Thailand’s investment-driven boom and crisis

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Analyses of the Asian crisis of 1997 have focused excessively on the financial sector, especially the banks. The role of the real sector in exposing the financial system to stress has been under-emphasized. This paper provides a real-sector explanation for Thailand’s crisis, demonstrating the role of the investment boom of the preceding decade. We build a full macroeconomic model of the Thai economy and use it to demonstrate that the investment boom and its changing composition generated record growth but also increased macroeconomic vulnerability. This vulnerability, combined with the trigger of an export slowdown in 1996, produced the crisis.

1. Introduction

1.1 From boom to crisis

Until the crisis of 1997 Thailand was widely considered a superstar of sustained development. Since the late 1950s the Thai economy had achieved a remarkable combination of sustained growth, with expansion of real GDP averaging over 7% from 1965 to 1996 (over 5% per capita), combined with macroeconomic stability and a steadily declining incidence of poverty. Not a single year of negative growth of real output per head of population was experienced between 1958 and 1996, a unique achievement among developing countries (Warr, 1993). This period had two principal phases: moderate to rapid growth from 1958 to 1986 (Ingram, 1971), and super-growth from 1987 to 1996 (Warr and Nidhiprabha, 1996). From 1965 to 1986, the average annual growth rate of Thailand’s real GDP was over 6% per annum and growth of GDP per person was about 4%. See Fig. 1. This compares with an average of 2.2% annual growth of real GDP per capita for low and middle income developing countries over the same period (World Bank 1998).

Then, beginning in 1987, growth accelerated even further. From 1987 to 1996 real GDP grew at an average annual rate close to 10% (around 8% per person). Both private domestic investment and foreign direct investment surged dramatically. During this decade the Thai economy was the fastest growing in the world.
Moreover, for roughly the first half of this boom decade, rapid growth of output was combined with low inflation. The currency had been pegged to the US dollar since the 1950s and the rate had scarcely moved except for two minor devaluations in the early 1980s. Thailand’s performance came to be described as a ‘miracle’ which others might emulate. Its principal economic institutions, including its central bank, the Bank of Thailand, were widely cited as exemplars of competent and stable economic management.

All this changed with the crisis of 1997–98: the exchange rate collapsed, following the decision to float the currency in July 1997; output and investment contracted violently—real GDP declined by 1.8% in calendar 1997 and by a further 10.4% in 1998, recovering moderately to 4% growth in 1999 and 2000; the government was compelled to accept a humiliating and seemingly ill-conceived IMF bailout package; and confidence in the country’s economic institutions, including the Bank of Thailand, was shattered. The incidence of poverty rose significantly. Many of the very commentators who had only recently been so impressed by the Thai experience now called it an example to be avoided. Something had gone badly wrong. What was it?

Until now, analyses of the Thai crisis of 1997 and the decade of economic boom which preceded it have been largely disconnected from one another. Earlier attempts to understand the boom period emphasised real variables, especially investment, and relied heavily upon quantitative growth accounting methods.1 Analyses of the crisis in Thailand and elsewhere have been largely qualitative. They have focused primarily on the financial sector, especially the banks, and have tended to emphasise the importance of irrational behaviour.2 But a seemingly endless list of other supposed causes has also been cited, including government corruption, lack of expertise in prudential regulation, expansion of Chinese exports in competition with Thailand, recession in Japan, currency fluctuations, activities of currency speculators, and poor policy advice from the IMF.3

1.2 Contribution of this paper

In this paper, we provide a quantitative analysis which produces a unified and simplified explanation for both the Thai boom and the Thai crisis. We demonstrate the role of the investment boom which occurred over the decade 1987 to 1996 in fuelling the output boom and in laying the foundation for the subsequent crisis. This integrated analysis requires a full, detailed macroeconomic model of the Thai economy. However, we leave the extension of our analysis to the crisis period as a topic for further investigation.

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1 For example, World Bank (1993). Similarly, the IMF studies of Robinson, et al. (1990) and Kochar, et al. (1996) ascribe the boom to wise policies leading to high rates of investment. For other interpretations of the East Asian ‘miracle’ which fit this pattern, see Kim and Lau (1994), Krugman (1994) and Young (1995) and Crafts (1999).

2 For example, Bhagwati (1998), Tobin (1998), and Radelet and Sachs (1998). Krugman (1999b) attributes the crisis to crony capitalism in the financial system.

3 The literature on Thailand includes Pasuk and Baker (2000 and 2002) and Hewison (2000).
economy, facilitating counterfactual simulation experiments. In Section 2, we describe the model we have constructed for this purpose and summarise its properties.

In Section 3 we use this model to show that the decade of very rapid, non-inflationary growth ending in 1996 can be fully explained by the boom in investment. We also show that the implications of this growth for the Thai current account of the balance of payments depended on the changing nature of the boom. The early part of the investment boom was dominated by a surge in direct foreign investment and we show that this did not induce a current account deficit. The later stages of the boom were dominated by a subsequent rise in domestic private investment and we show that this phase of the investment boom caused a large current account deficit to emerge.

Section 4 then demonstrates that this large current account deficit, arising from the surge in private domestic investment, created vulnerability to external crisis. Finally, we argue that when this vulnerability was combined with the exogenous trigger of an export slowdown in 1996, it fully explains Thailand’s crisis. Section 5 summarises and concludes.

2. The model
We base our account on an empirically-based, economy-wide macroeconomic model of the Thai economy. The method of analysis is to perform counterfactual simulations which compute the time paths of GDP and other key endogenous variables implied by hypothetical alternative time paths of key exogenous variables. By comparing these counterfactual time paths of GDP, exports, imports, price levels and so forth with their actual time paths it becomes possible to answer questions like ‘What would have happened if . . . ?’ and thereby to identify the significant sources of both the boom and the bust. The advantage of this modelling approach is that it facilitates controlled experiments—varying one exogenous variable at a time, holding all others constant.

