Indonesian Macro Policy Through Two Crises

Prayudhi Azwar and Rod Tyers

Indonesia fielded shocks due to the Asian Financial Crisis (AFC) and the Global Financial Crisis (GFC) quite differently. Financial contagion, policy misdirection, panic and political upheaval saw the AFC bring economic collapse. The GFC, however, brought about real domestic growth of 6.1 per cent (2008) and 4.5 per cent (2009)—amongst the world's best performances at the time. This paper reviews these events and employs numerical modelling of stylized AFC and GFC shocks to show that some of the contrast stems from differences in the shocks and intervening changes in Indonesia's economic structure. Critically, IMF conditionality during the AFC required unsustainably contractionary reforms. Capital flight elements were present in both crises, however, and exchange rate depreciations and money-financed fiscal expansions are shown to have contributed significantly to resolution.

1. Introduction

Indonesia has an open, developing economy that has been affected, occasionally dramatically, by shocks from abroad. The most substantial of these was the Asian Financial Crisis (AFC), which was transmitted from elsewhere in Asia via financial markets, eventually precipitating capital flight and a full run on the Indonesian currency (McLeod 1998; Berg 1999). The result was an extraordinary currency depreciation, a loss of financial stability and a dive in overall macroeconomic performance. In spite of its external origins, and in part because of the coincidence of an initially misdirected policy response and a reversal that triggered a panic and domestic political upheaval, this particular crisis left Indonesia with remarkably poor performance relative to all the countries affected (Djiwandono 2007).

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By contrast, during the Global Financial Crisis (GFC) a decade later, when most nations slumped into recession on the heels of the financial collapse in the US, the Indonesian economy slowed but did not recess, achieving real growth of 6.1 per cent in 2008 and 4.5 per cent in 2009. Indeed, the country's real GDP growth in 2009 was the third strongest in the G20, after China and India (OECD 2010). Two associated issues are addressed in this paper. First, this contrast in performance is seen to have two origins. On one hand, there were differences in the size and maturity of the economy over the intervening decade, and in the composition of the AFC and GFC shocks. More importantly, in our view, Indonesia's macroeconomic policy regime at the time of the AFC was unsustainable during a capital flight, leading to a policy reversal and an associated loss of confidence, which precipitated an extraordinary depreciation, large rises in debt service burdens, insolvencies and the temporary sequestering of physical capital. This clearly contributed to political upheaval, which further eroded confidence at the time.

Second, since both crises had elements of capital flight, with bond spreads indicating initial rises in investment risk premia of similar magnitude, this paper seeks to decompose the policy responses and identify the specific macroeconomic regimes that led to their ultimate resolution. Although there was some repatriation of foreign currency reserves in each case, this analysis suggests that the key elements were currency depreciations combined with fiscal expansions that depended, at least partially, on borrowings from Bank Indonesia, or money financing (Basri 2012). Indonesia's government entered the early stages of the AFC under pressure from the IMF to defend its de facto fixed exchange rate, reduce key subsidies and close insolvent banks, all of which proved to be contractionary in the ensuing capital flight, eventually engendering reversal and a currency float. Yet, at the time of the GFC, there was no policy reversal towards this regime. Having learned from its AFC experience, the Indonesian government implemented the policies that eventually worked in the GFC immediately. This was, however, also accompanied by a substantial depreciation, a rise in inflation and some labour dislocation, but these effects were far more moderate than their counterparts during the AFC.

The macroeconomic analysis applied here is based on an elemental economy-wide model that simulates interlinked changes in the labour market, the financial capital market and the markets for home money and foreign exchange. It is constructed in the Mundell (1963) –Fleming (1962) tradition, as updated by McCallum and Nelson (1997), with flexible price levels and expectational shocks. This conventional technique, applied to completely separate databases for 1996 and 2007, allows the decomposition of the effects of both external shocks and domestic policy responses so that relative contributions of each can be estimated.

The section to follow offers a short outline of events surrounding the AFC, while the third section provides similar background in the case of the GFC. The model used is detailed in the subsequent section, and the analysis of component AFC shocks and their impact is presented in the fifth section. The corresponding analysis of GFC shocks is presented in the sixth section, and the final section concludes.

2. The Asian Financial Crisis (AFC)

The AFC occurred during a period of strong performance in the advanced economies outside Asia, driven by the US information technology (IT) boom. Even in the Asian region, the Chinese economy grew strongly, as did that of Australia. As Figure 1 shows, asset markets were also strong in the lead-up, even during the crisis, at least for those economies not directly affected by it. The apparently sound macroeconomic conditions prevailing prior to 1997 saw almost no economic experts predict that the AFC would cut the Southeast Asian economies in general, and Indonesia's economy in particular, so deeply (Hofman, Rodrick-Jones, and Thee 2004). Indeed, the World Bank had just published its spectacular tome, *The East Asian Miracle: Economic Growth and Public Policy*, lionizing the policy regimes of the East and Southeast Asian governments (MacDonald 1993)[1] and Hal Hill's detailed

FIGURE 1
Asset Price Indices during the AFC and GFC
(Indices January 1995 = 1.0, January 2005 = 1.0)
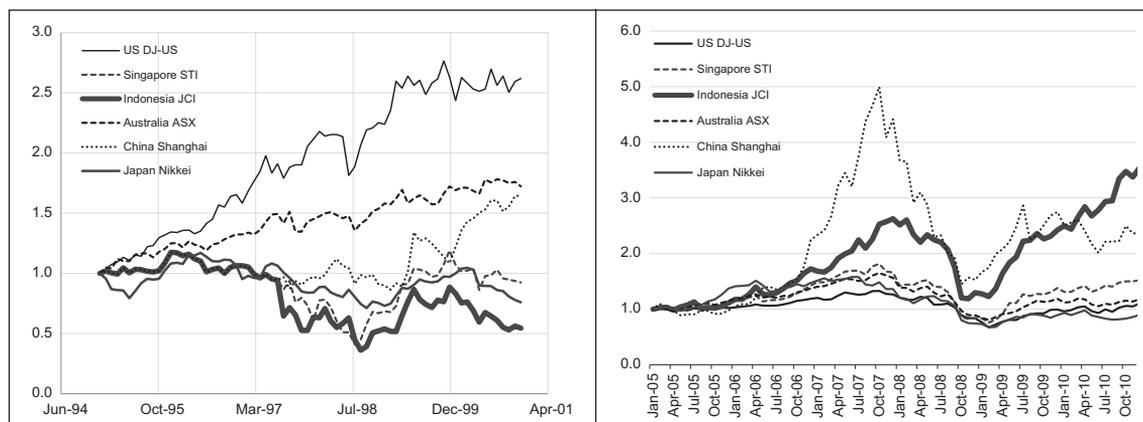
SOURCE: FRED, Quandl and Bloomberg.

analysis of the Indonesian economy, again with an optimistic tone reflecting the strong performance of the earlier 1990s, had emerged the year before the crisis (Hill 1996). The irony is evident in the title of the first book on the crisis to emerge afterwards: *East Asia in Crisis: From Being a Miracle to Needing One* (McLeod 1998).

The origins of the crisis were manifold, combining weakly supported US dollar pegs in Southeast Asia and Korea with the rapid expansion of competitive Chinese exports. Chinese competitiveness was supported at the time by its new (since 1994) US dollar peg and a depreciating underlying real exchange rate due to rapid Chinese reserve accumulation (Tyers, Bu, and Bain 2008).[2] An immediate trigger was a real depreciation of the yen relative to the US dollar, which was associated with a policy switch from monetary contraction to expansion in Japan as it struggled to deal with the banking crisis that underlay its first decade of stagnation (Horiuchi 1998; Tyers 2012). The considerable effect of this switch on the value of the yen, illustrated in Figure 2, proved important in Southeast Asia because Thailand and Indonesia, in particular, had received extensive foreign direct investment (FDI) from Japan since the 1980s. This was investment of the outsourcing type, which saw both countries depending increasingly on exports to Japan rather than to the US, notwithstanding their US dollar pegs. The strength of Indonesia's dependence on exports to Japan is evident from the export shares also shown in Figure 2. Further evidence of this can be seen from Figure 3, which, despite the beginnings of a depreciating trend against the US dollar, shows a sharp appreciation of the Indonesian rupiah against the yen just prior to the AFC.

Despite the immediate negative shock emanating from Japan, and the associated drop in exports destined for Japan illustrated in Figure 4, redirection to such destinations as China ensured that there was no significant net export demand shock. Instead, the Japanese depreciation and its effect on the terms of trade directed attention to fundamental problems with the Thai and Indonesian de facto US dollar pegs, undermining the confidence of domestic and foreign investors. Financial collapse began in Thailand and spread quickly to Indonesia, taking the form of an increase in the risk premium on Indonesian asset returns, precipitating a capital flight that developed into a run on the Indonesian currency, widespread

FIGURE 2

Yen-US Dollar Exchange Rate and Indonesian Exports Shares by Destination
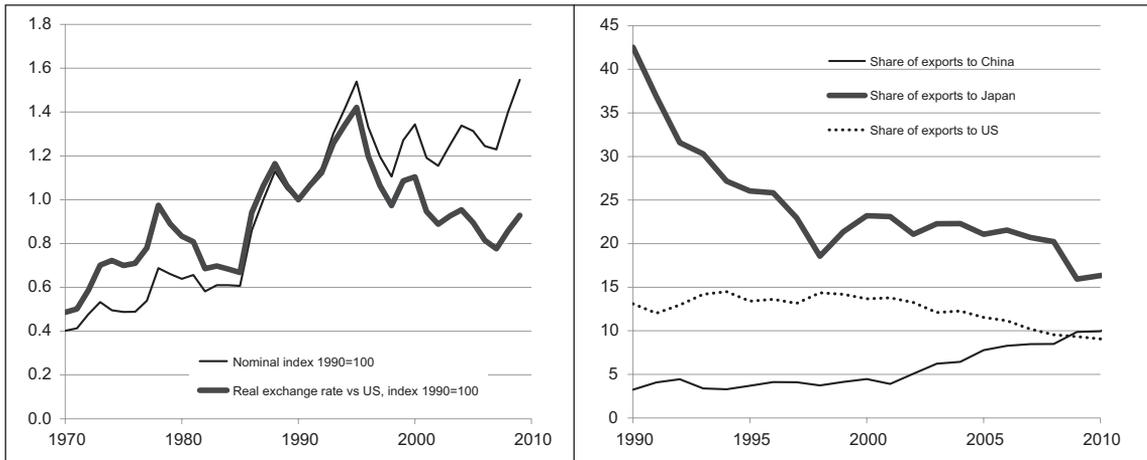
SOURCE: Nominal and real exchange rates are from Tyers (2012). Trade shares are derived from UN Comtrade data by Bank Indonesia.

