l is the logarithmic growth rate of the number of employees in firm *i* at time *t.*

FXV is the foreign exchange rate volatility measured, like in Campa (1993), among others, by the annual standard deviation of the log difference of monthly multilateral RER (*RERV*) using trade weights. As such, it includes both predictable and unpredictable components of volatility. Regarding its measurement, there is no consensus in the literature over the differences between uncertainty and sample variation (i.e. volatility in this case). Theoretically speaking, the former is caused by unpredictable innovations to the variable of interest, while the latter includes predictable innovations from past behavior as well.[9] As discussed earlier, we argue that volatility can have negative effects on firm growth even when it is predictable, especially given the lack of any self-insurance mechanisms in the financial markets of developing countries, including Turkey. However, as discussed later, for robustness analysis we also included two alternative measures that are 12 month moving standard deviation of the real exchange rate (that would be instrumental in capturing effects of volatility in the presence of sluggish adjustment in employment decisions and overlapping contracts), and the conditional variance from a GARCH (1,1) process (which is the most standard measure of uncertainty as opposed to volatility). In all cases, 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' investment and employment decisions than for financial firms given their longer time horizon. Based on the discussion before, we expect a negative relationship between *FXV* and employment growth.

RER is the logarithmic growth rate of the effective real exchange rate (an increase is a real appreciation) to control for the level effects as opposed to volatility. Increasing (appreciating) real exchange rate can reduce employment growth through decreasing export competitiveness or increasing import competition (Campa and Goldberg, 2001; Klein et al., 2003). It can also have a positive effect through falling cost of imported intermediate and capital goods (depending on cross elasticities), positive balance sheet effects, or lower wage demands because of lower expected domestic prices.

Assets is the natural log of firms' real total assets to control for size effects that may shape investment and employment growth through multiple channels. If growing firm size leads to diseconomies of scale, the size-growth relationship can be negative. Also, large firms have higher sunk costs and therefore may be more sensitive to increasing volatility, which suggest that firm size may be a proxy for the degree of irreversibility of investment (Rosenberg, 2004). Alternatively, scale and scope economies and entry barriers may favor large firms' expansion over small ones. Gibrat's law, on the other hand, argues that firms' growth is independent of its size. Last but not the least, firms' access to external credit may be (positively) dependent on firm size. Given that small and medium sized firms face higher external credit constraints than large firms, increasing volatility may hurt them more (Rosenberg, 2004).

ValueAdded is the firm level value-added growth rate controlling for firm specific shocks and productivity changes.

Industry is the logarithmic growth rate of two-digit manufacturing industry output of sector *j* at time *t* controlling for industry-wide demand shocks (a list of industries is provided in the appendix). The exchange rate volatility is expected to have smaller negative effect in

industries where firms have pricing power and production is less labor intensive (Campa and Goldberg, 2001).

Wage is the logarithmic growth rate of real wages in the manufacturing sector at time *t-1*. Here we use the lagged values to control for the possible contemporaneous effect of exchange rate uncertainty on employment through higher wages (Andersen and Sorensen, 1988) and also for the reverse causality from labor demand.

GDP is the logarithmic growth rate of real GDP controlling for aggregate demand shocks and business cycles. Given the possible endogenity between current GDP growth and exchange rate volatility, we used one-period lagged values.[10]

V is a vector of control variables including the following variables:

Sales is the logarithmic growth rate of net sales from production of firm *i* at time *t* controlling for demand shocks and output effects at firm level.

Exports is the natural log of one plus the percentage share of exports in total output. The export share shows the degree of output tradability, competitiveness and firm's access to international markets. Furthermore, Bernard and Jensen (1999) found that size, wages, productivity and capital intensity of exporting firms are higher than those of non exporting ones in the US. It is also found that the increase in foreign demand has three times stronger effect on employment than domestic demand (Bernard and Jensen, 1999). Given the higher efficiency of exporting firms, we expect a negative relationship. Due to the potential endogeneity between export performance and exchange rate volatility, we used one-period lagged values.

*FXV*Exports* is an interaction term between exchange rate volatility at time *t* and export share of firm *i* at time *t-1*. 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 other firms. Also, exporting firms may shield themselves from the disturbances in the domestic market created by exchange rate volatility. On the other hand, Klein et al. (2003) found that manufacturing industry openness to international trade increases the labor market response to RER in the US. Also, given the lack of financial development and hedging instruments against volatility in developing countries, exporting firms may be more exposed to exchange rate uncertainty and volatility. Especially given that exporters of manufactured goods are price takers in the foreign markets, changes in exchange rates have profound effects on firm profitability (Qian and Varangis, 1992).

Leverage is the natural log of leverage ratio, which is measured by the external debt to total assets ratio of firm *i* at time *t-1* and reflects both the degree of dependence on and access to external finance. The lagged value of *Leverage* is used to avoid the endogeneity problem. Increasing leverage reflects firms' access to external finance and therefore can have a positive effect on firms' growth. Yet, increasing indebtedness may make new borrowing more difficult and can slow down firm growth.

*FXV*Leverage* is an interaction term of exchange rate volatility at time *t* and the leverage ratio of firm *i* at time *t-1*. Exchange rate volatility may affect firms differently depending on their external indebtedness: firstly, firms that are exposed to currency mismatch problem will suffer from changes in their domestic currency value of external liabilities. Secondly, firms with maturity mismatch problem will suffer from changes in short term interest rates as the monetary authority intervenes to curtail excess volatility, or as the risk premium on external borrowing increases. And thirdly, as the risk premium increases, rising cost of external borrowing will hurt those firms with higher leverage ratios and external finance dependence through decreasing supply and increasing cost of external finance (Braun and Larrain, 2005). We therefore expect

the interaction variable to control for the effects of volatility on firms with different degrees of external finance dependence as well as different degrees of currency and maturity mismatch problems.

Profitability is the profitability rate defined by net profits to net sales ratio of firm *i* at time *t-1*. Increasing profitability is expected to increase employment growth. We used the lagged values to reduce the endogeneity problem with both the exchange rate volatility and the employment growth.

Tax is the natural log of total tax wedge between total labor costs to the employer (including employer payroll taxes) and the corresponding net take-home pay for single workers without children at average earnings levels (average percentage rate). It is a proxy variable for labor market rigidities. The extent to which exchange rate volatility affects firms' employment decisions is conditional on the degree of labor market flexibility (referring to both wage flexibility and easiness with which employers can fire/hire) and the bargaining power of labor. The effect of increasing tax burden may be negative or positive depending on labor market conditions and interactions as well as the sources of the increase such as income tax, or employee and employer social security contributions. We also experimented with two (unreported) additional labor market variables that are the "strictness of employment protection index" from OECD for 1990-2005, and the one period lagged overall unemployment rate.