The model is designed to capture features of the Thai economy central to an understanding of what happened during the boom-and-crisis period. These features include a pegged exchange rate and an open international capital market, implying that the domestic interest rate is equal to the world rate plus an exogenous risk premium. The model is explained in detail in an Appendix to this paper. With one exception, all of its behavioural equations are based on original econometric estimation using Thai data, also described in the Appendix. That exception, the equivalent of an expectations-augmented Phillips curve, was constructed by trial and error to give parameters providing consistency between the overall properties of the model and the time series behaviour of the Thai macro-economic data. The model has been exhaustively tested by means of a large number

4This Appendix is available at: http://www.oep.oupjournals.org
of diagnostic simulations. The most important of these, which give a clear indication of the model’s properties, are summarised in the Appendix. Here we describe the four features which are most important for understanding the simulation results.

(i) Aggregate supply (potential output) depends, via an aggregate production function, on labour supply (exogenous) and the accumulated stocks of three separately identified forms of capital: private, domestically-owned capital (endogenous); government-owned capital (exogenous); and foreign-owned capital (exogenous). This assumption is not necessarily appropriate. Public and private capital stocks typically perform different economic functions and accordingly may be imperfect substitutes, a point which recent endogenous growth literature has recognised (see Barro and Sala-i-Martin, 1995). But capital derived from domestic savings and foreign-owned capital may also be imperfect substitutes. In a developing country in particular, foreign capital can embody forms of technological knowledge which domestic capital does not, and may carry with it superior marketing linkages as well.

(ii) Aggregate demand is the sum of domestic absorption (consumption and investment, both public and private) and net foreign absorption (exports minus imports). Firms always produce a level of output equal to aggregate demand and adjust their demand for labour accordingly, given their stock of capital. In the long run aggregate demand (equals output) is equal to aggregate supply and this equality is brought about by price flexibility. But in the short run prices are sticky, because wages are sticky, and demand (equals output) is obtained from the sum of domestic absorption and net exports, at those prices. For aggregate demand (and output) to be more than aggregate supply implies that employment will be greater than the given level of labour supply at the sticky level of wages, and vice versa if demand (and output) are less than aggregate supply. But when employment is greater than labour supply, wages (and prices) rise; this is the mechanism whereby aggregate demand (and output) are brought into line with aggregate supply in the long run.6

5 These supply side features of the model give the analysis a strong edge over what is possible with, for example, a Keynesian demand-determined open economy model of the Mundell-Fleming/Swan-Salter kind.

6 All of these (now conventional) features are found in models such as the MSG and Multimod global econometric models (McKibbin and Sachs, 1992; Laxton, et al. 1999). The explicit modelling of aggregate demand gives our analysis an edge over most applications of CGE (computable general equilibrium) modelling, which attempt to explain events solely from the supply side by imposing full utilisation of resources. See Noland et al. (1998) for an application of this kind of analysis to the Asian crisis, an application which Vines (1999) argues is inadequate because it does not identify the effects of demand as well as supply.
(iii) There are avenues through which supply-side events influence aggregate demand in addition to those working through price flexibility. Private domestic investment is driven by a capital stock adjustment mechanism, which means that improvements in the supply side of the economy—driven, say, by inward foreign direct investment or by new export opportunities—stimulate investment. Exports themselves are also directly affected by the accumulated stock of capital (both domestically owned and, especially, that which results from foreign direct investment). And private consumption depends not just on income, as in a simple Keynesian consumption function, but on wealth, which is also influenced by the size of the capital stock.7

(iv) Finally, changes in aggregate demand influence the supply side. In particular, because the evolution of the domestic capital stock is driven by investment, this means that the supply side potential of the economy is endogenous to aggregate demand rather than being exogenous.

3. The anatomy of the boom

Figure 1 summarises time series data for some key macroeconomic magnitudes for Thailand. Panel (a) clearly shows the above-normal growth that occurred in the ten years from 1987 to 1996, inclusive, during which real GDP grew at around 10% per annum. Panel (g) shows the rate of price inflation over this period. In spite of very rapid growth it remained steady at around 5% per annum. Panel (h) shows the current account balance going sharply into deficit during the period of the boom, extending to 9% of GDP by 1990, falling back slightly and then again reaching more than 8% of GDP by 1995.

Panel (a) of Fig. 1 also shows the effect of fitting a logarithmic trend to real GDP from 1976 to 1986 (the growth rate is 6.1% per annum) and then projecting this trend from the level in 1986 (i.e. beginning in 1987) until 1998. In 1996 the actual level of real GDP was 33% above this hypothetical trend line. We take this 33% above-trend increase in real GDP from 1987 to 1996, as the size of the boom to be explained. In addition, we seek to explain the fact that this large boom caused no increase in price inflation, but that it caused the development of the current account deficit as shown.

3.1 The effects of ‘sound macroeconomic policies’

Conventional open economy macroeconomics suggests that successful export-led growth may result from a real exchange rate depreciation. One reading of Thailand’s boom is that its exchange rate policy was such as to produce a large

7 Wealth is also influenced by budget deficits since consumers are not ‘Ricardian’, i.e. an increased deficit does not lead to an equal, and so offsetting, increase in the present value of expected future tax payments.
real currency depreciation in the mid 1980s, which then fueled the boom of the late 1980s and early 1990s (see McKinnon and Pill 1999 for an argument of this kind.) A related view is that it was then possible for Thailand to have its boom in exports and output in the late 1980s without excess demand and inflation because there was also stringent budgetary discipline at the time (Robinson, et al. 1990).
Putting these two views together, one obtains a conventional, and seemingly plausible, open-economy macroeconomic interpretation of what happened in the early stages of the Thai boom, along ‘Swan-Salter’ lines: a real exchange rate depreciation (an expenditure-switching policy) was combined with fiscal consolidation (an expenditure-reducing policy). The important IMF study of the Thai economy by Robinson, et al. (1990) presented just such an interpretation, depicting Thailand’s macroeconomic boom as based jointly upon: (i) a fixed nominal exchange rate—to provide the necessary nominal anchor, but at a level depreciated enough to stimulate exports; and (ii) fiscal prudence—to make room for the export-led expansion. Praise for this successful strategy was strongly echoed in a further Fund study on Thailand published in December 1996 (Kochhar, et al. 1996).

