Crises and recovery in emerging markets: ‘Phoenix miracles’ or endogenous growth?

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Abstract

In recent crises in emerging markets, currency devaluation and associated balance sheet effects have played a key role. Does this call for a new paradigm? After a comprehensive survey of many crisis episodes - including the US Great Depression - Calvo and colleagues from IDB offer the paradigm of a ‘Phoenix Miracle’. It is a static, supply-side account where factor productivity falls in recession and rises promptly thereafter.

By contrast, we argue here that the real miracle in East Asia is economic growth. This can be rudely interrupted by external shocks: but then it restarts at a lower level of trend GDP. We show this in a simple model of endogenous growth, where investment is disturbed by balance sheet effects. Heterogeneity of production implies that both supply and demand effects are relevant as in New-Keynesian paradigm for monetary policy proposed by Stiglitz and Greenwald, where monetary contraction affects both supply (of traded goods) and demand (for non-traded goods); and in the dynamic general equilibrium approach of Cook and Devereux (2006).

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Introduction

Financial crises in SE Asia sharply interrupted stellar economic progress in the region: for a year economic growth went into reverse. While it did not take long for growth to resume, output has followed a lower trend path. What happened, and why?

That these events were triggered by external capital market shocks is now widely accepted; in the terminology of Calvo and his colleagues at IADB, events in SE Asia followed a Systemic Sudden Stop in capital flows[1]. Liability dollarisation and the balance sheet effects that accompanied currency devaluation played a key role in depressing investment and supply, as did the high interest rates used to defend the currencies. There is, it appears, agreement on the importance of a type Fisher effect[2] - a central element of so-called third generation models of crisis.

But how to explain the sharp falls of output that were almost synchronous with the devaluation - and the prompt recovery thereafter? Here there are sharp differences of view. Stiglitz (2006) has argued that these events are explicable in terms of the New-Keynesian paradigm for monetary policy he has developed in conjunction with Greenwald; and he was one of the leading critics of IMF policy for the demand-reducing effects of the tight monetary and fiscal policy prescriptions imposed as a condition for financial support in East Asia. Cook and Devereux (2006) also claim that careful calibration of a sticky price open economy model fits the data.

But after a comprehensive overview of crises in SE Asia and elsewhere, particularly in Latin America, Calvo and colleagues have arrived at a different conclusion; that the fall of output was attributable to adverse supply-side effects sharply lowering total factor productivity, whose prompt reversal they call a Phoenix miracle, CIT (2006). It is not a matter of remembering the Keynesian economics of depression: it is a matter of understanding how supply contracts in a financial crisis.

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[1] Jeffrey Sachs said at the time that the SE Asia crisis was like a bank run.

[2] So-called by Calvo et al. (2006) after Irving Fisher who emphasized the role of liability effects in the US Great Depression.

To capture the setting of ongoing growth in SE Asia, we first consider these issues in the framework of a simple model of endogenous growth. In this context, the Balance Sheet effect certainly interrupts growth: but does not in itself cause a sharp fall in output. A temporary fall in TFP will cut output, of course: but so too does a temporary fall of output below existing capacity. The endogenous growth model used is of a closed economy, but the arguments go through in a model of a small open economy with a Balance sheet effect, as we indicate in the following section using a popular third generation model of Aghion, Bachetta and Banerjee.

Shocks to demand and supply may better be distinguished when account is taken of the distinction between traded and non-traded goods. Supply side effects will be more relevant for traded goods and demand effects for non-traded, as in New-Keynesian paradigm for monetary policy proposed by Stiglitz and Greenwald (where devaluation and tight money restrict aggregate demand and disrupt supply in the traded goods sector); and in the dynamic, sticky-price model of a small open economy of Cook and Devereux (2007).

1. Literature review

The deterioration of corporate balance sheets is a key element of recent crises in emerging markets, as emphasized in so-called 'third generation' models. But the role of debt in triggering economic contraction has a much longer pedigree: what Irving Fisher referred to as 'debt deflation' operating in the US Great Depression provides a historical precedent. But for Fisher, balance sheets deteriorated as falling prices raised the real value of nominal debt[3]: while in emerging markets it is devaluation against the dollar that raises the local currency value of debt contracts denominated in foreign currency[4]. In the Biblical terminology of Eichengreen and Hausmann, the impact of the Fisher effect on private enterprise in emerging markets is a legacy of Original Sin. In Latin America, for example, the 'fear of floating' described by Calvo and Reinhart (2002) may be attributed to the balance sheet effects of devaluation and to the high interest rates that may be needed to check a fall in the currency.

3 Note that, when the US left the gold standard, President F.D. Roosevelt cancelled the Gold Clause in public and private debt.

4 As a consequence, debt can increase in real terms even when domestic prices rise.

Keynesian models can be adapted to take account of the Fisher effect. In is analytical afterthoughts on the Asian crises, for example, Krugman (1999) used a *demand-side* account of a small open economy to argue that "a loss of confidence by foreign investors can be self-justifying, because capital flight leads to a plunge in the currency, and the balance-sheet effects of this plunge lead to a collapse in domestic investment." In a much more detailed framework, Céspedes et al. (2003) show that for a highly dollarised open economy, the asset price effects of devaluation can overwhelm trade effects, leading to a contraction of aggregate demand.

In the "third generation" approach developed by Aghion, Bacchetta and Banerjee (2000), however, it is *supply-side* effects that play a central role. In the first place, the trigger for crisis is an unexpected idiosyncratic, permanent fall in productivity which lowers expected future supply. In the absence of a corresponding contraction of future money, the currency is expected to be weaker in future. Anticipation leads to prompt and unexpected devaluation with adverse balance sheet effects on investment further reduces future supply. Current output is unaffected by the crisis, however.

Productivity effects also play a key role in account of Calvo et al (2006), hereafter CIT, though here they are endogenous and temporary. The causal factor is a Sudden Stop which leads to devaluation and a fall in productivity of currently installed plant and equipment. "Sharp nominal (and real) currency devaluation in the presence of Liability Dollarisation may have worked in Emerging Markets as a new version of Fisher's Debt Deflation syndrome, and may be central in explaining output collapses." CIT (2006 pp.10, 11). How this might occur is explained by a partial equilibrium model, where all output can be sold, but a sharp rise in the ex ante short-term cost of borrowing not only reduces inventories and but also induces the firm to sell physical capital[5] to finance inventories: so firm output falls. (Alternative accounts might draw on models of equilibrium shift: e.g. Diamond (1982), Diamond and Digvig (1983) and Allen and Gale (2007).) Happily these effects are temporary and productivity soon recovers without recourse to outside finance for the firm: this is the Phoenix miracle.

[5] Capital is apparently perfectly liquid as it can be sold at a fixed price with no transactions cost.

Stiglitz and Greenwald, by contrast, stress both the demand-side and supply-side effects of tight monetary policy at the time of the crisis. In the case of Korea, for example, where interest rates were pushed above 25% to try to stabilise the currency, they argue that:

> it was exporters' failure to respond to the huge exchange rate reduction – which should have stimulated demand - which makes it clear that the economy was not just responding to a fall in aggregate demand. Such consequences were inevitable, unless the producer could obtain cheaper credit elsewhere … or unless wage and price adjustments were sufficiently large to compensate for the huge increase in capital costs. In practice, even reductions in real wages of 20% or more did not suffice. Thus monetary policy had the usual effect on aggregate demand (amplified by the adverse effect of f increased bankruptcy probabilities on firm demand) … but they also had huge effects on aggregate supply.

