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Kim Edwards and Sahminan Sahminan

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Kim Edwards^a and Sahminan Sahminan^b

^a Reserve Bank of Australia

^b Bank Indonesia

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In this paper we provide an overview analysis of the role of the exchange rate in the Indonesian economy. In particular, we have explored three main issues. The first is how the exchange rate is determined in Indonesia, the second is why the exchange rate matters to the Indonesian economy, and the third concerns the policy challenges presented by exchange rate fluctuations in the post-crisis period. We find some evidence to suggest that non-market factors continue to play a role in influencing the exchange rate, although many of the vulnerabilities typically associated with rupiah movements appear to have declined.

JEL classification: F31, F32

Keywords: Exchange Rate, Policy Challenges, Indonesia.

The views expressed do not reflect the views of Bank Indonesia or Reserve Bank of Australia.

Corresponding author: Sahminan Sahminan, Bank Indonesia, Jl. M.H. Thamrin No.2, Jakarta.
Email: sahminan@bi.go.id.

1. Introduction

Emerging market economies are often reluctant to allow their currencies to fluctuate freely (e.g. Calvo and Reinhart 2000), because of the potential for sharp exchange rate movements to exacerbate inflationary pressures and financial sector vulnerabilities. Although Indonesia adopted a floating exchange rate regime in the wake of the 1997 crisis, the value of the rupiah continues to be at least partly determined by non-market forces. Indeed, it appears that the central bank has been prepared to intervene in order to prevent sharp currency movements in both directions, while buying foreign exchange on a more sustained basis in an attempt to foster export competitiveness through the maintenance of a low, stable exchange rate.

In some instances the Indonesian authorities have openly acknowledged their role in managing the exchange rate, particularly when intervening to support the currency in periods of sharp depreciation. In these cases intervention often appears to be carried out under the pretext of “keeping volatility in check” (see section 2.2.1). Indeed, it seems to be widely accepted that intervention is a valid policy tool, which can be used, “possibly in conjunction with monetary policy, to stabilise market expectations, calm disorderly market, and limit unwarranted short-term exchange rate movements because of temporary shocks” (Warjiyo 2005). This may at least partly reflect public pressure on the central bank to manage the exchange rate at an appreciated level. If it is true that “the public monitors exchange rate developments every day”, then it is perhaps not surprising that the behaviour of the exchange rate may be regarded by some policy-makers as “a key indicator of central bank performance” (Hutabarat 2006).

That said, there are a number of other possible reasons for why (particularly emerging market) monetary authorities will prefer some degree of control over the exchange rate, even when operating an inflation targeting regime. First, high exchange rate pass-through into domestic prices may mean that exchange rate movements have important implications for monetary policy. In this respect, inflation targeting is not necessarily inconsistent with exchange rate intervention, if this intervention is only carried out in cases where it is compatible with the central bank’s inflation forecast. Second, the risks attached to currency depreciation will increase in cases where there is a large amount of external debt held by various sectors of the economy, leading to the potential for currency mismatches on domestic balance sheets. Of particular concern is the potential for fiscal dominance, whereby a large stock of foreign currency denominated government debt may lead to political pressure on the central bank to limit any declines in the domestic currency. Third, relatively underdeveloped financial markets may mean that dollar pegs are used to provide informal hedging for importers and exporters, in response to trade being largely invoiced in US dollars and ‘original sin’ problems of capital market incompleteness that make hedging difficult (McKinnon and Schnabl 2003). Finally, sharp reversals of capital flows may cause fear-driven momentum in exchange rate movements, leading to possible overshooting and potentially damaging volatility.

A possible conclusion is that a managed float designed to accumulate reserves and resist real appreciation could be preferable in some conditions over the polar extreme of free floating, for countries that are not prepared to accept the constraints of a hard peg (Hernandez and Montiel 2001). That said, there are some circumstances where attempting to actively limit movements in the exchange rate may not be the optimal policy response. Allowing nominal exchange rate appreciation as a response to sustained capital inflows, for instance, helps to contain the local-currency prices of imported goods and insulate the domestic supply of money and credit, mitigating inflationary pressures in the domestic economy (IMF 1997). As the ‘impossible trinity’ dictates that a central bank cannot indefinitely control both the nominal exchange rate and the money market rate in an economy open to capital flows, a floating exchange rate should also allow the authorities to retain more control over domestic monetary policy. More generally, allowing the nominal exchange rate to fluctuate in a wider range introduces uncertainty and increases perceived exchange risk which should help to deter purely speculative capital flows.

This paper touches on some of these policy issues in its investigation of the causes and effects of exchange rate movements in Indonesia. We first consider fundamental exchange rate determinants and measures of exchange rate flexibility, in conjunction with a more detailed analysis of the August 2005 depreciation and policy response, so as to obtain a broad picture of the factors that have driven exchange rate movements since the 1997-98 crisis. We then consider the effects of exchange rate movements on prices, the external sector, and balance sheets in Indonesia, and conclude by elaborating on some of the policy challenges presented by exchange rate fluctuations in the post-crisis period, in the context of Indonesia’s inflation-targeting regime.

2. Determinants of exchange rate movements in Indonesia

2.1 Fundamental determinants of the exchange rate

In line with a number of similar studies, we first attempt to estimate reduced-form models of the rupiah exchange rate in both nominal and real terms, incorporating some of the determinants commonly used in empirical exchange rate analyses. Related work includes that of Sahminan (2005), who employs an error correction framework to estimate the equilibrium real exchange rate of the rupiah using quarterly data from 1993 to 2005. In the long run, he finds that the real rupiah exchange rate exhibits a positive relationship with the level of net foreign assets, and a negative relationship with the terms of trade. In the short run, upward movements in the rupiah are driven by decreases in the terms of trade, and increases in interest rate differentials. Husman (2005) examines post-crisis drivers of the nominal exchange rate using monthly data from May 2002 to September 2005. Her study finds that oil prices, risk premia, the terms of trade, interest rate differentials, and the supply-demand ratio of foreign exchange are all significant determinants of the nominal exchange rate.

In estimating our models we confine ourselves to the post-crisis period, using monthly data from January 2000 to December 2006, so as to exclude the sharp exchange rate movements associated with the Asian crisis. We use an error correction framework incorporating interest rate differentials, the terms of trade, changes in net foreign assets, and measures of country risk and global risk as potential exchange rate determinants. Results can be found in Appendix A.

In the long run model with variables in levels, we find a negative relationship between the level of country risk and both the real and nominal exchange rate. Country risk, which is taken from the International Country Risk Guide and based on a composite of political, financial, and economic risk factors, is commonly used by investors as a proxy for default or regulatory risk. Our finding confirms that political turmoil and policy uncertainty have had marked effects on investor confidence and market sentiment since the turn of the decade. For instance, the weakening of the rupiah in April-July 2000 was mainly due to political uncertainty and social unrest, which were quickly reflected by downgrades to Indonesia's sovereign long-term and short-term debt. Uncertainty stemming from accusations of presidential graft also put downward pressure on the rupiah during January-April 2001, as did the further debt downgrades and forecasts of lower growth which again reduced investor and corporate confidence later in the year. The Bali bomb blast of October 2002 was another example of a political event which triggered panic buying of US dollars.

Long run results for the (non-oil) terms of trade also conform to our priors and contrast with those of Sahminan (2005). Under a floating exchange rate regime, movements in a country's terms of trade should be offset by corresponding exchange rate movements, cushioning the effect on income and output. For instance, a decline in the price of exports relative to imports will – assuming inelastic quantity responses – lead to a decrease in the supply of foreign currency relative to demand, resulting in an exchange rate depreciation that should in turn improve the competitiveness of export and import-competing industries. We find that the level of the terms of trade positively affects both the real and the nominal exchange rate. On the other hand, contrary to expectations changes in the terms of trade are found to have a significant and negative impact on changes in both the nominal and real exchange rate.

Among the determinants tested in the short run models incorporating the error correction term, only changes in net foreign assets have a significant effect on the exchange rate with the expected sign, indicating that capital inflows – reflected by a decrease in net foreign assets – lead to a rupiah appreciation (and vice versa). Indeed, while persistent current account surpluses may have placed sustained upward pressure on the exchange rate since the crisis, the model results suggest that fluctuations in capital flows appear to be a significant driver of shorter-term exchange rate movements. However, endogeneity may well complicate this relationship: part of the reason that shorter term portfolio flows are viewed as creating instability is because any initial depreciation caused by a withdrawal of capital may itself prompt further withdrawals.