The raw data in panels (b), (c), and (d) of Fig. 1 appear to support this view. Panel (b) shows that in 1985 Thailand experienced a large depreciation of the nominal effective exchange rate between 1985 and 1987, because the baht depreciated relative to the dollar in 1985 and because the dollar, to which the baht was pegged throughout the period, weakened relative to other currencies in 1986 and 1987. Panel (c) shows the extent of Thailand’s fiscal consolidation in the late 1980s. The budget balance went from a deficit larger than 5% of GDP in 1985 to a surplus equal to 7.5% of GDP in 1991. Panel (e) shows the principal means by which the fiscal surplus was achieved, the curtailment of government investment, beginning in the late 1980s.\(^8\)

Do the real depreciation/fiscal discipline explanations account for the boom? Our first two simulations investigate, respectively, what would have happened if there had been no currency depreciation (Simulation (a) and no fiscal consolidation (Simulation B). The logical structure of our discussion, repeated for all subsequent simulation experiments, may be summarised as follows. We wish to determine the degree to which the endogenous variables \(E\), with observed values \(E^0\), were influenced by exogenous variables \(Z\), which took the observed values \(Z^0\). The model is calibrated so that the simulated levels of endogenous variables \(E\) which result from setting the exogenous variables \(Z\) equal to \(Z^0\) are exactly equal to \(E^0\). We now simulate the model with hypothetical values of \(Z\) equal to \(Z^1\), different from \(Z^0\). This simulation experiment is called the ‘counterfactual’. The difference between the simulated, counterfactual values of \(E\), equal to \(E^1\), and the observed values \(E^0\), are then attributed to the difference between \(Z^1\) and \(Z^0\).

3.1.1 Currency depreciation Suppose, hypothetically, that the currency depreciation of 1985 and beyond shown in panel (b) of Fig. 1 had not occurred, but that, instead, the nominal effective exchange rate had remained constant, at the more appreciated 1984 level shown by the counterfactual dotted line in that figure. What

\(^8\) For details, including the political economy of this fiscal outcome, see Warr and Nidhiprabha (1996, ch.7).
would have happened? Simulation A uses the model to estimate the implications of such a counterfactual. The results are summarised in Fig. 2. Their crucial feature is that, because prices are endogenous in the manner indicated in Section 2, above, any change in the real exchange rate caused by a change in the nominal exchange rate is rapidly undone: the effect of a more appreciated nominal exchange rate is quickly eliminated by lower domestic prices.

The figure indicates that in the first four years after 1985 the simulated changes in the price level relative to base are, respectively, 15, 50, 75, and 100% of the percentage change in the nominal exchange rate. By the fifth year, 1990, the simulated percentage fall of the domestic price level has actually overshot the extent of the nominal appreciation by 40%; approximate homogeneity returns by year 11 (1995). Because of these price developments, the counterfactual levels of exports and output are lower than historical base by only 5.5 and 6%, respectively, in 1987. These declines quickly tail off and are actually reversed by 1991. By 1996 the real

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9 Recall that this simulation shows the effects, not of a of a step currency appreciation of a fixed proportional amount relative to historical 'base', but of an appreciation whose size is given by the—time-varying—distance between the solid and the heavy dotted figures in panel b of Fig. 1: 'overshooting' of the real exchange rate occurs because the extent of the counterfactual appreciation diminishes after the first three years. (The effects of a step exchange rate change of a fixed proportion are discussed in the Appendix where it shown that homogeneity returns after seven years.)

10 This must happen if the overshoot in domestic prices is to be removed, as is required by homogeneity.
effects have essentially disappeared. Our conclusion is therefore that rather little of the boom can be explained by exchange rate changes.\footnote{Our assumptions about price flexibility are clearly central to this conclusion. To investigate its importance we ran a variant simulation (not shown in the figures) in which there was the same counterfactual exchange rate change as in Simulation A but in which all flexibility in domestic output prices was suppressed. That would have significantly appreciated the real exchange rate and the model suggests that this would have caused aggregate demand to be as much as 30% lower than it actually was by 1996. Thus, at first sight, it appears that the nominal currency depreciation which actually happened would be capable of explaining a 30% increase in aggregate demand for output and so that it could explain the boom. However, recall our assumption that firms actually obtain the amount of labour which the production function says is necessary to produce actual output. Such a large increase in aggregate demand would have caused massive and sustained excess demand for labour.}

3.1.2 Fiscal discipline Simulation B explores what would have happened if, hypothetically, the government budget had not gone into surplus, as it did in the late 1980s, but instead there had been very large increases in government consumption expenditure, starting in 1988. The counterfactual expenditures used in the simulation are large enough to spend all of the increase in tax revenues which occurred as the boom got underway, so that, \textit{ex post}, the fiscal surplus was not positive but zero. The results are summarised in Fig. 3.

Fig. 3. Budget deficit counterfactual—simulation B
Initially, the effects on output are expansionary: real GDP is 2.7% higher in 1989 and 3.6% higher in 1990. But, through the operation of the Phillips curve relationship, domestic prices rise: they are 2.0% higher in 1989, 4.1% higher in 1990 and by 1992 they are 5.8% higher. As a result, exports are down by 2.2% and imports up by 8% (the latter stimulated both by higher output and reduced competitiveness). Thus, the current account balance worsens by 2% of GDP.

Without the fiscal surpluses that actually occurred, Thailand’s boom would have produced increases in both inflation and the current account deficit by the early 1990s. Thus the fiscal austerity that occurred helps to explain how a growth boom could coexist with low levels of inflation and, at least for the early part of the boom period, historically ‘normal’ current account deficits. But without the fiscal austerity, real output would have been much the same; fiscal austerity does not explain the underlying sources of the boom.