(b) Data

The firm-level panel is from the annual surveys of the Istanbul Chamber of Industry on the largest 500 manufacturing firms (based on sales) during 1983-2005. The second largest 500 manufacturing firm surveys and the Istanbul Stock Exchange online database are also utilized to complete some of the missing observations for some firms. The panel, apart from being one of

the most comprehensive micro level datasets from developing countries, also has the advantage that unlike the datasets from statistical institutes, it is a matched employer/employee dataset that includes the names of all firms in the sample and allows matching workers to firms for each year. Regarding the period selection, although our panel goes back to 1979 we limited ourselves to post 1983 era to avoid specification and measurement problems due to structural changes during Turkey's transition from an inward oriented to an outward oriented free market economy in the aftermath of a serious balance of payments crisis in 1979-80. One shortcoming of the dataset, however, is that it includes only surviving firms. It is possible that exiting firms might have had stronger reactions to exchange rate volatility than the survivors. This would bias our results against finding any significant effect of exchange rate volatility on firm growth and as such finding any significant effect among the surviving more successful firms will only strengthen our results further. To reduce this bias, we expanded the initial sample for some of the missing firm-years using the second largest 500 manufacturing firm dataset as well as the Istanbul Stock Exchange data on publicly traded firms. Lastly, because of data limitations, we had to assume homogenous labor which prevented us from exploring any possible differential effects of exchange rate volatility on skilled and unskilled workers.

All data were checked for recording errors and obviously misreported observations were discarded leaving us with a total of 747 private manufacturing firms. Next, we eliminated those firms with less than 5 consecutive years from the sample. After this restriction, we had 691 firms that on average accounted for 26% of total manufacturing value added in GDP and 48% of total exports of Turkey between 1983-2005 (Table 1 and 2). The annual number of firms ranges from 265 (1983) to 500 (1999) with the average total employment, and the median employment per firm reaching 304,475 and 775 respectively during the period analyzed. While the number of

firms with at least 10 continuous observations range from 183 in 1993 to 247 in 2005, 129 firms have observations for all years (for the full structure of the panel, see Table 8 in the appendix). The average share of re-entries is 7% of all annual entries with a maximum of 27% in 1990 and a minimum of 0% in 1984, 1986, 1994 and 2003-2005.

In terms of structural changes, we see that the median share of exports in total sales steadily increased from less than 10% in 1983 to more than 22% in 2005 with an average of 16% for the full period. Over these years we also observe a steady decline in the profitability rates of Turkish firms from around 7% in 1983 to less than 3% in 2005. On the other hand, the cross-sectional variance of employment changes is quite large such that the standard deviation of the rate of change of employment for each year reaches over 0.20 in 21of 23 years with an overall average of 0.27.

<Insert Table 1 and 2 Here>

The 691 firms are located in 27 manufacturing sectors based on two-digit ISIC codes (number of firms in parenthesis)[11]: 15(112), 16(9), 17(136), 18(23), 19(3), 20(6), 21(16), 22(11), 23(7), 24(66), 25(26), 26(66), 27(52), 28(25), 29(29), 30(2), 31(27), 32(11), 34(52), 35(2), 36(10). In terms of sectorial differences, in Table 3 we see that the highest median employment growth occurred in the manufacture of office machinery (ISIC 30) with 4.3% followed by the manufacture of motor vehicles (ISIC 34) with 3.5% while the lowest is in the manufacture of other non-metallic products (ISIC 26) with -0.9%. The highest level of median employment, on the other hand, is in the manufacture of radio, television and telecommunication equipment (ISIC 32) with 1156 workers and the lowest is in the manufacture of office machinery with 130 workers. In terms of tradability and openness, the manufacture of tobacco products (ISIC 16) with 70% and the manufacture of other transport equipment (ISIC 35) with 77% export shares

are the highest, while publishing, and the manufacture of coke and refined petroleum products (ISIC 22-23) are the lowest with 0% median export share. Regarding external liabilities, the highest indebtedness is in ISIC 32 with a leverage ratio of 78% and the lowest is in ISIC 35 with a ratio of 46%.

<Insert Table 3 Here>

4. RESULTS

The findings from the regression analysis in Table 4 using alternative specifications (columns 1-7) show a statistically significant (at 1% level) and robust negative effect of exchange rate volatility on employment growth. In terms of economic significance of the findings, holding other control and interaction variables at their sample means, the results suggest that for an average firm a one standard deviation increase in real exchange rate volatility (that is 0.02) reduces employment growth in the range of 1.42 – 2.11 percentage points (that we call the impact factor in Table 4).[12] For example, during the 2001 crisis when the *RERV* increased from 1.5% in 2000 to 8.3%, the average employment growth would be expected to fall in the range of 4.84 – 7.17 percentage points that is a significant magnitude. The estimation results also closely capture the actual country-wide decline in total private sector manufacturing employment growth in 2001, which was 7.5 percentage points (from -1.5% in 2000 to -9% in 2001). The actual fall in mean (median) employment growth in the sample was 5.411 (3.892) percentage points from -0.087% (-0.173%) in 2000 to -5.498% (-3.719%) in 2001. The estimated fall in mean (median) employment would correspond to 35 - 52 (25 – 37) employees per firm, or 18,094 - 26,775 employees in total sample (holding the number of firms constant). The actual fall in average number of workers per firm was 51 with a total of 34,128 workers.

<Insert Table 4 Here>

We also found increasing (appreciating) real exchange rate having a significantly negative effect on employment growth. Other control variables including firm size (measured by total assets), growth rate of value added per firm, sales growth, and industrial output growth in 2-digit ISIC sectors appeared to have statistically and economically significant positive effects on employment growth. As expected, real wage growth is found to reduce employment growth at both statistically (at 1% level) and economically significant levels. Accordingly, a one standard deviation increase in real wage growth (that is 0.138) is predicted to reduce employment growth in the range of 2.513 - 2.773 percentage points a year. Real GDP growth also has a statistically (at 1% level) and economically significant employment increasing effect. Accordingly, a one standard deviation increase in *GDP* (that is 0.047) increases employment growth by 0.651 - 1.02 percentage points.

