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Risk and Asian Exchange Rate Regimes

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Abstract

A panel regression gives evidence that more flexibility in Asian exchange rates reduces risk associated with bank borrowing abroad, but deviations from mean exchange rates, and from the renminbi, increase risk. Since the exchange rate regime affects bank behavior and the incentives to hedge, the results broadly support the bank run over the moral hazard view of twin banking and currency crisis. The results suggest that flexibility in exchange rates is required for Asian EMEs, but the flexibility has to be limited, and it depends on more flexibility in the renminbi. This has implications for current global imbalances in reserves and feasible adjustment paths.

Key words: exchange rate flexibility, risk, hedging, moral hazard, bank runs

JEL Classification nos.: F0, F3, F31

1.Introduction

East Asian had a twin crisis in the late nineties, a combined currency and banking crisis. We examine the analytical links between the two, in particular the effect of the exchange rate regime on the risky behavior of banks, and their willingness to hedge currency risk.

In order to examine the effect of exchange rate flexibility in reducing risk for banks, we regress, for eleven Asian EMEs, the growth of net foreign assets of the banking sector on the mean deviations and on the squared mean deviation, of each country's exchange rate, including macroeconomic control variables. The regressions are repeated for deviations from the renminbi, normalized by the mean. The cross county panel results show that a fixed exchange rate increases risk for Asian EMEs, and this risk rises with the distance from the renminbi.

Since the exchange rate regime affects risk-taking of banks, the results support the bank run view of the East Asian crisis (Velasco and Chang, 1999) over the broader moral hazard view (Corsetti, Pesenti and Roubini 1999). If exchange rates had not been largely fixed prior to the crisis banks would have undertaken less foreign liabilities, hedged currency risk more, and runs on banks, which turns illiquid banks insolvent, would not have occurred.

The implication is that a move to greater flexibility would lower currency risk for these countries, including for China. Although explicit monetary cooperation may be far in the future, our results suggest that there already is an implicit alignment among Asian exchange rates. Since the Chinese exchange rate plays a key role, more flexibility in the renminbi will make possible more flexibility in all Asian exchange rates.

After a brief comparison in section 2, of structure, macroeconomic policy and trade patterns across Asian EMEs, regressions are presented in section 3. The link between real wages and exchange rates and its implications for adjustment are explored in section 4. Section 5 draws out implications of the analysis for global risk and obstacles to adjustment before section 6 concludes.

2. Exchange rates and risk

Exchange rate regimes immediately affect the currency risk, or the risk of an unexpected change in the value of a currency. But currency risk can aggravate systemic, liquidity and credit risk. Therefore monetary and exchange rate policy has a role in developing markets, strengthening institutions, and moderating risk.

The East Asian currency crises have been called third generation or capital account crises. Unlike earlier crises, in which fiscal weakness played a major role, East Asian governments had low budget deficits and low public debt. Inflation was in single digits, economic growth was high and so were saving and investment ratios. Some external shocks in 1996, involving a fall in export demand, triggered a large capital outflow and currency depreciation in 1997. Banks had large foreign currency denominated unhedged debt. As currencies depreciated, the domestic currency value of the debt rose, and doubt about the credit worthiness of balance sheets of firms and banks escalated into twin currency and banking crises. Since gearing or the ratio of bank loans to equity is high in these economies, they are particularly sensitive to sharp changes in interest and exchange rates.

Many firms in EMEs borrow abroad in dollars but produce for the domestic market. Depreciation hurts the profitability and financial position of these borrowers, especially if they are unhedged, and may lead to a run on the banking system. A fall in credit leads to a fall in output, while a fall in money demand leads to further depreciation, culminating in the twin crisis.

Twin crises have been frequent in the post Bretton Woods period, and normally whenever they have occurred banks, have had a currency mismatch between their assets and liabilities, and they have not completely hedged the associated currency risk.

There are two views. One (for example, Corsetti, Pesenti and Roubini 1999) says that it was a financial not a currency crisis. Implicit and explicit government guarantees had created moral hazard, which encouraged overborrowing abroad and generated unhedged short-term liabilities. Foreign creditors were willing to lend to domestic agents against expected bailouts from the government. There were fundamental problems in the banks, which were inherently *insolvent*. The

second (Chang and Velasco, 1999) argues that bank runs[1] turn *illiquidity* into insolvency. The health of balance sheets after a run is misleading, since runs also occur on solvent banks. Self-fulfilling panics and herd behavior makes these problems worse. If illiquidity is the problem, a lender of last resort, or the availability of liquidity on tap, can restore market confidence.

