WORKING PAPER NO: 513

Exchange Rate Uncertainty and Employment Dynamics: Evidence from India

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Year of Publication – May 2016

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Abstract

This paper studies the impact of real exchange rate volatility on firm level employment using a dynamic panel data model applied on a panel of 700 Indian manufacturing firms. Real exchange rate volatility is found to have a significant and negative impact on firm level employment growth. Access to domestic equity finance is found to reduce the negative impact of exchange rate uncertainty significantly but the same cannot be said about foreign equity finance. Further, exposure to international trade in the form of exports and imports affects employment dynamics in the face of exchange rate uncertainty.

JEL Classification: F1, F4

Keywords: Real Exchange Rate Volatility, Trade Exposure, Employment

> "*With an open economy and large capital inflows, management of the exchange rate becomes an independent concern. The domestic currency can begin to appreciate (because of nominal appreciation) even with domestic price stability, if there are large capital inflows….Studies suggest that exchange rates are more volatile than can be explained by the macroeconomic fundamentals and moreover this excess volatility has in some cases inhibited international trade*"
>
> - Rangarajan and Prasad (2008)

I. Introduction

International economics has long been concerned with the effects of exchange rate movements on the real economy. The topic continues to attract theoretical as well as empirical researchers alike. Exchange rate movements can affect economic performance through a number of channels, such as the cost of imported inputs relative to other factors of production, price of exports relative to foreign competitors or the cost of external borrowing. One particular aspect of exchange rate movements that has been a cause of concern for policy makers and academics alike is their volatility.

The gold standard of the 19th and early 20th centuries and the ensuing Bretton Woods system are credited with fostering a period of sustained growth in trade and output across the world by providing a system of stable exchange rates; though, more nuanced analysts qualify the simple causal relationship between exchange rate stability and high growth and regard Gold standard & Bretton Woods as historically specific institutions instead that were sustained by specific circumstances that resulted in high growth and stable exchange rates.

India presents an interesting case for empirical investigation of the role of exchange rate volatility both because of its dynamic growth experience over the last two decades and also because of its unique approach to financial integration in the face of rapid globalization and trade openness. India's overall management of capital flows can be characterized by its calibrated and gradualist approach towards capital account liberalization. In line with that, the RBI has followed a managed floating exchange rate regime to balance the competing objectives of exchange rate stability, low inflation and domestic growth. Yet, studies examining the impact of exchange rate volatility on Indian firms are very few. In that respect this paper fills an important gap in the existing literature by looking at the impact of exchange rate volatility on firm level employment growth in India.

Key contributions of this paper are threefold: a.) developing a simple theoretical model highlighting the link between firm level employment growth and exchange rate volatility. b.) using firm level information to capture the role of heterogeneity in firm and industry level

characteristics in determining their response to exchange rate volatility. c.) examining the impact of access to foreign and domestic equity finance on firm's response to exchange rate volatility.

The paper is organized as follows: section 2 gives a brief review of literature while section 3 presents a small theoretical model to motivate the empirical analysis. Section 4 describes the dataset and methodology used in the empirical analysis and section 5 presents the results. Section 6 concludes.

II. Literature Review:

Macro and microeconomic effects of exchange rate volatility have long been a major concern in economics. Exchange rate volatility can affect growth through multiple channels and in theory; the sign of this relationship is ambiguous and depends on the underlying assumptions (Aiginger, 1987; Caballero and Pindyck, 1996; Dixit and Pindyck, 1994; the collection of articles in Aizenman and Pinto, 2005). In contrast, a rich body of empirical research points at an unambiguously negative effect of uncertainty on investment, employment, and growth (Aghion et al., 2009; Aizenman and Marion, 1999; Chong and Gradstein, 2009; Federer, 1993; Pindyck and Solimano, 1993; Rosenberg, 2004; Serven, 2003).

Studies show that exchange rate volatility works its effects through: a) changing the relative costs of production (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) with contractionary effects on employment (Nickell and Nicolitsas, 1999; Sharpe, 1994) and investment (Fazzari et al., 1988); c) decreasing aggregate output and productivity growth especially in countries where financial development is low (Aghion et al., 2009; Ramey and Ramey, 1995); d) increasing inflation uncertainty, which is found to reduce employment (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 (Baum and Caglayan, 2010).

That said, the idea that minimizing exchange rate volatility is an essential part of the growth recipe is disputed. The evidence linking exchange rate volatility to exports, employment and investment is less than definitive. Implications of volatility for financial stability and growth will depend on the presence or absence of the relevant hedging markets—and on the depth and development of the financial sector generally (Aghion et.al, 2009). There is some evidence that these markets develop faster when the currency is allowed to fluctuate and that banks and firms are more likely to take precautions, hedging themselves against volatility, than when the authorities seek to minimize volatility (e.g. Shah and Patnaik (2010)). There is evidence, for example, of faster development of these markets and instruments following the Asian crisis (see

Hohensee and Lee (2004)). More generally, Duttagupta, Fernandez and Karasadag (2004) show that countries with more variable exchange rates tend to have more liquid foreign exchange markets, since their banks and firms have an incentive to participate.

To be sure, there are limits to the argument that price variability is conducive to the development of hedging markets and instruments: high levels of volatility will be subversive to financial development, including even the development of hedging markets and instruments, insofar as it induces capital flight and leads the authorities to resort to policies of financial repression.

Illustrating the ambiguity in the empirical evidence further, some studies of currency crises conclude that these cause only temporary and transient disruptions to growth (See e.g. Calvo, Izquierdo and Talvi (2006)). Ghosh et al. (1997) found no relationship between observed exchange rate variability and economic growth for a sample of 136 countries over the period 1960–89, Bailliu et al. (2001) reported a positive association between the degree of exchange rate flexibility and economic growth.

Dollar (1992) does report evidence of a negative OLS relationship between real exchange rate variability and growth in a sample of 95 developing countries covering the period 1976–85. Using different measures and country samples, Bosworth et al. (1995) and Hausmann et al. (1995) report similar results. Belke and Kaas (2004) find the same thing focusing on employment growth in the Central and Eastern European transition economies for a subsequent period. But two other studies exploring the relationship between real exchange rate variability and growth in different developing country samples (Ghura and Grennes 1993 and Bleaney and Greenaway 2001) find little evidence of a relationship. Potential explanations include different country samples, different periods, different controls, different ways of measuring the real exchange rate, and different degrees of omitted-variables and simultaneity bias.

Some recent studies have tried to use firm level data to untangle the relationship between growth and exchange rate volatility. However, these studies are few and far between and, barring a few exceptions (e.g. Demir, 2009, 2013), focus on publicly listed firms from developed countries. A careful analysis of the relationship between exchange rate volatility and growth taking in to account firm heterogeneity, industry structure and role of financial access is therefore much called for.

III. Theoretical Model

In this section we present a simple model of the labor market that allows us to illustrate the mechanisms through which exchange rate swings can induce equilibrium employment adjustment. Following Campa and Goldberg (1999; 2001) and Nucci and Pizzolo (2001; 2010),

we consider the optimality conditions for profit maximization of a firm operating in an imperfectly competitive market. The firm's profit maximization problem is defined as:

$$\max_{q,q^*,z,z^*,l} \pi(q,q^*,z,z^*,l,e) = E\left[p_{i,t} \times q_{i,t} + p^*_{i,t} \times q^*_{i,t} \times e_t - z_{i,t} \times s_{i,t} - z^*_{i,t} \times s^*_{i,t} \times e_t - w_{i,t} \times l_{i,t}\right] \quad (1)$$

Subject to the technology constraint: $q_{i,t} + q^*_{i,t} = F\left(z_{i,t}, z^*_{i,t}, l_{i,t}\right)$ (2)

where q and q^* are the volumes of production for the domestic and the foreign markets, respectively, and the inverse demand functions $p(q,e)$ and $p^*(q^*,e)$, have been substituted into the profit function; l is the number of workers employed and z and z^* are the levels of domestic and imported non-labor inputs, respectively; w is the wage and s and s^* are the prices of the domestically produced and the imported inputs, respectively; e is the exchange rate, quoted as the number of domestic currency units per foreign currency unit (i.e., an increase of e denotes a currency depreciation).