In addition, we find that increasing export share in total output reduces employment growth significantly (at 1% statistical significance level).[13] This may result from increasing worker productivity, capitalization and competitive pressures. Furthermore, the employment reducing effect of exchange rate volatility is found to be significantly increasing with rising export shares (with a joint significance at 1% level). According to point estimates, if we compare firms in the 25^{th} (10^{th}) percentile with 3% (0%) export shares to those in the 75^{th} (90^{th}) percentile with 38% (63%) export shares, we find that a one standard deviation increase in exchange rate volatility reduces employment growth by 1.34 (1.33) percentage points for the former as opposed to 1.48 (1.57) percentage points for the latter.[14]

Next, we analyzed the effects of volatility on firms with higher leverage ratios. We find that rising leverage ratios not only negatively affect employment growth significantly (at 1% significance level)[15] but also make firms more exposed to exchange rate volatility (with a joint

significance at 1% level) possibly reflecting currency and maturity mismatch problems, as well as balance sheet effects. Using point estimates, when we compare those firms at the 25th (10th) percentile with 48% (32%) indebtedness with those at the 75th (90th) with 78% (88%) indebtedness, we find that a one standard deviation increase in volatility reduces employment growth by 1.53 (1.17) percentage points for the former as opposed to 1.95 (2.06) percentage points for the latter (see endnotes 12, 14 and 15).

We also find that increasing profitability significantly increases employment growth. Last, the control variable for labor market rigidities (*Tax*) is found with a positive yet statistically marginal effect. Other (unreported) control variables for the labor market conditions, such as the overall unemployment rate or the labor market rigidity index yielded similar results.

5. ROBUSTNESS TESTS

The first robustness test we employ is to explore how the use of nominal as opposed to real effective exchange rate volatility affects the results. To that end, we used the nominal effective exchange rate volatility (*NERV*) measured by the trade-share weighted average standard deviation of log differences of monthly nominal exchange rates.[16] The correlation between the *RERV* and *NERV* is 0.92. The reported results in Table 5 show that, similar to real exchange rate volatility, nominal exchange rate volatility has a statistically and economically significant negative effect on employment growth.[17] While the coefficient estimates for nominal exchange rate volatility is smaller than real exchange rate volatility, the impact factors are almost identical to those in Table 4. Accordingly, one standard deviation increase in nominal exchange rate volatility (that is 0.0286) reduces employment growth in the range of 1.45 – 1.88 percentage points. Likewise, with the exception of the *NER* that is found with a smaller but still significant

effect, other control variables yielded very similar coefficient estimates to those from Table 4.[18]

<Insert Table 5 Here>

Next, we repeated our regression analysis using a dynamic specification (given the sluggish adjustment in the labor markets) and employed the augmented Generalized Method of Moments (GMM) estimator by Arellano and Bover (1995) and Blundell and Bond (1998) that estimates a system of equations in the first differences and levels. Using the system GMM method we aim to control for any possible parameter endogeneity, state-dependence, and simultaneity bias as well as to correct for the correlation between the lagged dependent variable and firm specific effects and the error term.[19] In the level equation, variables are instrumented with their lagged first differences, while in the difference equation the differenced variables that are not strictly exogenous are instrumented with all their available lags in levels (strictly exogenous variables are instrumented with their own first differences) (for underlying assumptions see Bond, 2002; and Roodman, 2007). Thus, we re-estimated equation (1) using the two-step system GMM estimation with Windmeijer finite-sample correction method using asymptotically robust standard errors and *t-s* (for $s \geq 2$) dated variables as instruments.[20] The validity of the set of instruments used is tested by the Hansen test of overidentifying restrictions while the presence of serial correlation is tested by a second order serial correlation test (Bond, 2002).

<Insert Table 6 Here>

The results from Table 6 support the findings from Table 4. The exchange rate volatility variable continued to be statistically and economically significant, though with lower levels of impact factors ranging between 0.71 and 1.28.[21] Also, the lagged employment growth variable is found with varying degrees of statistical significance. Other control variables (with the exception

of exports that lost its statistical significance and the exports interaction term that reversed its sign yet remained insignificant) appeared with very similar coefficient estimates and significance levels.[22] The specification tests fail to show any strong evidence of correlated residuals and the Hansen test supports the validity of the instrument set.[23]

The third robustness test we use is to check for any bias caused by the exchange rate volatility measure itself. To explore this possibility, similar to Kenen and Rodrik (1986), we first employed the annual average of a 12-month moving standard deviation of the growth rate of the real exchange rate as an alternative measure of volatility. In the presence of sluggish employment adjustment due to overlapping contracts and other irreversibility problems due to labor market rigidities or firm investment planning, a moving standard deviation measure of volatility may be a better choice. The correlation between this and the default volatility measure is 0.93. Second, referring to the debate over the measurement (as well as effects) of uncertainty versus volatility, we adopted the annual average of the conditional variance from a GARCH (1, 1) process based on the following equation:

$$\begin{aligned} x_t &= \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \varepsilon_t \\ h_t^2 &= \beta_0 + \beta_1 h_{t-1}^2 + \beta_2 \varepsilon_{t-1}^2 \end{aligned} \qquad (2)$$

where x is natural log of monthly effective real exchange rate and h_t^2 is the conditional variance of ε_t, and is our uncertainty measure, which is found to have a 0.97 correlation coefficient with the default volatility measure. In both cases, the reported results from columns (1) and (2) in Table 6 as well as the unreported results using additional control variables as in Table 4 confirm the robustness of the findings. In particular, we find that both the statistical and economic significance of these exchange rate volatility/uncertainty measures are quite similar to those from Table 4.

<Insert Table 7 Here>

Fourth, we repeated the regression estimations in Table 4 for the sub-period of 1990-2005 to control for any bias or structural break resulting from the exchange rate regime switch after the Turkish currency (Lira) was made convertible in 1989. Accordingly, the reported (and unreported) regression results in column (3) of Table 6 show that exchange rate volatility continued to have a significantly negative employment effect during this period as well. The size of the coefficient estimate for the volatility measure as well as its impact factor, however, is smaller than the ones for the whole sample period suggesting that the economic cost of volatility was lower during the post-convertibility era.[24]

Furthermore, in columns (4) – (8) we reported regression results with the following additional sensitivity checks: a) First, we used the full sample *without* restricting it to only those firms with five or more continuous observations (column 4). b) Second, we dropped the outliers from the sample. Accordingly, we excluded those observations that exceeded the absolute value of 100% in terms of the annual employment growth (column 5), and all other firm level control variables (column 6). c) Next, we excluded those sectors that had less than 5 firms, which were (number of firms in parenthesis) ISIC2 19 (3), 30 (2), and 35 (2) (column 7) (we also repeated the exercise with a threshold of 10 firms). d) To test whether our results are driven by the excess exchange rate volatility in 1994, 2000 and 2001 that mark the dates of financial-cum-currency crises with excessive exchange rate volatility, we repeated our regressions after excluding these years for the full time period of 1983-2005 (column 8) and its (unreported) subset of 1990-2005. The reported results (as well as those unreported ones with additional control variables as in Table 4) after these robustness checks confirm our findings with regard to the negative economic and statistical significance of exchange rate volatility.[25]