Interest rate differentials may also affect capital flows into and out of a country, with corresponding implications for the domestic currency. This was the case in Indonesia during 2004, for instance, when declining interest rate differentials due to monetary policy tightening in the US triggered short-term capital outflows, while higher oil prices and concerns about the presidential election in July added to downward pressure on the rupiah. However, we find little evidence of a robust relationship between interest rate differentials and the exchange rate. There are a number of reasons why this may be the case. First, higher interest rate differentials will not necessarily attract foreign investment if they reflect correspondingly large differences in the levels of risk associated with such investment. Second, while higher interest rates may attract debt inflows, they may actually deter equity inflows through their dampening effect on the broader economy. Third, endogeneity may again be an important concern: it is possible that causality may run from exchange rates to interest rates as well as from interest rates to exchange rates. For instance, in April and May 2003 Bank Indonesia explicitly signalled that the strengthening currency gave it more leeway to spur the economy by lowering interest rates, which it said had room to fall. Such two-way causality will be present if the authorities' decision to alter domestic interest rates is in any way affected by movements in the currency, an issue that will be returned to later.

To clarify these causality relations we run Granger causality tests on the exchange rate and the explanatory variables in our model. We find that the nominal rupiah exchange rate Granger causes the interest rate differential and country risk, while the real effective exchange rate Granger causes the interest rate differential, country risk, and net foreign assets. Hence there is evidence to suggest that interest rates, capital flows, and perceptions of country risk may all themselves be affected by exchange rate movements, despite being treated as exogenous in the model. Moreover, rolling regressions show that many of the coefficient estimates are highly unstable, indicating that different factors matter at different times, and further reflecting the difficulties inherent in estimating a model of this nature. Indeed, three-year rolling regressions suggest that only the coefficient of country risk is stable over time, with most other coefficients changing in both magnitude and sign over the period.

We have already noted that if interest rates and exchange rates are co-determined, this will create problems for our particular modelling approach. More generally, if the exchange rate is in any sense treated as a target of policy in Indonesia, then models that include traditional market-oriented determinants are much less likely to be successful. Indeed, policy responses to exchange rate movements – such as intervention in foreign exchange markets – may in fact prevent the exchange rate moving towards a market-determined equilibrium. Our next step, therefore, is to examine whether and how much the exchange rate has been managed in the post-crisis period.

2.2 How managed is Indonesia's exchange rate regime?

To do so, we consider a number of indicators designed to measure the flexibility of Indonesia's exchange rate regime. It is often alleged that East Asian economies have generally

engaged in large-scale accumulation of foreign (largely US dollar) reserves since the crisis in an attempt to limit currency appreciation and maintain export-led growth. At first glance Indonesia appears to be no exception. Since the crisis Indonesia's nominal exchange rate has also remained at a depreciated level, even in comparison to the exchange rates of other countries in the region (Figures 1 and 2). In particular, the rupiah has remained relatively flat against the US dollar over the past couple of years, unlike the currencies of its East Asian neighbours which have all appreciated strongly.

Here we attempt to determine the extent to which exchange rate management can explain these stylised facts. Given the difficulty of obtaining actual data on exchange rate intervention, one approach is to use changes in central bank reserves as a proxy and, on this basis, to directly determine the extent to which the central bank appears to be intervening to influence the exchange rate. Another approach, closely following Baig (2001), is to compare the post-crisis behaviour of the rupiah and other nominal variables with their pre-crisis behaviour. In doing so, it may be possible to determine whether adjustments to achieve external and internal balance are occurring more through the exchange rate (instead of through other nominal variables), or whether there is instead any evidence to suggest that Indonesia has reverted to a *de facto* peg against the US dollar.

Figure 1
Asian Currencies Against US\$
December 1996 = 100

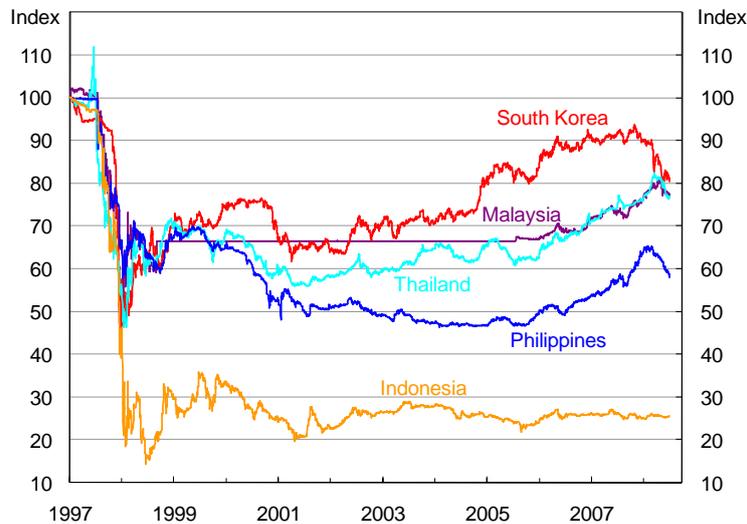
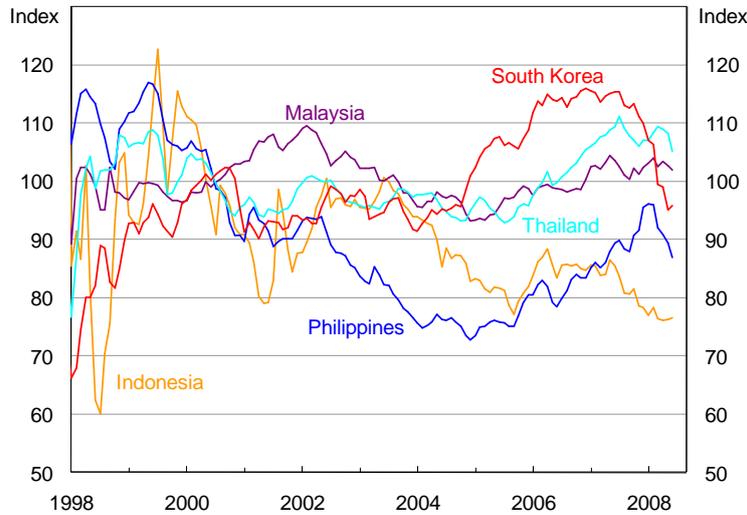


Figure 2

Asian Nominal Effective Exchange Rates
2000 = 100



2.2.1 Changes in reserve holdings and exchange rate movements

Co-movements between Bank Indonesia’s holdings of foreign reserves and the rupiah provide a first-pass approximation of the degree to which BI attempts to influence rupiah movements via the purchase and sale of foreign currency. Figure 3 suggests that the four major instances of sharp rupiah depreciation in recent years (in each of the four years to 2007) were all accompanied by declines in reserve holdings, providing a *prima facie* indication that the central bank attempted to alleviate downward pressure on the exchange rate in these periods by selling foreign currency. Moreover, twelve-month correlations between the exchange rate and reserves have risen since the start of the decade, providing further evidence that Bank Indonesia has been inclined to at least ‘lean against the wind’ to prevent unwanted exchange rate movements in both directions (Figure 4).

Figure 3

Foreign Exchange Reserves and the Exchange Rate
Monthly

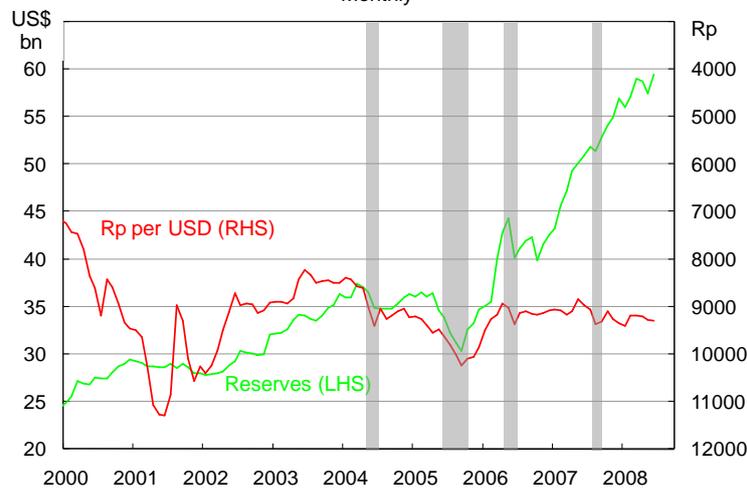
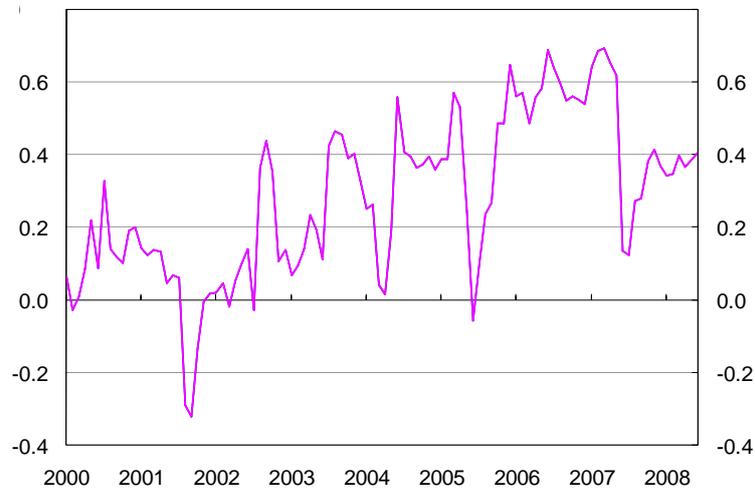