The first order conditions with respect to q and q^* for the solution of the constrained maximization problem (1) are:

$$\frac{\partial p_{i,t}}{\partial q_{i,t}} \times q_{i,t} + p_{i,t} = \lambda_{i,t} \quad (3)$$

$$\frac{\partial p^*_{i,t}}{\partial q^*_{i,t}} \times q^*_{i,t} \times e_t + p^*_{i,t} \times e_t = \lambda_{i,t} \quad (4)$$

where λ is the Lagrange multiplier. Similarly, the first order conditions for profit maximization with respect to z, z^* and l are:

$$-s_{i,t} + \lambda_{i,t} \times \frac{\partial F\left(z_{i,t}, z^*_{i,t}, l_{i,t}\right)}{\partial z_{i,t}} = 0 \quad (5)$$

$$-s^*_{i,t} \times e_t + \lambda_{i,t} \times \frac{\partial F\left(z_{i,t}, z^*_{i,t}, l_{i,t}\right)}{\partial z^*_{i,t}} = 0 \quad (6)$$

$$-w_{i,t} + \lambda_{i,t} \times \frac{\partial F\left(z_{i,t}, z^*_{i,t}, l_{i,t}\right)}{\partial l_{i,t}} = 0 \quad (7)$$

Assuming a constant return to scale production technology, the Euler's theorem can be used to express total output as follows:

$$q_{i,t}+q_{i,t}^{*}=\frac{\partial F\left(z_{i,t},z_{i,t}^{*},l_{i,t}\right)}{\partial l_{i,t}}\times l_{i,t}+\frac{\partial F\left(z_{i,t},z_{i,t}^{*},l_{i,t}\right)}{\partial z_{i,t}}\times z_{i,t}+\frac{\partial F\left(z_{i,t},z_{i,t}^{*},l_{i,t}\right)}{\partial z_{i,t}^{*}}\times z_{i,t}^{*} \qquad (8)$$

Using the first order conditions (3-7) along with the Euler equation (8) and defining $\frac{1}{\mu}=\left(1+\frac{1}{\eta}\right)$ and $\frac{1}{\mu*}=\left(1+\frac{1}{\eta*}\right)$ as the reciprocals of the mark-up ratios set, respectively, in the domestic and foreign product markets, we get the following equilibrium equation:

$$w_{i,t}\times l_{i,t}=E\left[\frac{p_{i,t}\times q_{i,t}}{\mu_{i,t}}-z_{i,t}\times s_{i,t}+\frac{p_{i,t}^{*}\times q_{i,t}^{*}\times e_{t}}{\mu_{i,t}^{*}}-z_{i,t}^{*}\times s_{i,t}^{*}\times e_{t}\right] \qquad (9)$$

Taking log of both sides we get:

$$\ln\left(l_{i,t}\right)=\ln\left(E\left[\frac{p_{i,t}\times q_{i,t}}{\mu_{i,t}}-z_{i,t}\times s_{i,t}+\frac{p_{i,t}^{*}\times q_{i,t}^{*}\times e_{t}}{\mu_{i,t}^{*}}-z_{i,t}^{*}\times s_{i,t}^{*}\times e_{t}\right]\right)-\ln(w_{i,t}) \qquad (10)$$

Equation 10 gives us the demand curve for labor.

Assume a standard supply curve for labor given by:

$$\ln\left(l_{i,t}\right)=a_{0}+a_{1}\times\ln\left(w_{i,t}\right)+a_{2}\times\ln\left(y_{i,t}\right) \qquad (11)$$

where $\ln(y)$is a measure of aggregate demand.

Using equation 11 to substitute for $\ln(w)$ in equation 10 we can get the following equation for equilibrium amount of labor:

$$\ln\left(l_{i,t}\right)=b_{0}+b_{1}\times\ln\left(\frac{p_{i,t}\times q_{i,t}}{\mu_{i,t}}-z_{i,t}\times s_{i,t}+E\left[\frac{p_{i,t}^{*}\times q_{i,t}^{*}\times e_{t}}{\mu_{i,t}^{*}}-z_{i,t}^{*}\times s_{i,t}^{*}\times e_{t}\mid\Omega_{t-1}\right]\right)+b_{2}\times\ln\left(y_{i,t}\right) \qquad (12)$$

To keep the model analytically tractable, assume that the only source of uncertainty is the exchange rate. Further, assume that the exchange rate follows a log-normal distribution with mean ν and variance σ_{t}^{2}, both of which are in the information set Ω_{t-1}. We can rewrite expression (12) as

$$\ln\left(l_{i,t}\right)=b_{0}+b_{1}\times\ln\left(\frac{p_{i,t}\times q_{i,t}}{\mu_{i,t}}-z_{i,t}\times s_{i,t}+\left(\frac{p_{i,t}^{*}\times q_{i,t}^{*}}{\mu_{i,t}^{*}}-z_{i,t}^{*}\times s_{i,t}^{*}\right)\times\exp\left(\nu+\frac{\sigma_{t}^{2}}{2}\right)\right)+b_{2}\times\ln\left(y_{i,t}\right) \qquad (13)$$

Equation 13 shows how the exchange rate volatility can affect employment. However, equation 13 is non-linear in variables of interest. In order to simplify the interpretation of coefficients and obtain an equation that can be used as the basis for empirical specification, equation 13 is linearized using first-order Taylor approximation. Assuming that the mark-ups in domestic and foreign markets are identical, we rearrange and linearize equation 13 around the steady state to obtain the following equation:

$$\ln(l_{i,t}) \approx \Psi_0 + \Psi_1 \times \ln(Cost_{i,t}) + \Psi_2 \times (e_t - \bar{e}) + \Psi_3 \times \left(Exposure_{i,t}^f - \overline{Exposure_i^f}\right) + \Psi_4 \times (\sigma_t - \bar{\sigma}) + \Psi_5 \times (LS_{i,t} - \overline{LS}) + \Psi_6 \ln(y_{i,t}) \quad (14)^1$$

where $Cost_{i,t} = Cost_{i,t}^d + Cost_{i,t}^f + w_{i,t} \times l_{i,t}$ is the total cost of production including labor and material inputs, $Exposure_{i,t}^f = \frac{R_{i,t}^f}{\left(R_{i,t}^d + R_{i,t}^f\right)} - \frac{Cost_{i,t}^f}{Cost_{i,t}}$ is the trade exposure of firm *i* defined as the difference between share of exports in total revenues and share of imported inputs in total costs, e_t is the exchange rate defined as domestic currency per unit of foreign currency while σ_t is the measure of exchange rate variability. $LS_{i,t}$ is the share of labor in total cost of production defined as the share of compensation to employees in total cost of production. $y_{i,t}$ is the total amount of sales in domestic currency.

Taking first difference of equation (14) we get:

$$\Delta l_{i,t} \approx \Psi_1 \times \Delta Cost_{i,t} + \Psi_2 \times \Delta e_t + \Psi_3 \times \Delta Exposure_{i,t}^f + \Psi_4 \times \Delta \sigma_t + \Psi_5 \times \Delta LS_{i,t} + \Psi_6 \Delta y_{i,t} \quad (14`)$$

Eq. (14') is the key expression driving our empirical methodology below. Next section describes in detail our dataset and empirical methodology based on this theoretical model.

IV. Data and Methodology

This section describes our empirical methodology and dataset in detail.

Empirical Model

Based on the expression in equation (14) in Section 3 the following econometric specification is proposed for the empirical analysis:

[1] See Appendix C for detailed derivation of equation 14

$$\begin{aligned}\Delta l_{i,t} = {} & a_0 + a_1 \times \Delta l_{i,t-1} + a_2 \times \Delta Cost_{i,t-1} + a_3 \times \Delta e_{t-1} + \\ & a_4 \times \Delta Exposure^{f}_{i,t-1} + a_5 \times \Delta \sigma_{t-1} + a_6 \times \Delta LS_{i,t-1} \\ & + a_7 \Delta y_{i,t-1} + a_8 \times \tau_{i,t-1} + a_9 \times f_{i,t-1} + \varepsilon_{i,t}\end{aligned} \qquad (15)$$

We use lagged growth rates of all firm level variables in our empirical model in order to avoid bias due to possible endogeneity[2]. A lag of the dependent variable is added in the empirical model to capture the sluggishness in firm level employment adjustment.

To control for idiosyncratic industry shocks – applying worldwide – we use industry specific time trends in our model $\tau_{i,t}$. These industry specific trends will help control for underlying worldwide changes in supply and demand, changes in pricing-to market behavior, changes in the degree of competition from low cost countries such as China, and other time-varying industry characteristics.

Apart from the firm level control variables described above, we also include variable $f_{i,t}$ to control for foreign ownership which can affect labor productivity and employment dynamics. The empirical model uses two different methods to control for foreign ownership. In the first set of regressions, the share of foreign equity in total equity is introduced as a continuous measure[3]. In the second set of regressions, foreign participation in the capital structure of the firm is captured using a dummy variable, Foreign[10], which is set equal to 1 when 10 percent or more of the equity is owned by foreign investors.

Foreign ownership may also affect the impact of real exchange rate uncertainty on firm level employment. Foreign owned firms might be more resilient in face of exogenous shocks due to better access to internal/external finance, higher productivity, better risk management etc. At the same time, foreign firms might be affected by changes in global investor sentiments to a greater extent as compared to domestic firms. We therefore include interaction between real exchange rate volatility σ_t and foreign ownership variable $f_{i,t}$ in a third set of benchmark regressions.