6. CONCLUSION

The findings suggest that exchange rate volatility (and uncertainty) has an economically and statistically significant negative effect on employment growth of manufacturing firms in Turkey. Furthermore, the negative effect appears to be significantly higher for firms with higher export shares in output, and higher levels of indebtedness. Given that sluggish employment growth that has increasingly become disconnected from output growth is a striking feature of the post-liberalization era in many developing countries, the results have significant policy implications. Despite an impressive 6.6% real GDP growth during 2002-2007, for example, the employment growth was a disappointing -0.26% in Turkey. On the other hand, the decreasing employment response of growth is not a unique feature of Turkish development rather appears to be a global trend. According to ILO (2007:19) estimates, employment elasticity (i.e. percentage change in employment for a percentage change in GDP growth) declined from an average of 0.34 during 1991-1995 and 0.38 during 1995-1999 to 0.30 during 1999-2003. The results also may help explain the increasing use of subcontracting and informalization of labour markets in developing countries. Given that the informal sector accounts for almost half of the employment in Turkey, large firms may be increasingly employing subcontractors for labor-intensive operations and cutting their labor force to reduce their exposure to macroeconomic uncertainty and volatility.

Given this picture, one major question concerns the policy tools available to developing countries to reduce the excess volatility in exchange rates. The use of capital controls (using market based or quantitative restrictions), encouraging FDI rather than speculative short term inflows, countercyclical fiscal and monetary policies, improving domestic financial system, keeping foreign currency denominated public and private debt in check, accumulation of

reserves for self insurance, limiting fiscal deficits, having manageable current account imbalances, among others, appear as the top policy recommendations. Some potential venues for future research here would be to explore the interaction of financial sector development, access to domestic and foreign capital markets, and foreign ownership rates with exchange rate volatility. One also needs to keep in mind that in explaining short term exchange rate fluctuations, fundamentals do perform poorly, in both developed and developing countries.[26]

A second related question that arises from our findings concerns the type of exchange rate regimes. There is a large literature arguing that the contractionary effects of domestic and external shocks are less pronounced under flexible than fixed exchange rate regimes. Accordingly, the negative effects of such shocks increase with the degree of rigidity of the exchange rate. However, as shown by Calvo and Reinhart (2000) and others, many countries including those that are de facto described as free floaters do indeed intervene in the exchange rate. The *fear of floating* therefore appears to be a fact of life for policy makers in many developing countries. According to the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions only nine developing countries (including Turkey) out of 188 IMF members had independently floating exchange rates in 2008. All other free floating countries, numbering 31, were high income countries or EU members. Those supporting managed (at different degrees of rigidity) exchange rates argue that benefits such as economic stability, lower inflation, prevention of large exchange rate misalignments and faster growth as well as avoiding the possibility of contractionary effects of exchange rate adjustments outweigh the costs of lack of flexibility. [27] The balance-sheet effects debate also suggests that the cost of exchange rate fluctuations may be particularly high in countries with large share of foreign currency denominated public and private debt stock. While the question regarding the effects of exchange

rate volatility under different currency regimes is beyond the scope of current study, possible extensions for future research includes testing the effect of real exchange rate volatility on employment performance under different exchange rate regimes in developing countries.

A third question is related to the welfare costs of exchange rate volatility as opposed to structural labor market rigidities. Given the emphasis by the IMF, WB and OECD, as well as others, to the labor market rigidities in explaining persistent unemployment rates in many developed and developing countries, it is a legitimate question to ask whether a "credible reduction of unanticipated exchange rate fluctuations" can have "effects very similar to the removal of employment-protection legislation and other direct restrictions of hiring and firing" (Belke and Setzer, 2003, p.170). That is whether limiting exchange rate uncertainty "can work as a substitute for labor market flexibility" (p.170)? Therefore, for future research, it would be very interesting to compare the effects of different labor market structures vis-à-vis exchange rate volatility.

Last but not the least, another venue for future research is the causes and effects of the stronger employment growth effect of exchange rate volatility compared to the GDP and sales growth. Given the sluggish employment generation amid high economic growth rates in several emerging markets the question is of significant importance for both researchers and policy makers alike.

ENDNOTES

[1] The real and nominal exchange rate volatility (defined as the annual standard deviation of the monthly percentage change in real and nominal exchange rates respectively) have also increased by 28% and 55% from 1982-89 to 1990-2005.

[2] Campa and Goldberg (2001) show that wages are more responsive to exchange rate shocks than employment in the US reflecting growing labor marker flexibility.

[3] However, even in the presence of forward markets for hedging, international trade may still be reduced. For a discussion see Qian and Varangis (1994).

[4] Note, however, that the exchange rate volatility is still known to exceed the volatility of prices, wages and productivity, especially in the short run (Belke and Goecke, 2004, p.4).

[5] While equation (1) is based on a partial equilibrium approach instead of a general equilibrium one that takes into account the determinants of exchange rate volatility, it can still be considered as a reduced form of a more general equilibrium model. Nevertheless, exploring the sources of exchange rate volatility, as discussed earlier, is beyond the scope of the current paper.

[6] We confirmed the stationarity of the variables using panel unit root tests of Im et al. (2003) as reported in the appendix. The appropriate lag structure is chosen based on the economic theory and to avoid a possible endogeneity and reverse-causality problem. We also used the omitted and redundant variable Likelihood Ratio test, and the Akaike and Schwarz information criteria in selecting the correct lag length.

[7] The Hausman test strongly confirms the appropriateness of fixed-effects (with a p-value well below 1%) over random-effects specification.

[8] This method specifies that the observations are independent across groups, but not necessarily within groups and yields the standard errors accordingly.

[9] For a discussion of different volatility and uncertainty measures, see Serven (1998), Aizenman and Pinto (2005), Hnatkovska (2005), and Wolf (2005).

[10] The simple correlation coefficient between *RERV* and real GDP growth is -0.47 while that of one-period lagged GDP growth is -0.06 that support the use of the lagged value.

[11] The definitions of ISIC codes are given in the appendix.

[12] The mean values of *Export* and *Leverage* in Table 4 are 0.193 and -0.531. The mean value of *RERV* is 0.028.

[13] At the mean value of *RERV* (0.028), the marginal effect of *Exports* in column (3) is -0.117 with a significance level at less than 1% level. Likewise, the marginal effect of *RERV* is -0.712 at the mean value of *Exports* with a significance level at less than 1%.