FIGURE 3

AFC and GFC Exchange Rates, against US Dollar , RMB, Yen and Euro
(per 1,000 rupiah, indexed January 1996 = 1, January 2007 = 1)
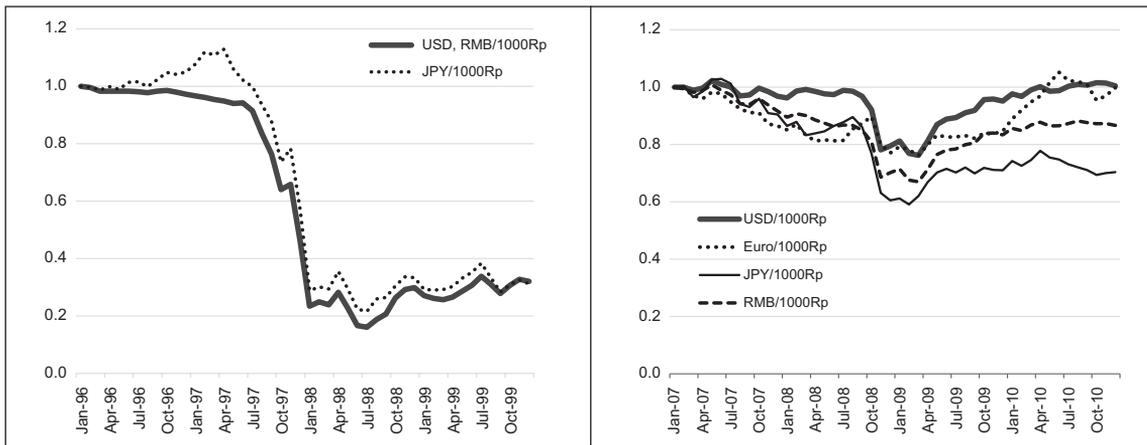
SOURCE: Bank Indonesia, Oanda and Federal Reserve Bank.

FIGURE 4
Monthly Indonesian Export Revenue by Key Destination
(Indices January 1995=1.0, January 2005=1.0)
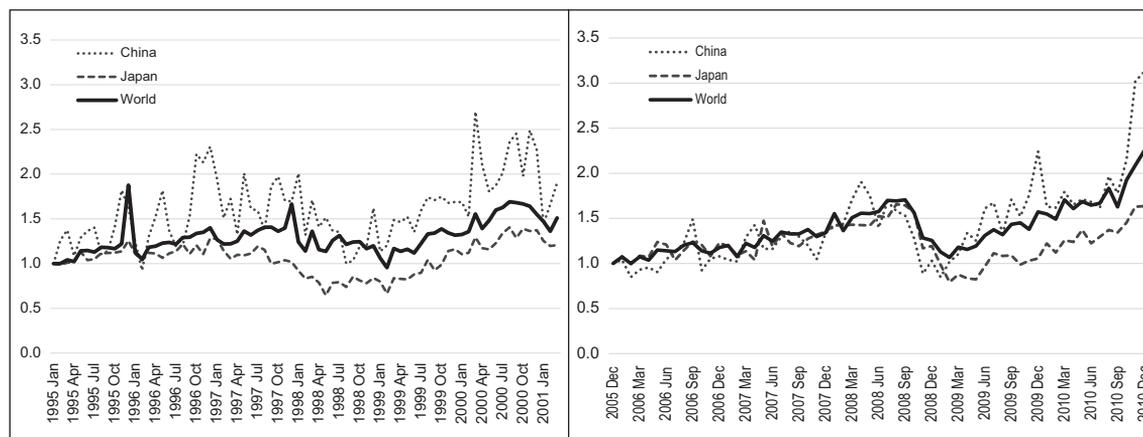
SOURCES: UN Comtrade, Bank Indonesia.

insolvency in the manufacturing and financial sectors, followed by shut-downs and the sequestration of manufacturing capital.

Indonesia's particularly deep crisis could be seen as rooted in a combination of external and internal problems. As for other affected countries, these included adherence to Indonesia's de facto US dollar peg. Financial yields inside the Indonesian economy were higher than those abroad, due primarily to regime risks perceived externally, as indicated in Figure 5. Yet, the exchange rate peg created moral hazard, which led Indonesian investors to borrow abroad at lower rates (Corsetti 1999). The volume of this debt eventually proved too large for the central bank to protect with the foreign reserves available. A complicating factor was the rise in short-term foreign currency debt, which was mostly unhedged and characterized by "double mismatch" (maturity and currency). These issues sat alongside particular weaknesses in Indonesia's commercial banking sector at the time. It carried high levels of non-performing loans, along with short-term debt denominated in domestic and international currencies.[3]

The composition of Indonesia's foreign liabilities is suggested by the investment flows on its balance of payments illustrated in Figure 6. Portfolio flows are clearly more volatile than FDI and, during the AFC and the GFC, there were considerable net outflows.[4] Yet, the level of gross external debt, relative to national income, which rose unprecedentedly during the AFC, has been stable at half its pre-AFC level since then, as indicated in Figure 7. While the preponderance of portfolio liabilities did make a financial retreat easier, we see this as arising out of the moral hazard and the structural problems that inhibited Indonesia's attractiveness as an investment destination at the time.

The "microeconomic reform" tradition had swept the advanced and developing world in the late 1980s and early 1990s and many countries embarked on the abrupt liberalization of their financial industries, inviting offshore capital movements. Indonesia was no exception, but its capital inflow was comparatively large, causing a considerable surplus on the capital account, booming investment and strong consumption demand. These factors raised the current account deficit and brought inflationary pressure. Overall, the volatility of Indonesia's economy rose. The policy settings of the time created a capital market system

FIGURE 5
Bond Yields through the AFC and GFC
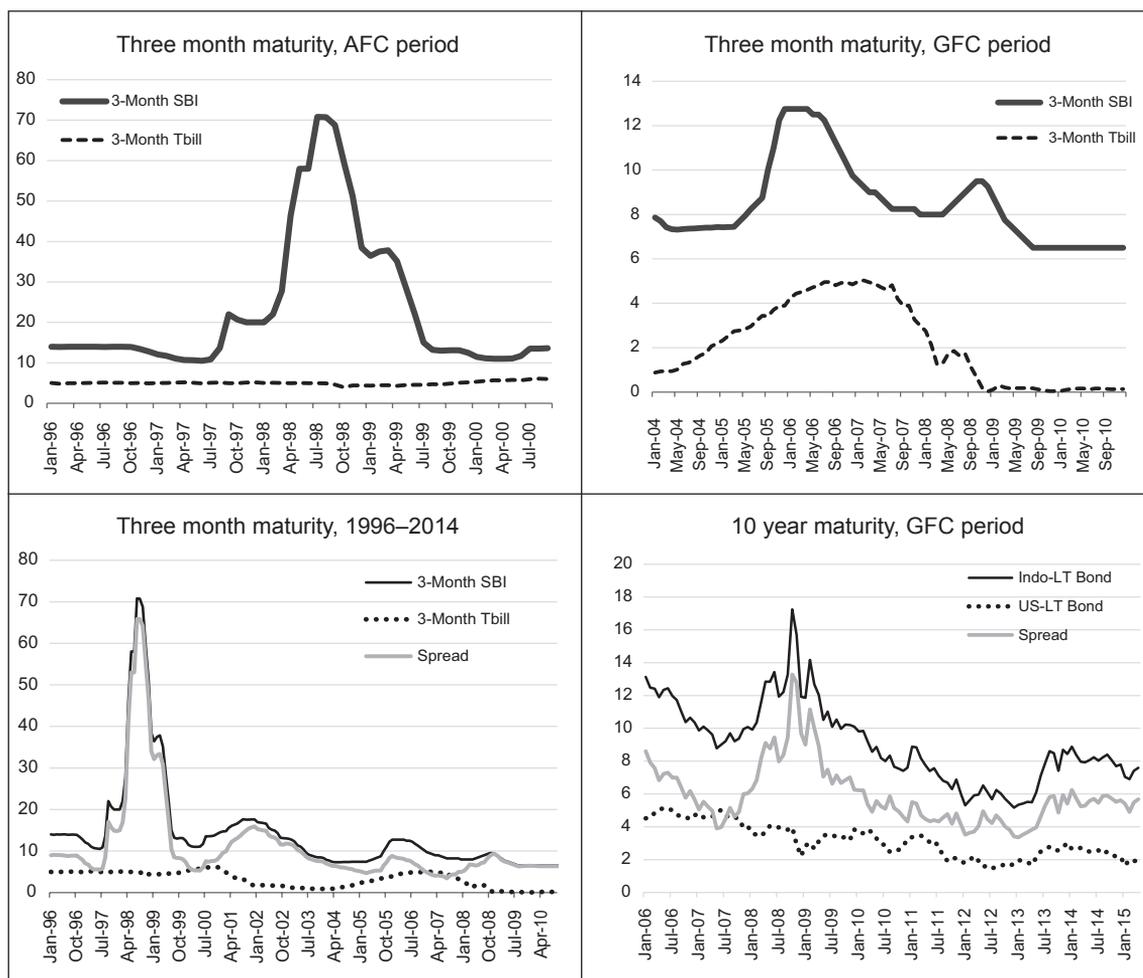
SOURCE: Bank Indonesia and Federal Reserve Bank.

that was highly volatile, subject to long-term swings and susceptible to contagion (Eatwell and Taylor 2000). This was exacerbated by the problem of crony capitalism, which cemented the triangular relations among government, industries, banks and political connections, leading to external debt accumulation and the weakening of institutional and manufacturing competitiveness. Overall, this comparatively poor performance by Indonesia is clear from Table 1.

It has since become widely conceded that a key additional cause of the depth of Indonesia's crisis was erroneous advice from the IMF in the early stages (Wade and Veneroso 1998; Stiglitz 2002). At the time, the crisis was seen as a standard current account adjustment problem that demanded monetary tightening, fiscal contraction (curtailment of food and fuel subsidies), removal of inefficient trade distortions and the closure of insolvent banks. While these policies made sense in the years leading up to the AFC, the need

FIGURE 6
Portfolio and Direct Investment Flows on the Balance of Payments
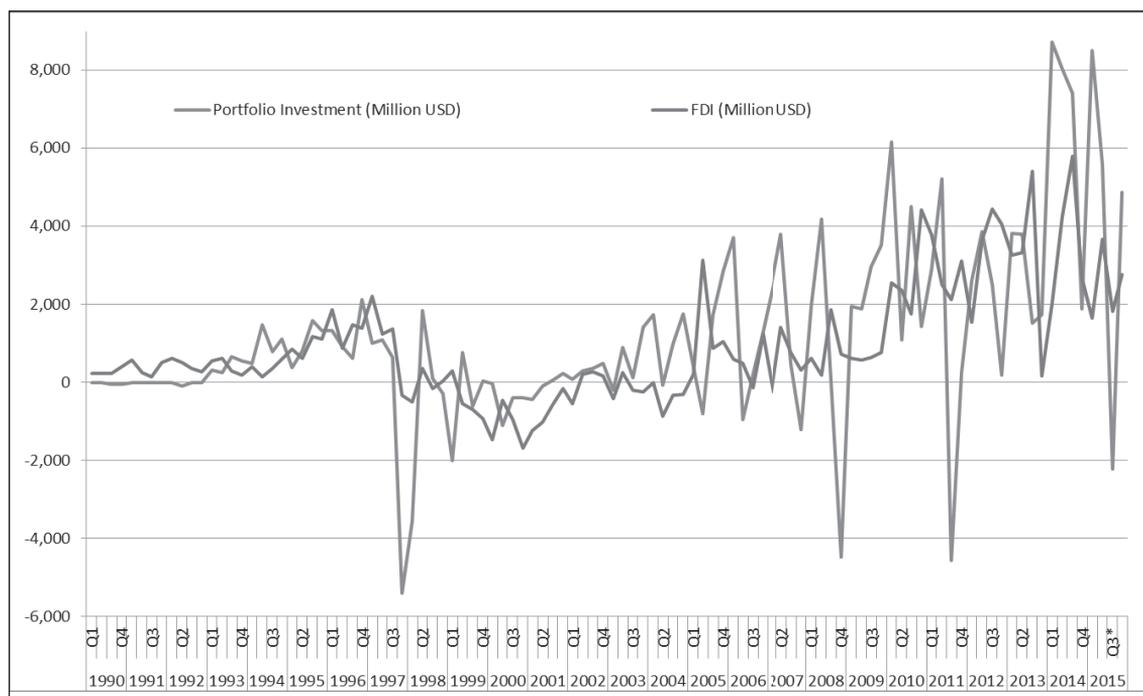
for IMF balance of payments support when the contagion began, and the IMF's emphasis on such reforms as conditionality, meant that the government's initial embarkation on them was poorly timed. They had a destructive impact on corporate profitability, including in the banking industry, and thus it intensified the crisis. Indeed, the closure of sixteen nominally insolvent banks during rapidly changing circumstances precipitated runs on the remaining banks.[5]