With lagged dependent variable in the equation, standard estimators are rendered inconsistent due to correlation between unobserved panel level effects and the lag of the dependent variable. We therefore use the two- step system GMM estimator suggested by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998)[4i] to estimate equation 15.

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[2] We use lagged level of real exchange rate volatility to instrument for the change in exchange rate uncertainty in line with our assumption of GARCH (1,1) model for exchange rate volatility.

[3] To be more precise we use the natural log of (1+ share of foreign equity/100)

[4] The system GMM estimator is itself based on the difference GMM estimator suggested by Arellano and Bond (1991)

Data

The firm level dataset consists of information on 700 manufacturing firms regarding the number of workers employed, sales, total assets, exports and imports. The data is obtained from the CMIE - PROWESS database and cover fifteen year period from 2000 to 2014. The data covers eighteen manufacturing industries classified according to the two digit NIC code[5].

The trend employment growth amongst the firms in our sample was about 2.3 percent during the entire period while trend growth in sales was 8.7 percent. Average size of asset holdings of the firms in our sample was INR 9100 million while average workforce was 2300 during this period.

The share of firm level foreign equity participation ranges from zero to 97 % of firm capital, with a standard deviation of 20%, and an average of 10.6%. Furthermore, around 16% of firms in the sample have foreign equity participation. Eighty percent of the firms in our sample are publicly listed while the remaining 20 percent are unlisted. Of the 900 firms in the sample roughly ten percent were non-exporters while four percent had no imported inputs during the period under consideration. Our sample contains information on both publicly traded and non-traded private firms apart from the information on foreign equity ownership. Hence, we can explore if exchange rate shocks affect firm productivity differently depending on firms' access to domestic or foreign equity capital. The dataset also contains information about export earnings and use of imported inputs by individual firm. This allows us to control for differences in the degree of trade exposure across firms. Table 1 presents some descriptive statistics of our dataset.

One shortcoming of the dataset is that it only includes the surviving firms and does not provide information on firms that exit from the sample due to exchange rate uncertainty. This survivorship, however, would bias our estimations against observing any significant effects of exchange rate uncertainty as the sample includes only the most successful firms, which must have developed the means to survive such negative shocks.

Prior to estimating our models we apply a number of sample selection criteria. First, we include only private firms with no public sector ownership. Secondly, we only keep firms with at least five consecutive years of data. Finally, due to multiple sources of information, a few firms had discrepancies in their reported export earnings and total sales figures. We drop those firms from our sample. This leaves us with a total of 692 firms.

[5] Appendix gives the details of industrial classification

Calculating Real Exchange Rate Uncertainty

To carry out our analysis, we need a proxy that captures the volatility of the exchange rate series. In the literature, different methodologies are used to construct measures of exchange rate uncertainty, although there is still no consensus on which one is the most appropriate (**Clark et al., 2004**).

Our benchmark measure of exchange rate uncertainty is based on the GARCH (1, 1) applied to log of monthly real exchange rate (we use real instead of nominal exchange rate since theoretically profits are affected by both nominal exchange rates and prices of traded goods). We estimate the GARCH (1,1) process using monthly data on real exchange rates from 1994 to 2014 provided by the *BIS*. The last estimated conditional standard deviation of each period is used as approximation of the conditional volatility at the beginning of the next period. For example, the conditional volatility for the year 2000 is the estimated conditional standard deviation for December 1999 in the GARCH (1,1) model using data from January 1994 to December 2014.

Table 2 presents broad trends in real exchange rate volatility in India over the sample period using five year non-overlapping averages of our GARCH based Conditional volatility measure. Uncertainty in the real exchange rate increased during this period as measured by our GARCH based measure. At the same time this period saw significant real appreciation of Indian rupee in response to growing capital inflows with the exception of second period.

The period between 2005 and 2009 saw RBI intervention in the foreign exchange market to prevent rupee appreciation driven by growing capital inflows. This intervention was 'sterilized' (initially using GOI securities followed by the use of specially issued Market Stabilization Scheme Bonds). By the end of 2007, however, monetary sterilization of forex intervention had become highly costly and ineffective. With the onset of sub-prime crisis in the US and the resultant increase in capital flow volatility globally, RBI was forced to move towards greater exchange rate flexibility and abandon its efforts at stabilizing the rupee. Overall trends in Table 2 capture this move towards greater exchange rate flexibility in the face of increasingly volatile capital flows and growing costs of monetary sterilization.

V. Results

Table 3 presents the results from the benchmark model of firm level employment. Key result from the benchmark model is that the volatility of real exchange rate affects firm level employment growth negatively and significantly. The coefficient is also economically significant. A one standard deviation increase in real exchange rate uncertainty (0.002) reduces firm level employment growth by 2.9 percentage points. Changes in the level of real exchange rate, on the other hand, do not affect firm level employment significantly (coefficient on lagged real exchange rate growth is positive but insignificant).

Foreign ownership is likely to have a negative relationship with employment growth if, as suggested by earlier studies, foreign firms are more capital intensive and more productive than their domestic counterparts. However, if foreign firms are in India in order to exploit cheap labor then we would expect to find a positive relationship between employment growth and foreign ownership. Variable capturing foreign ownership has a positive coefficient on its own in both specifications (1) & (2) though it is statistically significant only in the second case. Also, the sign of the coefficient changes and its significance disappears once we introduce its interaction with exchange rate variables in specifications (3) & (4).

Coefficient on interaction between foreign exchange rate variable and real exchange rate uncertainty is insignificant though positive for both specifications (3) & (4) indicating that foreign ownership does tend to mitigate the negative impact of exchange rate uncertainty on firm level employment but the effect is not statistically significant. It is possible that foreign ownership mitigates the impact of exchange rate uncertainty only after crossing a certain threshold. We therefore introduce foreign ownership threshold levels set at 50%, 75%, and 90% to check whether firms with higher foreign equity shares behave differently from others. Specifications (5) to (7) in Table 4 present the result from this exercise.

As we can see, volatility of real exchange rate still has a negative and significant impact on firm level employment growth in all the specifications. However, coefficient on the interaction term between exchange rate volatility and foreign ownership dummy differs in sign and significance across different specifications. Thus we only find mixed evidence for the hypothesis that foreign ownership makes firms more resilient against exchange rate shocks. Other results remain unchanged between specifications (1) to (7). Overall these results show an ambiguous role of foreign ownership in mitigating the impact of exchange rate volatility on firm level employment growth. Of the remaining variables, trade exposure consistently exhibits negative and significant coefficient in all the specifications. Sign and significance of the remaining variables change across different models.

Access to domestic equity finance can allow firms to deal with exchange rate shocks more effectively and reap the risk sharing benefits of foreign equity finance more effectively. We therefore divide the entire sample in to two groups – publicly listed firms (those which are listed on BSE or NSE[6]) & un-listed firms - and check for the role of foreign equity ownership in the face of exchange rate uncertainty. Table 5 presents the results from this exercise.

Exchange rate volatility affects firm level employment growth negatively and significantly for both publicly listed and un-listed firms but the coefficient on exchange rate uncertainty term is roughly three times bigger in size for the latter group. This may point towards the presence of

[6] BSE – Bombay Stock Exchange, NSE – National Stock Exchange

borrowing constraints in case of unlisted firms. Foreign equity ownership does not seem to have any significant mitigating effect in case of exchange rate uncertainty for either group. Foreign ownership on its own has no significant effect on firm level employment growth either. This confirms our earlier results. Foreign equity ownership plays an ambiguous role in the face of exchange rate uncertainty. There is no significant change in the sign and significance of the remaining coefficients. Trade exposure continues to be negative and significant as before. Most of the other variables are economically and / or statistically insignificant.

One striking difference between listed and unlisted firms is that lagged employment growth has a much larger and statistically significant coefficient in the case of latter; indicating that unlisted firms with faster employment growth in period 't' experience relatively slower employment growth in period t+1.

Lagged growth in trade exposure affects firm level employment growth negatively and the effect is both statistically and economically significant in all the specifications estimated so far. Larger trade exposure can be associated with a faster employment growth if it leads to higher productivity growth. At the same time, higher trade exposure can make firms more vulnerable to exogenous shocks, including exchange rate shocks, and therefore increase the impact of exchange rate uncertainty on firm level employment growth. To verify this hypothesis next section looks at the interaction between trade exposure and exchange rate volatility.

Trade Exposure and Exchange rate Volatility

As discussed towards the end of the previous section, trade exposure can affect firm level employment dynamics by making them more vulnerable to exchange rate shocks. In order to explore this possibility we include an interaction term between trade exposure as defined above and the volatility of real exchange rate in our benchmark model. This gives us the following equation:

$$\begin{aligned}\Delta l_{i,t} = {} & a_0 + a_1 \times \Delta l_{i,t-1} + a_2 \times \Delta Cost_{i,t-1} + a_3 \times \Delta e_{t-1} + \\ & a_4 \times \Delta Exposure^{f}_{i,t-1} + a_5 \times \Delta \sigma_{t-1} + a_6 \times \Delta LS_{i,t-1} \\ & + a_7 \Delta y_{i,t-1} + a_8 \times \tau_{i,t-1} + a_9 \times f_{i,t-1} \\ & + a_{10} \times \Delta \sigma_{t-1} \times \Delta Exposure^{f}_{i,t-1} + \varepsilon_{i,t}\end{aligned} \qquad (16)$$

Table (6) presents the results from this specification.