But fixed exchange rate regimes themselves create moral hazard, and increases banks' risk-taking. They are an implicit guarantee, create moral hazard, and generate overborrowing without hedging. To the extent fixed exchange regimes induced overborrowing the broader moral hazard view looses weight. The bank run view implies that a flexible exchange rate regime can actually reduce the possibility of a bank run. Since it is known a bank will not become insolvent, the incentive to run on a bank turning illiquidity into insolvency is removed. We examine this argument in more detail below.

2.1 Bank runs and the exchange rate regime

Consider a simple version of the Chang and Velasco (1999) model of foreign borrowing intermediated through banks. They show that run equilibria are possible with fix exchange rates, but not with flexible.

Consider a small open economy with three periods, a planning, a short and a long run. There is a single perishable freely traded consumer good in each period. The economy is dollarized with foreign prices normalized to a unit dollar.

Ex-ante identical depositors have a fixed endowment a in the first period. Each maximizes two-period consumption and can lend an infinite amount but borrow a fixed amount f from identical risk free foreign creditors. Each lends, investing in a liquid asset b and a long-term asset k. There is a probability λ of a shock, equal to the proportion of the unlucky population. A capital infusion of $i < a+f$ allows a return Rk to be earned in period 2, where $R(1-\lambda) > 1$. If the infusion is not available so that k has to be liquidated the return earned is rk, $r < 1$. The long-term asset is more profitable but is illiquid in the short-run. If the excess returns from holding the long-term assets to maturity exceed the opportunity cost of holding liquid assets, it will be optimal for consumption maximizing

[1] Their model is based on Diamond and Dybvig's (1983) early modeling of rational bank runs.

individuals to hold sufficient b to finance i. Since $R>1$, b will not exceed i; there is an opportunity cost of giving up R.

But consumers can do better if only the unlucky proportion λ of the population hold the liquid asset to finance i and others can invest in the long-run asset. Banks make this possible through the law of large numbers, pooling resources and maximizing consumption of the representative member. Now $b^* = \lambda i$, less than i, and therefore consumption is higher.

An optimal allocation (c^*, b^*, k^*) can be implemented through a demand deposit system. Given resources $a + f$ in period 0, banks invest b^* and k^*, in order to maximize consumption, c, subject to $k + b \leq w$, where w is wealth. In period 1, banks liquidate b^* or $b^* + rk^*$, to serve unlucky depositors on a first come first served basis, and in period 2, $c^* = R(w - \lambda i) - f$ is paid out, with depositors that did not withdraw in period 1 being served first. The incentive constraint $c^* \leq i$ is satisfied by assumption since $i \leq (Rw - f)/(1 + \lambda k)$. This ensures that lying about shocks, liquidating in period 1, and absconding is not profitable for lucky depositors, who do not receive a shock in period 1.

Since holding liquidity is costly the bank may choose to become illiquid in the short run, that is: $b^* + rk^* < i$. This condition is necessary and sufficient for a bank run equilibrium to occur. If $\lambda^r > \lambda$ depositors decide to withdraw in a run, the bank is forced to liquidate all assets and close. Therefore those who do not run will not be paid anything in period 2, so it is individually optimal for each of them to run on the bank.

Under dollarization, which is an extreme fix exchange rate regime we have seen that both an honest and a run equilibrium hold.

Now consider a fixed exchange rate regime with a lender of last resort (LOLR), the local central bank (CB). In this case the bank remains solvent but a currency crisis can occur. The CB gives a credit line to the commercial bank in return for the right to the banks assets. As depositors withdraw i in random order from the bank, it liquidates b^*, then borrows from the CB. The depositors buy foreign currency (dollars) with local currency b^* from the CB. The CB sells dollars first with the b^* dollars bought from the commercial bank in order to maintain the fixed exchange rate and then by

liquidating rk^*. If $b^* + rK^* < i$ it can run out of dollars and shut its windows implying a currency crisis.