(Towards a New Paradigm in Monetary Economics, p.264)

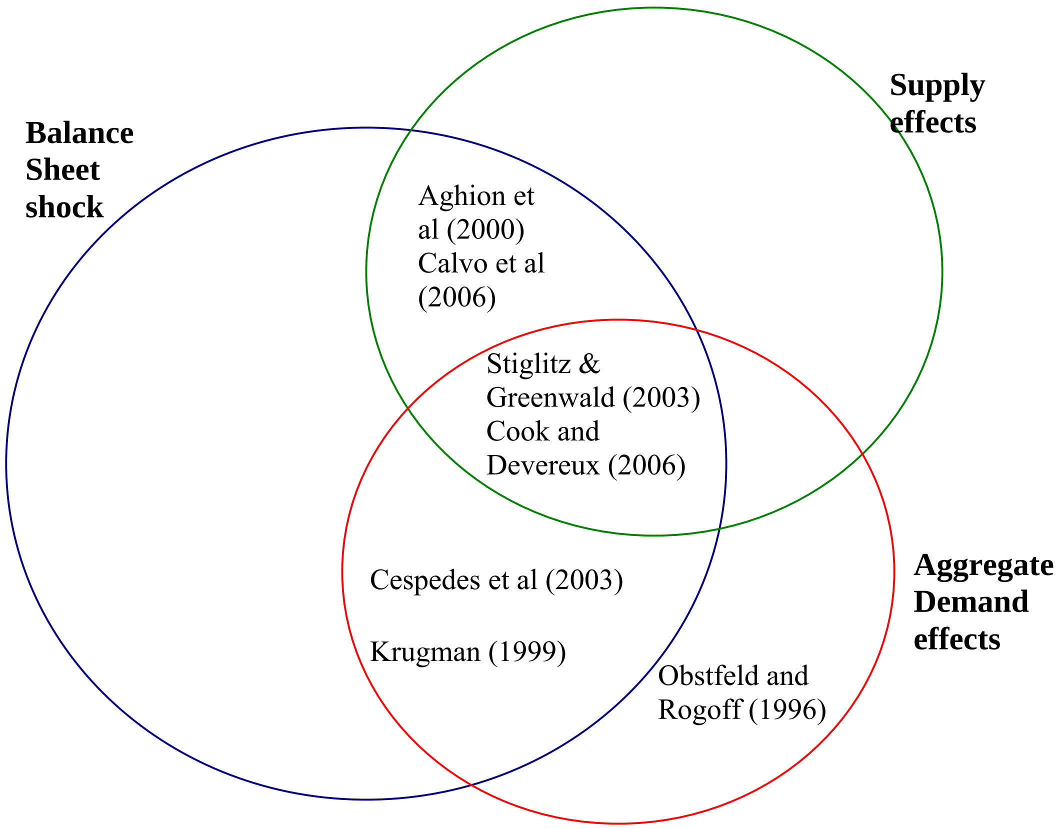
In a detailed exercise in calibration, Cook and Devereux find that they can account for the macroeconomic data on prices and output in South Korea, Malaysia and Thailand using a two-sector dynamic model with sticky prices to assess the response to an unanticipated rise in the country risk premium. They summarize the qualitative effects as follows:

> As all three countries are net debtors, the interest rate rise has a negative income effect, reducing optimal consumption…. [Given that the shock persists] the interest parity condition will imply an immediate depreciation of the nominal exchange rate. …In equilibrium, there is a decline in demand for domestic goods. The exchange rate depreciation does not immediately increase the quantity of exports, because exporters practice local currency pricing
>
> The impact of the risk premium shock on production depends on the stance of monetary policy. …The contractionary monetary policy, observed in the data and matched by both monetary rules in our model, involves an increase in domestic rates. This mitigates the immediate real exchange rate depreciation, and hence leads to a greater decline in absorption and output in domestic traded and non-traded goods. … we anticipate a bigger fall in output in the non-traded sector.

'Accounting for the East Asian Crisis'p.p.737,8

Views on the role of financial effects and the transmission mechanism are summarised in the following Venn diagram. The papers just discussed appear in the left circle as they ascribe a key causal role to the financial shocks – sharp increases in net liabilities amplified by high interest rates used to defend the currency; but they differ on the transmission mechanism -- whether they work through demand or supply.

Figure 1 Financial shock, demand and supply



An interesting contrast is provided by the treatment of the small open economy in Obstfeld and Rogoff (1996, Chapter 10.2), where the output of non-traded goods, whose prices are fixed in the short run, varies with the exchange rate. Monetary expansion leading to unanticipated devaluation has an unequivocally positive impact on demand and production of these goods as they become cheaper than flex-price traded goods (see Appendix). Maybe because it was written before the Asian crises, there is no role for the balance sheet effects in this model.[6]

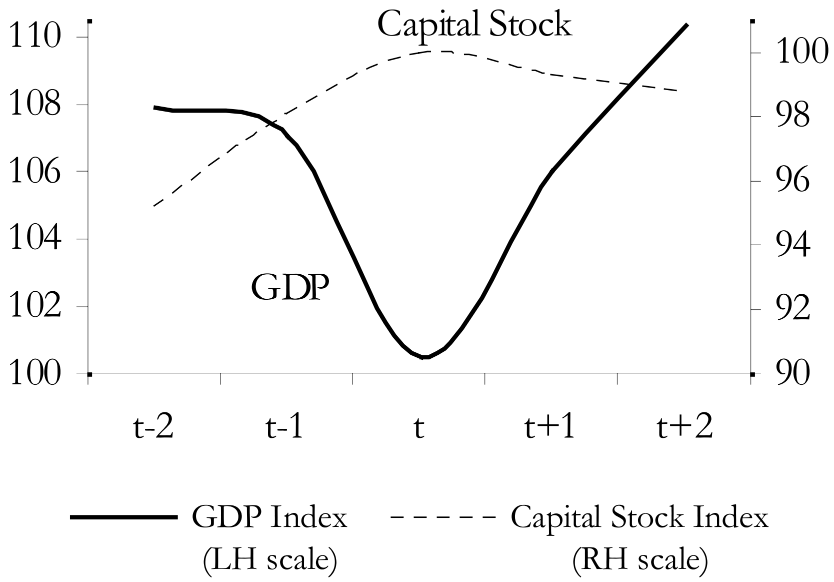
In the next section we show the stylised facts that Calvo and colleagues events describe as a Phoenix miracle. That their account takes no account of ongoing economic growth in the region is indicated briefly where the U shaped curve of CIT is shown alongside with the long run growth. But the data from India provide a striking contrast.

II. Phoenix miracle; or interrupted growth?

[6] Note that the eclectic approach of Cespedes et al. (2003) can deliver positive or negative effects of devaluation on output, depending on the relative importance of balance sheet considerations.

In CIT (2006), the stylized facts characterizing 3S output collapses are presented in a series of fascinating graphs averaging data across affected countries. To illustrate, Figure 2 reproduces the typical path of GDP so derived; and a matching index of the capital stock.