When Bank Indonesia was no longer able to defend the value of the rupiah, the policies had to be discarded, and so the exchange rate intervention band was widened on 11 July 1997 and a float commenced on 14 August 1997 (Figure 3). This policy reversal came as a shock to the financial community, precipitating a panic and an extraordinary depreciation. It exacerbated the transition of the crisis from the financial sector to the real sector, since borrowers were then faced with both depreciation enhanced debt service costs as well as outstanding debts. Insolvencies were then prominent, particularly in the heretofore expanding manufacturing sector, leading to capital sequestration and unemployment.

3. The Global Financial Crisis (GFC)

The GFC was characterized by a series of shocks, primarily to the economies of the US and UK. These followed a period of declining long bond yields (Arora and Tyers 2011), a sharp monetary tightening (upturn in US short yields) following the oil price shock that began in 2004 (Arora, Tyers, and Zhang 2015) and little-constrained financial innovation (credit default swaps and securitization) that ran ahead

FIGURE 7
Gross External Debt to GNI Ratio (Percentage)
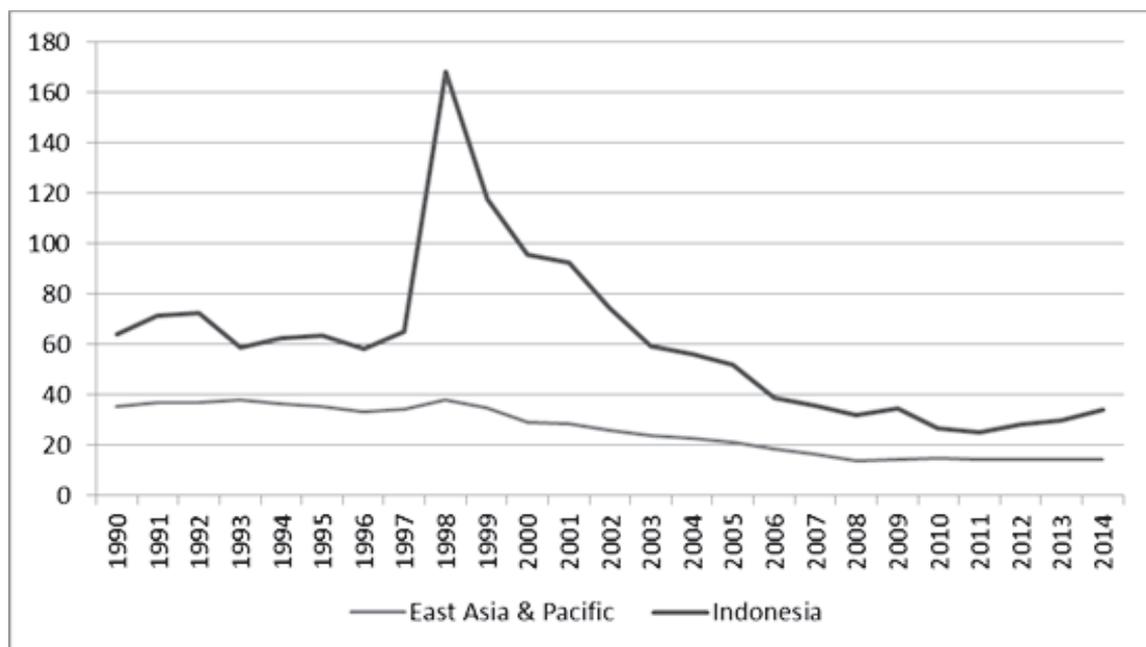
of regulation and ratings practice (Gorton 2010). Its effects were global, with some capital outflow from the US rising as the boom in its asset markets ended, followed by financial contraction in late 2008 and a global retreat to US dollar holdings. The short-term effects on asset prices in East and Southeast Asia were proportionally larger than those originating in the US financial market, as seen in Figure 1, due to global portfolio rebalancing that caused comparatively large changes in holdings in the smaller yet open financial markets.[6] Notwithstanding this asset market volatility, the Financial Stability Index of Indonesia during the GFC was far more constrained than it had been during the AFC, as seen in Figure 8.

While the lead-up to the GFC saw some escape from US assets and therefore financial flows into the "economies in transition", these flows were not significant in Indonesia. With the American financial crash and the failure of US monetary policy to stem deflation, there was a global retreat to the holding of money in general, and US dollar in particular, which would offer substantial real yields so long as US deflation continued. This led to a capital flight from Indonesia, a dip in its asset prices (Figure 1) and a spike in home long bond yields (Figure 5). The outflow put downward pressure on the currency, which was allowed to float from the outset (Figure 3). This was the major consequence for Indonesia from the GFC.

Unlike the AFC, the transition to Indonesia's real sector during the GFC did not result in vast insolvencies and capital sequestration. But the real sector was affected, this time by the corresponding transition in the US, and Europe ("from Wall Street to Main Street"), which arose from the contractionary effects of the deflation and the breakdown of financial sector services to solvent firms seeking refinance. Demand in the US then contracted and the country's major exporters were hit hard. These included Japan,

TABLE 1
Indonesia and ASEAN Countries Economic Performance (AFC)

	Indonesia	*Malaysia*	*Singapore*	*Thailand*
GDP Growth				
1991–95	7.8	8.7	8.5	8.6
1996	8.0	8.6	6.9	5.5
1997	4.7	8.0	7.8	–0.4
1998	*–13.6*	–6.7	1.3	–6.5
Inflation				
1991–95	8.9	3.6	2.6	4.8
1996	6.5	3.5	1.4	5.8
1997	11.6	2.6	2.0	5.6
1998	*65.0*	5.4	–0.2	8.1
CA/GDP				
1991–95	–2.4	–7	12.9	–6.2
1996	–3.3	–4.9	15.0	–7.9
1997	–2.9	–5.2	15.4	–2.0
1998	*5.4*	7.5	17.8	8.1
Budget/GDP				
1991–95	–0.2	0.3	12.4	2.8
1996	1.2	1.1	13.9	2.4
1997	1.2	5.5	6.0	–0.9
1998	*–5.5*	–1.0	–1.0	–4.5

Source: Hill (1999).

China and Korea, whose imports of manufacturing components collapsed, affecting Indonesia as it did the other economies in East and Southeast Asia, whose exports were in the process of redirection towards China.[7] As Figure 4 shows, there was a significant negative shock to total Indonesian export demand, which was simultaneous across all the major export destinations.

There are several possible reasons why Indonesia proved able to handle the GFC better, and to become the third fastest growing country in the G20. Some of these are readily amenable to the quantitative analysis on which this study embarks in the sections to follow. Others are less easy to observe in the available data, or to analyse with the small open economy model the paper offers, and so we note them here for completeness. First, Indonesia's economic fundamentals prior to the GFC were stronger. Compared with the lead-up to the AFC, it had high economic growth; low and stable inflation; a lower and still-declining debt-to-GDP ratio (Figure 7); higher international reserves; reformed institutional and business regulation; and strengthened corporate balance sheets. Second, although a drop in export demand was an important negative shock, the distribution of Indonesia's exports was more evenly spread across product lines (manufactures and commodities) and the rising share of its exports destined for still-growing China (Figure 2) offered some diversification gains. Moreover, as Figure 4 indicates, Indonesia's performance in the recovery phase was bolstered by further strong growth in its trade links with China.

FIGURE 8
Indonesia Financial Stability Index, 1996–2012
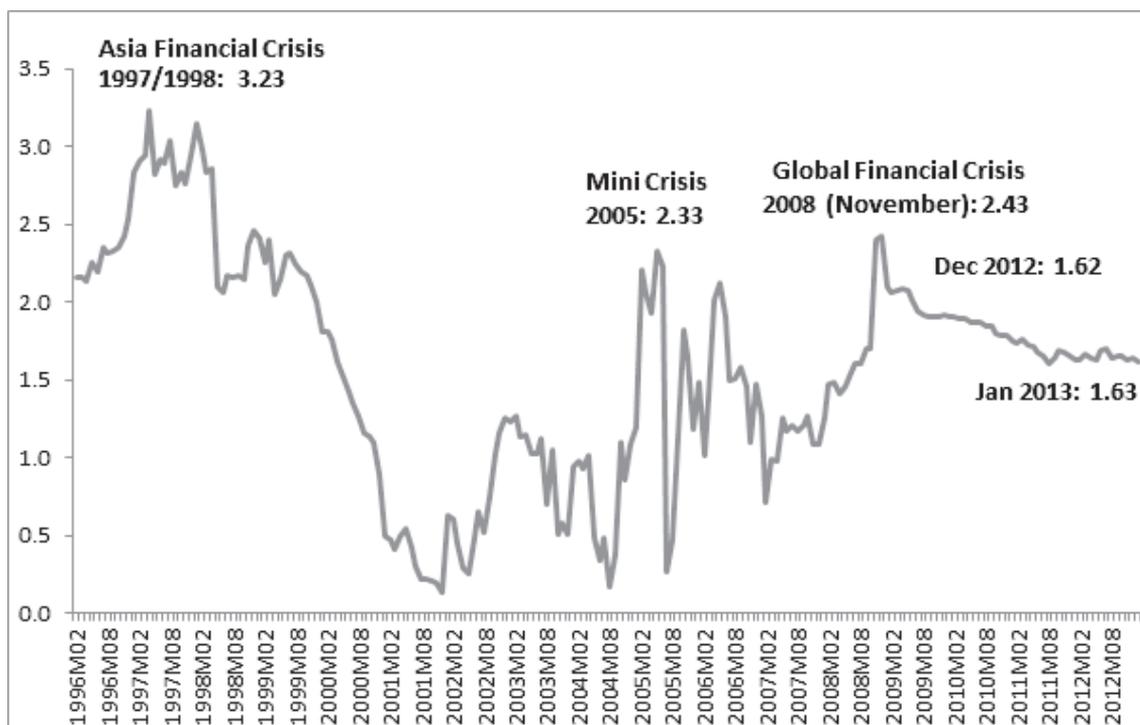
SOURCE: Bank Indonesia (2012).