Figure 4

Foreign Exchange Reserves and the Exchange Rate

12-month rolling correlations



Of course, there are a number of caveats associated with treating reserves as an indicator of intervention. Perhaps most importantly, the motivation underlying reserve accumulation may be purely precautionary. Building a large stockpile of reserves assets may be viewed as a way to reduce vulnerability to external shocks and forestall a sell-off of the domestic currency. Taking advantage of a favourable price by accumulating reserves when the rupiah exchange rate is high should not then be viewed as a signal of intervention. Also, fluctuations in reserves can reflect valuation adjustments, debt repayments, and other factors that do not necessarily represent market intervention. Moreover, forward market intervention is not fully captured by the gross reserves figures (Baig 2001).

Despite these caveats, there is anecdotal evidence to suggest that an interventionist motive explains at least part of the movements in reserve assets. This intervention is often publicly justified by the need to constrain ‘volatility’ in the rupiah. In practice, this often appears to imply intervening to prevent sharp exchange rate depreciations from continuing further. For instance, in July and August 2007 the rupiah depreciated by over 4 per cent due mainly to the sub-prime mortgage turmoil in the US, the impact of which spread to emerging markets as global investors reassessed their holdings of risky assets. Along with the Federal Reserve decision to cut interest rates, which triggered the return of capital inflows into rupiah assets, Bank Indonesia also intervened in the foreign exchange market to reduce downward pressure on the rupiah. At the end of August, the Governor of Bank Indonesia reported that a rupiah worth 9000 per US dollar was “best for our economy” and that BI would “remain in the market to keep volatility in check”.¹

Instances of shorter-term intervention to prevent sharp *appreciations* in the exchange rate can also be pinpointed. For example, in the months prior to the depreciation discussed above, the

¹ The Jakarta Post, August 28, 2007.

rupiah appreciated quickly, supported by higher yields on rupiah instruments relative to other instruments in the region. Together with the rising appetite of global investors for emerging market assets, these yield differentials helped fuel substantial foreign capital inflows in the first half of 2007. In this case, to prevent further exchange rate appreciation, Bank Indonesia stepped into the market and bought foreign exchange.

Moreover, although BI has shown an inclination in recent years to intervene to prevent sharp exchange rate movements in both directions, there are some signs that BI has been deliberately *buying* foreign exchange in the market over the longer term to maintain a low, stable rupiah for the benefit of exporters. Notably, although Indonesia's reserve accumulation has been relatively subdued until recently, in the past two years it has picked up dramatically, with reserve holdings doubling in size since the low reached in August 2005 (Figure 5). Notably, this two-year period corresponds closely to the period of relative flatness in the rupiah (refer to Figure 1), which has continued despite significant capital inflows, trade surpluses, and a broadly depreciating US dollar.

Hence there is some circumstantial evidence to suggest that BI is currently attempting to maintain an undervalued exchange rate on a more sustained basis. However, relatively high and persistent inflation may be undermining this effort through its effect on the real exchange rate. Despite its low and stable nominal exchange rate, Indonesia's real effective exchange rate has appreciated by around 200 per cent since the crisis, more than any other country in the region, and has returned to around its pre-crisis levels (Figure 6).²

² The reserve accumulation described above (and, in the absence of full sterilisation, the implied growth in base money) may have itself partly contributed to these inflationary pressures.

Figure 5

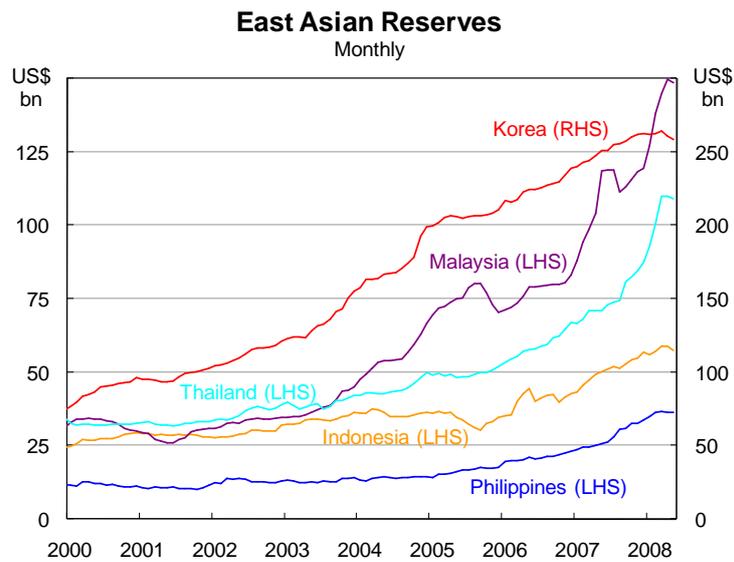
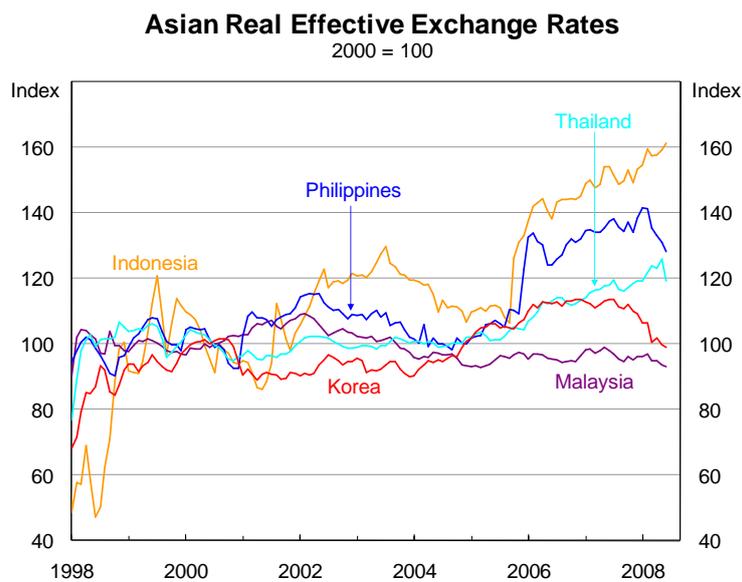


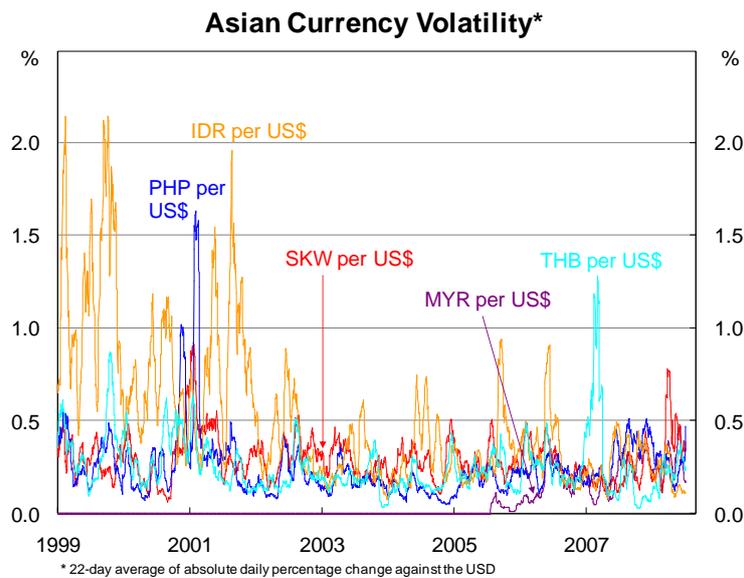
Figure 6



2.2.2 Volatility of the rupiah and other nominal variables

Like other East Asian currencies, the volatility of the rupiah against the US dollar has fallen substantially from the highs reached in the years following the crisis and Indonesia's adoption of a floating exchange rate (Figure 7). That said, the rupiah continues to experience periodic spikes in volatility, and has on average been more volatile than the currencies of other countries in the region.