Exchange rate volatility has a negative and significant impact on firm level employment growth as before, while a change in the level of real exchange rate does not affect the same significantly. More importantly, the interaction term between real exchange rate volatility & trade exposure is negative and significant. Coefficient on the trade exposure term, on the other hand, turns positive and significant after the introduction of this interaction term. This indicates that while higher trade exposure is associated with a faster employment growth at the firm level on its own, it magnifies the adverse impact of real exchange rate uncertainty on firm level employment. Joint coefficient on exchange rate volatility and its interaction with trade exposure is negative and significant.

A one standard deviation increase in trade exposure (0.11) at the mean level of exchange rate uncertainty (0.013) is associated with a reduction in employment growth by 1 to 1.5 percent. At the same time, the decline in firm level employment growth due to a one standard deviation increase in real exchange rate volatility (0.002) is about 5 percentage points higher for firms with trade exposure one standard deviation above the mean (0.11).

Sign and significance of the remaining variables remain mostly unchanged. Next section looks at the presence of possible non-linearity in the relationship between exchange rate volatility and trade exposure. These results do not change when we include the interaction term between exchange rate volatility and foreign equity ownership variable.

Non-linear Impact of Trade Exposure

To check for the presence of non-linearity in the relationship between trade exposure and firm level employment growth we replace the linear variable measuring trade exposure with a dummy that takes a value 1 if trade exposure is above a certain threshold[7]. Table 7 presents the results from this exercise.

Looking at the results from specification 17 to 20, we find evidence for the presence of non-linearity in the relationship between trade exposure and firm level employment growth. Coefficient on the trade exposure dummy is positive for all specifications indicating that firms with higher trade exposure experience higher employment growth, *ceteris paribus,* in the absence of exchange rate shocks. At the same time, the interaction term between real exchange rate volatility and exposure dummy has a negative and significant coefficient in all the four specifications indicating that firm level employment growth is more adversely affected by exchange rate volatility in the presence of higher trade exposure.

Coefficient on real exchange rate volatility is negative for all specifications but its significance varies across specifications. Joint coefficient on exchange rate volatility and its interaction with

[7] We use two alternative values of threshold for the exposure dummy –: 0.0475 (25^{th} percentile) and 0.15 (mean).

trade exposure dummy is, however, negative and significant for all specifications. Overall these results indicate that trade exposure affects firm level employment non-linearly. More significantly, higher exchange rate volatility leads to a much sharper decline in firm level employment growth amongst firms with bigger trade exposure, *ceteris paribus*.

We saw earlier that access to domestic equity finance can affect the dynamics of employment growth in response to exchange rate uncertainty. Next section, therefore, looks at the differences in behavior of firm level employment amongst firms with and without access to the domestic equity market.

Access to domestic equity markets

Access to domestic equity markets can have a significant effect on firm level employment dynamics in response to exchange rate shocks. If the borrowing capacity of a firm is related to its current earnings and if wages cannot be adjusted as the exchange rate fluctuates, then in response to exchange rate fluctuations the firm's ability to borrow will be affected, thereby affecting its employment growth. This would imply a smaller impact of exchange rate uncertainty on the employment growth of firms with access to domestic equity markets. At the same time, firms relying on equity markets for finance might be subject to exchange rate driven changes in investor sentiments and therefore, employment, to a much greater degree. We test for these differences by splitting our sample between listed and unlisted firms. Table 8 presents the results from this exercise.

Coefficient on real exchange rate volatility is negative and significant for publicly listed as well as unlisted firms. However, size of the coefficient is more than three times bigger for un-listed firms, which might indicate the presence of borrowing constraints. At the same time, coefficient on the interaction term between real exchange rate volatility and trade exposure is large and significant for listed firms while it is small and statistically insignificant for un-listed firms.

Thus, trade exposure affects firm level employment response to exchange rate uncertainty much more in the case of listed firms as compared to un-listed firms. This makes intuitive sense since publicly listed firms with higher trade exposure are likely to be affected much more by exchange rate driven changes in investor sentiments. Overall impact of a one standard deviation increase in the real exchange rate volatility (0.002) on firm level employment growth is, however, 5 percentage points higher for unlisted firms as compared to the publicly listed firms at mean level of trade exposure[8]. Thus access to domestic finance does seem to help in mitigating the negative effect of exchange rate uncertainty on firms even after taking in to account differenced in their trade orientation.

[8] The difference is obtained by calculating the impact of a one standard deviation increase in exchange rate volatility for publicly listed and unlisted firms at their respective mean levels of trade exposure.

Trade exposure, on its own, has a positive and significant coefficient in case of publicly listed firms while it has a negative but insignificant coefficient in case of un-listed firms. Thus, exposure to external trade can boost firm level employment growth provided the firms can access domestic equity market. These results hold with or without controlling for foreign equity ownership.

Robustness Check

In this section, we test the robustness of our key results to two alternative measures of real exchange rate volatility. The first one is based on the annual standard deviation of the first difference of the logarithm of the monthly real exchange rate. For each year, we use the average of this monthly standard deviation from the previous six years as a proxy for exchange rate uncertainty. For the second proxy we estimate a GARCH (1, 1) process separately for every year from 2000 to 2014 using monthly data on real exchange rates from the previous six years. As in Clark et al. (2004), we use the last estimated conditional standard deviation as the approximation of the conditional volatility at the beginning of the next period. For example, the conditional volatility for the year 2000 is the estimated conditional standard deviation for December 1999 in the GARCH (1,1) model using data from January 1994 to December 1999. The resulting measure of exchange rate volatility reflects medium- to long-run volatility.

Tables 8 and 9 present the results from this exercise. Our key results remain unaffected by the use of these alternative measures of exchange rate uncertainty. Real exchange rate volatility affects firm level employment adversely. In the absence of any trade exposure, employment growth in the un-listed firms is affected much more by real exchange rate volatility as compared to that in the publicly listed firms. The impact, however, varies significantly with the size of trade exposure for publicly listed firms (same is not true for un-listed firms). Once the impact of trade exposure is taken in to account, however, the publicly listed firms still show a smaller decline in their employment growth in response to increased real exchange rate volatility.

Trade exposure has a positive and significant coefficient only in the case of publicly listed firms. This is in line with our earlier results. Most of the remaining variables retain their earlier signs and significance[9].

Conclusion

As emerging markets open up to international trade and capital flows, they are forced to contend with sharp movements in their domestic currency. Efforts to dampen these movements in

[9] Similar robustness exercises were performed with these alternative measures of uncertainty for other specifications mentioned in the paper without any significant changes in our key results. Results from those are available from the authors upon request.

exchange rate involve significant costs (both implicit and explicit) including a potential loss in monetary policy autonomy. This paper looks at the impact of an increase in the real exchange rate volatility on firm level employment as measured by the number of workers. It uses firm level data on 700 Indian manufacturing firms and a benchmark model derived from the profit maximization problem of an imperfectly competitive firm to study the response of employment growth to higher exchange rate volatility.

The key findings of this paper are as follows: a. Real exchange rate volatility has a significant and negative impact on firm level employment growth; b. foreign equity ownership does not help in mitigating the adverse impact of exchange rate uncertainty unambiguously; c. Trade exposure affects the impact of exchange rate volatility on employment growth significantly for publicly listed firms but not for unlisted firms even though the overall impact of exchange rate uncertainty is higher for the unlisted firms; d. Trade exposure benefits firm level employment growth significantly only for publicly listed firms.

These results have important policy implications. Apart from developing foreign exchange market infrastructure to enable access to the full range of derivative products, maintaining a competitive exchange rate in order to boost exports is the key to managing currency risks in the long-run. At the same time, higher trade exposure can itself increase the vulnerability of firms to exchange rate uncertainty. In this context, access to domestic equity finance seems to play a far more significant role in mitigating the impact of exchange rate uncertainty than foreign equity ownership.

Even after taking in to account greater impact of exchange rate driven changes in investor sentiment on publicly listed firms, the overall impact of exchange rate uncertainty on firm level employment growth is much smaller for them as compared to unlisted firms. Trade exposure can promote employment growth only in the presence of domestic equity finance. Policies to boost trade must therefore go hand in hand with the development of domestic equity markets to promote sustainable growth.

An important drawback of this study is that it does not take in to account the role of firm entry and exit in the face of exchange rate uncertainty. Even though that omission is likely to bias our results against finding any significant impact of exchange rate uncertainty on employment growth, a careful analysis of such survival bias is called for. Further analysis is also required to understand the role of differences in the productivity levels of firms in determining employment dynamics.