Third, Indonesia had become a more advanced economy during the prior decade. Still the world's fourth most populous country, it had enjoyed a 29 per cent increase in GNI per capita in the decade since 1999 (World Bank 2013). This implied greater savings and a smaller proportion of its populace near the poverty boundary, providing a cushion against global turbulence. Fourth, the GFC originated from developed countries (the US and Europe) and, although there was capital flight from Indonesia, the financial contagion did not have the depth and proximity that it had during the AFC. The growth of nearby China and Indonesia's potential to further expand associated exports were a source of confidence that militated against a full-on currency run of the type that had occurred previously.

Fifth, the more flexible (dirty float) exchange rate regime was an effective buffer to domestic inflation. The rupiah floating rates against the RMB, the yen, the euro and the US dollar can be seen in Figure 3. These show the importance of the trade relationships with China and Japan in that, post-GFC, a return to pre-GFC parity was permitted against the US dollar but not against the yen or RMB, the currencies of Indonesia's principle export destinations. This path was influenced indirectly by Bank Indonesia, via the accumulation of reserves. Sixth, intervening economic and financial policy reforms had ensured that corporate balance sheets were healthier and commercial banks were more liquid and better capitalized.[8] Seventh, the onset of the GFC did not coincide, as did that of the AFC, with a major political transition.

A more stable and encompassing political environment provided wider participation in economic activity, the incentive for corporate innovation and room for creativity.

4. Modelling the Short-Run Effects of External Shocks

To assess quantitatively the key reasons for Indonesia's improved performance during the GFC and to decompose the effects of the primary shocks from components of the policy response in each case, we construct separate macro models of the Indonesian economy for 1996 and 2007. The models are designed to include the most elemental structures needed to illustrate the comparative effects and the contributions of components of the policy responses. The shocks and responses are therefore necessarily stylized compared with the actual events. The goal is to focus on the decomposition of the effects of the AFC and the GFC rather than to use the models to construct complete counterfactual scenarios. We do, however, use the 1996 model to illustrate the possible effects of the Indonesian government having persisted with its defence of the exchange rate peg at the same time as implementing the IMF's aforementioned conditionality requirements. To do this, we have found it necessary to complicate the models by incorporating both direct taxes, as well as consumption and trade taxes and subsidies. This then forms the basis for an enhanced discussion of a counterfactual pre-float reform scenario.

The models are calibrated to Bank Indonesia national accounts data for Indonesia in 1996 and 2007. They are constructed in the tradition of Mundell (1963) and Fleming (1962), as updated by McCallum and Nelson (1997), incorporating the markets for two products: differentiated home and foreign goods, and three primary factors—production labour, skill and capital.[9] Taxes are included on labour income, capital income, consumption expenditure, imports and exports. They are designed to represent a length of run over which investment contributes to demand but does not change the effective capital stock, so that their primary application is to comparative static analysis of shocks that cause departures from underlying steady state growth paths. The simulated economy is therefore not governed by steady state conditions, and so the expected rates of return that drive investment need not equal the real equilibrium rates of return in simulated financial markets. Moreover, the presented results must be seen as proportional departures from a particular Indonesian steady state growth path that has real GDP rising at something over 5 per cent per year. Expectational variables are included, though they are exogenous, so that unless they are shocked there are no anticipated changes in prices, rates of return, interest rates or exchange rates. All resulting inflations, deflations, depreciations and yield changes are then surprises to all represented agents.

The detailed model analytics are provided in the Appendix. As they indicate, a variety of macroeconomic and trade policies are incorporated and these are all available to construct representative responses to the external crisis shocks. These policy levers are detailed in Table 2. Solutions require a choice of shocks and closures. Closures define variables as exogenous or endogenous, with the number of equations in the models required to be equal to the number of endogenous variables. With the use of the Gempack software, however, it is a simple matter to change variable status from endogenous to exogenous. This allows the determination of the labour market equilibrium in each region (fixed or flexible nominal wage), the fiscal policy regime (fixed nominal or real government expenditure or a fixed nominal fiscal deficit) and the monetary policy regime (whether the target is the price level, the exchange rate or the money supply itself). These options are detailed in Table 3.

Exogenous variables hold their initial (calibrated) values unless they are shocked, allowing the representation of the important shocks occurring during the AFC or GFC. In effect, a shock requires a change to one or more of the exogenous variables and a new solution to the simultaneous equation problem representing the Indonesian economy. Responses to the shocks are then the proportional or levels

TABLE 2
Government Policy Instruments Represented in the Modelling

Policy	*Instrument*	
Fiscal policy	Government spending	G
	Labour income tax	Tax rate, t^L
	Capital income tax	Tax rate, t^K
	Consumption tax (GST)	Tax rate, t^C
	Import tariff	Tax rate, t^M
	Export tax	Tax rate, t^X
Monetary policy	Monetary base, US$ billion	M^B
(application depends on the target of monetary policy)[a]	Rate of increase of official foreign reserves, US$ billion/year	ΔR

NOTES: a: For the alternative targets, see the closures available in Table 4.
SOURCE: See the analytical description of the model in the text.

TABLE 3
Simulation Closures[a]

Closure	
Labour market:	Exogenous nominal production (unskilled) wage with endogenous production employment
Fiscal policy:	Exogenous nominal government spending and endogenous government revenue at exogenous rates of tax (or subsidy) on income, consumption and trade
Monetary policy targets[b, c]	1. Monetary base, M^B 2. Producer price level, P^P 3. Consumer price level, P^C 4. Production employment, L

NOTES:

a. Since the model is a system of non-linear simultaneous equations and more variables are specified than equations in the system, there is flexibility as to the choice of those to make exogenous. This choice mirrors assumptions about the behaviour of labour markets, fiscal deficits and monetary policy targets.

b. Money supplies can be set to target any of the three price levels (consumer, producer and GDP), nominal exchange rates against the US dollar or nominal GDP levels.

c. No changes in commercial bank reserve behaviour are assumed so that money multipliers remain constant.

SOURCE: See the analytical description of the model in the text.

changes in the models' endogenous variables. The composition of these shocks is considered in detail in the following sections.

5. Simulating the AFC Impact and Policy Responses

This section first examines a representative set of fiscal and trade reforms of the type sought by the IMF during the lead-up to the AFC, and imposed by them as conditions attached to financial assistance during the early stages of the crisis. These are examined as short-run shocks from a stable initial equilibrium (or steady state growth path that has real GDP rising at, say, 5 per cent per year). We do not dispute that these reforms would be expansionary for the Indonesian economy in the long run. Instead, we seek to identify whether their short-run effects are contractionary or require particular monetary policy regimes to ensure they yield continuously positive growth effects. The focus then shifts to the AFC shocks, which are detailed in Table 4, and their effects with and without these reforms and before and after the floating of the currency.

5.1 Fiscal and Trade Policy Reforms in the 1996 Economy

A stylized representation of possibly achievable reductions in consumption subsidies and trade taxes is considered. The shocks and assumptions concerning labour market and fiscal policy closures and monetary policy targets are detailed in Table 4. Although the government ran fiscal deficits in both 1996 and 2007, these reforms are simulated on the presumption that government spending on goods and services is adjusted to achieve fiscal balance. The results are summarized in Table 5. The results show that reduced consumption subsidies, reduced import tariff (equivalents) and reduced export tax (equivalents), taken individually, are always contractionary of employment, real GDP and welfare in the short run, even if they are conducted with a floating exchange rate and a monetary target that allows significant consumer price inflation.

In the case of reduced consumption subsidies, under the continuing US dollar peg, the central effect is to increase both private and government savings, which reduces the domestic interest rate and shifts the current account to surplus. This stimulates home investment and, presumably, future growth. In the short run, this might normally be expected to cause a real depreciation and therefore a contractionary deflation, but this effect is moderated by a substantial rise in government spending on goods and services, which could take the form of public investment. All of this is positive in the long run. Even the negative short-run effects of this are moderated by the associated shift in the composition of aggregate demand towards domestic goods, driven by a decline in private consumption (which includes substantial imports) and a rise in government consumption (which is focused on home goods). The net effect is a rise in the relative price of home goods and hence a real appreciation. With the US dollar peg, this implies an inflation across price level indices. The producer price level is the only one to fall, which results in a marginal decline in formal sector employment and in real GDP. The effects are more contractionary of welfare if we measure real incomes in terms of purchasing power at the newly higher consumer prices.

The reductions in trade taxes are more uniformly contractionary in the short run because they divert expenditure away from home goods towards foreign products, a trend that is exacerbated by the contractions in home product intensive government spending that are needed to retain fiscal balance on the loss of trade tax revenue. This causes substantial real depreciations. In the continuing presence of the US dollar peg, these then cause contractionary deflations in the short run. When all the policy reforms are combined under the US dollar peg, the effects remain contractionary in the short run, even though the real depreciation they cause raises competitiveness and stimulates home investment, enhancing future growth prospects that we expect will yield positive net welfare effects in the long run.

TABLE 4
Trade and Fiscal Policy Reform Shocks and Closures[a]

Scenario	Shocks, Percentage and Closure Elements
1. Fiscal reform—reduced consumption subsidy with spending adjustment for fiscal balance	Raise the power of the consumption tax, $(1 + \tau_C)$ by 10 per cent Fiscal deficit exogenous and shocked to zero Government spending, G, endogenous Monetary closure: exchange rate peg, E Labour market closure: fixed nominal wage, W
2. Import tariff reform with spending adjustment for fiscal balance[b]	Reduce the equivalent import tariff power $(1 + \tau_M)$ by 10 per cent Fiscal deficit exogenous and shocked to zero Government spending, G, endogenous Monetary closure: exchange rate peg, E Labour market closure: fixed nominal wage, W
3. Export tax reform with spending adjustment for fiscal balance[b]	Reduce the equivalent export tax power $(1 + \tau_X)$ by 5 per cent Fiscal deficit exogenous and shocked to zero Government spending, G, endogenous Monetary closure: exchange rate peg, E Labour market closure: fixed nominal wage, W
4. Combined fiscal and trade reforms with spending adjustment for fiscal balance[b]	All three tax and tariff reforms simultaneously Fiscal deficit exogenous and shocked to zero Government spending, G, endogenous Monetary closure: exchange rate peg, E Labour market closure: fixed nominal wage, W
5. Combined fiscal and trade reforms with spending adjustment for fiscal balance, but with floating exchange rate[b]	All three tax and tariff reforms simultaneously Fiscal deficit exogenous and shocked to zero Government spending, G, endogenous Monetary closure: target GDP price, P_Y Labour market closure: fixed nominal wage, W

NOTES:
a. These shocks are applied to the Indonesian economy as it is represented by the 1996 database. The database is summarized in Appendix Table A1. The closures, which are selected from the list in Table 3, correspond to the short run with reforms and government spending on goods and services adjusting to achieve fiscal balance. The analysis is intended to suggest the comparative short run effects of the reform agenda proposed by the IMF at the time of the AFC.
b. Import tariff and export tax reform are intended to capture reductions in tariff or export tax equivalents of the myriad distortions affecting tradable prices and quantities.
SOURCE: See the analytical description of the model in the text.