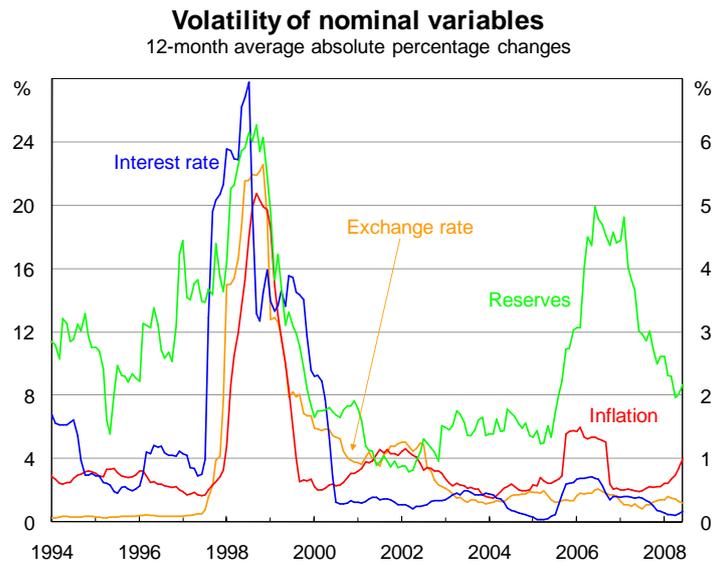
Figure 7



However, a more volatile exchange rate does not by itself mean that an exchange rate regime can be characterised as freely-floating. The volatility of interest rates and reserves might also be expected to show a corresponding decline in economies that shift away from targeting the exchange rate through monetary policy and intervention and towards a floating regime. Reserves volatility should fall as the monetary authorities are no longer bound to intervene via changes in reserve holdings to maintain the exchange rate at a predetermined level. Instead, balance of payments adjustments to capital flows (for instance) can occur through changes to the exchange rate. In regimes where the exchange rate is the nominal anchor, on the other hand, changes to interest rates may also be needed to help ensure that capital flows are consistent with balance of payments equilibrium at the desired exchange rate. Indeed, with the exception of Malaysia, the interest rates of the East Asian countries were substantially more volatile than those of floating countries during the pre-crisis period of fixed exchange rates (Baig 2001).

Figure 8 suggests that the volatility of both reserve holdings and interest rates in Indonesia has generally fallen in the post float period, suggesting that exchange rate movements are reducing some of the adjustment pressures formerly borne by other nominal variables. That said, reserves volatility rose sharply in the second half of 2005, and is now at around its pre-crisis levels.

Figure 8



2.3 The depreciation of August 2005 and its aftermath

We have offered some evidence that exchange rate continues to be viewed as a target of policy in Indonesia. If the authorities are indeed playing a direct role in exchange rate determination, this may explain the inability of fundamentals-based models to adequately capture the determinants of rupiah movements. The presence of two-way causality and coefficient instability in the formal model presented in section 2.1 also suggests that there may be value in analysing particular episodes in Indonesia's exchange rate history, so as to better disentangle the factors underlying exchange rate movements from the policy responses to those movements.

The 12-month period beginning with the market turmoil and rupiah depreciation of August 2005 provides a particularly interesting case study of exchange rate movements in Indonesia. In August 2005 the rupiah depreciated by over 10 per cent against the US dollar (Figure 9).

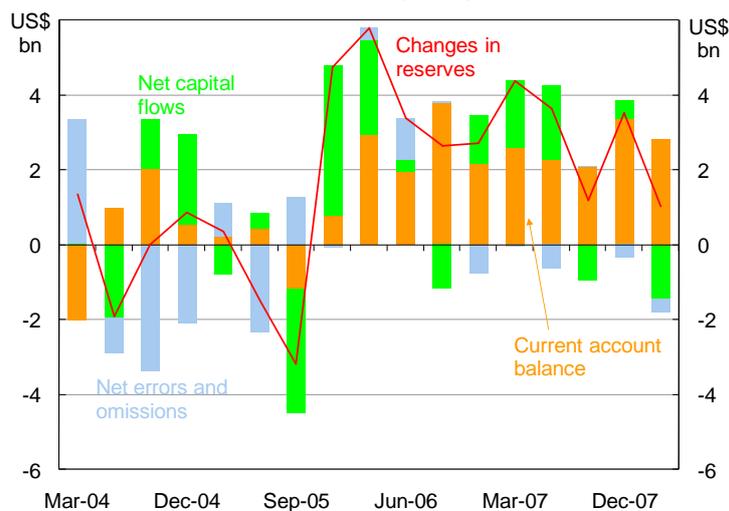
Figure 9

Rupiah per US dollar
Daily



Figure 10

Balance of Payments
CEIC data, quarterly



The primary causes of the depreciation were a weaker balance of payments, and negative sentiment towards fiscal sustainability due to a sharp increase in oil prices. These rising oil prices combined with increasing domestic demand to trigger a reversal in the current account from surplus to deficit (Figure 10). In particular, the oil price increase meant the fuel import bill of the state-run oil company Pertamina rose sharply, but the increase was not followed by a correspondingly higher volume of oil exports due to the prevailing constraints in oil production.

Negative sentiment towards fiscal sustainability due to the subsequent increase in the cost of fuel subsidies put further downward pressure on the exchange rate. Increases in the US federal funds rate (from 2.25 per cent in January 2005 to 4.25 per cent in December) also created an environment of uncertainty in world financial markets, raising the risk premium demanded on

investments in emerging markets. The short-term capital inflows (particularly bank and money market flows) that had provided a source of foreign exchange in the second half of 2004 sharply reversed, while foreign direct investment inflows were only marginal (Figure 11). Indeed, there is some evidence that perceptions of increased risk quickly became self-fulfilling in the third quarter of 2005, with mounting depreciation expectations stimulating further purchases of foreign exchange.

Figure 11

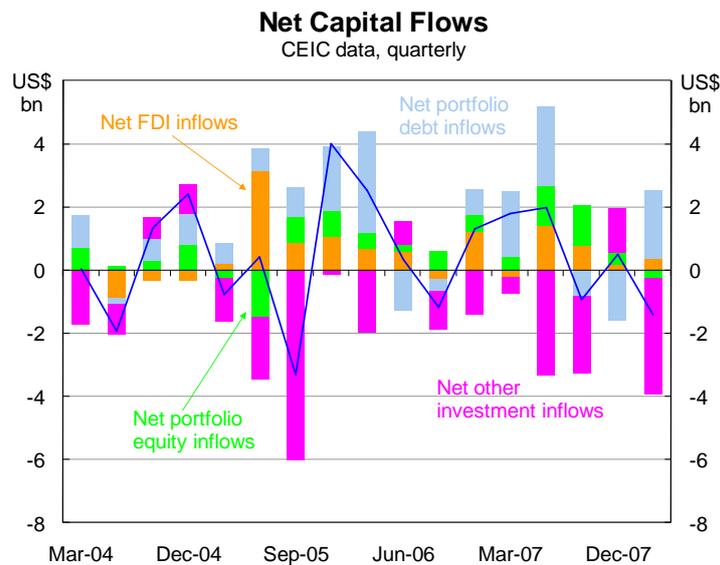
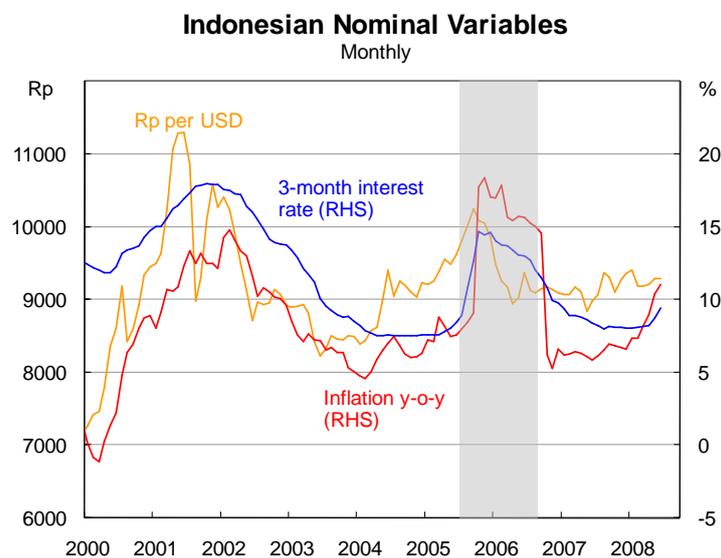


Figure 12



In response, fiscal measures were taken to reduce fuel subsidies, while Bank Indonesia's response to the ensuing surge in inflation and the external pressure on the rupiah was to increase the policy rate from 8.5 per cent in July to 12.75 per cent by the end of the year (Figure 12). Together with an increase in reserve requirements designed to absorb excess liquidity from the banking system, this tightening in monetary policy helped to restore investor confidence.