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Appendix A

Data definitions

$\Delta l_{i,t} = \left(l_{i,t} - l_{i,t-1}\right); t = 2000,...,2014$; Labor is measured as the number of workers employed.

$\Delta y_{i,t} = \left(y_{i,t} - y_{t,t-2}\right); t = 2000,...,2014$; Sales growth is deflated by the wholesale price index to get a measure of real output.

$$Exposure_{i,t}^{f} = \frac{R_{i,t}^{f}}{\left(R_{i,t}^{d} + R_{i,t}^{f}\right)} - \frac{Cost_{i,t}^{f}}{Cost_{i,t}}$$

Size = $\ln\left(\text{total assets}_{i,t}\right)$; Total assets are deflated using the Wholesale price index

$$\text{Labour Share} = LS_{i,t} = \frac{w_{i,t} \times l_{i,t}}{Cost_{i,t}}$$

$$\text{Foreign Debt} = \frac{\text{foreign borrowings}_{i,t}}{\text{total borrowings}_{i,t}}$$

Appendix B: Industry Classification

Industry Name	NIC-2008 Code/s
Food and Beverages	**10+11**
Tobacco	**12**
Textiles	**13**
Readymade Garments	**14**
Leather and Leather Products	**15**
Paper and Paper Products	**17**
Chemicals	**20+21**
Plastic and Rubber Products	**22**
Non-metallic mineral products	**23**
Basic Metal	**24**
Fabricated Metal Product	**25**
Computer and Electronics	**26**
Electrical Machinery	**27**
Misc. Machinery	**28**
Automobiles	**29**
Other Transport Equipment	**30**
Furniture	**31**

Appendix C: Linearization

$$\ln\left(l_{i,t}\right)=b_0+b_1\times\ln\left(\frac{p_{i,t}\times q_{i,t}}{\mu_{i,t}}-z_{i,t}\times s_{i,t}+\left(\frac{p^*_{i,t}\times q^*_{i,t}}{\mu^*_{i,t}}-z^*_{i,t}\times s^*_{i,t}\right)\times\exp\left(\nu+\frac{\sigma_t^2}{2}\right)\right)+b_2\times\ln\left(y_{i,t}\right) \quad (13)$$

Assume: $\mu_{i,t}=\mu_{i,t}{}^*=\dfrac{p_{i,t}\times q_{i,t}+e_t\times p^*_{i,t}\times q^*_{i,t}}{z_{i,t}\times s_{i,t}+e_t\times z^*_{i,t}\times s^*_{i,t}+w_t\times l_t}$

Define : $R^d_{i,t}=p_{i,t}\times q_{i,t}, R^f_{i,t}=e_t\times p^*_{i,t}\times q^*_{i,t}, Cost^d_{i,t}=z_{i,t}\times s_{i,t}, Cost^f_{i,t}=e_t\times z^*_{i,t}\times s^*_{i,t},$
$Cost_{i,t}=Cost^d_{i,t}+Cost^f_{i,t}+w_{i,t}\times l_{i,t}$

Linearize : $\mathrm{A}=\ln\left(\dfrac{p_{i,t}\times q_{i,t}}{\mu_{i,t}}-z_{i,t}\times s_{i,t}+\left(\dfrac{p^*_{i,t}\times q^*_{i,t}}{\mu^*_{i,t}}-z^*_{i,t}\times s^*_{i,t}\right)\times\exp\left(\nu+\dfrac{\sigma_t^2}{2}\right)\right)$

$$\mathrm{A}=\ln\left(\frac{R^d_{i,t}}{\left(\frac{R^d_{i,t}+R^f_{i,t}}{Cost_{i,t}}\right)}-Cost^d_{i,t}+\left(\frac{R^f_{i,t}/e_t}{\left(\frac{R^d_{i,t}+R^f_{i,t}}{Cost_{i,t}}\right)}-Cost^f_{i,t}/e_t\right)\times\exp\left(\nu+\frac{\sigma_t^2}{2}\right)\right)$$

$$\mathrm{A}=\ln\left(Cost_{i,t}\times\frac{R^d_{i,t}}{\left(R^d_{i,t}+R^f_{i,t}\right)}-Cost^d_{i,t}+\left(Cost_{i,t}\times\frac{R^f_{i,t}}{\left(R^d_{i,t}+R^f_{i,t}\right)}-Cost^f_{i,t}\right)\times\exp\left(\nu+\frac{\sigma_t^2}{2}\right)\times\frac{1}{e_t}\right)$$

$$\mathrm{A}=\ln\left(Cost_{i,t}\times\left(\frac{R^d_{i,t}}{\left(R^d_{i,t}+R^f_{i,t}\right)}-\frac{Cost^d_{i,t}}{Cost_{i,t}}+\left(\frac{R^f_{i,t}}{\left(R^d_{i,t}+R^f_{i,t}\right)}-\frac{Cost^f_{i,t}}{Cost_{i,t}}\right)\times\exp\left(\nu+\frac{\sigma_t^2}{2}\right)\times\frac{1}{e_t}\right)\right)$$

Define : $\dfrac{R^d_{i,t}}{\left(R^d_{i,t}+R^f_{i,t}\right)}-\dfrac{Cost^d_{i,t}}{Cost_{i,t}}=Exposure^d_{i,t}$ and $\dfrac{R^f_{i,t}}{\left(R^d_{i,t}+R^f_{i,t}\right)}-\dfrac{Cost^f_{i,t}}{Cost_{i,t}}=Exposure^f_{i,t}$

$$\mathrm{A}=\ln\left(Cost_{i,t}\right)+\ln\left(\left(Exposure^d_{i,t}+\left(Exposure^f_{i,t}\right)\times\exp\left(\nu+\frac{\sigma_t^2}{2}\right)\times\frac{1}{e_t}\right)\right)$$

Now

$$Exposure_{i,t}^{d} = \frac{R_{i,t}^{d}}{\left(R_{i,t}^{d} + R_{i,t}^{f}\right)} - \frac{Cost_{i,t}^{d}}{Cost_{i,t}} = 1 - \frac{R_{i,t}^{f}}{\left(R_{i,t}^{d} + R_{i,t}^{f}\right)} - \left(1 - \frac{Cost_{i,t}^{f} + w_{i,t} \times l_{i,t}}{Cost_{i,t}}\right)$$

$$= -\left(\frac{R_{i,t}^{f}}{\left(R_{i,t}^{d} + R_{i,t}^{f}\right)} - \frac{Cost_{i,t}^{f}}{Cost_{i,t}}\right) + \frac{w_{i,t} \times l_{i,t}}{Cost_{i,t}} = -Exposure_{i,t}^{f} + \frac{w_{i,t} \times l_{i,t}}{Cost_{i,t}}$$

Therefore

$$\mathrm{A} = \ln\left(Cost_{i,t}\right) + \ln\left(Exposure_{i,t}^{f} \times \left(\exp\left(\nu + \frac{\sigma_t^2}{2}\right) \times \frac{1}{e_t} - 1\right) + \frac{w_{i,t} \times l_{i,t}}{Cost_{i,t}}\right)$$

Define $\dfrac{w_{i,t} \times l_{i,t}}{Cost_{i,t}} = LS_{i,t} = \text{Labour Share}$

$$\mathrm{A} = \ln\left(Cost_{i,t}\right) + \ln\left(Exposure_{i,t}^{f} \times \left(\exp\left(\nu + \frac{\sigma_t^2}{2}\right) \times \frac{1}{e_t} - 1\right) + LS_{i,t}\right)$$

Linearize the non-linear term in the middle using first-order Taylor series approximation:

$$B = \ln\left(Exposure_{i,t}^{f} \times \left(\exp\left(\nu + \frac{\sigma_t^2}{2}\right) \times \frac{1}{e_t} - 1\right) + LS_{i,t}\right) \approx \Gamma_0 + \Gamma_1 \times \left(e_t - \bar{e}\right)$$
$$+ \Gamma_2 \times \left(Exposure_{i,t}^{f} - \overline{Exposure_i^f}\right) + \Gamma_3 \times \left(\sigma_t - \bar{\sigma}\right) + \Gamma_4 \times \left(LS_{i,t} - \overline{LS}\right)$$