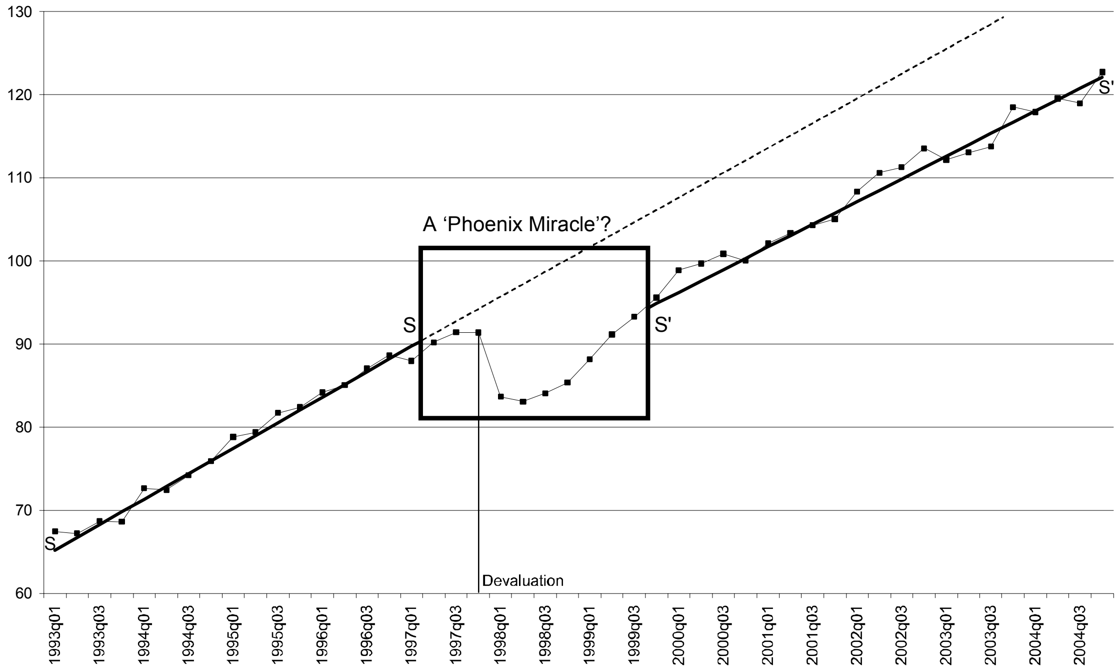
Figure 2 'Phoenix miracle'



"These episodes", they observe, "are characterized by two salient features. First, there is a dramatic collapse in output (…the average fall in GDP is 10 percent) accompanied by a collapse in credit, but without any correspondingly sharp collapse in either physical capital or the labour force. Second, recovery to pre-crisis output is swift and "credit-less"… *Thus, although a credit crunch appears to be central for explaining output collapse, recovery can take place without credit.* This remarkable phenomenon that resembles the feat of the proverbial bird "rising from its ashes" prompted us to call it Phoenix Miracle."

A longer run perspective may be obtained by plotting GDP for some time before and after the crisis. The longer run of data allows one to fit two trend paths, one before the crisis and one after (with quarterly seasonal adjustment around the split trend), so as to provide a crude estimate of potential GDP, of long run supply[7].

Figure 3 Korean GDP



For the case of Korea shown in Figure 3, starting in the box showing data around the time of the SE Asia crisis, one sees that GDP follows broadly the same trajectory shown in the earlier figure. Looking outside the box, however, gives a new perspective: though the trends fitted before and after have much the same slope, there is a difference of about 10 percent in the level. From a growth perspective, therefore, there appears to be a permanent loss of potential output. (Figures for Thailand and Malaysia show a similar pattern of a down-shift of trend potential. [8])

In addition to the sharp fall in output summarised in Figure 3, there also appears to be a down-shift in the trend path of output growth. As to why this might be so, the behaviour of capital stock shown in Figure 3 provides a clue: on average net capital

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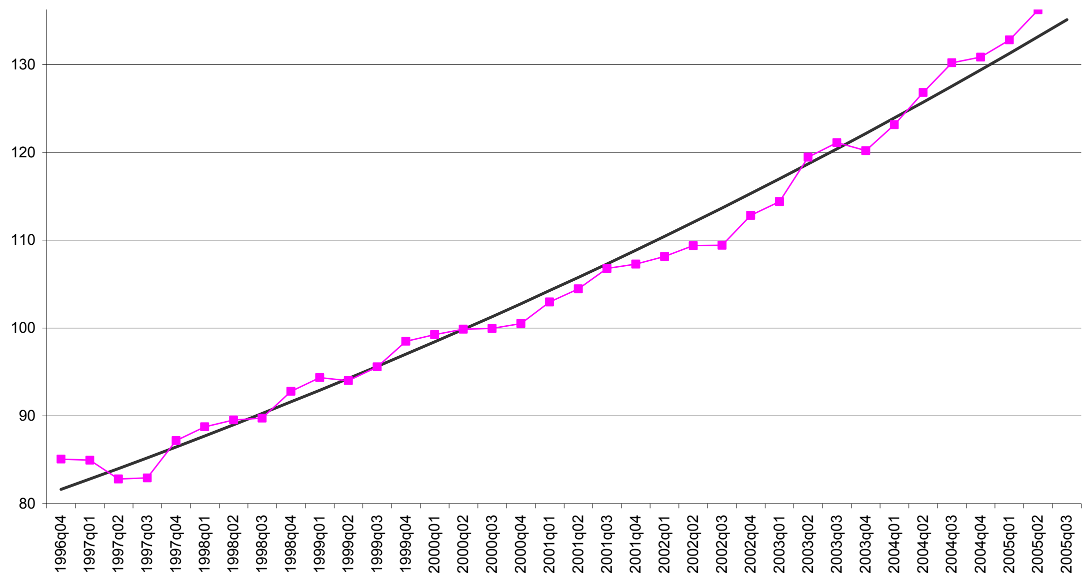
[7] Aghion and Banerjee (2005) provide a similar graph for Indonesia.

[8] Note also that, in their analysis of the earlier Tequila crisis, Kehoe and Ruhl (2007) find that they have to augment their supply-side model with an exogenous unanticipated but permanent fall in TFP of about 6% in order to make it fit the Mexican data.

formation effectively ceases during the crisis.[9] In the next section we sketch an endogenous growth model where a temporary dip in GDP leaves a permanent mark on potential GDP.

Figure 4 Indian GDP



Source: IMF:IFS. (Note: output volume is normalised to 100 in 2000; and the data seasonally adjusted by authors)

The data for output in India shown in Figure 4 provide a striking contrast, with very little evidence of the shock that shook its eastern neighbours. Indian capital markets were kept relatively closed during in the 1990s and the country escaped the currency and output shocks suffered by many of its neighbours, Williamson (1999). Figure 4 shows little sign of any shift of potential in India at the time of the SE Asian crisis, as a single exponential trend seems to fit the data.

III. Supply, Demand and Crises: an AK approach

As Fischer (2001) has emphasized, financial crises in South-East Asia involved an initial reversal of the growth rate, followed by prompt recovery: so output traces a V-

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[9] The lack of external corporate finance in recovery is part of what CIT have described as a miracle. The behaviour of real wages must surely be taken into account in this connexion, as a shift in factor shares in favour of profits will increase the potential supply of internal funds for financing recovery. While output falls by about 10% on average, CIT report that *real wages fall by about a quarter* in emerging market crises: and from this there is, apparently, no recovery.

shape and as shown in Figure 2. To capture the setting of ongoing expansion, we explain these output effects in stylised fashion using a simple AK model of endogenous growth which incorporates balance sheet effects and their impact on productivity and/or aggregate demand.