[14] The 25th (10th) and 75th (90th) percentile values of lagged *Exports* and *Leverage* are 0.0198 (0) and 0.315 (0.489) for the former and -0.703 (-1.099) and -0.245 (-0.126) for the latter, respectively.

[15] At the mean value of *RERV* (0.028), the marginal effect of *Leverage* in column (5) is -0.019 with a significance level at less than 1% level. Likewise, the marginal effect of *RERV* is -0.845 at the mean value of *Leverage* with a significance level at less than 1%.

[16] The currencies (and their weights) are as follows: German Mark (30%), Italian Lira (9%), French Frank (6%) and British Pound (5%), and USD (50%) until 1999, and Euro (45%) and British Pound (5%) and USD (50%) thereafter.

[17] The mean value of *NERV* is 0.030. The marginal effect of *NERV* in column (3) is -0.514 with a joint significance at less than 1% level. Likewise, the marginal effect of *NERV* in column (5) is -0.558 with a joint significance at less than 1% level.

[18] The marginal effect of *Exports* in column (3) is -0.117 with a joint significance at less than 1% level. The marginal effect of *Leverage* in column (5) is -0.019 with a joint significance at less than 5% level.

[19] In the presence of a lagged dependent variable in large samples, the within groups estimator is likely to cause downward bias given that it is not strictly exogenous (Bond, 2002). The GMM estimator, in that case, will provide a good robustness check of the results and the specification we adopted.

[20] The panel data estimates are obtained using the xtabond2 command in Stata 10.1 written by David Roodman.

[21] The marginal effect of *RERV* in column (3) is -0.378 with a joint significance at less than 5% level. Likewise, the marginal effect of *RERV* in column (5) is -0.459 with a joint significance at less than 1% level.

[22] The statistically insignificant marginal effect of *Exports* in column (3) is -0.019. The marginal effect of *Leverage* in column (5) is -0.022 with a joint significance at less than 1% level.

[23] Among the right hand side variables, the Hausman endogeneity test, the "difference-in-Hansen tests of exogeneity of instrument subsets", as well as the economic theory suggest that sales from production variable is most likely to suffer from reverse causality. The reported results are those with lagged dependent variable and sales defined as endogenous. In the instrument selection, we instrumented "net sales from production" with total net sales that include both sales from production and from other sources including imported final goods. The correlation between these two variables is 0.89. Given the low p-value of Hansen test, to test the sensitivity of results to our instrument selection, we repeated regressions using different sets of instruments. In particular, we experimented with all firm level variables and/or the exchange rate and volatility measures

identified as endogenous. We also experimented with different lag lengths in instrument selection. The economic and statistical significance of (unreported) coefficient estimates were similar to those reported, with the exception that the Hansen test's p-value decreased further signalling more serious instrument selection problems.

[24] To confirm this, we also run separate regressions for the 1983-1989 period. The (unreported) coefficient estimates show that the economic cost of volatility might actually be higher during this period. However, given that the number of observations and firms dropped to 2,104 and 391, respectively (from 6423 and 636, respectively for the 1990-2005 period), the results are not fully comparable.

[25] In an attempt to find out which sectors are more sensitive to exchange rate volatility, we repeated our baseline regression for those industries that had at least 10 firms. The results show that out of remaining 15 sectors with ten or more firms, all had a negative and economically significant response to the volatility variable with sectors 15, 17, 18, 25, 26, 27, and 28 being at statistically significant levels. The firms with a statistically significant volatility effect represent 67% of total firms included. However, we need to point out that, as shown in Table 3, that there is a high variation in terms of number of firms in each sector, ranging from 10 to 136.

[26] According to a survey, 97% of foreign exchange traders in UK believe that exchange rate movements within the day do not reflect changes in the fundamentals (Cheung et al., 2004).

[27] Using panel data on 81 developing and 21 developed countries, Dubas (2009) report that intermediate exchange rate regimes are indeed more effective helping developing countries limit exchange rate misalignments than free floating ones.

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Table 1: Summary Statistics

		Median Growth Rate of			Total	Median Levels	
	Sample Size	*Employment*	*Sales*	*Value Added*	*Employment*	*Exports (1,000 USD)*	*Employment*
1983	265	0.045	0.102	-0.053	207,265	2,000	729
1984	286	0.031	0.093	0.096	223,534	2,178	749
1985	304	0.029	0.079	0.051	238,144	2,132	766
1986	315	0.024	0.169	0.228	251,423	2,194	761
1987	324	0.042	0.199	0.249	278,480	3,249	765
1988	334	0.028	-0.036	-0.005	285,898	3,682	765
1989	340	0.014	0.046	0.05	300,954	4,043	781
1990	341	-0.004	0.069	0.132	301,695	4,435	789
1991	349	-0.069	0.04	0.101	273,031	5,605	760
1992	347	-0.031	0.12	0.103	264,560	5,614	742
1993	349	0	0.11	0.121	268,438	4,245	854
1994	341	-0.02	-0.123	-0.162	261,316	8,093	745
1995	364	0.025	0.096	0.123	288,459	8,972	730
1996	391	0.039	0.068	0.086	316,791	10,007	740
1997	413	0.043	0.084	0.083	365,068	9,283	727
1998	484	0.014	0.015	0.003	377,583	9,387	740
1999	500	-0.013	-0.034	-0.115	363,314	8,881	734
2000	497	0.002	0.011	-0.074	373,648	10,133	775
2001	493	-0.037	-0.009	-0.166	339,520	10,611	697
2002	477	0.007	-0.012	-0.04	342,586	11,954	754
2003	456	0.02	-0.018	-0.113	352,990	15,741	817
2004	438	0.035	0.097	0.187	367,895	20,641	926
2005	411	0.019	0.009	-0.07	360,344	22,439	989
Sample mean		0.017	0.035	0.044	304,475	21,942	751

Notes: Growth rates (except the value added) are in log differences. *Sales* includes only sales from production. *Exports* are in current dollars. Sample mean is the sample average of related variables.