Under a flexible exchange rate with a LOLR, the demand and supply for dollars can be equated by auction at the CB. The demand for dollars from depositors in a bank run will be $\lambda^r i$ and the supply of dollars from the CB will be λi. Equating the two, where E is the flexible exchange rate:

$$\lambda^r i = E\lambda I$$

or

$$E = \lambda^r/\lambda$$

In a run equilibrium where $\lambda^r > \lambda$ the exchange rate depreciates. Now a run equilibrium cannot occur since a lucky depositor withdrawing i will be able to consume only $i/E < i$, the bank does not need to liquidate k early and will be able to pay c^* to each $1 - \lambda^r$ depositors that do not run. Therefore it is not optimal for lucky depositors to participate in a run.

Thus flexible exchange rates reduce risk for banks by reducing the possibility of a run equilibrium where illiquidity can turn into insolvency.

2.2 Hedging

Flexible exchange rates also increase incentives to hedge, for both banks and their customers. Apart from informal ways of hedging risk it is possible to buy forward cover in the market. With two-way movement both importers and exporters have an incentive to reduce currency exposure. Hedging removes the effect of currency movement in any one direction on profits by creating exposure in the opposite direction[2]. Thin markets raise the cost of formal hedging, and a high interest differential

[2]During a period of steady depreciation of the Indian rupee over 1996-2002 only importers used to buy forward cover. Over 2003 as the rupee appreciated only exporters were hedging. Importers also rushed for cover when the rupee started depreciating in May 2004. There were news reports that major software firms such as Infosys and Wipro would not be able to gain from the depreciation because of the forward cover they had taken. The point is precisely that with hedging

raises the cost of informal hedging. If an importer holds a dollar deposit as an informal hedge he sacrifices domestic high interest. If he has to borrow in domestic currency he pays an additional higher interest rate at home. Similar considerations affect banks acting on behalf of retail trade. Banks will not hedge currency risk if exchange rates are fixed, but unless open exposure is strictly limited banks would arbitrage: take dollar deposits and make high interest domestic loans. If zero or low exposure is enforced, banks contribution to developing the forex market and discovering the value of the currency is limited. There creating incentives for hedging is better than quantitative restrictions on currency exposure.

Limited exchange rate volatility is easier to hedge than interest rate volatility. It makes it easier for monetary authorities to smooth interest rates, since the need for the interest rate defense is reduced. Interest volatility has a deeper impact particularly when bank loans are the dominant mode of finance as they are in Asian EMEs, where the reliance on bank debt is high. A rise in interest rates delivers a severe shock to the financial system. Moreover Jeanne (2003) argues that if firms choose the currency composition of their debts in order to minimize their probability of default, they will dollarize liabilities and reduce hedging precisely when the risk of a large devaluation increases. The reason is that domestic interest rates also rise in such conditions making domestic borrowing and hedging both costlier.

There is the original sin argument that EME banks have limits to borrowing in domestic currency. They must borrow in foreign currency and cannot hedge currency risk (Eichengreen and Hausman, 2000). But Burnside, Eichenbaum and Rebelo (2001) collect evidence that markets, instruments and opportunities existed for hedging in East Asian countries prior to the crisis, although there were some restrictions on the use of currency derivatives, for example in Korea. These markets certainly existed in a country like Sweden, which also had a twin crisis in the early nineties. The failure was more of incentives to hedge. They also present both BIS and IFS evidence for Asian and European countries that before a twin crisis both banks and firms held large net foreign liabilities. Even if banks hedge their own foreign exchange exposure, they are exposed to large indirect credit risk, from their client firms who have borrowed in foreign currency.

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they can stop worrying about the impact of the rupee on their profits, and trying to make money from rupee movements. Instead they can focus on their key activity, producing better software.

Thus flexible exchange rates should also decrease risk for banks by creating incentives for them and their customers to reduce currency exposure, thus lowering the effect of exchange rate volatility on balance sheets and its cumulative impact.