Let potential supply (Q) be determined by the capital stock (K) so

$$Q = AK \tag{1}$$

and net capital formation be defined as

$$\Delta K = I - \delta K \tag{2}$$

where Δ is the forward difference operator, and
δ is the rate of exponential depreciation.

Gross investment depends on the flow of savings and the impact of balance sheet effects, so

$$I = sQ - \beta K \tag{3}$$

where s is the propensity to save and βK is an adverse balance sheet effect, a Fisher effect, see Allen and Gale for a thorough treatment of the effects of financial crisis.

In the absence of balance sheet effects, one obtains the canonical growth rate, namely:

$$\boxed{\frac{\Delta Q}{Q} = \frac{\Delta K}{K} = \underbrace{sA - \delta}_{\substack{\text{Canonical} \\ \text{endogenous} \\ \text{growth} \\ \text{rate}}} \equiv g_c} \tag{4}$$

Phoenix Miracle

If an *adverse balance sheet effect* were simply to cut investment by βK for one period, the growth of capital and output following the shock will simply fall by β, so

$$g = \frac{\Delta Q}{Q} = \frac{\Delta K}{K} = sA - \delta - \beta = g_c - \beta\,; \tag{5}$$

but there will be no fall in output at the time of the shock. Adding a *temporary fall in productivity* at the time of the shock[10], so $Q = (1-\gamma)AK$, will reduce savings so capital will grow more slowly after the shock, specifically

$$\begin{aligned}\frac{\Delta K}{K} &= s(1-\gamma)A - \delta - \beta = g_c - \beta - \gamma sA \\ &= g_c - \beta - \gamma(g_c + \delta)\end{aligned} \tag{6}$$

Further, the fall of productivity means that output growth going into the recession will be approximately

$$\frac{\Delta Q}{Q} = sA - \delta - \gamma = g_c - \gamma$$

And there will be a sharp recovery coming out, namely

$$\frac{\Delta Q}{Q} = s(1-\gamma)A - \delta - \beta + \gamma A = g_c - \beta - s\gamma A + \gamma\,.$$

Consider for example the case where the balance sheet effect just offsets canonical growth, i.e. $\beta = -(sA - \delta) = -g_c$, but the productivity effect is twice as large, i.e. $\gamma = -2g_c$. In this case output growth will fall to $-g_c$ on entering into recession but recovery will take place at almost twice the canonical rate. This is illustrated in Figure 5.

[10] Could one appeal to Allen and Gale's analysis to justify this? Or Diamond (1982)?

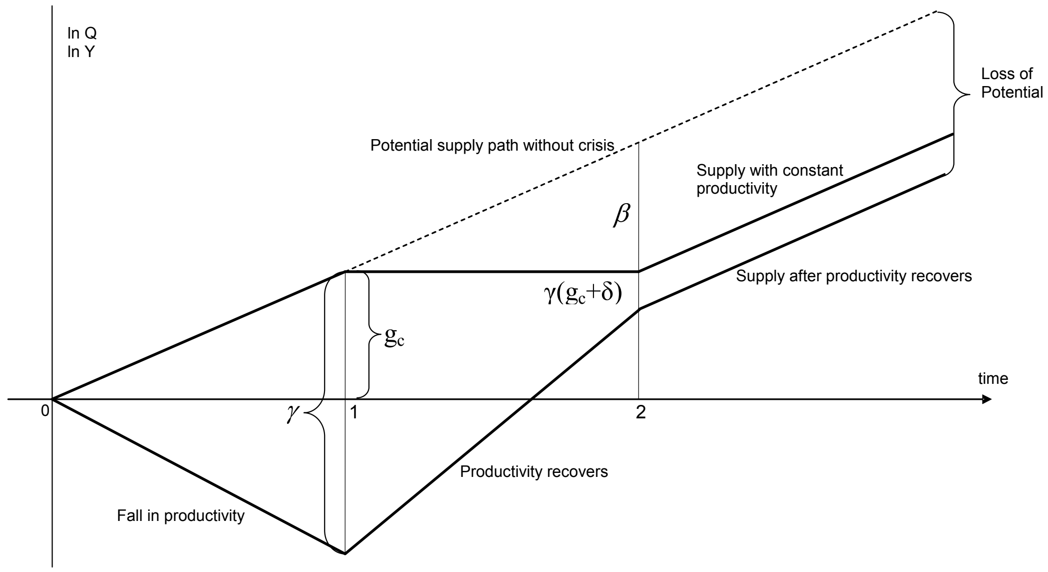


Figure 5: Financial shock: short and long run effects on supply.

The impact of an adverse balance-sheet effect induced by currency devaluation at period 1, *assuming no productivity shock,* means that output is not affected in period 1 but falls below the pre-existing trend by β% in all subsequent periods, as shown by the upper solid line in the figure[11]. If the balance sheet effect triggers a fall in TFP so that the growth rate of GDP changes sign (as was roughly the case for countries in SE Asia), then the dip will lower potential supply yet further by the amount, $\gamma(g_c+\delta)$ even if productivity recovers promptly in period 2. With the productivity recession, the lower bold line shows output exhibiting the familiar V-shape in the period of crisis and recovering promptly thereafter (but to a lower trend) in period 2. This satisfies the output pattern of a Phoenix miracle and the longer term downshift of supply shown in Figure 2.

A similar pattern may be observed in recent crises affecting countries in Latin-America, as Talvi (2006) indicates. Using Central-American GDP as proxy for the trend of potential supply, he finds the characteristic V-shaped recession. Economic recovery, accompanied by the redistribution of income in favour of profits but without external credit, is fairly rapid; but it does not take output back to the previous trend.

[11] Drawn on the convenient, but not essential, assumption that the balance sheet effect is sufficient to wipe out the effects of one year's growth, i.e. $\beta = sA - \delta$.

Keynesian Recession

Much the same results follow if recession causes demand to fall below supply. Consider a simple Keynesian-multiplier account of the same phenomenon, assuming, as before, an adverse balance sheet effect that cuts investment by βK for one period. If this fall of investment has a multiplier effect on income, then there will be a recession as output falls beneath the capacity by βK/s. These deviations from trend growth will be temporary if investment and demand recover promptly as balance sheet problems are resolved, but output will lie below its previous trend.