TABLE 5
Simulated Effects of Fiscal and Trade Policy Reforms on the 1996 Indonesian Economy[a]

% changes	Reduced Consumption Subsidy with Spending Adjustment for Fiscal Balance	Import Tariff Reform with Spending Adjustment for Fiscal Balance[b]	Export Tax Reform with Spending Adjustment for Fiscal Balance[b]	Combined Fiscal and Trade Reforms with Spending Adjustment for Fiscal Balance[b]	Combined Fiscal and Trade Reforms, Spending Adjustment for Fiscal Balance, Floating Exchange Rate, PY Target[b]
Domestic real long yield, r	−12.0	2.9	−1.5	−5.4	−9.9
Monetary base, M_B	5.6	−11.2	−5.1	−3.9	0.3
Government spending, G[c]	41.6	−66.0	−48.4	−0.6	1.7
Consumer price level, P_C	9.8	−7.6	−1.8	2.8	7.5
Producer price level, P_P	−0.9	−7.2	−3.4	−5.7	−2.7
GDP price level, P_Y	4.5	−9.2	−4.4	−3.0	0.0
Exchange rate vs US dollar, E	0.0	0.0	0.0	0.0	−5.8
Real exchange rate vs US dollar, e_R	4.5	−9.2	−4.4	−3.0	−5.8
Change in current account $\Delta CA/Y_0$ %	4.6	−1.9	0.7	2.4	3.9
Change in fiscal position $\Delta S^G/Y_0$ %	2.3	2.3	2.3	2.3	2.3
Real rate of return on K, r_C	−0.2	−1.9	−0.9	−1.5	−0.7
Real investment, I/P_P	7.6	−2.7	0.4	2.4	5.8
Real production low-skill wage, W/P_P	0.9	7.7	3.5	6.0	2.8
Production employment, L	−1.1	−8.9	−4.3	−7.1	−3.4
Real consumption low-skill wage, W/P_C	−8.9	8.2	1.8	−2.7	−7.0
Real consumption skilled wage, W_S/P_C	−9.9	−1.5	−2.5	−9.6	−10.2
Real capital income, Y_K/P_C	−9.9	−1.5	−2.5	−9.6	−10.1
Real output (GDP), Y/P_Y	−0.2	−1.9	−0.9	−1.5	−0.7
Real collective income $(Y+N/E)/P_C$	−4.9	−3.8	−3.6	−7.1	−7.7

NOTES:
a. These results are from the model described in the text with the closures and shocks as for Table 4. Note that all results refer to the immediate short run and indicate effects from a stable starting point, in the absence of capital flight or other financial shocks.
b. Import tariff and export tax reform are intended to capture reductions in tariff or export tax equivalents of the distortions affecting tradable prices and quantities.
c. Government spending includes only expenditure on goods and services, excluding transfers.
SOURCE: Simulations of the model described in the text.

Even if these reforms were to be undertaken in a floating exchange rate environment, as indicated in the last column of Table 5, the results indicate that they would still have been contractionary in the short run. Of course, this result depends on the central bank's choice of monetary target. We have assumed the targeting of the GDP price level, since the reduced consumption subsidies inflate the consumer price level to the extent that, targeting it, would cause deflation of the other price indices and a greater contraction in employment and output. But additional monetary expansion is possible in this scenario, for example, targeting the producer price level. This would certainly eliminate the contraction in formal sector employment and output, at the expense of greater consumer price inflation. This latter scenario is of limited relevance, however, since a fully floating exchange rate was not in prospect in 1996.

5.2 The AFC Shocks and Responses

A stylized representation of the early AFC shocks and responses is considered. The particular shocks and closures are detailed in Table 6 and the simulation results are presented in Table 7. The first core shock is a substantial increase in the investment risk premium demanded of assets in Indonesia. That this occurred is obvious from Figure 5, with the spread over external rates rising manyfold during the crisis. We consider the effects of the initial doubling, which is clear from the figure. This is because the subsequent extreme rise in yields was a consequence of panic and overshoot in association with the abandonment mid-crisis of the US dollar peg. Our simulations set expectations over prices and exchange rates to be myopic and so changes are surprises.[10] The effect of this core shock in the continuing presence of the US dollar peg is major tightening of the domestic financial market, an associated collapse in home investment and a reversal of the current account deficit. The contraction in demand for home goods ensures that there is also a large real depreciation, and a substantial monetary contraction is required to defend the US dollar peg. This leads to significant deflation, labour dislocation and loss of real GDP and real income.

When we add the fiscal and trade reforms of Tables 4 and 5, collectively, to this mix, the result is worsened considerably. The contractions in formal sector employment and real GDP are larger by half and those in the real purchasing power of incomes at the new consumer prices are larger by three quarters. Clearly, these reforms were unsustainable under the capital flight conditions prevailing at the time, making the subsequent policy reversal inevitable. The subsequent AFC simulations cover the case in which these reforms are abandoned and the currency is floated. As discussed previously, the resulting depreciation was then so large as to cause insolvencies and closures among firms carrying foreign debt and hence the (at least temporary) sequestering of capital. A reduced capital stock is therefore added to the shocks that represent the period following the float.

In the brief period represented by this simulation, no particular target of monetary policy is considered; the central bank is assumed merely to hold the monetary base constant. The real and nominal depreciations do, in fact, turn out to be large, but the contraction in money demand due to the higher domestic yield (indeed the flight from domestic assets including money) causes a large contraction in the value (purchasing power) of the home money stock. While the supply of home money is unchanged, this requires a devaluation of money relative to goods and hence the anticipated inflation, which occurs across all three price indices. This result offers an overall improvement, however, since it lessens the home financial tightening and the associated investment collapse. Because it turns deflation into inflation, it also eliminates the employment loss and reduces the real GDP decline, which in turn, lessens the contraction in savings and so eases the financial tightening. The high inflation, however, greatly reduces the purchasing power of incomes at consumer prices and so reduces welfare across the board.

Finally, we consider the policy combination that arrested the crisis, which was the float combined with a money-financed fiscal expansion. During capital flights, agents eschew all domestic assets, including both home money and home government debt, and so the only possible monetary expansion at such

TABLE 6
Stylized AFC Shocks, Closures and Policy Responses[a]

Scenario	Shocks, Percentage and Closure Elements
1. AFC primary shock with no response	Change in yield spread as proportion of *ex ante* foreign yield, ρ 100 per cent Government spending, G, exogenous Monetary closure: exchange rate peg, E Labour market closure: fixed nominal wage, W
2. AFC with fiscal and trade reforms	Change in yield spread as proportion of *ex ante* foreign yield, ρ 100 per cent Raise the power of the consumption tax, $(1 + \tau_C)$ by 10 per cent Reduce the equivalent import tariff power $(1 + \tau_M)$ by 10 per cent Reduce the equivalent export tax power $(1 + \tau_X)$ by 5 per cent Fiscal position, S_G, exogenous and shocked to zero Government spending, G, endogenous Monetary closure: exchange rate peg, E Labour market closure: fixed nominal wage, W
3. AFC with float	Change in yield spread as proportion of *ex ante* foreign yield, ρ 100 per cent Sequestering of physical capital, K, 15 per cent Monetary closure: float with target M_B Fiscal closure: fixed nominal expenditure, G Labour market closure: fixed nominal wage, W
4. AFC with float and money financed fiscal expansion[b]	Change in yield spread as proportion of *ex ante* foreign yield, ρ 100 per cent Sequestering of physical capital, K, 15 per cent Nominal government spending, G, rises by 7 per cent Monetary target MB, shocked to match ΔG, 10 per cent Labour market closure: fixed nominal wage, W

NOTES:
a. Closures vary with cases, as indicated, but are selected from the list in Table 3.
b. In this experiment the fiscal expansion is matched to the increase in the monetary base associated with the coincident monetary expansion. The expansion is small compared with initial GDP (5 per cent) but this outcome does away with the very substantial monetary contractions needed in the other cases.
SOURCE: Simulations of the model described in the text.

times is facilitated by the expansion of government debt, and the only possible fiscal expansion is one that is money-financed. By facilitating a monetary expansion in what is already an inflationary situation, the downside to this policy response is the additional inflation it brings and the further undermining of a currency that is already under immense pressure. In the crisis situation, however, it was essential to sustain economic activity and employment, even at this increased cost.[11] The simulation results in the last column of Table 5 support this contention, combining accelerated inflation with a significant curtailment of the GDP shortfall. Of course, neither of the policy regimes with currency floats is attractive when the criterion is the purchasing power of domestic income at consumer prices. This is because of the inflating effect

TABLE 7

Effects of Stylized AFC Shocks and Policy Responses[a]

% Changes	AFC with Peg and No Other No Response	AFC with Peg and Fiscal, Trade Reforms	AFC with Float, MB Target	AFC with Float and Money Financed Fiscal Expansion
Domestic real long yield, r	79.2	59.0	21.5	12.3
Monetary base, M_B	–21.1	–25.6	0.0	10.0
Government spending, G^c	0.0	–15.4	0.0	7.0
Consumer price level, P_C	–7.5	–5.8	25.6	41.4
Producer price level, P_P	–13.6	–20.0	11.3	18.8
GDP price level, P_Y	–13.3	–17.5	13.2	21.5
Exchange rate vs US dollar, E	0.0	0.0	–30.7	–42.6
Real exchange rate vs US dollar, e_R	–13.3	–17.5	–21.6	–30.3
Change in current account $\Delta CA/Y_0\%$	4.5	5.9	15.9	21.7
Change in fiscal position $\Delta S^G/Y_0\%$	–0.5	2.3	1.0	1.2
Real rate of return on K, r_C	–3.7	–5.6	5.9	7.7
Real investment, I/P_P	–26.3	–23.1	–13.8	–8.8
Real production low-skill wage, W/P_P	15.8	25.1	–10.2	–15.9
Production employment, L	–16.8	–24.6	0.2	8.8
Real consumption low-skill wage, W/P_C	8.1	6.2	–20.4	–29.3
Real consumption skilled wage, W_S/P_C	–10.1	–19.9	–20.2	–23.1
Real capital income, Y_K/P_C	–10.1	–19.8	–20.2	–23.1
Real output (GDP), Y/P_Y	–3.7	–5.6	–10.0	–8.4
Real collective income $(Y + N/E)/P_C$	–10.1	–17.7	–19.4	–22.1

NOTES:

a. These results are from the model described in the text with the closures and shocks as for Table 4. Note that all results and policy responses refer to the immediate short run. A physical capital contraction is included following the currency float, due to sequestered capital, which recovered in the longer run with eventual property rights reassignment in a manner not represented here.

SOURCE: Simulations of the model described in the text.

the currency depreciations have on consumer prices, and hence on the cost of living. Increased poverty in Indonesia was an inevitable outcome of the AFC, whichever policy response had been implemented. The money-financed fiscal expansion at least offered the government resources to maintain emergency supplies of essentials and to manage the crisis more generally.

