In this economy both the Covered Interest Rate Parity (CIP) and the Uncovered Interest Rate Parity (UIP) hold and are set by a representative risk neutral foreign investor. This implies that $E^{s}_{t}[e^{S}_{t+1}]=F^{s}_{t}$, where $F^{s}_{t}$ is the forward exchange rate and $E^{s}_{t}$ is the foreign investor’s expectation of the second period’s exchange rate.

It is assumed that the representative investor faces market imperfections that limit the liquidity in the covered FC debt market. $s$ is the inverse of these market imperfections. Higher $s$ means lower market imperfections and higher liquidity.

As a consequence of these market imperfections, for the representative investor, the marginal cost to procure an extra unit of covered FC debt is a positive and convex function of the size of the firm. In comparison to small firms, big firms need a larger portion of the aggregate liquidity of the market in order to hedge a similar share of their principal. Therefore, the representative investor chooses a firm-specific forward exchange rate $R^{s*}$ which is an increasing function of size.

Conditional on firm size $s$ and all types of hedging, the second period expected profit per unit of local currency terms is given by:

$$E[\pi_{i}^{F C}]=\gamma_{i}^{*} [R^{s*} - R^{s}] + \delta \alpha_{i}^{*} [\gamma_{i}^{*} - R^{s*}]^{+} - K.$$  

where $K$ is the interest rate in domestic currency, $R^{s*}$ is the interest rate of FC, and $K$ is a fixed cost of entry to the covered FC debt market.

Optimal shares: Intensive margin

From the first-order conditions, the optimal share of uncovered FC debt $\alpha_{i}^{*}$ covered FC debt $\gamma_{i}^{*}$ and domestic currency debt $\gamma_{i}$ are given by:

$$\alpha_{i}^{*} = R^{s*} - R^{s}$$ 

$$\gamma_{i}^{*} = \frac{\delta}{\delta + R^{s*}} [\gamma_{i}^{*} - R^{s}]^{+}$$

And:

$$\gamma_{i} = 1 - \alpha_{i}^{*} - \gamma_{i}^{*}$$

Intuitively, the first term on the right hand side of equation (2) captures the funding cost saving characteristic of uncovered FC debt. The second term depicts the natural hedging provided by the share of FC revenues in firm’s income.

Equation (3) shows that covered FC debt is an increasing function of the relative cost of domestic currency borrowing. Once the CIP is introduced, the last equality of equation (3) shows that a higher market’s expectation about tomorrow’s depreciation would imply larger hedges irrespective of firm size or market liquidity.

Theory

The economy is populated by a continuum of firms, indexed by $i \in [0,1]$, which live for two periods. They are born with different expectations about the second period’s spot exchange rate $E^{s}_{t}[e^{S}_{t+1}]$, risk aversion $\psi_{i}$, productivity $\omega_{i}$, size $m_{i}$ and currency composition of revenue ($1-\delta$) FC share). They are also average foreign exchange investors (the distribution of the former is at the right of the distribution of the latter). However this distinction no longer holds when restricting the sample to firms that use FC forwards. These facts are suggestive evidence of a fixed cost of entry to the covered FC debt market.

Figure 1: Size and the extensive margin: Fixed cost

a) Size by type of FC debt
b) With FC forwards

Figure 2: Size and the intensive margin. Bigger firms hedge less?

a) Long position forward vs size
b) Share of covered FC debt

The characterization provided by panel a) and b) of figure 3, tells us that the bigger $(s)$ (more liquidity), the larger and more homogenous the optimal shares across firms of different sizes. Intuitively, the lower the market imperfections faced by the representative investor, the easier to procure and supply funds to the covered FC debt market, the less constrained and more similar the optimal hedges of firms irrespective of their size.

Extensive margin

The decision to enter or not enter the covered FC debt market is summarized as a function of the expected profits of the firm when using the optimal debt shares $(\alpha_{i}^{*}, \gamma_{i}^{*}, \gamma_{i})$, with respect to the expected profits in the case that the firm chooses to use uncovered FC debt, and the second stage of the optimal debt share provides a high entry cost limit the entrance of small firms and the hedges of big firms. Policy-induced distortions: Given FC firms in the margin not to hedge – they feel implicitly protect by the CB

Figure 4: Extensive margin condition: concave and non-monotonous in firm size

a) High $s$: low $K$
b) Low $s$: high $K$

Figure 5 panel a) shows that for firms below the median log of assets ($\approx 6.4$), the AME of FC debt on FC forwards is positive and statistically significant (although economically small). For firms above the median there is a negative and economically important effect. For firms in the $p99$, an increase of 1 p.p of the share of FC debt implies a reduction in the share of FC forwards of 0.45 p.p. The bigger the firm, the lower the hedges.

Figure 6: Average Marginal Effect of FC debt on FC forwards

a) AME for different firm sizes
b) AME for different FXI sizes

Empirical Strategy

We use a two-stage tobit model with an instrumental variable. In the first stage, we instrument firm size with the interaction of exports to sales ratio to control for market imperfections. In the second stage the dependent variable is firm level FC forwards and the variable of interest is the first stage predicted firm level FC debt. With the help of the censored tobit we are able to estimate the Average Marginal Effect (AME) of the increase of 1 p.p of the FC debt to liabilities ratio on the FC forwards to liabilities ratio, evaluated in different sections of the distribution of a third variable such as size or FXI.

Panel b) shows that moderate FXI (the average of interventions during the period was equivalent to 0.2% of the volume transacted in the spot market) reduces the incentives of firms to use the financial sector to protect themselves against exchange risk: they are implicitly protected by the monetary authority. Interventions above a certain threshold, shift FC liquidity to the hedging market increasing the shares of FC debt that are hedged by firms.

Conclusions

We find that the heterogenous hedging in an emerging market economies comes from two sources: –Market distortions: The lack of liquidity in the FC forwards market and a high entry limit cost the entrance of small firms and the hedges of big firms

–Policy-induced distortions: Given FC firms in the margin opt not to hedge – they feel implicitly protected by the CB

Policy Recommendations

When an extreme exchange rate depreciation hits the economy:

–The CB should provide ample liquidity in the derivatives market to avoid higher demand pressures on the spot exchange rate

–This might reduce the increase in the policy rate and would imply a lower contractionary impact on economic activity

–Such a strategy might be more cost-effective than using other policy tools such as Sterilized FXI

Alternative monetary policy could not distort the optimal FC derivatives’ decisions of firms

In order to increase liquidity, the CB could reassess the calibration of the exchange rate band and make sure that the spot market is not perceived by firms as a marginal protection against exchange risk making them reduce their long positions in the FC derivatives market. On the other hand, equation (3) and (6) show that the FCX could increase the covered FC debt market liquidity, increasing the shares of covered FC debt and the marginal probability of entry.

The model and Foreign Exchange Intervention (FXI)

Through the lens of the model, the sterilized FCXI could impact firms’ decisions through three different channels. The first two channels conditional on the UIP not to hold. On the one hand, equation (2) tells us that the shares of uncovered FC debt would increase given a lower expectation of change rate deprecation and ii) lower exchange rate volatility: The action of the Central Bank (CB) in the spot market might be perceived by firms as an implicit protection against exchange rate risk, making them reduce their long positions in the FC derivatives market. On the other hand, equation (3) and (6) show that the FCXI could increase the covered FC debt market liquidity, increasing the shares of covered FC debt and the marginal probability of entry.