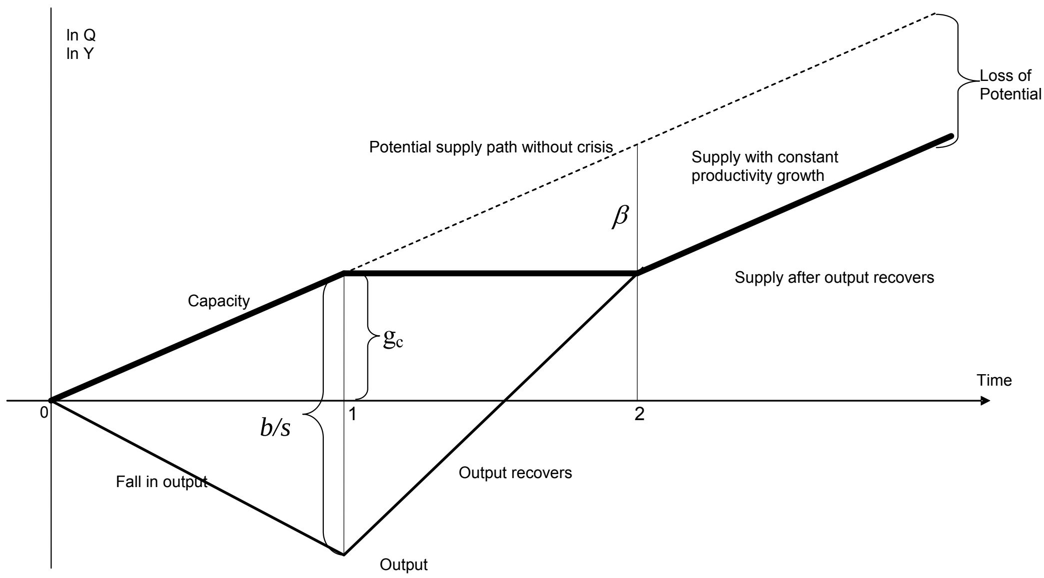


Figure 6: Financial shock: effects on demand and supply

In this case, capacity will continue to grow as $\frac{\Delta Q}{Q} = sA - \delta = g_c$ in the period of crisis but output evolves as $\frac{\Delta Y}{Y} = g_c - \frac{b}{s}$. The temporary fall in investment will lower future potential, but there will be a sharp recovery coming out of recession, as shown in Figure 6.

IV. Financial shocks to a small open economy

The endogenous growth model just considered was for a closed economy. How to take account of open economy aspects? The comprehensive exercise conducted by Cook and Devereux (2006) involves a sophisticated dynamic general equilibrium model of a small open economy; and requires calibrating a set of more than thirty equations. As an alternative approach, we make use of a popular supply-side model of monetary policy in a small open economy written to capture to the exchange rate and balance sheet effects operating in East Asia by Aghion, Bacchetta and Banerjee (2000), hereafter ABB. It was, we gather, designed as a workhorse to analysing some of the issues involved.

Specifically, we use this framework to consider how financial shocks might have both supply side and demand effects, leaving longer run growth aspects to one side. In an open economy financial restriction could, for example, affect the supply of traded goods (for which there is elastic demand), and the output of non-traded goods (where it is only local demand that matters). Two changes inspired by the work of Calvo and his colleagues at IDB are introduced into the ABB framework. First *the cause of the crisis is taken to be an external financial shock* (not an exogenous shock to domestic TFP). Second *financial conditions are assumed to impede the expansion of exports* in the short run so that the economy lacks the stabilising feature of unlimited foreign demand that assures full employment of resources even in the short run. The results can be interpreted as the effect of a Sudden Stop in capital flows in an economy temporally deprived of an automatic stabiliser.

The basic ABB model in summary form

The ABB model is a dynamic supply-side model which focuses on the balance sheet effects of devaluation on the private sector in a small open economy. With liability dollarisation and one-period of price stickiness for the traded good, a rise in the price of the dollar generates adverse balance sheet effects; so investment is cut back, reducing productive potential in the next period. This "third generation" account offers a persuasive channel for the transmission of the exchange rate effects to the supply side; and the multiplicity of equilibria opens up the prospects of sudden shifts in the exchange rate. Key features of this widely cited two-period model may be summarised as follows.[12]

There is full capital mobility and uncovered interest parity holds. Purchasing Power Parity (PPP) for traded goods also holds, except in period 1 when an unanticipated shock leads to a deviation as prices are preset, but other variables — the nominal exchange rate in particular — are free to adjust. The actual timing of events in period 1 is: the price of traded output is pre-set according to the ex-ante PPP condition and firms invest; then there is an unanticipated shock[13], followed by the adjustment of interest rate and the exchange rate; finally, output and profits are generated, with a fraction of retained earnings saved for investment in period 2. Together with investment funded by lending, this determines the level of production in the second period, when prices are flexible so PPP is restored.

An attractive feature of this model is that the equilibrium can be found as the intersection of two schedules relating the exchange rate and output in the following period, called the IPLM curve and the W curve. The former, as the name suggests, is a combination of the Uncovered Interest Parity, money market equilibrium and the PPP condition for the second period. Formally, it is written as:

$$E_1 = \frac{1+i^*}{1+i_1} \frac{M_2^s}{L(Y_2, \overline{i_2})} \tag{7}$$

where E_1 is the exchange rate for the first period, i^* is the foreign interest rate, i_1 i1 and $\overline{i_2}$ are domestic interest rates for periods 1 and 2, M_2^s and Y_2 are money supply and output in period 2, and $L(Y_2, \overline{i_2})$ is the money demand function. This IPLM curve is downward sloping in the E_1 and Y_2 space because higher output in the second period increases money demand (i.e., higher L(.) given interest rate in period 2) and so strengthens the exchange rate (note that M_2^s is given).

[12] The relevant equations are given in Appendix B.

[13] If the shock is anticipated, the expected price adjustment eliminates the balance sheet effect, Becker (2006).

The second of the two schedules, the W-curve, characterizes the supply of output on the assumption that entrepreneurs are credit-constrained. (The production function is assumed to be linear in capital stock, which *depreciates completely at the end of the period*.) Total investment consists of last-period retained earnings together with borrowing (in both domestic and foreign currencies, with proportions given exogenously) which is limited to a given fraction $\mu_t(i_{t-1})$ of retained earnings. The introduction of $\mu_t(i_{t-1})$ (with $\mu_t' < 0$) captures credit market imperfection. The W-curve is specifically given by

$$Y_2 = \sigma\left(1 + \mu\left(i_1\right)\right)\left(1 - \alpha\right)\left[Y_1 - \left(1 + r_0\right)D^c - \left(1 + i^*\right)\frac{E_1}{P_1}\left(D_1 - D^c\right)\right] \quad (8)$$

where σ is the productivity parameter, α is the fraction of output consumed in each period, D_1 is the total level of borrowing and D^c is its domestic currency component. The W-curve so constructed is a downward sloping straight line in E_1 and Y_2 space[14]. Clearly this formulation captures the contractionary effect of devaluation on the supply-side, i.e. the Fisher effect.

ABB (2000) use the framework to analyse the policy dilemma posed by a negative TFP shock which lowers anticipated future output. With no changes in anticipated future money supply, the expected higher future price level and lower value of the currency induces current devaluation, which triggers adverse balance sheet effects and damages investment[15]. Raising interest rates to strengthen the currency risks further contraction of investment and in future output.

Supply constrained exports and aggregate demand failure

The ABB analysis assumes that there is no aggregate demand failure resulting from the productivity shock: investment may fall due to balance sheet effects, but this does not affect output at the time of the currency crisis. The demand for exports of a small open economy is typically assumed to be unlimited: so exports, in theory, can adjust

[14] Note that Y_2 is set to zero if the right hand side of (2) turns out to be negative, where $Y_2 = 0$ signifies the depression level of output.
[15] Note that the alternative monetary policy options discussed by Cook and Devereux (inflation and exchange rate targeting) might well avoid these adverse effects.

to provide an 'automatic stabiliser' for demand shocks to demand. The data, however, are not consistent with this reassuring hypothesis. Calvo and Reinhart (2000), for example, find that in case of an emerging market currency crisis, exports typically *fall* before recovering to their pre-crisis levels: the lag before recovery is 8 months or, with a banking crisis, 20 months. In an investigation of devaluations in emerging economies, Frankel (2005, p.157) concludes "that devaluation is contractionary, at least in the first year, and perhaps in the second as well."