3. Empirical tests

After the East Asian currency crisis many Asian countries have moved towards more flexible exchange rate regimes. But the Chinese renminbi has been fixed to the dollar since 1994. Therefore we estimate the impact of this structure of exchange rates on banks creation of risk through foreign borrowing. In order to capture the effect of both exchange rate deviations and fluctuations on changes in banks net foreign assets, we regress, for eleven Asian EMEs, the growth of net foreign assets of the banking sector on the mean deviations and on the squared mean deviation, of each country's exchange rate, including macroeconomic control variables. Since economic and banks' activity and foreign interest differentials affect banks net foreign assets these variables are included as controls. The regressions are repeated for deviations from the renminbi, normalized by the mean. Significant coefficients would imply that the exchange rate regime affects banks net foreign assets, and the signs would indicate the structure of the effect. The coefficients would also help to distinguish between the moral hazard and bank run hypotheses.

Significant exchange rate variables would support the bank run over the extended moral hazard school explanation for twin crises. To the extent that the fixed exchange rate was responsible for perverse incentives that created unhedged currency mismatch, the role played by other types of moral hazard is reduced. For example, Burnside, Eichenbaum and Rebelo (2001) argue that broader government guarantees to banks' foreign creditors, such as full repayment in the event of a default, eliminate banks' incentives to hedge the risk of devaluation. Since hedging profits from forward contracts are realized if there is devaluation, but these go to the government in the event of a devaluation-induced bankruptcy, banks do not want to hedge. If in the post-crisis period during which the estimation is undertaken, flexible exchange rates increase banks net foreign assets, and thus reduce unhedged liabilities, while other government guarantees continue, their argument does not find support; just a different exchange rate regime creates incentives for banks to reduce currency mismatch.

If flexible exchange rates reduce the probability of a sharp devaluation, and a devaluation induced bankruptcy, according to the bank run model, they will increase banks incentives to hedge. This, and more hedging by their clients will further reduce risk for banks.

The coefficients for mean deviations would give the affect of deviations from the mean on risky behavior of banks. Since the renminbi remains fixed to the dollar, this will also have implications for the level and alignment of Asian exchange rates and potential adjustment paths in response to the global imbalances in reserve accumulation and current account deficits.

3.1Data and methodology

The dependent variable, GY, is growth rate of net foreign assets of the banking sector. The independent variables are X1, deviation of the exchange rate from the mean divided by the mean, X2, square of X1 used as a proxy for variance of exchange rate, X3, deviation of domestic exchange rate from Chinese exchange rate (both normalized by the respective means), and X4, the square of X3. The exchange rate is measured as national currency per US $. Control variables used are, the growth rate of the Index of Industrial Production (IIP), growth in bank credit (GBC), and deviation of the domestic deposit interest rate from the US deposit rate (II). The sum of money and quasi money is used as a proxy for bank credit.

The monthly data points extend over 1998-1 to 2002-12. They exceed 400. Countries included are China, India, Indonesia, S. Korea, Malaysia, Singapore, Thailand, and Turkey. Table 5 gives the summary statistics of the variables.

The data is largely sourced from the IFS CDNET. Data for the dependent variable has been collected from central bank websites except for China and Korea. For Turkey, Korea and Indonesia, the data was in billions of national currency which was converted into US$ millions.

3.2Results

The coefficients of the exchange rate variables are all significant at 1 per cent in the fixed effects regression (Tables 7 and 8). The deviations from the mean or the level variables X1 and X3 have

negative signs and the squared deviations capturing fluctuations in the exchange rates, X2 and X4, have positive signs. Growth of the net foreign assets falls with the distance of the exchange rate from its mean value but rises with flexibility in the exchange rates[3]. Except for IIP, which is less directly relevant to a bank's decision, the other two control variables are significant.

The results imply that limited exchange rate flexibility increases banks net foreign assets and thus lowers risk. It reduces the risk of associated with currency mismatch and may also be encouraging hedging. In addition to flexibility of exchange rates itself encouraging hedging, reduction in the risk of sharp devaluation and smoother interest rates also improve incentives for hedging.

Since the exchange rate regime affects bank behavior the regressions support the bank run, rather than the moral hazard explanation of the East Asian crisis. The fixed exchange rate regimes that prevailed during that period probably increased banks acquisition of net foreign liabilities and reduced their incentives to hedge.

But risk associated with net foreign liabilities and currency mismatch rises as the distance between the exchange rates of Asian EMEs from their own mean values and from the Chinese exchange rate rises. This implies first, that movements in exchange rates have to be limited, or managed, in order to prevent a large deviation of levels, which raises risk. Second, that unless China moves its peg, a major change in the level of Asian exchange rates will raise risk. Banks net foreign liabilities increase as their country's exchange rate deviates far from its mean value or from the renminbi, but limited exchange rate flexibility lowers such risky behavior.