3.1.3 Summary The simulations summarised in Figs 2 and 3, above, are concerned with expenditure switching and expenditure reduction, respectively. Unless one assumes what we consider an implausible degree of money illusion, this combination of policies cannot be used to explain the boom. ‘Sound macro-economic policies’ were not the underlying cause of the boom, but the fiscal austerity adopted did make it possible for the boom, however caused, to happen without generating unacceptable inflation and external deficits.

3.2 The effects of the investment boom
We now turn to explanations for the boom which focus on the resources used in the production process. Improvements in the quality of the labour force could not have been the source of Thailand’s boom because the performance of its educational sector has been among the weakest in East Asia. Secondary school participation rates are low and have not improved greatly in the past two decades (Khoman, 1993, 2003). Similarly, since the 1960s the expansion of the cultivated land area was small, so growth of the stock of land was not the source either. The answer must lie with the capital stock.

The data on foreign direct investment, government investment and domestic private investment are summarised in panels (d), (e), and (f) of Fig. 1. Both foreign direct investment (FDI) and domestic private investment grew dramatically in the...
years since 1987, but growth of FDI began first and in the early years of the boom the rate of growth of the FDI capital stock was much larger. After reaching a peak in 1991 the rate of inflow of FDI tapered off and domestic investment accelerated, after which the rate of growth of the domestically-owned capital stock was much larger. Government investment followed a very different path. It declined significantly in the late 1980s but its growth accelerated after 1991.

3.2.1 Foreign direct investment  From annual rates of inflow varying between US$100 and $400 million over the previous 15 years, the annual rate of inflow of FDI rose more than five fold over the late 1980s, to over US$ 2 billion per year and remained at over US$1 billion per annum for the next eight years. Rates of domestic saving and investment were also high, but in the earlier years of the boom the stock of capital represented by the accumulated inflow of FDI was increasing much more rapidly than the stock represented by domestic investment.

According to our econometric estimates (see Section A.3.1 of the Appendix), using Thai data, the elasticity of substitution between the two is about 0.45, certainly not infinity, as implied by the usual aggregation. That is, the foreign and domestic components of the aggregate capital stock are net complements, rather than substitutes. Simply adding these two capital stocks is inappropriate because it will miss the implications of this point. When the foreign component of the total capital stock increases, the effect on the productivity of the domestic capital stock is different from that of adding more domestic capital; the productivity of the domestic capital stock increases, possibly very significantly, rather than declines. This suggests that an explanation of Thailand’s boom should take note of the massive inflow of foreign capital, combined with the complementarity between the foreign and domestic capital stocks.

We shall ask three questions regarding this boom in FDI. First, can it explain the large increase in aggregate supply which occurred over the boom decade? An (exogenous) increase in the stock of foreign capital will stimulate aggregate supply in two ways: directly, simply because it is an increase in factor supply; and indirectly, because it will raise the productivity of the domestic capital stock, thus stimulating the (endogenous) accumulation of domestic investment, further augmenting aggregate supply. Second, did the boom in FDI raise aggregate demand more than it raised supply, with the consequent risk of inflation? A large increase in foreign investment will stimulate domestic investment. That will in turn stimulate consumption, via its effects on income. There is a danger that, although aggregate supply increases, the increase in aggregate demand may run ahead of it, generating inflationary pressure and more particularly, under a pegged exchange rate regime, a deteriorating current account balance. Our third question is thus how the boom in FDI affected the balance of payments.

Simulation C explores these three questions in turn and the results are summarised in Fig. 4. The figure shows the simulated implications of a counterfactual time path of foreign investment growing at only 6.1% per annum after 1986, equal
to the average growth rate of real output from 1975 to 1986, along the solid dotted line in panel (d) of Fig. 1, instead of the enormous increase in actual FDI shown by the solid line in the figure. In this simulation, domestic investment is endogenously determined: its value is that which the model says it would have taken if FDI had occurred at its lower, counterfactual level just defined. That is, in this case we allow this reduced level of FDI to inhibit the accumulation of domestically-owned capital.

Panel (b) of Fig. 4 shows that the reduction in aggregate supply (i.e. potential output) is very large. In 1996 the simulated level of potential output is 24% lower than its actual value. The panel also dissects the reason for this: the stock of foreign capital is lower than its observed historical value by a massive 58% and there is an induced fall in the stock of private capital of 13%. This panel thus provides a core component of our explanation for the boom. It indicates that the boom in foreign direct investment, and the increase in private investment which it induced, can explain approximately two thirds of the above-trend increase in output which occurred between 1987 and 1996.

Panel (c) of Fig. 4 shows that the counterfactual simulation, far from reducing inflation, actually causes it to increase. The explanation rests on the change in aggregate demand (i.e. actual GDP) (see Panel (a) relative to aggregate supply. By 1996 GDP is lower than its observed historical value by 24%, the same as the amount by which aggregate supply is below its historical value. But initially, aggregate supply falls more rapidly than aggregate demand, which is why inflation is
above base until 1994 (see panel c). On the supply side there is the strong effect of reducing foreign capital: output declines directly and also indirectly by lowering the productivity of the domestic capital stock. On the demand side there is the large import content of FDI, damping its effect on aggregate demand. This counterfactual simulation thus indicates that the boom in foreign investment which occurred in Thailand, together with the increase in private investment which it stimulated, was weakly counter-inflationary because, at least initially, it enhanced aggregate supply by more than it increased aggregate demand.

Panel (d) shows that the current account balance improves in response to the drop in FDI in the counterfactual simulation, but only by a very small amount; even by 1996 the improvement is less than 2% of GDP. There is a massively lower level of imports in the counterfactual simulation, as a result of the dampening effect on imports of the 24% decline in aggregate demand, and also because of the additional direct effect on imports of lower FDI. But there are also much lower exports, both because (as explained above) aggregate supply falls by more than aggregate demand and so prices are higher, and also because of the lower stock of capital, particularly foreign capital. Thus, comparing the counterfactual with the observed data, this simulation suggests that the boom in foreign investment which actually occurred in Thailand, together with the increase in domestic investment which it directly stimulated, did not cause a significant deterioration in the balance of payments. Although imports increased, so did exports.