At the same time, various policies aimed at exchange rate stabilisation were also instituted. Through the 27 April 2005 policy package, Bank Indonesia increased the scale of foreign exchange intervention, raised the maximum interest rate under the guarantee-scheme on foreign exchange deposits, and required commercial banks to maintain a net open position in foreign currency on an intraday basis. Following the August depreciation, BI adopted a further series of policy measures to curb speculation in the foreign exchange market. The 30 August 2005 policy package launched foreign currency swaps with 1-7 days maturity as an instrument of open market operations, provided 3-6 month swap facilities with the option of extension for hedging by investors, and prohibited margin trading of the rupiah against foreign currency. BI also began to more intensively monitor non-underlying foreign exchange transactions by banks, and limited rupiah transactions and the provision of foreign exchange credits by banks to non-residents (Bank Indonesia 2006).³

As a result of the more attractive yields available, as well as improving macroeconomic fundamentals and an ensuing improvement in the risk environment, there was an influx of short-term capital in the December 2005 and March 2006 quarters, which in turn put upward pressure on the exchange rate and restrained inflationary expectations. At this time high levels of liquidity in global financial markets flowed to a number of emerging market countries, particularly Indonesia, which offered investment returns that were amongst the highest in the region. Meanwhile, the current account surplus also rose in 2006, as it did in a number of other East Asian countries, leading to further upward pressure on the rupiah. In Indonesia's case the stronger current account balance reflected strong exports growth and slowing import growth after the decline in economic activity caused by the fuel price hikes in October 2005. Moreover, the growing US current account deficit and Asian current account surplus meant that the US dollar exchange rate weakened more broadly over this period.

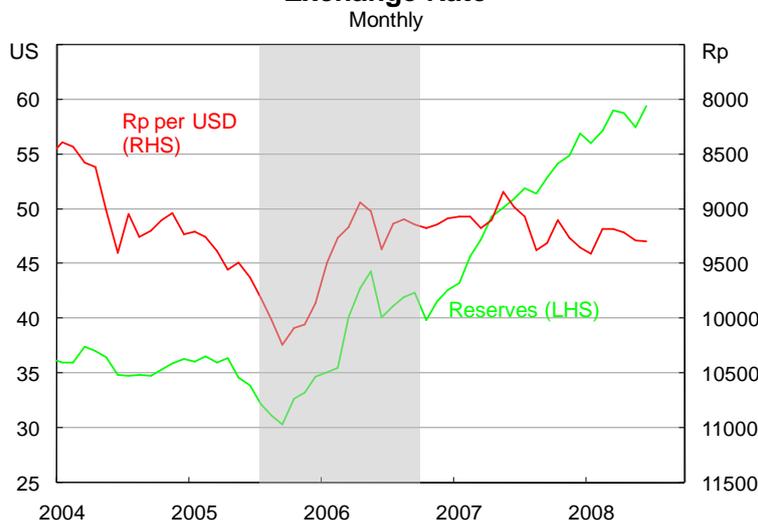
In line with the growth in the balance of payments surplus, official reserves expanded to reach \$42.6 billion at the end of 2006. It is difficult to deduce how much of BI's reserve accumulation over the period was intended to enhance reserve coverage (the precautionary motive for reserve holdings), and how much was intended as foreign exchange intervention. At September 2005 reserves had hit their lowest level since late 2002, suggesting a precautionary justification for increasing reserve holdings. However, by mid-2006 there were some concerns that rupiah appreciation had adversely affected exports, especially in the manufacturing sector. In particular, the real effective exchange rate reached its highest level in five years in May. Hence both motivations may have played a role. The close correlation between international reserve movements and movements in the exchange rate over the period

³ A number of broader measures were also adopted. Bilateral swap arrangements and Asian swap arrangements with the ASEAN countries plus Japan, China and Korea were signed to bolster access to foreign currency reserves. Bank Indonesia and the Government also agreed to establish a mechanism for dollar demand management in Pertamina. In addition, the 5 July 2005 policy package required State-Owned Enterprises (SOEs) to repatriate their export revenues. See Bank Indonesia (2006) for more details.

suggests that the changes in central bank reserves can at least partly be attributed to intervention (Figure 13).

Figure 13

Foreign Exchange Reserves and the Exchange Rate



As a whole, the 2005-06 period draws attention to a number of key themes. For instance, it is clear that, at least in this period, market sentiment and yield differentials were important drivers of ‘hot’ capital flows in Indonesia. More generally, while the sharp exchange rate decline in August 2005 can clearly be traced to balance of payments pressures, there is some evidence to suggest that this depreciation was also at least partly responsible for the shift to current account surplus and the subsequent recovery that took place in 2006. At least in this case, it appears that externally-driven exchange rate movements had an equilibrating impact on the external balance. Finally, this episode also reveals the authorities’ willingness to employ a combination of policy measures to combat the effects of exchange rate depreciation, including monetary tightening, foreign exchange intervention, capital controls, and other measures aimed at exchange rate stabilisation. However, it remains unclear whether these measures were designed solely to mitigate the inflationary threat associated with currency weakness, or whether the exchange rate was also targeted during this period for reasons independent of its pass-through effect on inflation.

3. The impact of exchange rate movements on the Indonesian economy

There are a number of possible reasons why monetary authorities may be reluctant to let the exchange rate move sharply or persistently in either direction, particularly in emerging market economies (Ho and McCauley 2003). While the potential impact on domestic prices might be the most obvious concern, movements in the exchange rate may also affect the external sector and financial stability in important and potentially undesirable ways.

3.1 The effect of the exchange rate on inflation

A major issue for monetary policy in emerging markets is that exchange rate pass-through to domestic prices tends to be high. Changes in the exchange rate may affect domestic price inflation through their impact on the prices of traded final goods, the prices of imported intermediate goods, and inflation expectations (Ho and McCauley 2003). *A priori*, we might expect the strength of these effects to be particularly strong in the case of emerging market economies such as Indonesia, which have a high-inflation history and have only recently shifted to an inflation targeting regime. If exchange rate depreciations do tend to cause significant increases in consumer prices, policy-makers may attempt to more actively manage the exchange rate, even within the context of an inflation-targeting regime. Indeed, targeting the exchange rate as a (particularly important) inflation determinant is not necessarily incompatible with treating low and stable inflation as the overriding objective of monetary policy.

There are a number of studies which have provided estimates of exchange rate pass-through to domestic prices in Indonesia, most of which find that pass-through in Indonesia is higher than pass-through in other Southeast Asian countries. Using quarterly data from 1985 to 2000, Sahminan (2005) finds complete exchange rate pass-through to import prices in Indonesia. Yanuarti and Hutabarat (2006) find that a 1 per cent exchange rate depreciation increases domestic prices in Indonesia by 0.25 per cent, which is larger than the inflationary effect of exchange rate movements in Malaysia, the Philippines, and Thailand. Bank Indonesia's SSMX model also generates estimates of exchange rate pass-through to domestic prices. The SSMX model estimates that a 1 per cent exchange rate depreciation leads to a 0.48 per cent increase in import prices and a 0.16 per cent increase in consumer prices. More recently, Ito and Sato (2006) show that exchange rate pass-through into CPI in Indonesia is larger than in Korea, Thailand, Singapore, and Malaysia, and that exchange rate pass-through in Indonesia has not declined significantly since the crisis (in the period to August 2005).

Kurniati (2007) uses an error correction framework to model exchange rate pass-through in two stages: the first round effect of exchange rate changes on import prices, and the second round effect of import price changes on consumer price inflation. She finds that short-run pass through to import prices has declined significantly in the post-crisis period compared to the pre-crisis period (from 0.38 to 0.21), while long-run pass through is relatively unchanged. She also finds that both short-run and long-run exchange rate pass-through to consumer prices have fallen in the post-crisis period. These declines in pass-through are attributed to a decline in the import to GDP ratio, a more stable history of inflation outcomes and a decline in inflation expectations.