To account for the 'Phoenix Miracle', CIT (2006) have, as we have seen, invoked a large (but temporary) economy-wide productivity shock affecting current output: specifically they argue that there is an immediate contraction of supply across all sectors of the economy, attributable in large part to the reduction of working capital[16]. For Stiglitz and Greenwald, such supply-side factors certainly apply to exports -- but demand effects operate elsewhere.

Following CIT (2006), let us postulate a temporary fall in productivity across the economy, captured by a fall in an 'efficiency term' η appearing in the supply function in the period that the crisis breaks. This is assumed to determine the behaviour of exports relative to their trend growth rate- but not the fall in total output as in the Phoenix Miracle account as aggregate output is demand-determined due to the multiplier effect of depressed investment on GDP. (In support of the Keynesian specification of demand determination used here, note that firms are in any case *credit-constrained* in the ABB model; and where devaluation is accompanied by a banking crisis ("twin crises"), both consumers and producers will typically be denied access to new credit.)

With demand-determined output, the fall of investment will cut current output and consumption. Specifically, let output in period 1 be determined as follows:

$$Y_1^D = A_0 + \gamma\beta\left(Y_1 - D_1^*\right) + \left(1+\mu_2\right)\left(1-\beta\right)\left(Y_1 - D_1^*\right) + \bar{X} - mY_1 \tag{9}$$

[16] In their partial equilibrium analysis, this is augmented in deep crises by the sales of physical capital to further economise on inventories: what happens in general equilibrium is not clarified, however.

where $D_1^*(E_1) = (1+r_0)D^c + (1+i^*)(E_1/P_1)(D_1 - D^c)$ is the total cost of debt service and Y_1 is aggregate demand measured in constant prices. The first term, A_0, represents autonomous expenditure (which is not related to debt or current income). The second term indicates how consumption demand depends on income and debt, where $\beta < 1$ is the labour share of income and $\gamma < 1$ is the fraction spent on consumption. The third term is demand for investment with $(Y_1 - D_1^*)$ representing corporate profits net of borrowing costs, and μ the credit multiplier. The last two terms represent net exports: while imports vary proportionally with current income, the export volumes in the current period are taken to be a fraction ϕ of aggregate supply $\bar{X} = \phi\eta Y_1^S$

where Y_1^S is the supply in the absence of the shock and the efficiency parameter η is given by

$$\eta = \eta(\mu_2(i_1) - \mu^*) = \begin{cases} 1 & if \quad \mu_2(i_1) - \mu^* \geq 0 \\ <1 & if \quad \mu_2(i_1) - \mu^* < 0 \end{cases} \tag{10}$$

When interest rates are relatively low, such that the credit multiplier is above the threshold μ^*, the efficiency parameter η is equal to 1. But when interest rates are sufficiently high to cause the credit multiplier to fall below the threshold μ^*, the efficiency parameter falls below 1. (CIT (2006) go further, arguing that supply will make a jump decrease as interest rates go pass the threshold that leads to a deep crisis.)

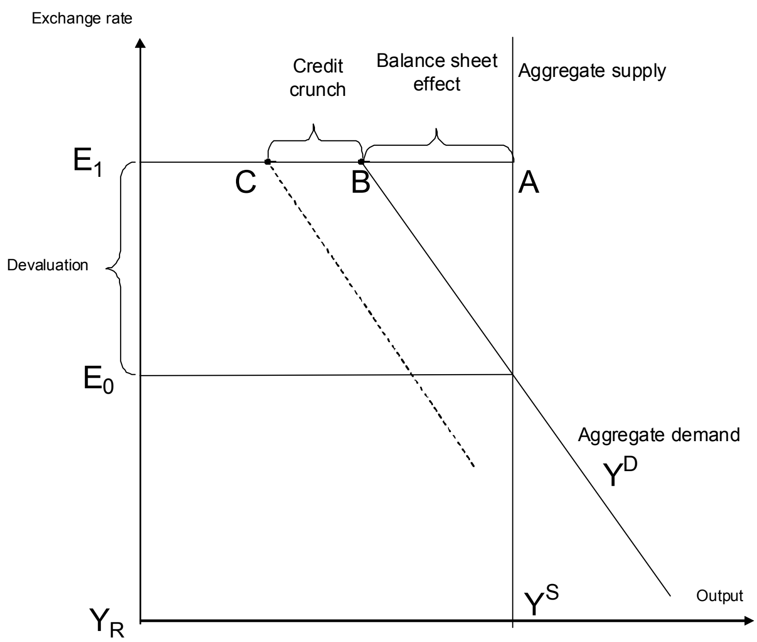
The failure of export volumes to stabilise demand means that a collapse of investment (due to balance sheet effects, for example) can reduce realized output in the current period (as well as supply potential in the next period), as can be seen from the solution for current output:

$$Y_1^D = \frac{A_0 + \bar{X} - D_1^*(E_1)\left[\gamma\beta + (1+\mu_2(i_1))(1-\beta)\right]}{1 + m - \left[\gamma\beta + (1+\mu_2(i_1))(1-\beta)\right]} = \frac{A_0 + \phi\eta Y_1^S - \xi D_1^*}{1 - \xi + m} < Y_1^S \tag{11}$$

where $\xi = \gamma\beta + (1+\mu_{t+1})(1-\beta)$ and $1 > 1 - \xi + m > 0$. The predetermined factors in the numerator include debt service and exports volumes; and the term $1/(1-\xi+m)$ is a Keynesian-style open economy multiplier, where 1-ξ is the marginal propensity to save and m is the marginal propensity to import.

How demand failure can lead to prompt contractionary devaluation is indicated in Figure 7, with output in period 1 on the horizontal axis and the exchange rate in period 1 on the vertical. As it depends essentially on output and interest rate in the previous period, aggregate supply (in the absence of the crisis effect on TFP) appears as a vertical line Y_1^S. Aggregate demand, however, moves inversely with the current exchange rate due to the adverse balance-sheet effects of a devaluation which raises the price of a dollar from E_0 to E_1 and increases $D_1^*(E_1)$ in equation (2). At E_1, for example, demand has fallen by AB.

Figure 4: Aggregate demand and supply in period 1.



In a "*twin crisis*", where devaluation is accompanied by a credit crunch, aggregate demand will fall even further.[17] Two scenarios are considered here. The first is that a devaluation results a mild credit crunch where credit multiplier $\mu_2(i_1)$ falls on impact but remains above the threshold $\mu*$. In this case, the aggregate supply in period 1 is unaffected at the level of Y_1^S, and aggregate demand shifts further to the left due to

[17] Becker (2006) discusses the conditions under which a credit crunch will reduce output in this context.

the credit crunch (as shown by the dotted line in the Figure). At E_1, further demand fall due to the credit crunch is measured by the distance BC in Figure 7. The second scenario, a severe credit crunch, which lowers $\mu_2(i_1)$ below the threshold value $\mu*$, will have an additional supply side effects. First, the severe credit crunch shifts the current period aggregate supply from Y_1^S to $\eta Y_1^S < Y_1^S$. This fall in supply reduces exports, causing additional contraction in aggregate demand. So output could fall below C at E_1. As for the effects of raising interest rates to defend the exchange rate, they are demand-contractionary: an increase in the period 1 interest rate will reduce Y_1^D as high interest rates impact adversely on the credit multiplier and so on investment.