Overall, simulation C implies that the increase in FDI which actually occurred, and the induced increase in domestic investment, together explain about two thirds of the size of the observed boom in output. Moreover, this stimulus was non-inflationary. However, the FDI boom does not explain the dramatic worsening of the external deficit which actually occurred.

3.2.2 Government investment  Government investment is also identified separately in our analysis. As already noted, there was significant fiscal discipline from the mid 1980s onward. Panel (e) of Fig. 1 shows that, at least during the early stages of the Thai boom, government investment was restrained well below what might have been expected; this panel reminds us that this was the chief way in which fiscal restraint was implemented. (See also Warr and Nidhiprabha, 1996, ch. 7.) The panel shows a counterfactual path for government investment which is less contractionary, at least until 1994: along this path government investment starts out at its actual level in 1986 and grows from there at a steady rate of 6.1% per annum—the annual growth rate of real output from 1975 to 1986, the same as that used above to construct the counterfactual path for foreign investment.

In Simulation D (results in Fig. 5) foreign investment remains on the counterfactual path used in Simulation C, as described above, but in addition government investment is also made to follow the more expansionary counterfactual path just explained. One difference from the results presented for Simulation C is that with less fiscal restraint prices would have risen slightly faster, because the initial demand
effects would have been higher.\footnote{Less fiscal restraint would have stimulated an increase in aggregate supply, but by less than it stimulated aggregate demand. Figure A3 shows that in the short run the demand effects of an expansion of government investment dominate the supply effects.} Also, at least in the earlier years, the current account deficit would have been slightly worse. This simulation thus suggests that the fiscal contraction which occurred, at least until 1994, slightly reduced both inflation and the current account deficit.

Overall, these results imply that the increase in FDI, plus the increase in domestic investment directly induced by this FDI plus the contemporaneous fiscal restraint together explain about two thirds of the boom in output. Remarkably, they indicate that this combination of events also caused a discernable reduction in inflation, and that until in the later part of the boom decade when the fiscal restraint was undone, an improvement in the current account of the balance of payments.

3.2.3 Private domestic investment It remains to be explained both why Thailand’s output boom was even larger than that so far accounted for by the increase in FDI, and why the current account blew out to such a massive deficit. We shall show that the explanation lies with the behaviour of private domestic investment, and its economic effects. Panel (f) of Fig. 1 shows that actual private domestic investment...
boomed massively from 1987 onwards. The reasons for the boom in private domestic investment are discussed in detail in Section 3.3 below. For comparison, this panel also shows a counterfactual path for private domestic investment, beginning at its actual level in 1986 and thereafter growing at a steady rate of 6.1% per annum, equal to the annual growth rate of real output from 1975 to 1986; by 1996 actual private domestic investment (annual flow) was approximately 250% of what it would have been on this much more restrained counterfactual path.

In simulation E, we thus keep the same counterfactually lower level of FDI as in Figs 4 and 5, and the same counterfactual level of government investment used in Fig. 5, and in addition we suppose that private domestic investment grew only along the counterfactual path just defined. Panel (b) of Fig. 6 shows that the reduction in aggregate supply (i.e. potential output) is now much larger than in Figs 4 and 5. By 1996 the simulated value is 36% below its observed value. The panel dissects the reason for this; there is an induced fall in the private capital stock which is much larger than in the previous figures, because of the much larger reduction in private domestic investment. The panel thus shows that what happened to the three categories of investment between 1987 and 1996 explain an increase in aggregate supply almost exactly equal to the above-trend increase in output which actually occurred.

Panel (c) of Fig. 4 shows that, in contrast with what happened in simulations C and D, inflation is initially slightly lower. The reason is that, at least initially, aggregate supply falls less rapidly than aggregate demand (i.e. actual GDP; see panel a). The difference from our earlier simulations is that each unit reduction of private domestic investment has a smaller effect on supply than does the same reduction in FDI. But by 1996 aggregate supply is below its observed historical value by 36%, exactly the same as the amount by which aggregate demand falls, and inflation has stabilised. This counterfactual simulation thus reveals that the combination of FDI increase, fiscal restraint and private domestic investment boom that actually occurred in Thailand was such as to cause only moderate inflation in the beginning of the boom period—never higher by more than 1.5% per annum—and that even these small inflationary effects were reversed from 1990 onwards, as supply side effects of the boom came to dominate the demand side effects. This is entirely consistent with Thailand’s experience that, overall, the boom period was one in which inflation was neither high nor increasing.

\footnote{This is the same rate of growth as that used to construct the counterfactual path for foreign investment.}

\footnote{Although we do not model the labour market explicitly, our simulation is consistent with the direct empirical evidence of Warr (1999) that real wages rose strongly over the boom period even although prices did not rise. Our explanation of the boom involves a massive increase in capital, and thus in capital per worker, over the boom period. This will have increased the productivity of labour; such a large increase in labour productivity must have been associated with rising real wages if massive excess demand for labour were not to have developed. This occurred through a rise in the money wage level at a time when overall prices were not greatly rising.}
Panel (d) shows that the current account massively improves in this counterfactual simulation. This result is in striking contrast to the effects of lower FDI shown in Fig. 4 and discussed above. The reason is that although the counterfactual reduction in private domestic investment causes lower imports it does not cause exports to fall in the same way that lower FDI does; because of the importance of the stock of FDI in stimulating exports, a smaller stock of foreign capital has a much larger export-reducing effect than does a smaller stock of private domestic capital. Also, as we have seen, a smaller stock of private domestic capital is associated with a lower price level and thereby actually stimulates exports, and reduces imports, in a way that is not true of a lower stock of FDI. Remarkably, the improvement in the actual current account balance in this counterfactual simulation almost exactly mirrors the size, and time-profile, of the worsening of the actual current account balance over the period 1987 to 1996, shown in panel (h) of Fig. 1. It follows that the increase in private domestic investment during the period of the Thai boom almost exactly explains the deterioration in the balance of payments which actually occurred.