6. Simulating the GFC Impact and Policy Responses

In the lead-up to the GFC, Indonesian macroeconomic indicators were more prudent and robust than they had been prior to the AFC. Of particular importance in Indonesia's resilience in the face of external

shocks were its comparative fiscal balance, lower debt service ratio and lower share of foreign sourced loans. Unlike its first response to the AFC, there was no immediate tightening of monetary policy and no fiscal contraction. Of course, these positions were made easier by the continuing glut of global savings, which saw international long borrowing rates low and large and unconventional Northern Hemisphere monetary expansions that sustained the downward pressure on these rates.

Northern Hemisphere economies had become increasingly indebted and, following the US financial collapse in 2008, the wealthy private agents who had been the beneficiaries of higher government spending and reduced taxation were then able to force governments to carry the burden under the rubric of "too big to fail". Private sectors deleveraged while governments faced debt crises, with servicing facilitated by monetary expansions. But the monetary expansion was insufficient and eventually constrained by the lower bound zero interest rate. This had two effects. First, transitions to unconventional monetary policy notwithstanding, monetary expansion would henceforth offer weaker defence against deflation and so global portfolios rebalanced towards money holdings in general, and US dollar in particular.[12] Second, the deflation, combined with prospects for its continuation, led to a substantial drop in Northern Hemisphere aggregate demand, reducing global trade. Indonesia therefore faced two key consequences: a rise in its risk premium as financial flows fled the country for US dollar assets and a drop in foreign demand for Indonesian products (Figure 4). The former is the capital flight element in common with the AFC, which caused substantial financial tightening, as indicated in Figure 5.

Indonesia's first line of defence was to run down its foreign reserves.[13] These had risen steadily during the decade since the AFC, in part so as to sustain parity with other Asian currencies, and particularly the RMB, and in part to sterilize substantial growth in financial inflows after 2009, peaking in 2010.[14] Foreign reserves were contracted in 2008, generating an inflow on the balance of payments to offset the GFC-driven outflows (Figure 7), though this inflow only partially mitigated the financial shock and the exchange rate depreciated against the US dollar (Figure 2). Home yields rose substantially (Figure 5) and domestic investments fell. To compound this negative financial shock, the demand for Indonesian exports then fell.

To analyse this, we use the second model, constructed around the database on the Indonesian economy in 2007 detailed in the Appendix, Table A2. We consider the stylized representation of these two negative shocks, based roughly on the proportional changes evident in Figures 4 and 5, along with the short-run effects of offsetting policy responses, as indicated in Table 8. On the monetary side, these included the reserve run-down, and a "dirty float" that partially sterilized the reserve run-down but still allowed the currency to depreciate. Initially, this is simulated as having the same effect as a pure float with consumer price target, the achievement of which requires significant monetary contraction. Subsequently, the monetary contraction is softened, allowing some consumer price inflation and relieving the pressure on domestic firms.

Also included in the response is a substantial fiscal expansion and a surge in investment confidence. The evidence for the latter shock is supported by the growth of foreign direct investment during the period and the continued expansion of exports to China (Figure 4). China's very brief contraction and strong resurgence to benchmark growth (well ahead of the other large economies) would have sustained optimism amongst investors supplying to the Chinese economy, including from Indonesia.

The simulation results are summarized in Table 9, which shows that the primary external shock to the investment risk premium was similar in magnitude to that occurring during the AFC, but the GFC primary shock also included a contraction in export demand. The more mature economy of 2007 accommodated this combination of shocks with outcomes not dissimilar from the initial effects of the AFC (while the US dollar peg was sustained and without the IMF fiscal and trade reforms), notwithstanding the greater negativity of the GFC shocks. Comparing the first columns of Tables 7 and 9, changes in the home interest rate, the level of producer price inflation, real domestic investment, formal sector employment and real

TABLE 8
Stylized GFC Shocks, Closures and Policy Responses[a]

Scenario	Shocks, Percentage and Closure Elements	
1. GFC with float and no other policy response	Change in yield spread as proportion of *ex ante* foreign yield, ρ	100
		−20
	Export demand contraction, a_X	
	Monetary closure: float with target, P_Y	
	Fiscal closure: fixed nominal expenditure, G	
	Labour market closure: fixed nominal wage, W	
2. GFC with float and a run-down of foreign reserves	Change in yield spread as proportion of *ex ante* foreign yield, ρ	100
		−20
	Export demand contraction, a_X	−4.8[b]
	Foreign reserve run-down, ΔR (percentage of GDP)	
	Monetary closure: float with target, P^C	
	Fiscal closure: fixed nominal expenditure, G	
	Labour market closure: fixed nominal wage, W	
3. GFC shocks with float, reserve run-down and fiscal expansion	Change in yield spread as proportion of *ex ante* foreign yield, ρ	100
		−20
	Export demand contraction, a_X	−4.8[b]
	Foreign reserve run-down, ΔR (percentage of GDP)	10.6
	Government spending expansion, G (percentage of GDP)	
	Monetary closure: float with target, P^C	
	Labour market closure: fixed nominal wage, W	
4. GFC shocks with reserve run-down, fiscal expansion and softer monetary policy[c]	Change in yield spread as proportion of ex ante foreign yield, ρ	100
		−20
	Export demand contraction, a_X	−4.8[b]
	Foreign reserve run-down, ΔR (percentage of GDP)	−10.6
	Government spending expansion, G (percentage of GDP)	−5[c]
	Monetary closure: target M^B with contraction	
	Labour market closure: fixed nominal wage, W	
5. GFC shocks with reserve run-down, fiscal expansion, softer monetary policy[c] and stronger business confidence	Change in yield spread as proportion of *ex ante* foreign yield, ρ	100
		−20
	Export demand contraction, a_X	−4.8[b]
	Foreign reserve run-down, ΔR (percentage of GDP)	−10.6
	Government spending expansion, G (percentage of GDP)	−5[c]
	Monetary closure: target M^B with contraction	−20
	Investment confidence, r_c^e	
	Labour market closure: fixed nominal wage, W	

NOTES:

a. Closures vary with cases, as indicated, but are selected from the list in Table 3.

b. This is the difference between the level of reserves had the original rate of accumulation been sustained and the level after the run-down. It is therefore larger than the actual run-down.

c. With the original float, defending the consumer price level would have required a monetary contraction amounting to 24 per cent of the original monetary base. This shock is easier by 80 per cent, though it does leave substantial inflation.

SOURCE: Text analysis and simulations of the model described.

TABLE 9
Effects of Stylized GFC Shocks and Policy Responses[a]

% changes	GFC Shocks with Float and No Other Policy Response	GFC Shocks with Float and a Run-Down of Foreign Reserves	GFC Shocks with Float, Reserve Run-Down and Fiscal Expansion	GFC Shocks with Reserve Run-Down, Fiscal Expansion and Softer Monetary Policy	GFC Shocks with Reserve Run-Down, Fiscal Expansion, Softer Monetary Policy and Stronger Business Confidence
Domestic real long yield, r	88.7	61.8	97.5	66.2	73.8
Monetary base, M^B	–24.0	–21.4	–14.9	–5.0	–5.0
Government spending, G^c	0.0	0.0	127.0	127.0	127.0
Consumer price level, P_C	0.0	0.0	0.0	12.8	11.5
Producer price level, P_P	–14.5	–13.2	–6.4	0.5	0.9
GDP price level, P_Y	–15.4	–14.1	–7.4	–0.4	–0.1
Exchange rate vs US dollar, E	–20.7	–18.4	–7.9	–24.3	–21.5
Real exchange rate vs US dollar, e_R	–32.9	–30.0	–14.7	–24.6	–21.6
Change in current account $\Delta CA/Y_0$ %	4.9	3.5	–2.8	3.15	1.6
Change in fiscal position $\Delta S^G/Y_0$ %	–2.3	–2.1	–12.2	–11.9	–11.9
Real rate of return on K, r_C	–4.6	–4.1	–1.9	0.2	0.3
Real investment, I/P_P	–22.9	–18.9	–23.3	–18.4	–14.3
Real production low-skill wage, W/P_P	16.9	15.2	6.8	–0.5	–0.9
Production employment, L	–18.4	–16.8	–8.2	0.7	1.2
Real consumption low-skill wage, W/P_C	0.0	0.0	0.0	–11.4	–10.3
Real consumption skilled wage, W_S/P_C	–18.4	–16.8	–8.2	–10.7	–9.3
Real capital income, YK/P_C	–18.3	–16.8	–8.2	–10.7	–9.3
Real output (GDP), Y/P_Y	–4.6	–4.1	–1.9	0.2	0.3
Real collective income $(Y+N/E)/P_C$	–19.7	–18.1	–9.4	–11.9	–10.4

NOTES:
a These results use the closures and shocks as for Table 6. Note that all results and policy responses refer to the immediate short run.
SOURCE: Simulations of the model described in the text.

GDP are all similar in magnitude. This is despite the effects of the loss of export tax revenue under the GFC float on the fiscal deficit, which enhances the associated financial tightening, and the substantial real and nominal depreciations that reduce the purchasing power of domestic incomes.

The run-down in reserves during 2008 offered a minor offset to the overall impact, but the most significant countervailing effect is seen to be due to the fiscal expansion, which is large enough to help stem the currency depreciation. As during the AFC, the fiscal expansion, by being directed at mostly non-traded home products and services, tended to stem the real depreciation (Froot and Rogoff 1995; Galstyan and Lane 2009). Further mitigation stems from the softer monetary policy and sustained business confidence, which can be seen as being enhanced by the government's more decisive action in the face of the crisis, thus avoiding the policy redirection mid-crisis that plagued the AFC experience. Financial resiliency had greatly improved and growth in exports to China was very likely a source of business confidence during this period.

7. Conclusion

Although the origins of the AFC and the GFC were external, during the AFC, the coincidence of financial contagion with mid-stream policy redirection, an associated panic and domestic political upheaval saw the Indonesian economy collapse. By contrast, during the decade-later GFC, when most nations slumped into recession, the Indonesian economy slowed but did not recess, recording one of the world's best performances for the period. Here, separate numerical models of the Indonesian economy of 1996 and 2007 are used to examine stylized AFC and GFC effects relative to an underlying Indonesian steady state growth path. Emphasis is placed on decomposing the effects of component shocks and policy responses to show their respective contributions to economic performance outcomes.

The strengthening of the Indonesian economy's capacity to absorb external shocks is evident from its reduced dependence during the GFC on external financing and associated policy prescriptions, not to mention its increased size following a decade of growth in the shadow of the larger and more rapidly expanding Chinese economy. It is important to note that the capital flight effects are estimated to be similar between the initial (pre-float) AFC shock to Indonesia's investment risk premium and that occurring during the GFC. Yet, the modelling shows that the 2007 Indonesian economy, without policy response, was able to absorb this shock, in combination with a significant cut in exports and export tax revenue, with outcomes that were little different from the pre-float AFC experience. The policy response to the GFC shocks was a fiscal expansion that was partly money-financed. This paper shows that this was sufficient to restore formal sector employment and real GDP to near its initial position on Indonesia's long term growth path, thus enabling it to record its remarkable outperforming of the rest of East and Southeast Asia, where most countries suffered not only major asset price collapses but, contrastingly, periods of stalled or negative growth.