Table 2: Summary Statistics

	Std Employment Growth	*Median Levels*			*Share in Total Exports*	*Value Added/ GDP*
		Export Share	*Leverage*	*Profitability*		
1983	0.183	0.095	0.653	0.066	0.531	0.191
1984	0.206	0.120	0.663	0.073	0.462	0.220
1985	0.279	0.110	0.687	0.058	0.375	0.209
1986	0.188	0.090	0.721	0.055	0.458	0.205
1987	0.219	0.100	0.737	0.076	0.396	0.255
1988	0.210	0.110	0.726	0.075	0.451	0.242
1989	0.246	0.110	0.682	0.067	0.528	0.234
1990	0.265	0.100	0.676	0.060	0.498	0.243
1991	0.220	0.105	0.673	0.043	0.509	0.259
1992	0.214	0.100	0.695	0.055	0.472	0.274
1993	0.222	0.070	0.703	0.065	0.438	0.288
1994	0.227	0.175	0.705	0.090	0.491	0.239
1995	0.268	0.160	0.553	0.090	0.484	0.264
1996	0.206	0.180	0.586	0.076	0.479	0.289
1997	0.213	0.190	0.614	0.061	0.493	0.323
1998	0.323	0.190	0.592	0.044	0.493	0.315
1999	0.500	0.190	0.633	0.027	0.504	0.288
2000	0.311	0.190	0.620	0.034	0.496	0.293
2001	0.320	0.275	0.658	0.014	0.511	0.230
2002	0.391	0.270	0.582	0.042	0.509	0.273
2003	0.438	0.270	0.529	0.044	0.513	0.278
2004	0.313	0.250	0.467	0.041	0.530	0.319
2005	0.232	0.220	0.459	0.027	0.493	0.228
Sample mean		0.238	0.650	0.042	0.483	0.259

Notes: *Std Employment growth* is the standard deviation of employment growth, *Export share* is the median share of exports in total sales; *Leverage* is the median debt to total assets ratio; *Share in Total Exports* is the share of total exports of sample firms in total exports of Turkey, *Value added/GDP* is the share of total value-added by sample firms in the total manufacturing value added in GDP.

Table 3: Median 2-Digit ISIC Summary Statistics

ISIC-2	*Number of firms*	*Employment Growth*	*Value Added Growth*	*Sales Growth*	*Median Employment*	*Export Share*	*Leverage*
15	112	0.009	0.017	0.054	400	0.07	0.676
16	9	0.001	0.054	0.052	459	0.7	0.775
17	136	0.003	-0.003	0.019	900	0.33	0.635
18	23	0.028	0.033	0.028	677	0.6	0.737
19	3	0.017	0.344	-0.051	247	0.34	0.734
20	6	0.030	0.015	0.082	335	0.06	0.595
21	16	0.010	0.014	0.038	337	0.07	0.529
22	11	0.000	0.018	0.042	386	0	0.580
23	7	0.013	0.077	0.075	610	0	0.484
24	66	0.013	0.041	0.052	471	0.05	0.706
25	26	0.013	0.040	0.044	414	0.18	0.570
26	66	-0.009	0.045	0.044	431	0.1	0.543
27	52	0.027	-0.001	0.056	380	0.27	0.668
28	25	0.031	-0.001	0.056	360	0.26	0.628
29	29	0.012	0.060	0.069	540	0.08	0.732
30	2	0.043	0.020	0.101	130	0.03	0.583
31	27	0.007	0.021	0.049	442	0.16	0.741
32	11	0.011	0.119	0.078	1156	0.17	0.784
34	52	0.035	0.067	0.093	662	0.11	0.642
35	2	0.112	0.040	0.041	127	0.77	0.459
36	10	0.016	0.017	0.062	450	0.1	0.649

Notes: For variable definitions refer to Table 1 and 2. Two-digit industry classification codes are given in the appendix.

Table 4: Employment Growth and Real Exchange Rate Volatility

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
RERV	-0.839***	-0.716***	-0.666***	-0.844***	-1.086***	-0.742***	-1.054***
	(0.154)	(0.153)	(0.222)	(0.153)	(0.235)	(0.157)	(0.189)
RER	-0.087**	-0.054	-0.053	-0.097***	-0.096***	-0.077**	-0.133***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.045)
Assets	0.011*	0.015**	0.015**	0.010	0.010	0.008	0.013*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
ValueAdded	0.0004*	0.0005**	0.0005**	0.0004*	0.0004*	0.0005**	0.0004*
	(0.0002)	(0.0002	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Sales	0.123***	0.130***	0.130**	0.122***	0.122	0.125***	0.122***
	(0.023)	(0.027)	(0.027)	(0.023)	(0.023)	(0.024)	(0.023)
Industry	0.104***	0.106***	0.107***	0.105**	0.103***	0.105***	0.093***
	(0.019)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)
$Wage_{-1}$	-0.189***	-0.194***	-0.194***	-0.189***	-0.188***	-0.182***	-0.201***
	(0.023)	(0.024	(0.024)	(0.023)	(0.023)	(0.023)	(0.024)
GDP_{-1}	0.189***	0.217***	0.217***	0.164**	0.164**	0.176**	0.139*
	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)	(0.074)	(0.076)
$Exports_{-1}$		-0.117***	-0.110**				
		(0.040)	(0.046)				
$RERV*Exports_{-1}$			-0.238				
			(0.720)				
$Leverage_{-1}$				-0.019***	-0.006		
				(0.007)	(0.010)		
$RERV*Leverage_{-1}$					-0.455*		
					(0.279)		
$Profitability_{-1}$						0.069**	
						(0.029)	
Tax							0.080*
							(0.042)
cons	-0.229	-0.314**	-0.316**	-0.209	-0.202	-0.165	-0.563**
	(0.154)	(0.147)	(0.146)	(0.154)	(0.154)	(0.148)	(0.240)
Impact factor	-1.678	-1.433	-1.424	-1.689	-1.690	-1.483	-2.108
2001 crisis effect	-5.706	-4.871	-4.843	-5.741	-5.745	-5.043	-7.166
Interaction t-stat			-4.62***		-5.53***		
R-sq: within	0.066	0.074	0.074	0.067	0.067	0.071	0.067
between	0.279	0.134	0.133	0.283	0.279	0.242	0.264
overall	0.077	0.071	0.071	0.078	0.078	0.079	0.076
obs	8527	8160	8160	8497	8497	8441	8527
groups	691	690	690	691	691	691	691

Notes: (-1) refers to the first-lag of the variable. Unless otherwise stated, all growth rates are measured by logarithmic differences. (***), (**), (*) refer to significance at 1, 5 and 10 percent levels respectively. All variables are in decimals. *RERV* is the real exchange rate volatility; *RER* is the growth rate of effective real exchange rate. *Assets* is the log of total assets; *ValueAdded* is the percentage change in the real value added; *Industry* is the real aggregate output growth in two-digit manufacturing industries; *Wage* is the manufacturing sector real wage growth; *GDP* is the real GDP growth; *Sales* is the real sales from production growth; *Exports* is the log of one plus the share of exports in total sales; *Leverage* is the log of external debt to total assets ratio, profitability is the profits to net sales ratio; *Tax* is the tax wedge in natural log; *cons* is the constant variable. Impact factor is the impact of one-standard deviation increase in *RERV* on employment growth in percentages. 2001 crisis effect is the impact of the increase in *RERV* (*NERV* in Table 5) in 2001 on employment growth in percentages. *Interaction t-stat* is the t-statistics of the linear combination of the *RERV* with the interaction terms at the mean values of *Exports* and *Leverage*. *Obs* is number of observations, *Groups* is the number of cross-section units.