The regressions suggest that reducing financial risk requires flexible exchange rates. But the movement has to be limited suggesting an implicit alignment of Asian exchange rates. These results also have implications for the imbalances that have built up across countries and regions in foreign exchange reserves. The US has a large current account and fiscal deficit and many Asian EMEs have a surplus in their balance of payments and capital inflows. They are accumulating substantial reserves in order to prevent their currencies from appreciating.

[3] In these regressions X3 and X4 for China reflect its link to the dollar. If the Chinese exchange rate is considered as fixed to its own mean, which makes X3 and X4 equal zero for China, the coefficients are still significant, and the signs remain unchanged, but their size falls.

Dollar depreciation will be more effective in reducing US deficits if the Chinese currency appreciates somewhat against the dollar. Although many Asian currencies have been appreciating, our regressions suggest that appreciation would be less risky if the Chinese currency also appreciates, so that Asian currencies are able to retain risk-minimizing alignments with the renminbi.

Limited flexibility of the renminbi coming, for example, from a change to a multiple-currency peg would actually reduce risk and instability in Asia and enhance the degree of flexibility of Asian currencies. This would encourage the development of forex and financial markets, which is a major objective for China and other countries in the region. Since these countries have thin financial markets, but are keen to deepen them, managed floating or limited exchange rate flexibility would further this purpose.

The regressions also imply that the currencies would appreciate along with the renminbi to maintain optimal alignments so that China would not loose competitive advantage in Asia. To the extent Asian EMEs are trade competitors this makes adjustment easier. But other non-competitive types of intra-Asian trade are large and growing, so that effects on competition should not be the major consideration.

Adjustment of Asian real exchange rate levels is also limited by potential adjustment in real wages in some of the labor-intensive economies of Asia. This topic is explored in Goyal (2005).

6.Conclusion

A panel regression gives evidence that more flexibility in Asian exchange rates reduces risk associated with bank borrowing abroad, but deviations from mean exchange rates, and from the renminbi, increase risk. Since the exchange rate regime affects bank behavior and the incentives to hedge, the results broadly support the bank run over the moral hazard view of twin banking and currency crisis. The results suggest that Asian EMEs should move to more flexibility in exchange rates, but the flexibility will have to be limited, and it depends on more flexibility in the renminbi. This has implications for current global imbalances in reserves and feasible adjustment paths.

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Table 1: Summary statistics for the regressions

Variable	Observation	Mean	Std. Dev.	Min	Max
Exchange rate	480	103573.3	323576.7	1.58	1685920
GY	406	.0662797	2.745253	-28.9269	41.04155
GIIP1	418	.0431803	.5460506	-.8548387	7.571429
GBC	462	.0146866	.0281009	-.0725257	.2713284
II	420	11.18014	23.16401	-5.01	115.37
X1	480	-9.68e-11	.2302291	-.7375563	1.060777
X2	480	.0531211	.1635352	0	1.125247
X3	480	.1083333	.6367681	-1.177167	1.08759
X4	480	.416365	.4819939	3.79e-09	1.385721

Table 2: Exchange rate: level and volatility effects

GY	COEF	STD ERROR	T	P>|t|	95% Conf interval	
X1	-.7466172	.1977538	-3.78	0.000	-1.135777	-.357457
X2	1.270968	.3905886	3.25	.001	.502328	2.039609
GIIP	-.0112455	.0895944	-.13	.900	-.1875586	.1650676
GBC	-3.340085	1.792995	-1.86	.063	-6.868526	.1883551
II	.0092267	.0052742	-1.75	.081	-.0196059	.0011525

Table 3: Deviations from renminbi

GY	COEF.	STD. ERR.	T	P>|T|	[95% CONF. INTERVAL]	
X3	-.5437506	.1763097	-3.08	0.002	-.8907109	-.1967902
X4	.7546954	.3141732	2.40	0.017	.1364331	1.372958
GIIP	-.0109269	.0903104	-0.12	0.904	-.1886489	.1667951
GBC	-3.218941	1.807701	-1.78	0.076	-6.776321	.338439
II	-.0077217	.0052738	-1.46	0.144	-.0181	.0026567