The analysis suggests that some of the contrast between Indonesia's performance during the AFC and the GFC stems first, from its mid-stream retreat from a macroeconomic policy regime that included policy reforms required as part of IMF conditionality, but which were contractionary in the short run and made more contractionary by the capital flight conditions of the time. Second, there were differences in the mix of external and domestic shocks. The export contraction was the distinguishing feature of the GFC; yet, this was more readily offset by domestic demand growth from a fiscal expansion than the insolvencies and the sequestering of capital that restricted output during the AFC.

Nonetheless, in the end, a similar policy prescription applied in both cases—a real and nominal depreciation combined with a money-financed fiscal expansion. Implementation differences during the GFC were, first, that there was no mid-stream change of macroeconomic policy response to invite investor panic. Second, the fiscal expansion was more readily financed and so very high inflation was avoided.

Third, foreign reserves were more substantial and a run-down during 2008 helped limit the negative financial impact to be offset, and fourth, greater optimism prevailed over investment given the very significant trading relationship that was building with a Chinese economy that had expanded miraculously in the preceding decade and which recovered quickly following the initial GFC shocks.

APPENDIX

The analytical structures of the models used are listed first, followed but the databases and parameters for each model.

A1: Model Analytics
We begin with the supply-side factors that determine GDP and then proceed to the demand side, centred on the open economy markets for home returning assets, home money and foreign exchange.

The Supply Side
Production: Output is assumed to be Cobb-Douglas in the three primary factors, labour, skill and capital, so that the production of home goods and services and the local marginal product of capital are:

(1) $\qquad y = A L^{\beta_L} S_K^{\beta_S} K^{\beta_K}$ where $\beta_L + \beta_S + \beta_K = 1$

(2) $\qquad MP_K = \beta_K \dfrac{y}{K} = [A \, \beta_K \, S_K^{\beta_S} \, K^{\beta_K - 1}] \, L^{\beta_L}$

The rate of return on installed capital is then the ratio of the value of the marginal product of capital and the price of capital goods, net of depreciation. If the producer price level is P_P and P_K is the price of capital goods, the ratio of these can be applied to (2). But, since only a single home good is modelled, the latter is related to the producer price level via an exogenous constant: $P_K = \theta P_P$, which can be shocked to represent differences in the trend of capital and final goods.

(3) $\qquad r_C = \dfrac{P_P MP_K}{P_K} - \delta = \theta MP_K - \delta,$

where δ is the depreciation rate. Recall, from above, that the simulated economy is not in a steady state and so, in general, this net return does not equal the real return the collective home portfolio, r, so $r_C \neq r$.

The product real wages of low-skill and high-skill workers depend on the corresponding marginal products.

(4) $\qquad w = \dfrac{W}{P_Y} = MP_L = \beta_L \dfrac{Y}{L}$

(5) $\qquad w_S = \dfrac{W_S}{P_Y} MP_{S_K} = \beta_S \dfrac{Y}{S_K}$

The unemployment rate is calculated for all workers, where the labour force is F.

(6) $\qquad u = \dfrac{F - S_K - L}{F}$

The Demand Side
Both direct and indirect tax revenues, T^D and T^I, play key roles in the formulation. GDP at factor cost (or producer prices), Y^{FC}, is the total of direct payments to the collective household in return for the use of its factors. Nominal GDP is then

(7) $\qquad Y = Y^{FC} + T^I, \; Y^{FC} = C + T^D + S^P.$

This is the standard disposal identity for GDP, or the collective household budget, where C is the total value of final consumption expenditure, including indirect taxes paid, and S^P is private savings. The GDP price, P_Y, and the producer price, P_P, would be the same were it not for indirect taxes. In their presence we have:

(8) $\qquad Y = P_Y \, y = Y^{FC} + T^I = P_P \, y + T^I$, so that $P_Y = P_P + \dfrac{T^I}{y}.$

Conventionally, overall balance on expenditure is constrained by:

(9) $\qquad Y = C + I + G + X - M ,$

where all uppercase characters signify measurement in currency, in this case billion rupiah. I is expenditure on investment, G is government spending on goods and services (net of transfers), X is export revenue (including export tax revenue) and M is the landed cost of imports (pre-tariff) in domestic currency.

Income tax: A constant marginal direct tax rate, tW, is assumed to apply to all labour income, while the marginal tax rate on capital income is t_K. The corresponding "powers" of these rates are $\tau_W = (1 + t_W)$ and $\tau_K = (1 + t_K)$ and these appear in the coding of the model. There is no distinction between home goods and capital goods, so the capital goods price is P_P.

$$(10) \qquad T_Y = t_W (WL + W_S S_K) + t_K r_C P_P K$$

Note that capital income is taxed based on its actual net (of depreciation) rate of return, r_C, rather than the market interest rate, r.

Consumption: Aggregate consumption, here volume c, corresponding with expenditure C, depends negatively on the real after-tax return on savings and positively on disposable money income. This is nominal GDP, $Y = P_Y y$, combined with net factor income from abroad, less direct tax:

$$(11) \qquad Y_D = Y + \frac{N}{E} - T_Y,$$

where N is nominal net factor income from abroad, which is set as constant in foreign currency and E is the nominal exchange rate in foreign currency per unit of home currency. Real consumption volume, c, depends positively on the present and expected future levels of disposable income, Y_D and Y_D^e, deflated by the consumer price, which depends as indicated below on the home producer price and the import price, marked up by the consumption tax.

$$(12) \qquad c = \frac{C}{P_C} = A^C \left(\frac{r}{\tau^K} \right)^{-\varepsilon^{CR}} \left(\frac{Y^D}{P_C} \right)^{\varepsilon^{CY}} \left(\frac{Y^{De}}{P_C [1 + \pi^{Ce}]} \right)^{\varepsilon^{CY}}.$$

To capture the home household's substitution between home goods, which it consumes in volume c_H, and foreign goods, consumed as imports the real volume of which is m, aggregate consumption is a CES composite of the two:

$$(13) \qquad c = (\alpha_H c_H^{-\rho} + \alpha_M m^{-\rho})^{-\frac{1}{\rho}}$$

The home household then solves the following problem: for given aggregate consumption, C, above, choose C_H and m to minimize consumption expenditure:

$$(14) \qquad P_C C = P_P (1 + t_C) c_H + \frac{P*}{E} (1 + t_M) (1 + t_C) m = P_P \tau_C c_H + \frac{P*}{E} \tau_M \tau_C m$$

To obtain the prices home consumers actually face, here the volumes, c_H and m, are each multiplied by their respective domestic prices as augmented by the "powers" of the consumption tax and the import tariff, τ_C and τ_M. $P*$ is the foreign currency denominated price of foreign goods before any import tariff is paid and E is the nominal exchange rate in foreign per unit of home currency.

Optimum consumption yields an elasticity of substitution between home goods and imports of $\sigma = 1/(1 + \rho)$ and the initial expenditure shares of each in the composite of consumption are $s_H = \alpha_H^\sigma$ and $1 - w_H = \alpha_M^\sigma$. The volumes of the home and foreign varieties of goods consumed then depend on the "powers" of the consumption tax and import tariff and the prices:

$$(15) \qquad c_H = s_H c \left[\frac{P_P \tau_C}{P_C} \right]^{-\sigma}, \ m = (1 - s_H) c \left[\frac{\frac{P*}{E} \tau_M \tau_C}{P_C} \right]^{-\sigma}$$

Given these consumption volumes, the composite price of all consumption emerges from the combination of (12), (13) and (14) as:

$$(16) \qquad P_C = \tau_C \left[\alpha_H^\sigma P_P^{1-\sigma} + \alpha_M^\sigma \left\{ \frac{P*}{E} \tau_M \right\}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

Private savings: This is the residual after direct tax and consumption (gross of consumption tax) are deducted from the nominal value of GNP, which includes both nominal GDP PYY and net factor income from abroad, N, set as constant in foreign currency. We can also expand the final term by substituting from (13), above:

(17) $$S^P = P_Y y + \frac{N}{E} - T_Y - P_C C = P_Y y + \frac{N}{E} - T_Y - P_P \tau_C C_H - \frac{P^*}{E} \tau_M \tau_C M$$

Indirect tax revenue: This includes that from import and export taxes:

(18) $$T_M = t_M \frac{P^*}{E} M = (\tau_M - 1) \frac{P^*}{E} M, \ T_X = t_X P_P X = (\tau_X - 1) P_P X.$$

and from consumption tax, which is levied on both home goods and imports:

(19) $$T_C = t_C P_P C_H + t_C \frac{P^*}{E} (1 + t_M) M = (\tau_C - 1) P_P C_H + (\tau_C - 1) \tau_M M.$$

Government (+central bank) revenue: This is government revenue less the sum of government expenditure and the annual increment to the holdings of official foreign reserves. So the dollar value of government savings is then:

(20) $$S^G = T_Y + T_C + T_M + T_X - P_P G - \Delta R.$$

To simplify the demand side, government spending is assumed to be directed only at home goods free of consumption tax, whose home price is P_P.

Domestic savings: This is then the (value) sum of private and government savings in the home economy.

(21) $$S^D = S^P + S^P$$

Capital and financial account flows: On the inflow side, these are associated with acquisitions of home assets by foreigners, while on the outflow side, they represent acquisitions of foreign assets by home residents. These flows are assumed to depend on the extent of the departure from uncovered interest parity, which links the yield from the home collective portfolio to the yield required by those abroad to invest in the home economy. This link is based on changes in a parity ratio that depends on the after tax yield on the home collective portfolio, r and the expected rate of return on foreign assets, which in turn depends on the current real yield abroad, r^*, a risk premium, ρ, and the expected rate of change in the real exchange rate, $\hat{e}^e$:

(22) $$\lambda = \frac{r(1 - t^K)}{r^* + \rho + \hat{e}^e}.$$

Home to foreign flows, SHF, and foreign to home flows, SFH, are then:

(23) $$S_{HF} = S_D \phi \left(\frac{\lambda_0}{\lambda}\right)^{\sigma_H}, \ S_{FH} = S_{FH}^0 \left(\frac{\lambda_0}{\lambda}\right)^{\sigma_F},$$

where the subscript *0* refers to initial equilibrium conditions, ϕ is the initial proportion of home savings that is directed abroad, σ_H is the elasticity of substitution between home and foreign assets, viewed from the home economy, and σ_F is the corresponding elasticity, as viewed from abroad.[15] While we do not distinguish the different propensities for cross border flows that apply to controlling equity and portfolio investments, changes in this composition can be represented via changes to these two elasticities.

Investment: This comprises real break-even investment, δK, and *real* net investment, i^N. Real net investment depends on the (expected) profitability of new physical capital, which depends in turn on the expected value of the net real rate of return on installed capital, r_C, from (3), compared with its opportunity cost, the real rate of return on the collective home portfolio, r.[16] The (expected) net return from the last unit of physical capital purchased is larger the larger is the quantity of effective labour to go with it. So the (expected) return from investment in new capital must also be larger the larger is the expected number of effective workers in employment—that is, following technical change or an increase in employment.[17] Here this determines real net investment via a Q-style ratio, γ, in which the numerator reflects the current value of new capital (determined by the expected future net rate of return) and the denominator its current financing cost (determined by the current portfolio yield).