Table 5: Employment Growth and Nominal Exchange Rate Volatility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NERV	-0.571***	-0.509***	-0.409***	-0.568***	-0.737***	-0.512***	-0.659***
	(0.104)	(0.105)	(0.152)	(0.104)	(0.171)	(0.107)	(0.119)
NER	-0.025**	-0.017	-0.017	-0.028**	-0.030**	-0.021*	-0.043**
	(0.012)	(0.013)	(0.013)	(0.012)	(0.012)	(0.012)	(0.018)
Assets	0.010	0.015**	0.015**	0.008	0.008	0.007	0.011*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ValueAdded	0.0004*	0.0005*	0.0005**	0.0004*	0.0004*	0.001**	0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Sales	0.122***	0.129***	0.130***	0.122***	0.122***	0.125***	0.122***
	(0.023)	(0.027)	(0.027)	(0.022)	(0.023)	(0.023)	(0.023)
Industry	0.108***	0.109***	0.109***	0.110***	0.110***	0.108***	0.107***
	(0.019)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)
$Wage_{-1}$	-0.180***	-0.189***	-0.190***	-0.180***	-0.179***	-0.174***	-0.188***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)
GDP_{-1}	0.296***	0.297***	0.297***	0.277***	0.277***	0.271***	0.287***
	(0.069)	(0.069)	(0.069)	(0.068)	(0.068)	(0.069)	(0.068)
$Exports_{-1}$		-0.119***	-0.101**				
		(0.041)	(0.045)				
$NERV^{*}\ Exports_{-1}$			-0.544				
			(0.621)				
$Leverage_{-1}$				-0.018**	-0.009		
				(0.008)	(0.009)		
$NERV^{*}\ Leverage_{-1}$					-0.337		
					(0.224)		
$Profitability_{-1}$						0.070**	
						(0.030)	
Tax							0.065
							(0.047)
cons	-0.228	-0.326	-0.329**	-0.206	-0.200	-0.164	-0.494*
	(0.152)	(0.145)	(0.145)	(0.152)	(0.152)	(0.146)	(0.254)
Impact factor	-1.632	-1.453	-1.468	-1.623	-1.594	-1.463	-1.884
2001 crisis effect	-4.890	-4.353	-4.398	-4.862	-4.776	-4.382	-5.645
Interaction t-stat			-4.90***		-5.44***		
R-sq: within	0.066	0.074	0.074	0.067	0.067	0.071	0.066
between	0.288	0.133	0.131	0.293	0.288	0.245	0.277
overall	0.077	0.071	0.071	0.078	0.079	0.080	0.077
obs	8527	8160	8160	8497	8497	8441	8527
groups	691	690	690	691	691	691	691

Notes: *NERV* is the nominal effective exchange rate volatility; *NER* is the nominal effective exchange rate in log differences. For other variable definitions refer to Table 4.

Table 6: Employment Growth and Real Exchange Rate Volatility: GMM Estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LD_{-1}	-0.041	-0.074**	-0.074**	-0.042	-0.044	-0.067**	-0.041
	(0.039)	(0.034)	(0.034)	(0.039)	(0.038)	(0.034)	(0.039)
RERV	-0.450***	-0.381**	-0.411	-0.462***	-0.749***	-0.356**	-0.639***
	(0.168)	(0.171)	(0.269)	(0.1678)	(0.246)	(0.176)	(0.212)
RER	0.005	0.024	0.024	-0.011	-0.009	0.015	-0.035
	(0.038)	(0.037)	(0.037)	(0.038)	(0.038)	(0.039)	(0.049)
Assets	0.011***	0.010***	0.009***	0.011***	0.011***	0.010***	0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
ValueAdded	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0003)	(0.0004)
Sales	0.085***	0.104***	0.106***	0.082***	0.083***	0.099***	0.081**
	(0.032)	(0.039)	(0.039)	(0.032)	(0.032)	(0.034)	(0.033)
Industry	0.101***	0.094***	0.094***	0.104***	0.102***	0.099***	0.093***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)	(0.022)
$Wages_{-1}$	-0.144***	-0.144***	-0.144***	-0.147***	-0.145**	-0.138***	-0.154***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.027)
GDP_{-1}	0.207***	0.238***	0.237***	0.178**	0.183**	0.209***	0.164**
	(0.080)	(0.079)	(0.079)	(0.081)	(0.081)	(0.081)	(0.082)
$Exports_{-1}$		-0.020	-0.024				
		(0.022)	(0.035)				
$RERV^{*}\ Exports_{-1}$			0.172				
			(0.899)				
$Leverage_{-1}$				-0.024***	-0.006		
				(0.008)	(0.011)		
$RERV^{*}\ Leverage_{-1}$					-0.548*		
					(0.298)		
Profitability						0.069**	
						(0.035)	
Tax							0.071
							(0.048)
cons	-0.251***	-0.213***	-0.211***	-0.259***	-0.255***	-0.226***	-0.516***
	(0.074)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.193)
Impact factor	-0.899	-0.763	-0.756	-0.923	-0.901	-0.713	-1.278
2001 crisis effect	-3.058	-2.594	-2.571	-3.139	-3.063	-2.424	-4.346
Interaction z-stat			-2.18**		-2.76***		
m1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
m2	0.875	0.954	0.943	0.861	0.860	0.889	0.905
Hansen	0.157	0.140	0.141	0.154	0.142	0.099	0.147
obs	7826	7733	7733	7806	7806	7752	7826
groups	691	690	690	691	691	691	691
Instruments	512	513	514	513	514	513	513

Notes: Two-step system GMM results using Windmeijer finite-sample correction. *LD* is one-year lagged dependent variable. For other variable definitions refer to Table 4. *Hansen* is Hansen tests of over-identifying restrictions, *m1* and *m2* are AR(1) and AR(2) tests. *Interaction z-stat* is the z-statistics of the linear combination of the *RERV* with the interaction terms at the mean values of *Exports* and *Leverage*. All test statistics are given by their p-values. *Instruments* refer to the number of instruments used.