If it is true that the responsiveness of consumer price inflation to exchange rate changes has fallen, there may be less justification under an inflation targeting regime for an aggressive policy response to any given exchange rate shock. However, Kurniati also suggests that domestic prices appear to respond proportionally more to large exchange rate changes (such as

those experienced during the crisis) than small changes, suggesting a potential asymmetry in exchange rate pass-through. As a result, she does not necessarily rule out the need for a broader policy response if the exchange rate experiences a “high and permanent” change.

3.2 The effect of the exchange rate on the external sector

Movements in the exchange rate may also be cause for concern because of their impact on the external sector. The real exchange rate, which reflects the price of domestically produced goods relative to foreign goods, is an important determinant of a country’s trade competitiveness, which may in turn affect the external balance and aggregate demand. Because of this, it is often alleged that many East Asian economies in particular have attempted to hold their exchange rate artificially low in pursuit of export-led growth. On the other hand, persistent inflationary pressures in Indonesia have meant that the real exchange rate continues to rise, offsetting measures which may have been taken to contain the nominal appreciation. As mentioned in section 2.3, concerns have recently been raised about whether this real appreciation has led to an erosion of competitiveness in Indonesia, particularly in its labour-intensive manufacturing sector (IMF Article IV Report 2007).

That said, compared with other emerging market economies in Asia, the Indonesian economy remains one of the least integrated into world trade. This in turn makes Indonesia relatively more insulated from the external sector consequences of exchange rate fluctuations. Actual trade openness (as measured by the ratio of exports plus imports to GDP) is around 50 per cent, compared to an average of 130 per cent for ASEAN countries, and unlike its neighbours Indonesia’s trade integration with the global economy has not increased since the mid-1990s (IMF Selected Issues 2007).

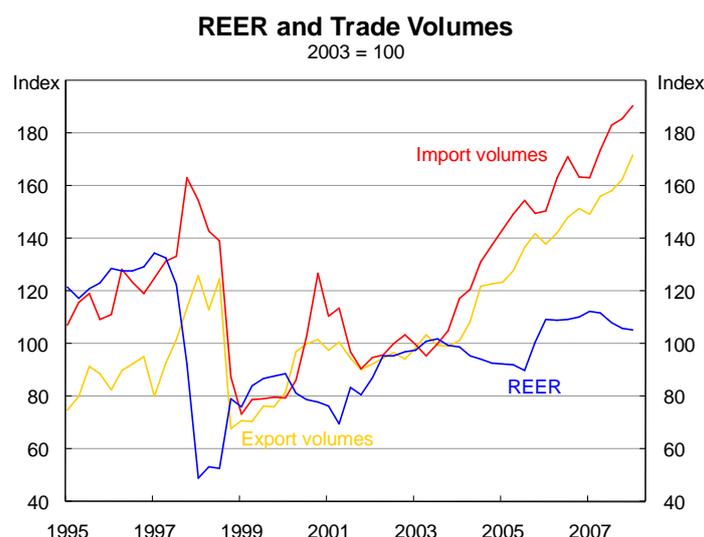
Nevertheless, the traded sector still forms a substantial proportion of the Indonesian economy, and hence it is important to assess how and to what extent this sector is affected by movements in the exchange rate. Previous research is somewhat inconclusive on this issue.⁴ Astiyah and Santoso (2006), for example, find that a real exchange rate depreciation does not improve the trade balance in the short-run, while in the long-run, the positive impacts of a real exchange rate depreciation on export volumes are offset by an increase in imports. Husman (2005), on the other hand, provides contrary evidence that the Marshall-Lerner condition holds for Indonesia’s trade balance with US, Japan, Korea, Taiwan, and Germany in the period from 1993-2004. Nonetheless, the estimated coefficient on the real exchange rate is relatively small, indicating that non-exchange rate factors (particularly on the supply side) may have a greater role in determining the trade balance.

Here we confine our attention to simple aggregated models of export and import volumes. Although this approach involves a number of limitations, our aim is simply to obtain a broad

⁴ The part on previous research that follows is directly cut from Warjiyo (2005)

picture of the impact of exchange rate movements on the real economy.⁵ We use a standard aggregated trade model which expresses import volumes as a function of domestic GDP and the real effective exchange rate (REER), and export volumes as a function of foreign GDP and the REER. Quarterly data from 1995 to March 2008 were obtained on imports and exports (using constant price series from the national accounts), domestic and foreign GDP (the latter being a weighted average of Indonesia's eight major trading partners), and the real effective exchange rate (Figure 14).

Figure 14



We use a standard two-step error correction procedure to derive the relevant elasticities. In the first step we regress levels of real imports (exports) on the REER and levels of domestic (foreign) GDP, with all variables in logs. In the second step we estimate dynamic equations in first differences including the lagged residuals from the first-stage regressions – the error correction terms – as explanatory variables. Lags of REER differences and GDP differences are also included in the second step regressions, with Akaike's information criterion used to select the lag structure.

Results of these regressions are set out in Appendix B (Tables 1 and 2). As expected, the long-run elasticity of real exports is negative with respect to the REER. Contrary to standard theory, however, the equivalent coefficient in the equation for real imports is also negative (and larger than the exports coefficient) indicating that a decline in the REER is also associated with an increase in imports. Similarly, the short-run REER elasticities are generally negative for both exports (as expected) and imports (contrary to expectations).

The apparently negative relationship between import volumes and real exchange rate movements over the post crisis period contradicts the expected price effect of exchange rate changes. One possible explanation is Indonesia's dependence on imported inputs in the production of exports. If imported inputs comprise a high proportion of the total inputs

⁵ For instance, aggregation biases may mean that the trade models used here underestimate the response of trade volumes to relative prices,

required to produce exports, then to the extent that a depreciation of the currency increases export demand (through the standard price effect), it will also increase the demand for imports. We might also expect a production lag before exporters are able to use imported inputs to increase export production. Hence, if this explanation is correct, imports should increase before and in anticipation of an increase in exports. To test this, we run pairwise Granger causality tests on the first differences of export and import volumes. Results are reported in Appendix B (Table 3), and suggest that changes in import volumes do indeed Granger cause changes in export volumes over the full sample period and in the post-crisis sample. On the other hand, there is no evidence to suggest that changes in export volumes Granger cause changes in import volumes.

The degree of exchange rate pass-through to rupiah-denominated import and export prices may also affect the above relationships. Specifically, if export prices are more closely linked to the exchange rate than import prices, then the *positive effect* of the exchange rate depreciation on import volumes will be amplified. This is because, for any given depreciation, the margin between the local-currency price of exports and the cost of imported inputs will be relatively larger, while the price effect on imports for consumption will be relatively smaller. We test this by running regressions of the first difference of import and export wholesale price indices on lagged differences of themselves and contemporaneous and lagged differences of the exchange rate (note that lagged differences of the exchange rate are not found to be significant in any instance). Our results, reported in Appendix B (Table 4) suggest that rupiah-denominated export prices are almost twice as responsive to exchange rate movements as rupiah-denominated import prices are, and this result is robust across different specifications.

Overall, these findings suggest that exchange rate movements may have a relatively low real impact on Indonesia's external sector, which in any case accounts for a relatively small proportion of the Indonesian economy. As further support for this result, we also find no clear relationship between the real exchange rate and the US dollar denominated trade balance over the post-crisis period. Our explanation pertaining to Indonesia's dependence on imported inputs is in line with previous empirical studies that have cited the imported input effect (amongst other factors) as an explanation of why exchange rate depreciations can in fact be *contractionary* in terms of their overall effect on the Indonesian economy (e.g Hutabarat 2006). At very least, offsetting cost and revenue exposures to exchange rate movements in Indonesia's external sector appear to reduce the impact of these movements on trade and output. This may also imply that any exchange rate response to an external shock needs to be relatively large in terms of size and/or duration if it is to stimulate the traded sector adjustment required to establish external balance.

3.3 Financial vulnerabilities to exchange rate movements

because they do not account for large differences in response across sectors or individual goods.