(24) $$i = i^N + \delta \overline{K} = i_0^N \left[\frac{\gamma}{\gamma_0}\right]^{\varphi} + \delta \overline{K}, \ y = \left(\frac{r_C^e}{r}\right),$$

where φ is an elasticity of response to changes in the ratio.

Financing domestic investment: This is financed from domestic savings and net foreign savings. Nominal expenditure on investment is I:

$$(25) \qquad I = P_K i = \theta P_P i = S^D + S^{FH} - S^{HF}.$$

Real exchange rate: This is defined as the ratio of the home currency price of home goods to the (before import tax) home currency price of foreign goods:

$$(26) \qquad e = \frac{P_Y}{\left(\dfrac{P^*}{E}\right)} = E\frac{P_Y}{P^*} \quad (E \text{ in foreign per unit of home currency}).$$

Exports: The quantity of home goods demanded by foreigners is x while its nominal value is X. These depend negatively on the (after export tax) foreign currency price of home goods relative to the foreign currency price of foreign goods:

$$(27) \qquad x = a_X - b_X\left[\frac{EP_Y(1 + t_X)}{P^*}\right] = a_X - b_X e_R (1 + t_X) = a_X - b_X e_R \tau_X, \ X = x P_P \tau_X.$$

Imports: The quantity of foreign goods demanded by home consumers is m, from (14), while its nominal value is M, which is the landed value of imports and so excludes tariff and consumption taxes.

$$(28) \qquad M = \frac{P^*}{E}m.$$

The balance of payments: This sets private and public net inflows on the capital account, KA, equal to net outflows on the current account (the current account deficit $-CA$). Note that inflows on the current account associated with exports incorporate export tax revenue since foreigners pay the export tax, at rate t_X or with power τ_X. Import tax revenue does not appear, since this is a transfer between the domestic household and the government. Current account inflows also include net factor income from abroad, N, which is held constant in foreign currency.

$$(29) \qquad KA = S^{FH} - S^{HF} - \Delta R = -CA = M - X - \frac{N}{E}$$

The money market (LM equation): These offer a textbook characterization of the home money market, with transactions demand for home money driven by GDP and the opportunity cost of holding home money set at the nominal yield on the home portfolio (long maturity, since the aggregate portfolio comprises mainly long term assets), which is the real yield plus the expected inflation rate, π^e. The short interest rate determines the monetary base, M_B, with the monetary base the active monetary policy variable and so short yields are in the background here. The money supply and the monetary base are linked by an exogenous money multiplier, μ. Real money balances ($m^D = m^S$) are measured in terms of purchasing power over home goods.

$$(30) \qquad m^D = a^{MD}\,(y)^{\varepsilon^{MY}}\left(\frac{r\,(1 + \pi^e)}{\tau^K}\right)^{-\varepsilon^{MR}} = m^S = \frac{M^S}{P_Y} = \frac{\mu M_B}{P_Y}$$

A2: Model databases and operation

The model databases are built on national accounts as well as international trade and financial data for the Indonesian economy, as supplied by Bank Indonesia, for 1996 and 2007. The numbers used and their compilation are detailed in Tables A1 and A2.

TABLE A1

Database and Parameters, 1996

Variables and Base Values billion (2010) rupiah		Key Parameters	
Volumes:		*Production shares*:	
GDP, Y	4,217	β_L	0.206
Consumption, C	2,619	β_S	0.144
Investment, I	1,325	β_K	0.650
Government spending, G	304[a]		
Exports, X	1,086	*Money market parameters*:	
Imports, M	1,175	Elast of money demand to	
Net foreign factor income, N	–66	Y	1.00
		r	–0.10
Values:		Reserve to deposit ratio	0.10
Tax revenue	205		
Direct	82[a]	*Powers of marginal tax rates*	
Consumption	–289[b]	$(1 + t_W) = \tau_W$	1.02
Import	279	$(1 + t_K) = \tau_K$	1.02
Export	142	$(1 + t_C) = \tau_C$	0.898[b]
M_S	2,109	$(1 + t_M) = \tau_M$	1.25
M_B	211	$(1 + t_X) = \tau_X$	1.15
K stock	11,800		
Private savings, S^P	1,328	*Consumption parameters*:	
Government savings, S^G	–99	Elasticity consumption to Y^D	1.00
Total domestic savings, S^D	1,228	Elasticity consumption to r	–0.10
Financial outflow, S^{HF}	201	Elasticity of exports to e_R, σ	1.00
Financial inflow, S^{FH}	61		
Reserve growth, ΔR	42	*Trade parameters*:	
		Elasticity substitution c_H-m	1.50
Price, initial calibrated levels:		Elasticity of exports to e_R	–1.00
r	0.232		
r^*	0.070	*Financial flow parameters*:	
P_C	0.872	Elasticicy S_{HF} to parity ratio λ	3.0
P_P	0.971	Elasticity S_{FH} to parity ratio λ	10.0
P_Y	1.000	Initial share of home savings	
P^*	0.777	invested abroad, ϕ	0.05
E	1.000		
e_R	1.287	*Investment parameters*:	
		Elasticity of I_N to (r_c^e/r)	1.00
Labour:		Depreciation rate, δ	0.05
Skill share of L	0.08		

Initial skill premium, W_S/W	8.0
Participation rate, L/N	0.63
Population, millions, N	195

Notes: a. G is government expenditure on goods and services. This and direct tax revenue are both net of transfers.
b. The effective consumption tax rate is negative due to food and energy consumption subsidies.
Sources: Parameter values are indicative. Flows and levels from raw data are drawn from IMF, *World Economic Outlook Database*, April 2016 update, and Bank Indonesia.

TABLE A2
Database and Parameters, 2007

Variables and Base Values *billion (2010) rupiah*		*Key Parameters*	
Volumes:		*Production shares:*	
GDP, Y	5,736	β_L	0.230
Consumption, C	3,270	β_S	0.182
Investment, I	1,836	β_K	0.589
Government spending, G	482[a]		
Exports, X	1,543	*Money market parameters:*	
Imports, M	1,394	Elast of money demand to	
Net foreign factor income, N	–52	Y	1.00
		r	–0.10
Values:		Reserve to deposit ratio	0.10
Tax revenue	347		
Direct	179[a]	*Powers of marginal tax rates*	
Consumption	–261[b]	$(1 + t_W) = \tau_W$	1.032
Import	263	$(1 + t_K) = \tau_K$	1.032
Export	165	$(1 + t_C) = \tau_C$	0.926[b]
M_S	2,868	$(1 + t_M) = \tau_M$	1.189
M_B	217	$(1 + t_X) = \tau_X$	1.119
K stock	20,267		
Private savings, S^P	2,068	*Consumption parameters:*	
Government savings, S^G	–135	Elasticity consumption to Y^D	1.00
Total domestic savings, S^D	1,932	Elasticity consumption to r	–0.10
Financial outflow, S^{HF}	156	Elasticity of exports to e_R, σ	1.00
Financial inflow, S^{FH}	173		
Reserve growth, ΔR	115	*Trade parameters:*	
		Elasticity substitution c_H-m	2.42
Price, initial calibrated levels:		Elasticity of exports to e_R	–1.00
r	0.162		
r^*	0.050	*Financial flow parameters:*	
P_C	0.899	Elasticity SHF to parity ratio λ	4.22
P_P	0.971	Elasticity SFH to parity ratio λ	10.0
P_Y	1.000	Initial share of home savings	
P^*	0.817	invested abroad, ϕ	0.081
E	1.000		
e_R	1.225	*Investment parameters:*	
		Elasticity of I_N to (r_c^e/r)	1.00
Labour:		Depreciation rate, δ	0.05
Skill share of L	0.104		
Initial skill premium, W_S/W	6.78		

Participation rate, *L/N*	0.65
Population, millions, *N*	228

NOTES: a. *G* is government expenditure on goods and services. This and direct tax revenue are both net of transfers.
b. The effective consumption tax rate is negative due to food and energy consumption subsidies.
SOURCES: Parameter values are indicative. Flows and levels from raw data are drawn from IMF, *World Economic Outlook Database*, April 2016 update, and Bank Indonesia.

NOTES

1. Indeed, the World Bank volume was so lauded that a summary of it was republished the following year in the NBER Macroeconomics Annual of 1994 as Page (1994).
2. Though it was three years earlier than the AFC, the major policy transition that established the Chinese US dollar peg also saw a very substantial devaluation of the yuan, rendering Chinese exports very competitive. We are grateful to an anonymous reviewer to pointing this out.
3. We are grateful to an anonymous reviewer for pointing out the central role of Indonesia's commercial banking sector.
4. Interestingly, in the lead-up to the AFC there was little sign of this comparative volatility, suggesting that the sudden outflows of the time might have been genuinely unanticipated. Since the GFC it has clearly increased, as has global financial volatility.
5. We thank an anonymous reviewer for this detail.
6. The figure suggests that there might have been a financial bubble in the Chinese asset markets prior to the GFC. Capital controls and domestic change in China heavily influenced these markets prior to the GFC but they show evidence of substantial outflow with its onset. Peak to trough proportional falls in stock indices were 49 per cent for the US. For the Asian and regional countries, they were 71 per cent for China, 57 per cent for Japan, 58 per cent for Singapore, 55 per cent for Indonesia and 51 per cent for Australia.
7. The literature on the post-2000 growth of Asian trade in manufacturing components is now vast. A key early contribution is by Athukorala (2005).
8. We owe this point to an anonymous reviewer.
9. More recent progenitors are employed by Tyers (2001) and Rees and Tyers (2004).
10. We might have added an extra phase in which a depreciation was then expected, which would have greatly enlarged the simulated changes in the yield and exchange rate. During our experiments it became clear that such a shock, implying pure panic conditions, would have pushed our model well beyond its behaviourally reliable range.
11. In addition to which the fiscal expansion, by being directed at mostly non-traded home products and services, tended to stem the real depreciation. See Froot and Rogoff (1995) and Galstyan and Lane (2009).
12. The initial, anticipatory, effect in the Northern Hemisphere had been an outpouring of financial flows from the US and so a brief influx to economies in transition during the lead-up to the GFC. When the US crash occurred, however, there was a global rush to hold US dollar and so there was a reversal of the lead-up flows. We focus here in the latter period.
13. With its commitment to a controlled float, and hence exchange rate flexibility, monetary tightening was less of an initial priority.
14. Bank Indonesia accumulated US$30 billion in international reserves in 2010 alone.
15. It is assumed that the elasticity viewed from home is smaller given the comparatively idiosyncratic nature of home assets and investors and of home capital market distortions.
16. Note that the equilibrium real yield from the home portfolio is influenced by the risk premium imposed by financial investors, via (21) and (22).
17. To allow the expected net return on installed capital to be fixed exogenously (for example, reflecting a change in expectations not determined within the model) we add a slack variable, so $r_c^e = r_c \cdot RCSLK$. If expectations require an exogenous shock to the expected net return on installed capital, $RCSLK$ is made endogenous and the link between the net returns in the current and future periods is severed. If, on the other hand, the current and expected future net returns are to be the same, then $RCSLK$ is made exogenous and set to unity.

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