Where $\Gamma_0 = \ln\left(\overline{LS_i} + \left(\exp\left(\nu + \frac{\bar{\sigma}^2}{2}\right) \times \frac{1}{\bar{e}} - 1\right) \times \overline{Exposure_i^f}\right)$

$$\Gamma_1 = \frac{\dfrac{\overline{Exposure_i^f}}{\bar{e}^2} \times \exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right)}{\left(\overline{LS_i} + \left(\exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right) - 1\right) \times \dfrac{\overline{Exposure_i^f}}{\bar{e}}\right)}$$

$$\Gamma_2 = \frac{\dfrac{\exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right)}{\bar{e}} - 1}{\left(\overline{LS_i} + \left(\exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right) - 1\right) \times \dfrac{\overline{Exposure_i^f}}{\bar{e}}\right)}$$

$$\Gamma_3 = \frac{\dfrac{\overline{Exposure_i^f}}{\bar{e}} \times \exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right)}{\left(\overline{LS_i} + \left(\exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right) - 1\right) \times \dfrac{\overline{Exposure_i^f}}{\bar{e}}\right)}$$

$$\Gamma_4 = \frac{1}{\left(\overline{LS_i} + \left(\exp\left(\nu + \dfrac{\bar{\sigma}^2}{2}\right) - 1\right) \times \dfrac{\overline{Exposure_i^f}}{\bar{e}}\right)}$$

We can therefore rewrite eq. (13) as:

$$\ln\left(l_{i,t}\right) \approx \Psi_0 + \Psi_1 \times \ln\left(Cost_{i,t}\right) + \Psi_2 \times \left(e_t - \bar{e}\right) + \Psi_3 \times \left(Exposure_{i,t}^f - \overline{Exposure_i^f}\right) + \Psi_4 \times \left(\sigma_t - \bar{\sigma}\right) + \Psi_5 \times \left(LS_{i,t} - \overline{LS}\right) + \Psi_6 \ln\left(y_{i,t}\right) \quad (14)$$

Where

$\Psi_0 = b_0 + b_1 \times \Gamma_0$, $\Psi_1 = b_1$

$\Psi_2 = b_1 \times \Gamma_1$, $\Psi_3 = b_1 \times \Gamma_2$

$\Psi_4 = b_1 \times \Gamma_3$, $\Psi_5 = b_1 \times \Gamma_4$, $\Psi_6 = b_2$

Taking the first difference of {14} gives us

$$\Delta l_{i,t} \approx \Psi_1 \times \Delta Cost_{i,t} + \Psi_2 \times \Delta e_t + \Psi_3 \times \Delta Exposure_{i,t}^f + \Psi_4 \times \Delta \sigma_t + \Psi_5 \times \Delta LS_{i,t} + \Psi_6 \Delta y_{i,t} \quad (14`)$$

Since:

$\Psi_0 = b_0 + b_1 \times \Gamma_0$, $\Psi_1 = b_1$

$\Psi_2 = b_1 \times \Gamma_1$, $\Psi_3 = b_1 \times \Gamma_2$

$\Psi_4 = b_1 \times \Gamma_3$, $\Psi_5 = b_1 \times \Gamma_4$, $\Psi_6 = b_2$

This implies - $\Gamma_1 = \Psi_2 / \Psi_1$; $\Gamma_2 = \Psi_3 / \Psi_1$; $\Gamma_3 = \Psi_4 / \Psi_1$; $\Gamma_4 = \Psi_5 / \Psi_1$

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
ln(Workers)						
Foreign	1885	7.3	7.1	1.4	2.7	11.3
Domestic	4994	6.5	6.6	1.4	0.69	11.9
Public	5709	6.8	6.8	1.5	0.69	12
Non-public	1188	6.6	6.6	1.2	3.1	11.3
∆ ln(Workers)						
Foreign	1667	0.02	0.01	0.21	-2.7	1.4
Domestic	4216	-0.0	0	0.29	-6.6	3.1
Public	4921	0.02	0.0	0.35	-6.6	7.8
Non-public	1014	-0.03	-0.02	0.36	-5.8	3.8
ln(Sales)						
Foreign	2400	4.04	4.04	1.75	-3.9	10
Domestic	6843	2.6	2.6	1.76	-6.9	10.2
Public	8211	3.04	3.0	1.9	-6.9	10.2
Non-public	1660	2.4	2.4	1.7	-6.7	7.8
∆ ln(Sales)						
Foreign	2395	0.12	0.12	0.27	-1.67	3.6
Domestic	6735	0.09	0.1	0.40	-5.7	5.8
Public	8110	0.02	0.9	0.80	-11.8	7.5
Non-public	1599	-0.07	0.08	0.89	-9.9	3.3
Exposure [f]						
Foreign	2397	0.14	0.06	0.20	-0.01	0.99
Domestic	6811	0.15	0.03	0.23	-0.01	0.99
Public	8184	0.16	0.05	0.23	-0.01	0.99
Non-public	1651	0.09	0.00	0.16	-0.01	0.94
∆ Exposure [f]						
Foreign	2391	0.0	0.00	0.06	-0.54	0.73
Domestic	6702	0.0	0.00	0.08	-1	1
Public	8076	0.0	0.0	0.11	-1	1
Non-public	1591	-0.0	0.0	0.1	-0.97	0.57
Labor Share						
Foreign	2397	2.7	0.18	18.7	0.00	182
Domestic	6851	11.8	0.18	37.6	0.00	182
Public	8215	8.3	0.16	30.9	0.00	182
Non-public	1661	18.5	0.40	45.5	0.00	182
$\Delta\sigma_t$	10381	0.013	0.01	0.002	0.01	0.02
Δe_t	10381	0.01	-0.00	0.04	-0.06	0.11
$\Delta\sigma_t \times$ ∆ **Exposure** [f]	10381	-0.00	0.01	0.001	-0.01	0.01
$\Delta e_t \times$ ∆ **Exposure** [f]	9667	-0.0	0	0.005	-0.06	0.08
Foreign	9668	0.25	0	0.43	0	1

Table 2: Indian Experience of Real Exchange Rate Volatility

Period	**REER Volatility**	**REER Change (log diff.)**
2000-2004	0.013	0.04
2005-2009	0.016	0.00
2010-2014	0.017	0.03

Table 3: Exchange Rate Uncertainty (GARCH) and Employment Growth[10]

Dependent Variable: (Δl_t)	**(1)**	**(2)**	**(3)**	**(4)**
Δl_{t-1}	-0.4 [0.04]	-0.04 [0.04]	-0.04 [0.04]	-0.04 [0.00]
$\Delta\sigma_{t-1}$	-14.3*** [4.5]	-13.9*** [4.4]	-17.1*** [5.6]	-16.8*** [5.5]
Δe_{t-1}	0.00 [0.07]	0.01 [0.06]	-0.05 [0.08]	-0.05 [0.08]
$Foreign_{t-1}$	0.06 [0.1]		-0.33 [0.26]	
$\Delta\sigma_{t-1*} Foreign_{t-1}$			29.7 [18.2]	
$\Delta e_{t-1*} Foreign_{t-1}$			0.53 [0.34]	
$Foreign_{t-1}$[10]		0.06** [0.03]		-0.1 [0.1]
$\Delta\sigma_{t-1*} Foreign_{t-1}$[10]				11.9 [7.5]
$\Delta e_{t-1*} Foreign_{t-1}$[10]				0.23* [0.14]
$\Delta cost_{t-1}$	-0.04 [0.02]	-0.04* [0.02]	-0.04* [0.02]	-0.04* [0.02]
$\Delta sales_{t-1}$	0.08 [0.05]	0.09 [0.05]	0.08 [0.05]	0.08 [0.05]
$\Delta labourshare_{t-1}$	-0.00** [0.00]	-0.00** [0.00]	-0.00* [0.00]	-0.00** [0.00]
$\Delta exposure_{t-1}$	-0.23*** [0.08]	-0.24*** [0.08]	-0.23*** [0.08]	-0.24*** [0.08]
$\Delta size_{t-1}$	-0.01 [0.05]	-0.01 [0.05]	-0.016 [0.04]	-0.016 [0.04]
Industry dummies	Yes	Yes	Yes	Yes
Observation	4161	4161	4161	4161
No. of Firms	668	668	668	668
No. of Instruments	116	116	118	115
AR(1)	0.00	0.00	0.00	0.00
AR(2)	0.69	0.70	0.69	0.70
Hansen	0.44	0.47	0.45	0.49

[10] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.