3.2.4 Summary and interpretation  We have used our macroeconomic model to explore the effects of the boom in direct foreign investment, fiscal restraint, and the boom in private domestic investment which actually occurred. This exercise has shown that, taken together, these variables almost exactly account for Thailand’s output boom, combined with low inflation and the emergence of a large current account surplus.
account deficit. But more than this, they show that the composition of the investment increases was important to the outcomes. Table 1 provides a qualitative summary of the crucial differences between the macroeconomic effects of increases in foreign domestic investment and private domestic investment. Although the increase foreign direct investment explains two thirds of the increase in potential output, it does not—particularly when combined with fiscal restraint—explain all the emergence of the Thai current account deficit. It is the large boom in domestic private investment which, as well as explaining the remainder of the increase in potential output, was the reason for the emergence of the current account deficit. This outcome is crucial for Section 4, which follows.

3.3 Explaining the private domestic investment boom

Why did private domestic investment increase so much, from 1990 onwards? Some events in Thailand clearly contributed. Prior to 1990, financial capital movements had been subject to elaborate controls. But these controls were largely dismantled from 1990 onwards. In part, it was hoped that Bangkok might replace Hong Kong as a regional financial centre following the restoration of Chinese sovereignty in Hong Kong in 1997, but the liberalisation of capital controls was

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Table 1 Simulated macroeconomic effects of increased investment

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<th></th>
<th>Foreign direct investment</th>
<th>Private domestic investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate supply</td>
<td>Increases strongly, as foreign capital stock rises, followed by the positive effects of induced increases in private domestic capital</td>
<td>Weaker effect than foreign direct investment</td>
</tr>
<tr>
<td>Aggregate demand</td>
<td>Moderate effect, but including strong rise in exports and a subsequent increase in private investment</td>
<td>Stronger effect than foreign direct investment</td>
</tr>
<tr>
<td>inflation</td>
<td>At first negative and then positive effect, as demand overtakes supply, then falling back</td>
<td>Initial effect positive, gradually declining as aggregate supply effects build up</td>
</tr>
<tr>
<td>Current account</td>
<td>Net effect small: initially worsens as FDI causes an almost one-for-one increase in imports, but offset by expansion of exports</td>
<td>Strongly negative effect: higher output attracts imports and higher prices discourage exports</td>
</tr>
<tr>
<td>Reserve vulnerability</td>
<td>Initially little effect as financing of FDI matches extra imports; actually falls as exports expand</td>
<td>Worsens one-for-one with negative effect on current account balance</td>
</tr>
</tbody>
</table>

*Note:* The concept of ‘reserve gap vulnerability’ is defined in Section 4.

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16 The increase was larger than our model can explain as the consequence of the boom in FDI: We can infer from Simulations C and E that the stock of private capital increased by about 40% whereas only about one third of this was explained by the model as induced by the increase in FDI. (See panel b in Figs 4 and 6).

17 For further details, see Warr (1999).
also apparently supported by the IMF. Furthermore, beginning in 1993 the Thai government encouraged banks to borrow short-term through its establishment of the Bangkok International Banking Facility (BIBF), again with the apparent approval of the IMF. Following this liberalisation, both the entry and exit of foreign funds was now very much easier, making it easier to finance investment which might previously have been credit rationed.

In addition, the Bank of Thailand insisted on retaining its policy of pegging the baht closely to the US dollar, and yet maintaining an independent monetary policy with a higher interest rate than that abroad (Warr and Nidhiprabha 1996), despite the fact that capital was much more mobile internationally. This enabled domestic investors to finance investment abroad at an interest rate lower than that at home (which is the cost of finance in the investment function used in the model’s investment function) whilst at the same time believing itself protected against risk because of the Bank of Thailand’s implicit guarantee of a fixed exchange rate. Effectively, the boom in investment was thus partly a consequence of the Bank of Thailand’s refusal to recognize the ‘impossible trinity’. 19

All of these developments made short-term borrowing from abroad easier and more attractive for domestic banks and from the point of view of the foreign lender, these loans were protected by implicit guarantees from the Bank of Thailand. From this time on there was a dramatic increase in short term bank loans. In addition to new short-term loans, significant substitution of short-term loans for longer-term loans also occurred. Beginning in 1993, the stock of long-term bank loans actually declined for around two years while short-term loans accelerated. All of these things again made the financing of domestic investment easier.

Finally, the Bank of Thailand indirectly encouraged short-term borrowing abroad and long-term lending domestically on the part of non-bank financial institutions. For many years prior to the crisis, banking licenses in Thailand had been highly profitable. The issuance of new licenses is tightly controlled by the Bank of Thailand but it had become known that the number of licenses was to be increased significantly. Thai finance companies immediately began competing with one another to be among the lucky recipients. To project themselves as significant players in the domestic financial market, many companies were willing to borrow large sums abroad and lend domestically at low margins, thereby taking risks they would not previously have contemplated. With lenders eager to lend vast sums, real estate was a favoured investment because purchase of real estate requires almost no specialist expertise, only the willingness to accept risk.

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18 See the IMF reports by Robinson, et al. (1990) and Kochhar, et al. (1996) for favourable accounts of this policy change. On the other hand, see Warr and Nidhiprabha (1996, p.204), for a discussion of the dangers inherent in this programme of capital market liberalisation in combination with a pegged exchange rate. Warr and Nidhiprabha recommended that if the capital market liberalisation was to be maintained, Thailand would require a more flexible exchange rate system.

19 See Corbett and Vines (1999a, 1999b).
The above events clearly contributed to the boom of domestic private investment. But they cannot be expected to explain it fully. Indeed, the fact that large investment booms were simultaneously occurring elsewhere in East Asia—notably in Indonesia, Malaysia and the southeastern corner of China—suggests that single-country explanations should not be expected to do so.\(^{20}\) Explaining fully the investment booms which occurred in Thailand and elsewhere in East Asia at this time remains a subject for ongoing research.