In Table 1 we compare and contrast the standard ABB model, where output is supply-determined, with what occurs when exports are predetermined. For ABB, an adverse devaluation-induced shock to the balance sheet in period 1 has no effect on period 1 output (which is determined by previous period investment), but cuts it in period 2 via reduced capital accumulation, see column 1.

Table 1: How demand failure modifies output levels. [18]

	ABB(2000)	As modified
Y_1	$Y_1^S(ABB) = \sigma\left[1+\mu_1(i_0)\right](1-\alpha)\left[Y_0 - D_0^*\right]$ $Y_1 = Y_1^S(ABB) = Y_1^D$	$Y_1^D = \left[\gamma\beta + (1+\mu_{t+1})(1-\beta)\right](Y_t - D_t^*) +$ $+ A_0 + \overline{X} - mY_t$ $Y_1 = Y_1^D < Y_1^S = Y_1^S(ABB)$
Y_2	$Y_2^S(ABB) = \sigma\left[1+\mu_2(i_1)\right](1-\alpha)\left[Y_1 - D_1^*\right]$	$Y_2^D = Y_2^S < Y_2^S(ABB)$

When there is excess supply in period 1, however, the impact of an anticipated currency collapse is more immediate and more damaging. Balance-sheet effects reduce investment in period 1 directly: but this triggers a contraction of income within

[18] Note that in table 1, we have followed ABB in assuming that output in period 2 is supply-determined. This does not mean that output in period 2 matches that of the ABB model, however: the contraction is greater because of the reduced investment associated with the fall in aggregate demand in period 1.

the period, which in turn leads to even less investment as profits fall. The knock-on effect on period 2 means that future supply is less than predicted by the ABB model.[19]

Adding endogenous growth

The simplifying assumption made by ABB that capital depreciates completely within one period highlights the effect of reduced investment in dramatic fashion: this period's investment is next period's capital stock! But the exaggerated rate of depreciation effectively rules out the growth-creating effects of capital formation. A more attractive alternative is a growth model (with depreciation well below unity), where lower investment cuts future supply and also leads to a sharp recession via its effects on aggregate demand. How can this be incorporated?

In the ABB model, output is defined by

$Y_2 = \sigma\left(1+\mu\left(i_1\right)\right)K_2$

and implicitly investment by $I_1 = \left(1-\alpha\right)\left(Y_1^D - \left(1+r_0\right)D^c - \left(1+i^*\right)\frac{E_1}{P_1}\left(D_1 - D^c\right)\right)$

(Note that with 100% annual depreciation K_2=I_1).

To fit their analysis into an endogenous growth framework one could interpret (and modify) this investment equation along the lines of equation (5) in Section II, namely

$\Delta K = S - \delta K = \sigma AK - \beta K - \delta K$

i.e. to assume all saving is invested but to allow for only partial depreciation. Thus, with very little violence to their algebra, it appears that their model can be transformed into a model of endogenous growth.

V. More tools?

The dilemma for the monetary policy arises from having two objectives – to strengthen the currency and protect the economy – with only one instrument, i_1. Tinbergen's principle would suggest looking for another policy instrument.

[19] Cutting μ_1, credit multiplier corresponding to period 0, would have same effects on period 1 supply in both models.

What if tight money is complemented by an easing of fiscal policy? The logic in support of this is straightforward. If fiscal policy is used to stabilise aggregate demand in the way that exports would have (if they had time to adjust), the demand effects can be avoided. It is no surprise that IMF policy targets for fiscal *tightening* in the midst of the East Asia crisis attracted serious criticism.[20] In fact, as Fischer (2001Chapter 1, p. 15) notes in his Robbins Lecture on 'The First Financial Crises of the Twenty First Century', "The internal debate over appropriate fiscal policy, both within the staff and with the Board [of the IMF], intensified as the crisis worsened, and as outside criticisms increased. By early 1998, budget targets began to be eased".

More broadly, China and its neighbours now seem to believe believe that massive reserve accumulation at a national will insure against Sudden Stops. Is this in fact a guarantee of low sovereign spreads: or will it call for the further development of regional or global liquidity insurance schemes?

The use of capital controls, as in India (ex ante) or Malaysia (ex post), is another possible substitute for tight money in a crisis of confidence. The US stock market uses circuit-breakers to check self-fulfilling runs amplified by automatic sell orders; and London capital markets use temporary outflow controls as bulkheads to limit outflows from pension funds for example. So temporary controls are not necessarily inconsistent with developed financial markets.

VI. Conclusion

The insight of ABB was to trace the impact of devaluation on domestic investment and the supply-side of the economy via the balance sheets of credit-constrained firms. Their account of a Fisher effect for emerging markets helps to explain why emerging markets should be possessed by a "Fear of Floating". But the supply-side economic contraction they describe would surely come later and last longer than the V-shaped recession observed in SE Asia. To account for the latter, the Phoenix miracle account

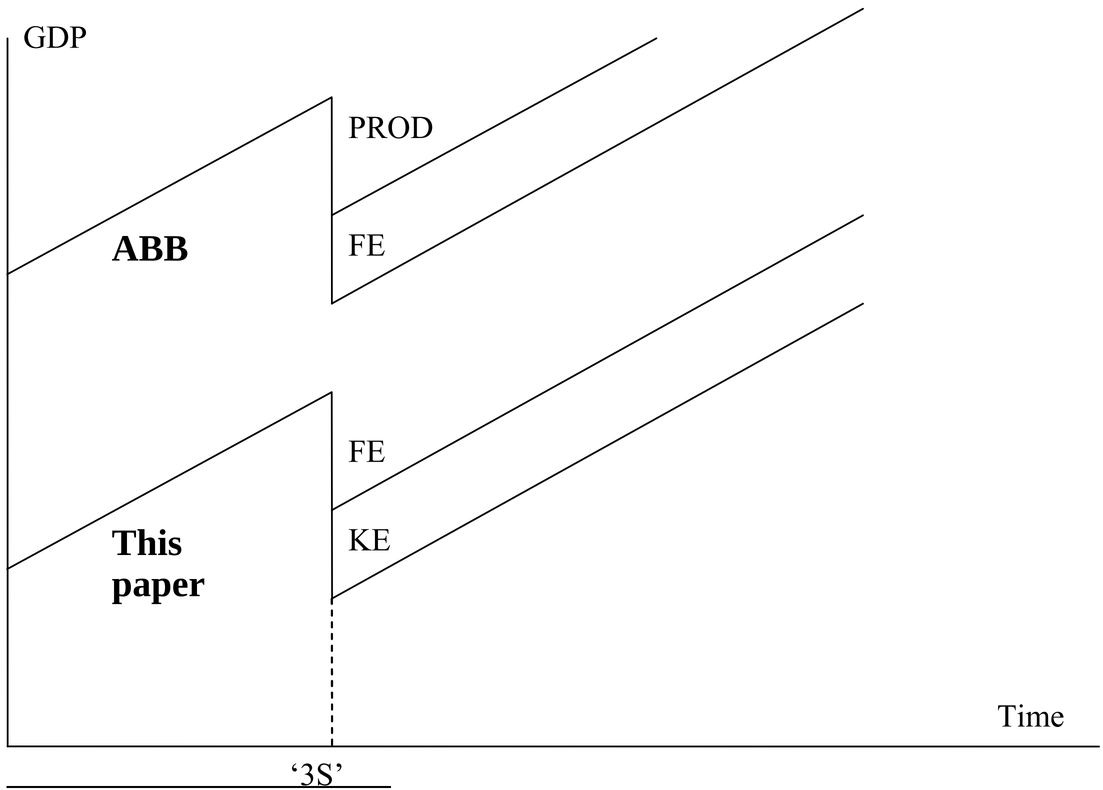
[20] See for example Stiglitz (1999).

of CIT involves a temporary supply-side contraction of TFP driven by high interest rates[21].