Table 4: Threshold Effects of Foreign Ownership - GMM Estimates[11]

Dependent Variable : Employment Growth (Δl_t)	**Foreign >50 (5)**	**Foreign >75 (6)**	**Foreign > 90 (7)**
Δl_{t-1}	-0.04 [0.04]	-0.04 [0.04]	-0.03 [0.04]
$\Delta\sigma_{t-1}$	-16.6*** [5.3]	-14.7*** [4.6]	-14.1*** [4.5]
Δe_{t-1}	-0.04 [0.07]	-0.01 [0.06]	0.00 [0.06]
$Foreign^{50}$	-0.22** [0.1]		
$\Delta\sigma_{t-1*} Foreign^{50}$	16.3** [8.2]		
$\Delta e_{t-1*} Foreign^{50}$	0.29 [0.17]		
$Foreign^{75}$		-0.18 [0.25]	
$\Delta\sigma_{t-1*} Foreign^{75}$		14.4 [17.2]	
$\Delta e_{t-1*} Foreign^{75}$		0.54 [0.27]	
$Foreign^{90}$			0.10 [0.51]
$\Delta\sigma_{t-1*} Foreign^{90}$			-0.12 [0.40]
$\Delta e_{t-1*} Foreign^{90}$			0.14 [0.89]
$\Delta cost_{t-1}$	-0.04* [0.02]	-0.04* [0.02]	-0.04* [0.2]
$\Delta sales_{t-1}$	0.08 [0.05]	0.08 [0.05]	0.08 [0.05]
$\Delta labourshare_{t-1}$	-0.00** [0.00]	-0.00** [0.00]	-0.00** [0.00]
$\Delta exposure_{t-1}$	-0.23*** [0.08]	-0.23*** [0.08]	-0.23*** [0.08]
$\Delta size_{t-1}$	-0.02 [0.04]	-0.01 [0.05]	-0.01 [0.05]
Industry dummies	YES	YES	YES
Observation	4161	4161	4161
No. of Firms	668	668	668
No. of Instruments	118	118	118
AR(1)	0.00	0.00	0.00
AR(2)	0.70	0.68	0.70
Hansen	0.42	0.42	0.44

[11] . (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively

Table 5: Publicly Listed Versus Unlisted Firms[12]

Dependent Variable : (Δl_t)	**Publicly Listed (8)**	**Unlisted (9)**	**Publicly Listed (10)**	**Unlisted (11)**	**Publicly Listed (12)**	**Unlisted (13)**
Δl_{t-1}	-0.02 [0.0]	-0.35*** [0.1]	-0.02 [0.0]	-0.35*** [0.1]	-0.02 [0.0]	-0.35*** [0.1]
$\Delta\sigma_{t-1}$	-12.3*** [5.1]	-36.8** [14.4]	-13.7** [6.1]	-38.5** [15.3]	-13.3** [6.4]	-39.9** [15.7]
Δe_{t-1}	-0.00 [0.1]	-0.31* [0.1]	-0.02 [0.1]	-0.33** [0.1]	-0.02 [0.1]	-0.40** [0.2]
$Foreign_{t-1}$			0.11 [0.3]	-0.75 [0.5]		
$\Delta\sigma_{t-1*}$ $Foreign_{t-1}$			13.4 [17.3]	51 [42]		
Δe_{t-1*} $Foreign_{t-1}$			0.17 [0.2]	0.64 [1.0]		
$Foreign^{10}{}_{t-1}$					0.00 [0.1]	-0.39 [0.3]
$\Delta\sigma_{t-1*}$ $Foreign^{10}{}_{t-1}$					4.9 [8.4]	32.5 [24]
Δe_{t-1*} $Foreign^{10}{}_{t-1}$					0.16 [0.2]	0.64 [0.2]
$\Delta cost_{t-1}$	-0.05 [0.0]	0.01 [0.0]	-0.04 [0.0]	0.01 [0.0]	-0.04 [0.0]	0.01 [0.0]
$\Delta sales_{t-1}$	0.08 [0.0]	0.09 [0.1]	0.07 [0.0]	0.09 [0.1]	0.08 [0.1]	0.09 [0.1]
$\Delta labourshare_{t-1}$	-0.00* [0.0]	0.00 [0.0]	-0.00 [0.0]	0.00 [0.0]	-0.00* [0.0]	0.00 [0.0]
$\Delta exposure_{t-1}$	-0.18* [0.1]	-0.37** [0.2]	-0.19** [0.1]	-0.40** [0.2]	-0.18* [0.1]	-0.35** [0.2]
$\Delta size_{t-1}$	-0.05** [0.0]	0.09 [0.1]	-0.05** [0.0]	0.09 [0.1]	-0.05** [0.0]	0.09 [0.1]
Industry dummies	YES	YES	YES	YES	YES	YES
Observation	3499	546	3499	546	3499	546
No. of Firms	547	113	547	113	547	113
No. of Instruments	115	111	118	114	118	114
AR(1)	0.00	0.07	0.00	0.07	0.00	0.07
AR(2)	0.72	0.60	0.72	0.56	0.72	0.58
Hansen	0.43	0.55	0.36	0.44	0.35	0.47

[12] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.

Table 6: Trade Exposure and Volatility - GMM Estimates[13]

Dependent Variable : Employment Growth (Δl_t)	**(14)**	**(15)**	**(16)**
Δl_{t-1}	-0.03 [0.04]	-0.03 [0.04]	-0.03 [0.04]
$\Delta\sigma_{t-1}$	-14.0*** [4.4]	-13.8*** [4.3]	-13.9*** [4.4]
Δe_{t-1}	0.01 [0.07]	0.02 [0.06]	0.01 [0.07]
Foreign[10] $_{t-1}$		0.05* [0.03]	
$Foreign_{t-1}$			0.05 [0.09]
$\Delta exposure_{t-1}$	2.8** [1.2]	2.9** [1.2]	2.8** [1.2]
$\Delta\sigma_{t-1*}\ \Delta exposure_{t-1}$	-226.5*** [96]	-230.5*** [93.2]	-228.1** [97.4]
$\Delta e_{t-1*}\ \Delta exposure_{t-1}$	-1.0 [1.2]	-1.1 [1.2]	-1.1 [1.2]
$\Delta cost_{t-1}$	-0.03 [0.02]	-0.03 [0.04]	-0.03 [0.02]
$\Delta sales_{t-1}$	0.06 [0.05]	0.06 [0.05]	0.06 [0.05]
$\Delta labourshare_{t-1}$	-0.00* [0.00]	-0.00* [0.00]	-0.00 [0.00]
$\Delta size_{t-1}$	-0.01 [0.05]	-0.02 [0.05]	-0.01 [0.05]
Industry dummies	YES	YES	YES
Observation	4161	4161	4161
No. of Firms	668	668	668
No. of Instruments	117	118	118
AR(1)	0.00	0.00	0.00
AR(2)	0.72	0.73	0.71
Hansen	0.23	0.27	0.24

[13] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.

Table 7: Non-linearity in Trade Exposure[14]

Dependent Variable : (Δl_t)	**(17)**	**(18)**	**(19)**	**(20)**
Δl_{t-1}	-0.03 [0.04]	-0.03 [0.04]	-0.03 [0.04]	-0.04 [0.04]
$\Delta\sigma_{t-1}$	-4.2 [5.4]	-3.9 [5.2]	-9.2* [4.7]	-8.8* [4.7]
Δe_{t-1}	0.04 [0.07]	0.04 [0.07]	0.02 [0.06]	0.02 [0.7]
$dumexposure_1$	0.19** [0.09]	0.19** [0.09]		
$\Delta\sigma_{t-1*}$ $dumexposure_1$	-19.5** [8.0]	-19.7** [8.0]		
Δe_{t-1*} $dumexposure_1$	0.12 [0.09]	0.13 [0.09]		
$dumexposure_2$			0.14 [0.08]	0.15* [0.09]
$\Delta\sigma_{t-1*}$ $dumexposure_2$			-15.3** [7.5]	-16.3** [7.4]
Δe_{t-1*} $dumexposure_2$			0.1 [0.1]	0.1 [0.1]
$Foreign_{t-1}$	0.05 [0.09]		0.05 [0.09]	
$Foreign10_{t-1}$		0.06** [0.02]		0.06** [0.02]
$\Delta cost_{t-1}$	-0.04 [0.02]	-0.04 [0.02]	-0.04 [0.02]	-0.04 [0.02]
$\Delta sales_{t-1}$	0.08 [0.06]	0.08 [0.06]	0.08 [0.06]	0.09 [0.05]
$\Delta labourshare_{t-1}$	-0.00 [0.00]	-0.00 [0.00]	-0.00* [0.00]	-0.00** [0.00]
$\Delta size_{t-1}$	-0.02 [0.05]	-0.03 [0.04]	-0.02 [0.04]	-0.02 [0.05]
Industry dummies	YES	YES	YES	YES
Observation	4161	4161	4161	4161
No. of Firms	668	668	668	668
No. of Instruments	118	118	118	118
AR(1)	0.00	0.00	0.00	0.00
AR(2)	0.78	0.80	0.72	0.74
Hansen	0.54	0.58	0.46	0.52

[14] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.