Table 7: Robustness Test

Robustness tests	*MA12* (1)	*GARCH* (2)	*1990-2005* (3)	*Include Full Sample* (4)	*Exclude Outliers-1* (5)	*Exclude Outliers-2* (6)	*Exclude ISIC 19, 30,35* (7)	*Exclude Crisis Years* (8)
RERV	-0.914***	-16.297***	-0.473***	-0.838***	-0.864***	-0.622***	-0.837	-0.839***
	(0.177)	(3.226)	(0.174)	(0.153)	(0.128)	(0.125)	(0.153)***	(0.154)
RER	-0.041	-0.100***	-0.030	-0.087**	-0.090***	-0.069***	-0.087**	-0.087**
	(0.034)	(0.039)	(0.057)	(0.037)	(0.027)	(0.027)	(0.037)	(0.037)
Assets	0.010	0.012*	0.047***	0.011*	0.010**	0.013***	0.010*	0.011*
	(0.006)	(0.007)	(0.010)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
ValueAdded	0.0004*	0.0004*	0.0004*	0.0004*	0.0003	0.035***	0.0004*	0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.007)	(0.0002)	(0.0002)
Sales	0.123***	0.122***	0.112***	0.123***	0.089***	0.159***	0.123***	0.123***
	(0.023)	(0.023)	(0.025)	(0.023)	(0.019)	(0.012)	(0.023)	(0.023)
Industry	0.112***	0.101***	0.140***	0.103***	0.111***	0.084***	0.104***	0.104**
	(0.018)	(0.019)	(0.029)	(0.019)	(0.016)	(0.016)	(0.019)	(0.019)
$Wages_{-1}$	-0.198***	-0.185***	-0.110***	-0.188***	-0.185***	-0.190***	-0.186***	-0.189***
	(0.024)	(0.023)	(0.028)	(0.023)	(0.018)	(0.017)	(0.023)	(0.023)
GDP_{-1}	0.190***	0.198***	0.097	0.184***	0.203***	0.239***	0.183**	0.189***
	(0.073)	(0.073)	(0.077)	(0.073)	(0.051)	(0.053)	(0.073)	(0.073)
cons	-0.205	-0.257*	-1.113**	-0.223	-0.220**	-0.295***	-0.222	-0.229
	(0.153)	(0.154)	(0.246)	(0.153)	(0.108)	(0.114)	(0.154)	(0.154)
Impact factor	-1.512	-1.699	-1.117	-1.676	-1.728	-1.243	-1.673	-1.678
2001 crisis effect	-4.243	-5.669	-3.220	-5.699	-5.875	-4.226	-5.688	-5.706
R-sq:								
within	0.066	0.066	0.066	0.066	0.072	0.101	0.066	0.066
between	0.290	0.274	0.095	0.168	0.054	0.100	0.283	0.279
overall	0.077	0.076	0.060	0.076	0.070	0.102	0.076	0.077
obs	8527	8527	6423	8654	8429	7463	8509	8527
groups	691	691	636	747	691	690	688	691

Notes: *MA12* and *GARCH* are the regression results using the moving standard deviation and GARCH based measures of exchange rate volatility and uncertainty; *1990-2005* refer to the limited sample period regression of 1990-2005; *Include full sample* is the full-sample regressions; *Exclude outliers- 1 and 2* are regression results without outliers (in employment only and in all other control variables); *Exclude ISIC 19, 30, 35* and *Exclude Crisis Years* refer to regressions excluding ISIC 19, 30, 31, and the crises years of 1994, 2000- 2001.

Table 8: Number of Incumbent Firms that Remained in all previous *t* Number of Years

Year/t	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1983																						
1984	258																					
1985	281	253																				
1986	298	275	247																			
1987	300	283	260	234																		
1988	311	287	270	248	224																	
1989	319	296	272	256	238	219																
1990	319	299	276	254	241	224	205															
1991	324	302	282	262	241	228	214	198														
1992	336	311	289	269	251	232	221	208	192													
1993	325	314	289	268	252	236	221	211	197	183												
1994	326	302	291	266	247	234	221	207	198	186	173											
1995	331	316	292	281	258	239	227	215	201	192	182	169										
1996	358	325	310	287	276	253	236	224	212	197	189	179	167									
1997	385	352	319	304	281	271	249	236	223	210	196	189	179	168								
1998	402	374	341	308	293	275	265	245	233	219	206	194	186	177	168							
1999	473	391	364	331	298	285	269	262	245	234	218	205	194	189	180	167						
2000	481	454	372	346	316	284	272	255	248	234	224	210	198	186	181	175	161					
2001	478	462	436	355	330	301	270	258	242	235	224	212	200	188	177	174	169	156				
2002	470	455	439	413	336	315	289	260	248	231	225	214	203	191	179	169	168	163	150			
2003	456	449	434	418	392	320	301	275	251	240	224	217	205	193	183	171	162	161	156	144		
2004	438	438	431	416	401	377	308	290	266	242	231	215	209	197	186	176	165	155	154	149	136	
2005	411	411	411	404	389	375	353	289	271	247	225	217	202	199	188	179	169	159	149	148	143	129

APPENDIX

A. Two-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.

B. Unit Root Test

Im, Pesaran and Shin (2003) W-stat, Null hypothesis: Unit root

Worker	*RER*	*RERV*	*RERVMA*	*RERV-Garch*	*Assets*
-44.2***	-103.2***	-63.4***	-37.5***	-78.3***	-9.5***
Industry	*GDP*	*ValueAdded*			
-134.2***	-132.1***	-84.8***			

Notes: *Worker*, *RER*, *Industry*, *ValueAdded* and *GDP* are logarithmic growth rates of number of workers, real exchange rate, 2-digit manufacturing industry output, real GDP, and firm level value added, respectively. *Asset* is natural log of firm level net assets in real prices. *RERV*, *RERVMA*, and *RERV-Garch* are the real exchange rate volatility variables using the average standard deviation, moving average standard deviation and the Garch measures, respectively, as discussed in the paper. Other unit root tests including Levin, Lin & Chu t-test (that assumes a common unit root process) and ADF - Fisher Chi-square and the Phillips-Perron- Fisher Chi-square tests (that, like Im Pasaran and Shin, 2003 test, assume individual unit root process) also strongly rejected the null hypothesis at 1% level.

C. Data Sources

Firm Level data (number of workers, total asset, value added, net sales, exports, leverage ratio, profitability rate): Istanbul Chamber of Industry

Tax Wedge: OECD Taxing Wages Database

RER, NER: Turkish Central Bank online data dissemination system.

Industry: Turkish Institute of Statistics

Wage rate: Turkish Institute of Statistics

GDP: Turkish Central Bank online data dissemination system.

D. Panel Description

<Insert Table 8 Here>