4. Vulnerability and crisis

We have so far described a very large output boom, and have fully explained it as the outcome of an enormous investment boom, partly due to an exogenous increase in FDI, and partly due to an increase in private domestic investment, beyond what can be explained by the increase in FDI. We have also explained why this boom was essentially non-inflationary, and why it was accompanied by the emergence of a large current account deficit. But why should the current account deficit have mattered? The Lawson doctrine (see Corden, 1994) suggests that if a current account deficit is the obverse of an investment boom, then all should be well. All was not well.

4.1 Reserve vulnerability

The concept of vulnerability is given a vivid expression by Dornbusch when he writes: ‘[V]ulnerability means that if something goes wrong, then suddenly a lot goes wrong’ (Dornbusch, 1997, p. 21). The idea implies a non-linearity: a state of affairs is vulnerable when, even if there are only small changes in fundamentals, there can be a big shift to some sort of bad outcome.

It is possible to conceive of several forms of vulnerability. For the purpose of this analysis, we focus on the relationship between the stock of international reserves, on the one hand, and the stock of foreign-owned, internationally mobile funds which could be presented against them; the smaller the former relative to the latter, the greater the vulnerability. For obvious reasons, we shall call it ‘reserve vulnerability’.\(^{21}\)

\(^{20}\) For discussions of this investment boom, see World Bank (1993, pp. 221–42), Asian Development Bank (1997, pp. 61–137) and Stiglitz (2001).

\(^{21}\) There are a number of ways in which vulnerability can arise in an open economy with a fixed exchange rate, as Dooley (1999, 2000), Morris and Shin (1998, 1999), Obstfeld (1994, 1995), Irwin and Vines (1999), and Krugman (1999a) make clear. In light of this we are not advancing our measure as an ideal measure of crisis vulnerability, but it has the advantage of being both conceptually meaningful and tractable in terms of the variables entering our model. McKibbin (1998) and McKibbin and Stoeckel (1999) model the Asian crisis, and the crisis in Thailand in particular, as a consequence of an exogenous rise in the premium applied to Thai assets, but do not explain the reasons for this rise. In contrast, our measure of vulnerability is endogenously explained by our model.
The change in vulnerability is given by the difference between that component of the balance on capital account consisting of short-term capital (the change in the stock of mobile capital) and the change in reserves. In the Appendix it is shown that this difference is identically equal to the deficit on current account minus that component of the balance on capital account consisting of long-term capital (the change in the stock of immobile capital). Equivalently, it is equal to that part of the deficit on current account which is not financed by long-term capital inflow. For the purposes of this analysis we identify the long-term balance on capital account with the net inflow of direct foreign investment, measured in foreign currency, say US$. The level of vulnerability is now obtained by accumulation of the change in vulnerability over a large number of years.22

4.2 Empirical results

Figure 7 summarises our empirical results with regard to reserve vulnerability. Our empirical measure arbitrarily sets its level at zero for an early year (1972 is chosen) and accumulates its value for all subsequent years, as summarised above. The calculated values of reserve vulnerability, as indicated by the actual macroeconomic data, are shown in the series labeled ‘Vulnerability base values’ and the units are $US billions. They show a dramatically increased level of reserve vulnerability over the years from 1993 onwards.

What caused this? To answer this question, we now examine the levels of reserve vulnerability resulting from counterfactual simulations C, D, and E, as described above. The results are indicated in Fig. 7 by the three series labeled Vulnerability C, D, and E, respectively. From Vulnerability C it is apparent that in the absence of the foreign investment boom there would have been scarcely any difference to vulnerability. As noted above, the current account improves slightly in counterfactual Simulation C, suggesting that the foreign investment boom which occurred worsened the current account, but only by a very small amount. Overall, when we set the small current account deficit (a negative item), against the inflow of long term financing of direct foreign investment (a positive item) vulnerability hardly changes as a result of the large boom which foreign investment causes—even allowing for the induced increase in private investment. The observed increase in vulnerability did not result from the foreign investment boom.

Turning to Simulation D, if neither the restraint in government investment nor the foreign investment boom had occurred, then vulnerability (indicated by the series Vulnerability (d) would have been somewhat larger than it was, at least in the short-to-medium term (see Table 1). We know that fiscal consolidation reduces both demand and supply and that in the model the demand effects dominate. The

22 See the Appendix for a more formal derivation of the measure of vulnerability in terms of the variables entering our model. See also Athukorala and Warr (2002) and Warr (2002) for a further discussion of the concepts involved.
'cooling' effects of the fiscal consolidation were relatively small. If government investment had been larger, vulnerability would have been worse; by inference, if government investment had been smaller, vulnerability would have been lower, but the effect is small compared with the increase in vulnerability that actually occurred.

Finally, from Simulation E, in the absence of the foreign investment boom, the fiscal consolidation, and the domestic investment boom, then vulnerability would have remained at essentially zero. Thus our analysis attributes all of the increase in vulnerability which actually occurred to the increase in private domestic investment—indeed, to that part of it which did not occur as a productivity-induced consequence of the foreign investment boom.\(^{23}\) This is a striking conclusion.

### 4.3 The trigger

While vulnerability to a crisis originated as discussed above, a trigger was required to initiate a crisis. The trigger that actually undermined confidence sufficiently to set a speculative attack on the baht in process was the collapse of export growth in 1996. Export growth declined from over 20% per year in previous years, a perfor-

\(^{23}\) It is actually slightly more than all of the increase, because if just the fiscal consolidation had happened and nothing else we can infer from Simulation D that vulnerability would have fallen.
mance which made the high current account deficits of the time seem (almost) sustainable, to around zero in 1996, which made the deficit seem unsustainable.

The export slowdown of 1996 has attracted many attempted explanations from observers of the Thai economy. They have included: monetary policy; Thailand’s trade liberalisation; the congestion of industrial infrastructure; falsification of export data to receive value added tax rebates; increasing competition in international markets from China since the latter’s devaluation in 1994; a slowdown in demand in importing countries; and effective appreciation of the baht through pegging to the dollar while the latter appreciated relative to the yen from late 1995 through 1997.