Table 8[15] : Publicly listed versus Un-listed Firms[16]

Dependent Variable : Δl_t	**(21) (Listed)**	**(22) (Unlisted)**	**(23) (Listed)**	**(24) (Unlisted)**	**(25) (Listed)**	**(26) (Unlisted)**
Δl_{t-1}	-0.01 [0.05]	-0.35*** [0.11]	-0.01 [0.05]	-0.35*** [0.1]	-0.01 [0.05]	-0.35*** [0.11]
$\Delta\sigma_{t-1}$	-11.5** [4.9]	-36.8** [14.4]	-11.1** [4.9]	-37.1*** [14]	-11.6** [4.9]	-36.8** [14.4]
Δe_{t-1}	0.00 [0.08]	-0.29* [0.16]	0.02 [0.08]	-0.30* [0.17]	-0.00 [0.08]	-0.29* [0.17]
$Foreign^{10}_{t-1}$			0.07** [0.02]	-0.00 [0.06]		
$Foreign_{t-1}$					0.30** [0.14]	-0.12 [0.11]
$\Delta exposure_{t-1}$	3.7*** [1.4]	-0.38 [2.0]	3.5*** [1.3]	-0.16 [2.2]	3.6** [1.4]	-0.28 [2.1]
$\Delta\sigma_{t-1*}\ \Delta exposure_{t-1}$	-286*** [107]	-1.8 [163]	-276.8*** [104]	-18.7 [173]	-281.5*** [108]	-10.3 [169.7]
$\Delta e_{t-1*}\ \Delta exposure_{t-1}$	-2.3** [1.1]	3.6 [3.9]	2.0 [1.1]	3.3 [3.7]	2.15* [1.1]	3.8 [4.1]
$\Delta cost_{t-1}$	-0.03 [0.02]	0.01 [0.02]	-0.03 [0.02]	0.01 [0.02]	-0.03 [0.02]	0.01 [0.02]
$\Delta sales_{t-1}$	0.06 [0.04]	0.09 [0.08]	0.06 [0.04]	0.08 [0.08]	0.06 [0.04]	0.08 [0.08]
$\Delta labourshare_{t-1}$	-0.00 [0.00]	0.00 [0.00]	-0.00* [0.00]	0.00 [0.00]	-0.00* [0.00]	0.00 [0.00]
$\Delta size_{t-1}$	-0.06** [0.03]	0.08 [0.11]	-0.05** [0.02]	0.08 [0.11]	-0.05** [0.03]	0.09 [0.11]
Industry dummies	YES	YES	YES	YES	YES	YES
Observation	3499	546	3499	546	3499	546
No. of Firms	547	113	547	113	547	113
No. of Instruments	117	113	118	114	118	114
AR(1)	0.00	0.07	0.00	0.07	0.00	0.07
AR(2)	0.73	0.62	0.75	0.64	0.74	0.62
Hansen	0.38	0.41	0.40	0.38	0.34	0.42

[15] We tried similar analysis for foreign equity ownership status of the firms but our results were sensitive to the choice of threshold for foreign equity ownership as well as model specifications.

[16] [16] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.

Table 9: Robustness Check – I (Std. Dev)[17]

Dependent Variable : Δl_t	**(27) [Entire Sample]**	**(28) [Entire Sample]**	**(29) [Publicly Listed]**	**(30) [Publicly Listed]**	**(31) [Un-listed]**	**(32) [Un-listed]**
Δl_{t-1}	-0.03 [0.0]	-0.03 [0.0]	-0.01 [0.0]	-0.01 [0.0]	-0.37*** [0.1]	-0.36*** [0.1]
$\Delta\sigma_{t-1}$	-4.4 [4.5]	-5.0 [4.5]	-3.1 [5.3]	-2.9 [5.5]	-30.2*** [10.3]	-30.1*** [10.1]
Δe_{t-1}	0.14 [0.0]	0.14 [0.0]	0.14** [0.0]	0.12 [0.0]	0.03 [0.2]	0.03 [0.2]
$Foreign^{10}_{t-1}$	0.06** [0.0]		0.07** [0.03]		0.00 [0.7]	
$Foreign_{t-1}$		0.07 [0.1]		0.30** [0.1]		-0.14 [0.1]
$\Delta exposure_{t-1}$	1.4 [0.6]	1.3* [0.7]	1.64** [0.7]	1.6** [0.7]	-0.15 [1.2]	-0.21 [1.2]
$\Delta\sigma_{t-1*}\ \Delta exposure_{t-1}$	-108** [49.1]	-102.4** [51.6]	-124.1** [53.5]	-122.8** [54.9]	-16.9 [87.4]	-13.0 [87.5]
$\Delta e_{t-1*}\ \Delta exposure_{t-1}$	1.8 [1.2]	1.7 [1.2]	1.7 [1.4]	1.6 [1.4]	3.9 [3.4]	4.1 [3.5]
$\Delta cost_{t-1}$	-0.03 [0.0]	-0.03 [0.0]	-0.04 [0.0]	-0.04 [0.0]	0.02 [0.0]	0.02 [0.0]
$\Delta sales_{t-1}$	0.07 [0.0]	0.07 [0.0]	0.07 [0.0]	0.06 [0.0]	0.08 [0.0]	0.07 [0.0]
$\Delta labourshare_{t-1}$	-0.00 [0.0]	-0.00 [0.0]	-0.00* [0.0]	-0.00 [0.0]	0.00 [0.0]	0.00 [0.0]
$\Delta size_{t-1}$	-0.01 [0.0]	-0.01 [0.0]	-0.05** [0.0]	-0.05** [0.0]	0.09 [0.1]	0.08 [0.1]
Industry dummies	YES	YES	YES	YES	YES	YES
Observation	4161	4161	3499	3499	546	546
No. of Firms	668	668	547	547	113	113
No. of Instruments	118	118	118	118	114	114
AR(1)	0.00	0.00	0.00	0.00	0.00	0.07
AR(2)	0.77	0.75	0.78	0.78	0.67	0.67
Hansen	0.23	0.22	0.39	0.36	0.37	0.41

[17] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.

Table 10: Robustness Check – II (Year Specific GARCH)[18]

Dependent Variable : Δl_t	**(33) [Entire Sample]**	**(34) [Entire Sample]**	**(35) [Publicly Listed]**	**(36) [Publicly Listed]**	**(37) [Un-listed]**	**(38) [Un-listed]**
Δl_{t-1}	-0.03 [0.05]	-0.03 [0.05]	-0.01 [0.05]	-0.01 [0.05]	-0.36*** [0.11]	-0.36*** [0.11]
$\Delta\sigma_{t-1}$	-1.8 [4.2]	-2.2 [4.3]	-2.1 [5.0]	-2.3 [5.0]	-22.1** [10.5]	-22.2** [10.3]
Δe_{t-1}	0.13** [0.05]	0.13** [0.06]	0.13** [0.06]	0.11* [0.06]	-0.01 [0.2]	-0.02 [0.19]
Foreign[10] $_{t-1}$	0.06** [0.03]		0.07** [0.03]		0.00 [0.07]	
$Foreign_{t-1}$		0.07 [0.1]		0.31** [0.15]		-0.16 [0.12]
$\Delta exposure_{t-1}$	1.0 [0.5]	0.9 [0.6]	1.2** [0.6]	1.2** [0.6]	-0.2 [0.9]	-0.3 [1.0]
$\Delta\sigma_{t-1*}\ \Delta exposure_{t-1}$	-82.5** [41]	-78.5* [43]	-97.3** [45]	-96.7** [45.9]	-15.8 [70.2]	-7.2 [77.7]
$\Delta e_{t-1*}\ \Delta exposure_{t-1}$	1.5 [1.2]	1.3 [1.2]	1.3 [1.3]	1.2 [1.3]	4.3 [3.5]	4.6 [3.6]
$\Delta cost_{t-1}$	-0.03 [0.02]	-0.03 [0.02]	-0.03 [0.02]	-0.04 [0.02]	0.02 [0.03]	0.02 [0.03]
$\Delta sales_{t-1}$	0.08 [0.06]	0.07 [0.06]	0.07 [0.04]	0.07 [0.05]	0.08 [0.08]	0.08 [0.08]
$\Delta labourshare_{t-1}$	-0.00 [0.00]	-0.00 [0.00]	-0.00 [0.00]	-0.00 [0.00]	0.00 [0.00]	0.00 [0.00]
$\Delta size_{t-1}$	-0.01 [0.04]	-0.01 [0.04]	-0.05 [0.02]	-0.05** [0.02]	0.09 [0.11]	0.09 [0.1]
Industry dummies	YES	YES	YES	YES	YES	YES
Observation	4161	4161	3499	3499	546	546
No. of Firms	668	668	547	547	113	113
No. of Instruments	118	118	118	118	114	114
AR(1)	0.00	0.00	0.00	0.00	0.07	0.07
AR(2)	0.8	0.75	0.77	0.77	0.77	0.76
Hansen	0.16	0.14	0.35	0.32	0.45	0.47

[i] Arellano and Bond/Blundell and Bond

[18] **Notes:** Two-step system GMM results using Windmeijer finite-sample correction. All growth rates are measured by logarithmic differences. (***), (**) and (*) refer to significance at 1%, 5% and 10% levels respectively. σ is real exchange rate volatility. Foreign is the log of one plus the percentage share of foreign equity; Foreign10 is a dummy variable taking the value of 1 for firms with 10% or higher foreign ownership at time t.