New Keynesian analyses stress the role of deficient demand for non-traded goods. National income might be adversely affected if supply- side disruptions prevent *exports* substituting for falling investment orders which could lower demand for non-tradables. The impact of balance sheet effects in the *non-traded goods* sector[22] would have a more direct impact. .

As for the trigger for crisis, ABB typically ascribe the Balance Sheet effects in SE Asia as the unfortunate consequence of idiosyncratic negative productivity shocks: but the coincidence of the crises in the countries concerned must throw some doubt on this interpretation as the Fisher effects may be triggered by the Sudden Stops in capital flows described in Calvo, Izquierdo and Talvi (2003).

Figure 8: Two views of crises in Emerging Markets



[21] In their supply-side account of the Mexican data, Kehoe and Ruhl find it necessary to postulate an even greater role for TFP contraction: they assume a crisis-induced permanent fall in TFP of more than ten percent.
[22] (IADB, 2004 Figure 4.7, p.53 shows that in Argentina and Uruguay 70% of the liabilities of small business in the non-traded sector were dollarised).To capture this, one could put a Fisher effect into the model of Obstfeld and Rogoff (1996) outlined in the Appendix.

The resulting view of emerging market crises – and how it compares with that of ABB – is indicated in broad brush fashion in Figure 8.

The view developed in this paper is of a synchronised capital market shock affecting several open economies more-or-less simultaneously, as indicated by the symbol 3S indicating the Systemic Sudden Stop as described by Calvo et al. (2003). The resulting exchange rate collapse triggers a powerful Fisher effect which in turn is amplified by a Keynesian multiplier. Growth resumes thereafter but at a lower level. For ABB the exchange rate collapse is attributed to adverse idiosyncratic productivity shocks which by definition reduce supply reduce supply: but their impact is sharply amplified by the associated Fisher effects.

What of the Indian experience? Does it not suggest that successful stabilisation of output in SE Asia might even have prevented *any* step-down in trend GDP. Could the long term reduction in potential be due to the lagged effects of low investment and bankruptcy in a severe demand recession?[23] On this interpretation, the contagion that spread from Thailand to Korea was not some irresistible strain of supply-side decline, but spreading exchange rate panic[24] which, properly handled, could have avoided the hysteresis effects of a recession. Treating the initiating shock not as a fall in productivity but as credit contraction induced by financial contagion might be more appropriate in such circumstances, as Aghion and Banerjee (2005, p.108) seem to acknowledge.

The framework proposed in this paper consists of an endogenous growth model of the supply side together with a demand recession triggered by balance sheet effects. Paul Krugman once remarked that each emerging market crisis seems to need a new economic model. But the pattern of V-shaped recession and damaged trend growth is common to both East Asia and in Latin America. Are they sufficiently similar to be

[23] There was, for example, a pronounced step-down in trend output in the US as result of the Great Depression.
[24] With respect to the crises in Indonesia and Korea, 'contagion seemed to play a dominant role. But the contagion hit economies with serious financial and corporate sector weaknesses.' Fischer (2001, chapter 1, p. 11).

analysed using a common framework -- of endogenous growth interrupted by a demand recession linked to liabilities in dollars?

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APPENDIX:

New Open Economy Macroeconomic model of Small Open Economy

In their New Keynesian model of a SOE, Obstfeld and Rogoff (1996, chapter 10.2) assume that the output of non-traded goods with one-period sticky prices is *demand determined* in the short run. Because they have no Fisher effect in the model, they find that unanticipated devaluation *expands* the demand for and production of nontraded goods. So this is no model of crisis! Adding a Fisher effect in the non-traded sector could presumably reduce demand and, if sufficiently strong, induce contraction after currency devaluation (much as in the traded-good-only model of ABB where export demand is constant).

The positive sign of the Keynes effect in the SOE is derived as follows.
Assume the representative consumer maximises

$$U = \left(\gamma \log C_{T,1} + (1-\gamma)\log C_{N,1} + \log \frac{M_1}{P_1} - \frac{k}{2} y_{N,1}^2 \right)$$

$$+\beta \left(\gamma \log C_{T,2} + (1-\gamma)\log C_{N,2} + \log \frac{M_2}{P_2} - \frac{k}{2} y_{N_2,1}^2 \right) + \ldots$$

where

C_T is consumption of traded good (an endowment);

C_N is consumption of non-traded good;

P is a price index, $P = P_T^{\gamma} P_C^{1-\gamma}$;

subject to period-by-period budget constraints written as

$$P_{T,1}C_{T,1} = \left(P_{T,1}\left(1+r\right)B_1 + M_0 + P_{N,1}y_{N,1} + P_{T,1}\overline{y}_T - P_{T,1}T_1 - P_{T,1}B_2 - M_1\right)$$

$$P_{T,2}C_{T,2} = \left(P_{T,2}\left(1+r\right)B_1 + M_1 + P_{N,2}y_{N,2} + P_{T,2}\overline{y}_T - P_{T,2}T_2 - P_{T,2}B_3 - M_2\right)$$

Since bonds are denominated in tradables and the international bond rate equals the rate of time preference (i.e. $\beta(1+r)=1$), we obtain the following first order conditions:

(1) $$\frac{\partial U}{\partial B_2} = -\frac{\gamma}{C_{T,1}} + \frac{\gamma\beta(1+r)}{C_{T,2}} = 0 \qquad \rightarrow \qquad C_{T,1} = C_{T,2}$$

[Demand for tradables]

(2) $$\frac{\partial U}{\partial M_1} = -\frac{\gamma}{P_{T,1}C_{T,1}} + \frac{\gamma\beta}{P_{T,2}C_{T,2}} + \frac{1}{M_1} = 0$$

[Money demand and arbitrage]

(3) $$\frac{\partial U}{\partial C_{N,1}} = \frac{1-\gamma}{C_{N,1}} - \frac{\gamma}{C_{T,1}}\frac{P_{N,1}}{P_{T,1}} \rightarrow P_{N,1}C_{N,1} = \frac{1-\gamma}{\gamma}P_{T,1}C_{T,1}$$

[Expenditure Pattern]

(1), (2), (3) implies money market equilibrium as follows

(4) $$M_1 = \frac{P_{T,1}C_{T,1}}{\gamma\left(1-\left(\frac{\beta P_{T,1}}{P_{T,2}}\right)\right)} = \frac{P_{N,1}C_{N,1}}{\left(1-\gamma\right)\left(1-\left(\frac{\beta P_{T,1}}{P_{T,2}}\right)\right)}$$

Log linearising (4) as in O/R p. 693 yields the following simple specification of the evolution of money and traded-good prices – and so the exchange rate:

(5) $$m = p_T + \frac{\beta}{1-\beta}\left(p_T - \overline{p_T}\right) = c_N + \frac{\beta}{1-\beta}\left(p_T - \overline{p_T}\right).$$

(This can be obtained by setting $\varepsilon = 1$ in equation (96) of O/R)

So for an unanticipated monetary shock, $m = p_T = c_N = e$.