Our modelling work can say little about these claims, except that it can show that currency appreciation was not of itself the cause of this rapid falloff in exports. Appreciation could not explain the fact that the falloff was so rapid. As shown on panel (b) of Fig. 1 the actual appreciation of the nominal effective exchange rate was small, and as shown in Fig. A2 in the Appendix a 10% change in the exchange rate (more that what happened) is likely to cause only about a 3% change in exports in the first year.

Inspection of the equation for exports in the model shows that it tracks the behaviour of exports very well up to, but not including 1996, exactly predicting the level in 1994 and over-predicting by just 2% of the level in 1995. In 1996 it predicts a continuation of the 20% growth rate of exports which characterised the preceding years, rather than the zero growth that was observed. We attribute this sudden slowdown to a drastic worsening of Thailand’s external export environment.

We have investigated the effects of this collapse in a counterfactual simulation, designed to see how much larger GDP would have been if this unexplained cessation of export growth had not happened. The results suggest that GDP would have been around 7% higher. Prices would have been 4.5% higher. The current account as a percentage of GDP would have been almost exactly unchanged. The actual growth slowdown in 1996 was a reduction in the growth rate of around 4% below the levels of the preceding years. This effect continued through the first half of 1997 until the collapse of the exchange rate in the middle of the year. The above simulation results suggest that the collapse in export growth which

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24 See Warr (1999) for a fuller discussion.

25 This is a result of exports, imports, consumption, and investment becoming, respectively, 20%, 18%, 6%, and 11% higher. Back of the envelope calculations roughly support these magnitudes. In 1995 the share of exports in GDP was 46%. For an export slowdown of 20%, compared with a counterfactual base in 1996 of 20% higher than the 1995 level implies a reduction in GDP of 7.7%.

26 The reason is that the counterfactual rise in output causes a rise in imports which is, proportionately, nearly as large as the rise in exports; in absolute terms it is just as large because imports begin from a larger base.
occurred in 1996 is capable of explaining all of the growth slowdown which occurred in 1996 and which continued into early 1997.  

4.4 The onset of the crisis

How did this trigger provoke the crisis? Our argument at this stage is familiar— it happened through the collapse of the exchange rate peg (see Warr, 1999; Corbett and Vines 1999a, 1999b). It appears that, when the slowdown came, investors argued that if growth was to be resumed, monetary easing and a devaluation of the Thai baht would be required. By late 1996 this possibility was being widely canvassed and by early 1997 the IMF was advising the Thai government to devalue. Once this possibility became accepted, and an exodus of liquid funds began, the rate of capital outflow was so large that the exchange rate could not be defended with the existing reserves.

Exogenous trade shocks like the 1996 slowdown happen from time to time and healthy economies can adjust to them. We contend that the existence of a high level of reserve vulnerability was what converted that event into a trigger for the collapse of the currency. This vulnerability—built up as a consequence of its investment boom—transformed the need for adjustment into a crisis.

5. Conclusions

This paper provides an integrated analysis of the origins of Thailand’s growth boom, which spanned the decade ending in 1996, and its 1997 currency crisis. The contribution of the paper lies in clarifying the connection between these two sets of events. It demonstrates that the Thai crisis can be understood only in relation to the earlier economic boom. The crisis was the collapse of that boom.

The key to our explanation lies in the behaviour of the three components of aggregate investment—foreign direct investment, private domestic investment and public sector investment, especially the first two. The boom which preceded the crisis was caused initially by exceptionally high levels of direct foreign investment. Our results reveal that if the investment boom had consisted only of this and the domestic investment which it directly stimulated, Thailand would have experienced moderately rapid growth without either inflation or a large current account deficit. Restraint in the behaviour of public investment assisted in containing the inflationary impact of this investment boom.

However, there was an additional boom in aggregate demand, caused by a surge in private domestic investment—in excess of that induced by the boom in foreign investment—and its effects were quite different from those of the foreign investment boom. It led, through the early to mid-1990s, to a further expansion of

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27 The slowdown in output growth in 1996 was from the previous rates of around 10%.
28 See also the references cited in footnote 21.
output, but also to large current account deficits, well in excess of the inflows of long term foreign investment. The difference was financed by an inflow of short-term foreign-owned financial capital, consisting of bank loans, portfolio investment and foreign-owned bank accounts. These events implied the progressive build-up of a stock of potential short-term claims on reserves unmatched by an increase in the level of reserves. The cumulative effects of the boom in domestic private investment thereby laid the foundations for the crisis of 1997.

Given Thailand’s pegged exchange rate policy of the time, by the mid-1990s the Thai economy was vulnerable to any shock which induced an outflow of this huge stock of mobile, short-term capital because reserves were by then insufficient to defend the fixed exchange rate against such a capital outflow. A shock of just this kind occurred in 1996: a drastic and unexpected slowdown in export growth, which induced capital outflow by substantially increasing the perceived likelihood of an exchange rate depreciation. In the face of the massive loss of reserves which resulted, policy-makers were able to sustain the existing policy framework for less than a year before the exchange rate collapsed on 2 July 1997.

Our finding in this paper is that the behaviour of the major components of aggregate investment, particularly foreign direct investment and private domestic investment, along with their different macroeconomic consequences, explain both Thailand’s output boom over the decade ending in 1996 and the progressive development of vulnerability to a currency crisis which occurred at the same time. This finding has important policy implications. Reform initiatives in Thailand and elsewhere, following the 1997 crisis and directed at avoiding future crises of this kind, have focused on structural problems within the financial system, particularly the banks (see Fane, 2000). This reform agenda mirrors earlier analyses of the causes of the crisis, which have emphasised the role of the financial system. Such a program of reform may generate efficiency benefits in its own right, but it may not be an effective strategy for avoiding future currency crises. It will be effective in achieving that much more important goal only if it results in the avoidance of unsustainable, vulnerability-inducing booms in private domestic investment.

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