Countries that finance themselves by issuing foreign currency-denominated debt are selling investors protection against the risk that the domestic currency will depreciate, and, in the process, increasing their own vulnerability to exchange rate movements. If a substantial portion of debt is denominated in foreign currencies, as is often the case in emerging economies, the resulting currency mismatch between foreign-currency debts and revenues means that an exchange rate depreciation can lead to an increase in the domestic currency cost of repayments without a commensurate increase in ability to pay.⁶

Prior to the 1997 crisis the private sector had a number of incentives to borrow from abroad, resulting in substantial currency mismatches on corporate balance sheets. Tight monetary policy, a lack of domestic liquidity, and the absence of a domestic bond market all motivated firms to source their funding offshore. Importantly, currency risk appeared low as movements in the exchange rate were constrained by a policy of tightly managed depreciation (of around 5 per cent per year) against the US dollar. While corporate revenues were primarily domestic, the exchange rate peg meant that the ensuing currency mismatches were not generally viewed as cause for concern, and short-term external debts were rolled over relatively easily.⁷

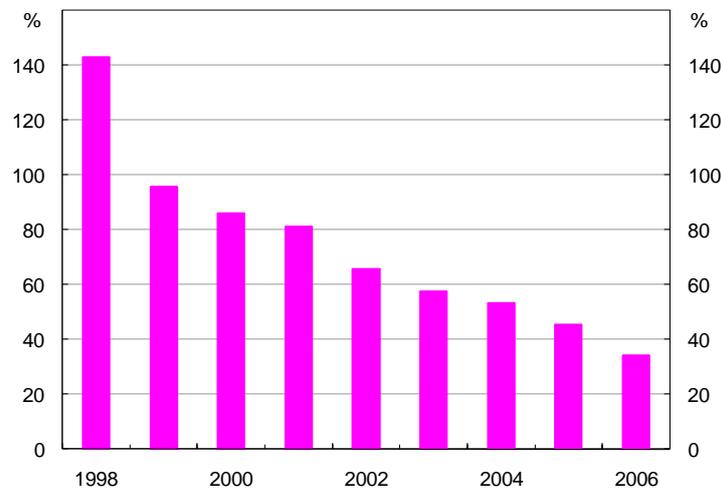
However, as the rupiah depreciated during the 1997 crisis, firms were suddenly confronted with a large increase in the rupiah value of their external debts. As most of their liabilities were short-term in nature, they had little time to restructure their debts, adding a maturity mismatch problem to that of the currency mismatch. These problems quickly flowed through to the banks, which had matched the currency composition of their assets and liabilities by extending credits in foreign currency, but whose balance sheets nevertheless deteriorated. This was because the credit quality of banks' foreign currency assets (which were mainly loans to the corporate sector) became severely impaired, even though the valuation effects of the depreciation may have been reflected on both sides of their balance sheets. The government's finances were similarly adversely affected. Taxation revenues from the private sector declined, while expenditures on safety net programmes and subsidies aimed at alleviating the burden of the crisis on the poor increased. As a result, the government's ability to service its external debt also weakened significantly.

Prima facie, it appears that both public and private sector balance sheets have become less vulnerable to exchange rate depreciations in the post-crisis period. The level of external debt outstanding as a proportion of GDP is one indicator that suggests that declines in the exchange rate may now affect the debt servicing burden less adversely than previously (Figure 15). Unfortunately, as is the case for most emerging market economies, the lack of available data makes it difficult to conduct a fully-fledged balance sheet analysis in the Indonesian case. In particular, data on private sector balance sheets (particularly the currency composition of assets) are generally unavailable or inaccurate.

6. Also, if an increase in the domestic interest rate is used to stabilise the exchange rate, domestic currency borrowers will instead be adversely affected.

7. This discussion of the crisis draws heavily on Kusumaningtuti (2004).

Figure 15
External debt outstanding
Per cent of GDP



3.3.1 *Public sector balance sheets*

An exchange rate depreciation may affect government finances in a number of ways. A decline in the exchange rate will increase the domestic currency cost of servicing foreign debt, which is generally denominated in foreign currency. Hence if a large proportion of the public debt is sourced from offshore, this may leave the budget vulnerable to exchange rate depreciation, reducing the capacity of fiscal policy to respond to a negative economic shock. Government finances may also be adversely affected by exchange rate declines if the government chooses to guarantee or bail out private sector entities (and banks in particular) that have currency mismatches on their own balance sheets, as was the case in the 1997 crisis.

As a result, the authorities may have strong incentives to prevent the exchange rate from falling sharply. However, the data show that public sector external debt has remained relatively flat in absolute terms since the crisis, suggesting no increase in vulnerability to exchange rate movements (Figure 16). The government has also gradually increased its use of domestic debt finance, while attempting to facilitate the development of a domestic bond market, both of which should assist in mitigating balance sheet risks (Bank Indonesia, 2006).

3.3.2 *Private sector balance sheets*

Figure 16 also shows that the level of corporate foreign debt has fallen in absolute terms since 1998, suggesting that the vulnerability of corporate sector balance sheets to exchange rate movements has declined (assuming that levels of foreign currency assets have risen over the same period, or at least not fallen by as much as foreign currency debt). While data on the foreign currency assets of the corporate sector are sparse, data on the currency composition of financial sector balance sheets is slightly better. Figure 17 shows that commercial banks' foreign currency deposits have exceeded their foreign currency credits since 1999, unlike in the pre-crisis period when the currency composition of banks' assets and liabilities were more

closely matched. However, the lower foreign currency credits may simply reflect an attempt on the part of the banking sector to reduce their credit risks, in the light of their experience during the crisis. Perhaps more importantly, the foreign currency composition of commercial banks' balance sheets has fallen in recent years on both the asset and the liability side, suggesting reduced exposure to foreign exchange risk overall (Figure 18).

Figure 16

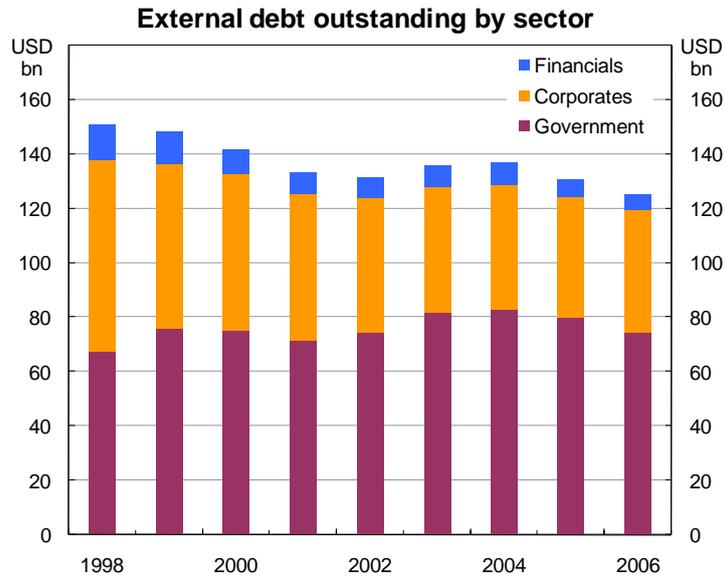


Figure 17

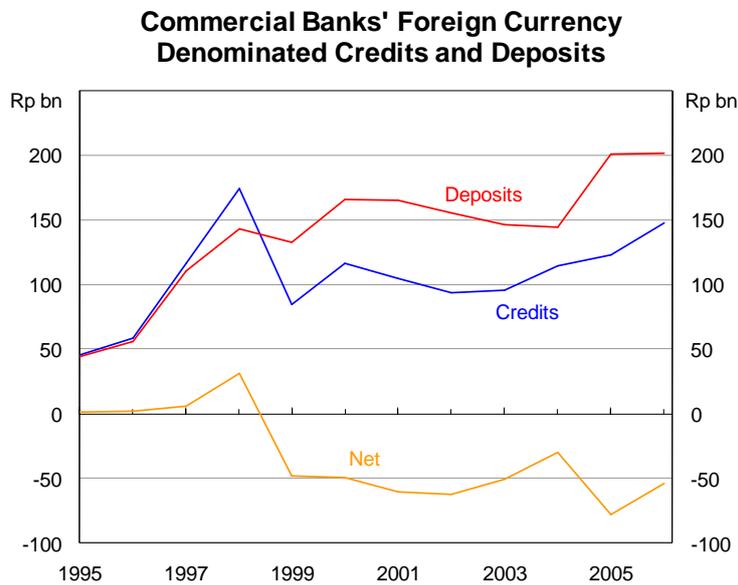
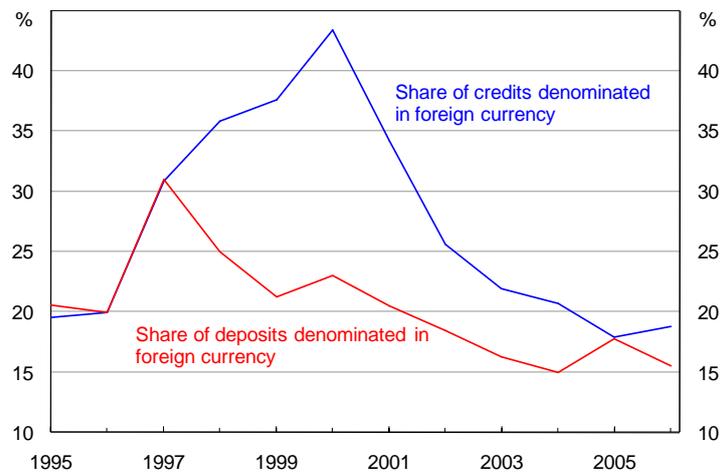


Figure 18
Share of Credits and Deposits Denominated in Foreign Currency
 Commercial banks, per cent of total



4. Policy implications and conclusion

- The main determinants of exchange rate movements in Indonesia are market sentiment and capital flows. Many of the other ‘traditional’ exchange rate determinants (such as interest rate differentials and the terms of trade) do not seem to apply to the rupiah, possibly because it continues to be fairly closely managed.
- BI’s motivations for maintaining the stability of the exchange rate may include the perceived inflationary effects of exchange rate depreciation and the potential adverse effects of instability / appreciation on the traded sector.
- But although the effects of exchange rate movements in the post-crisis period have not been entirely clear empirically, it appears that these vulnerabilities are not as great as they might have been previously. Exchange rate pass-through appears to be declining. The effect of exchange rate movements on the traded sector is ambiguous at best. Balance sheet vulnerabilities appear to be stable or falling.
- That said, there are possible non-linearities in the effect of exchange rate movements on inflation, traded sector, balance sheets, etc (i.e. a large exchange rate movement may have a disproportionately large impact on these variables), which are hard to predict given that rupiah movements have been muted post-crisis.
- Also, monitoring the exchange rate and intervening in certain circumstances is not necessarily incompatible with inflation targeting. For instance, if the exchange rate threatens to move inflation outside its target, a monetary policy response may be warranted. In 2000 (and to an extent in August 2005), Indonesia instigated monetary policy tightening in response to the inflationary threat associated with significant currency weakness.
- However, current circumstances are somewhat different. Inflation is well outside its target band, and for a number of years the nominal exchange rate has been stable and at a lower level than that suggested by Indonesia’s persistent surpluses on both the

current and capital account. Allowing the rupiah to appreciate may therefore help to reduce inflation by reducing the price of imported goods and reducing the pressure on the money supply.

Appendix A

Table 1: Results of Unit Root Tests

Variable	ADF Test	PP Test
<i>LRPUSD</i>	-3.557	-3.042
<i>LREER</i>	-0.719	-0.690
<i>RDIF</i>	-1.254	-1.106
<i>LTOT</i>	-0.760	-0.728
<i>LCRISK</i>	-0.623	-0.045
<i>LGLOBAL</i>	-2.886	-2.727
<i>LNFA</i>	-0.430	-0.430

Notes: Critical value for ADF test is -2.90 for 5%; 3.51 for 1%.
Critical value for PP test: -2.90 for 5%; 3.51 for 1%.

Table 2: Estimation Results for the Variables in Level

	NER	REER
<i>Interest Rate Differential</i>	-0.008* (0.004)	0.009* (0.003)
<i>Terms of Trade</i>	1.041* (0.369)	0.222 (0.335)
<i>Country Risk</i>	-1.096* (0.457)	-1.828* (0.411)
<i>Global Risk</i>	-0.1337 (0.125)	-0.072 (0.142)
<i>Net Foreign Assets</i>	0.025 (0.106)	0.243* (0.090)
Adj. R ²	0.333	0.830
Durbin Watson	0.696	0.914

Notes: Numbers in the parentheses are standard errors.
* denotes significance at 5% significance level.

Table 3: Estimation Results for the Variables in Difference

	Lag	NER	REER
<i>Error Correction Term</i>	1	-0.252* (0.076)	-0.344* (0.102)
<i>Exchange Rate</i>	1	0.448* (0.125)	0.370* (0.129)
<i>Interest Rate Differential</i>	0	-0.007 (0.006)	-0.005 (0.007)
	1	-0.011* (0.006)	-0.005 (0.007)
<i>Terms of Trade</i>	0	-0.505* (0.214)	-0.407** (0.236)
	1	-0.086 (0.229)	-0.169 (0.247)
<i>Country Risk</i>	0	0.284 (0.303)	0.168 (0.352)
	1	-0.077 (0.231)	0.037 (0.261)
<i>Global Risk</i>	0	0.023 (0.066)	0.035 (0.074)
	1	-0.013 (0.064)	0.026 (0.072)
<i>Net Foreign Assets</i>	0	-0.256* (0.080)	-0.171** (0.089)
	1	0.167 (0.084)	0.040 (0.094)
Adj. R ²		0.432	0.323
Durbin Watson		2.092	2.113

Notes: Numbers in the parentheses are standard errors

* denotes significance at 5% significance level;

** denotes significance at 10% significance level.

Appendix B

Table 1: First step estimation results
Long-run elasticities (1995Q1 – 2008Q1)

	Export volumes (<i>lxvol</i>)	Import volumes (<i>lmvol</i>)
<i>constant</i>	-0.818	-1.513
<i>lreer</i>	-0.044	-0.090
<i>lgdpf</i>	1.245	1.465
Summary statistics		
Adjusted R squared	0.640	0.540
Durbin-Watson statistic	0.547	0.315
t statistic of Augmented Dickey-Fuller test on residuals	-2.788	-2.945

Table 2: Second step estimation results
Short-run elasticities (1995Q1 – 2008Q1)

	Changes in export volumes (<i>dxvol</i>)		Changes in import volumes (<i>dmvol</i>)	
	AIC preferred model	Baseline model (no lags)	AIC preferred model	Baseline model (no lags)
<i>constant</i>	-0.019 (-1.100)	-0.016 (-0.839)	-0.022* (1.961)	0.000 (0.023)
<i>error correction term</i>	-0.217** (-2.573)	-0.277*** (-3.578)	-0.203*** (-3.023)	-0.204*** (-2.743)
<i>dreer</i>	-0.450*** (-5.296)	-0.589*** (-6.441)	-0.355*** (-4.181)	-0.404*** (-4.144)
<i>dreer_{t-1}</i>			-0.276** (-2.071)	
<i>dreer_{t-2}</i>	-0.233*** (-2.835)			
<i>dreer_{t-3}</i>	0.320*** (3.403)			
<i>dgdpf</i>	2.767** (2.090)	2.802* (1.840)		
<i>dgdpd</i>			2.259*** (3.099)	1.113* (1.902)
<i>dgdpd_{t-3}</i>			1.435*** (2.738)	
Summary statistics				
Adjusted R squared	0.666	0.508	0.546	0.337
Standard error of the regression	0.063	0.076	0.070	0.083
Durbin-Watson statistic	2.242	2.111	2.072	1.836
Akaike information criterion	-2.562	-2.246	-2.368	-2.061

Notes: t statistics are in parentheses. One, two, and three asterisks indicate that the coefficient is significant at 10, 5 and 1 per cent levels respectively.

Table 3: Granger causality tests
Changes in export volumes (*dxvol*) and import volumes (*dmvol*)

	Test sample	
	Mar 1995 to Mar 2008	Mar 1998 to Mar 2008
<i>dmvol</i> → <i>dxvol</i>	Yes (0.059)	Yes (0.082)
<i>dxvol</i> → <i>dmvol</i>	No (0.772)	No (0.884)

Note: p-values in parentheses. $X \rightarrow Y$ means “X Granger-causes Y”, or, more formally, the rejection of the null hypothesis “X does not Granger-cause Y”, using a Granger causality test with 4 lags and assuming a 0.10 p-value threshold.

Table 4: Exchange rate pass-through to export and import wholesale price indices (WPIs)

	Changes in export WPI (<i>dwpix</i>)		Changes in import WPI (<i>dwpim</i>)	
	<i>constant</i>	-0.035*** (5.278)	0.018** (2.674)	0.023*** (4.093)
<i>dwpix_{t-1}</i>	0.116 (1.514)	0.042 (0.539)		
<i>dwpim_{t-1}</i>			0.308** (2.686)	0.222*** (2.734)
<i>dreer</i>	-0.902*** (-11.463)		-0.491*** (-7.064)	
<i>dneer</i>		-0.845*** (-10.903)		-0.512*** (-10.790)
Summary statistics				
Adjusted R squared	0.775	0.757	0.559	0.751
Standard error of the regression	0.039	0.040	0.032	0.024
Durbin-Watson statistic	2.054	1.584	2.152	2.376

Notes: t statistics are in parentheses. One, two, and three asterisks indicate that the coefficient is significant at 10, 5 and 1 per cent levels respectively. The estimation sample is from Mar 1998 to Mar 2008.

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