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ASSET BUBBLES, LEVERAGE AND 'LIFEBOATS': ELEMENTS OF THE EAST ASIAN CRISIS*

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Collapsing credit markets have been blamed for the depth and persistence of the Great Depression in the United States. Could similar mechanisms have played a role in ending the East Asian economic miracle – and in creating fragility in global financial markets? After a brief account of the nature of the East Asian crises of 1997/8, we use the framework of highly-leveraged, fully-collaterised firms due to Kiyotaki and Moore (1997) to explore the impact of a credit crunch. The paper emphasises the fragility of equilibrium and how rapidly boom can turn to bust.

> The Asian story is really about a bubble in – and subsequent collapse of – asset values in general, with currency crises more a symptom than a cause. Krugman (1998, p. 73).

Introduction: Aims and Objectives

In early 1997 Korea, Indonesia, and Thailand had completed another year of rapid growth. There were some warning signs – large current account imbalances and stock markets past their peak – but nothing to indicate impending disaster. By the year-end all three countries were in the throes of severe financial crisis, with share prices falling by a half in local currency value, and currencies halving against the dollar despite emergency funding from the IMF.

Before the crisis, the won, the rupiah and the baht were effectively pegged to the dollar and competitiveness was lost as the dollar strengthened. But surging capital inflows allowed an excessive credit build-up during the economic boom, financed in large part by the banks borrowing short term in foreign currency; this created over-valued assets, especially in the real estate or property sector. When the financial crisis was triggered by speculative attacks on the over-valued currencies, it rapidly led to a vicious downward spiral in other financial markets.

There has been extensive research on the role of the banking sector in the

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macroeconomy and its importance in propagating business cycles; see, for example, Bernanke (1983) on the Great Depression, Bernanke and Gertler (1995), King (1994), Kiyotaki and Moore (1997), and Allen and Gale (2000). These studies show how the banking sector can amplify the magnitude of the business cycle because bank credit behaves procyclically. A booming economy raises expectations about the future, increases the willingness of firms to invest and induces them to borrow more, causing an expansion in bank credit: in a downturn, loans are recalled tightening credit and exacerbating the recession. In addition, the paper by Allen and Gale emphasises the moral hazard problem that arises when investors are able to use borrowed funds so as to gain from good outcomes but avoid losses because of limited liability.

In a globally integrated environment, with strong growth and large capital inflows (as in East Asia), these credit market effects can be more pronounced than in closed economies, as capital inflows give banks and near-banks a larger supply of funds to intermediate, allowing them to increase credit rapidly and substantially change the allocation of resources.[1] The lax regulation of financial institutions in East Asia meant that poor investment of borrowed funds was not uncommon, though it took different forms in different countries: in Thailand there was excessive property development, in Korea overinvestment in Chaebol, and in Indonesia the problem of 'connected' lending. For recent evidence of an association between large capital inflows, lending booms and banking/currency crises, see World Bank Report (1997), Goldstein and Turner (1996), Kaminsky and Reinhart (1996) and Gavin and Hausmann (1996).

This paper (and earlier work on which it is based[2]) draws on this literature and takes much the same perspective as Krugman (1998) who observes that, to understand the crisis in Asia, one must focus on the role of financial intermediaries and the price of land and other assets. Krugman focuses on the incentives for undercapitalised and deregulated financial intermediaries to overvalue risky assets and create an asset bubble; here we take up the story after the bubble breaks. We show how the scramble for liquidity in credit-constrained markets can rapidly turn financial boom into bust. Our aim in this paper is to employ a consistent approach to study both the dynamics of financial contraction and techniques of crisis management. The framework used is one where collateral plays a central role and adverse exogeneous shocks can trigger a vicious spiral of falling asset values and loan recalls.[3] The crisis management measures we analyse are those actually implemented in East Asia. Taken together, they explain how highly-leveraged financial institutions can survive major adverse shocks without complete breakdown, as drastic stabilisation measures prevent asset prices from collapsing and dragging down the entire financial system.

[1] As Krugman (1998, pp. 78–9) points out, in a closed economy, it would be the rate of interest rather than the volume of investment that responds excess demand.

[2] Edison and Miller (1997) and Luangaram (1997) used similar techniques to analyse a potential collapse in the credit market after the Hong Kong handover in 1997 and crisis in the Thai property market, respectively.

[3] For an alternative approach to financial vulnerability in emerging economies – with endogeneous cycles but no collateral requirements – see Aghion *et al.* (1998).

The paper is organised as follows. We begin with brief background details on the Asian crisis, its origins and nature. Section 2 outlines the analytical framework used here, namely the model of credit cycles developed by Kiyotaki and Moore (1997) (henceforth KM) where temporary shocks generate persistent fluctuations in land prices due to credit market imperfections. As the equilibrium is incredibly fragile in the linear quadratic formulation we specify, it is made more robust by introducing a margin requirement (i.e. credit-constrained firms cannot borrow the full value of their collateral). In Section 3, we examine the effects on land prices of two shocks which have hit the East Asian economy: the bursting of an asset price bubble (with origins, it may be, in the moral hazard problem of under-regulated financial institutions as Krugman and others suggest); and an unanticipated devaluation (with unhedged foreign currency borrowing). Numerical examples illustrate the existence of multiple equilibria in the face of small shocks, and show how large shocks can cause financial collapse as the efforts of credit-constrained firms to repay loans by selling land turns illiquidity into insolvency.

Section 4 discusses how wholesale financial collapse can be averted by co-ordinated loan roll-overs in the form of a general financial freeze: and how the breathing space gained in this way can be used to arrange for loan write-downs or capital injections. These are the measures that have, in fact, been used in Thailand to resolve the financial crisis. In Section 5, domino effects are discussed in a setting where there are two types of property companies ('prudent' and 'imprudent'): though prudent firms can survive the initial capital losses due to an adverse shock, they may well succumb when the imprudent firms are liquidated. These contagious effects can be checked if the latter are taken over as going concerns, i.e. by 'launching a lifeboat'. (The take-over of a global hedge fund, Long-Term Capital Management, in late 1998 provides a graphic illustration.)

Crisis management may avert collapse, but Section 6 concludes that the vulnerability of financial systems like those in East Asia to foreign currency withdrawals calls for preventive measures (in the form of capital inflow controls, for example).

1. The East Asian Crisis

1.1. *Origins*

According to Stanley Fischer, first deputy managing director of the IMF, the problems in these countries were mostly homegrown, although he conceded that developments in the advanced economies and global financial markets contributed significantly to the build-up of the imbalances that eventually led to the crises. The key domestic factors leading to the East Asian crisis were, in his view:

> 'first, the failure to dampen overheating pressures that had become increasingly evident in Thailand and many other countries in the region and were manifested in large external deficits and property and stock

market bubbles; second, the maintenance of pegged exchange rate regimes for too long, which encouraged external borrowing and led to excessive exposure to foreign exchange risk in both the financial and corporate sectors; third, lax prudential rules and financial oversight which led to a sharp deterioration in the quality of banks' loan portfolios ...' Fischer (1998, p. 21).

1.2. *Developments in Asset Prices*

Summary evidence of overall macroeconomic conditions in Korea, Indonesia and Thailand (referred to subsequently as the KIT economies) in the lead-up to the crisis is provided in Appendix 1. In addition, there follows a brief account of asset prices and the state of short-term indebtedness. (More extended discussions are to be found in Bhattacharya *et al.* (1998); Miller and Luangaram (1998) and Montes (1998), for example.)

1.2.1. *Equity markets and the value of property companies*

Although the timing and the severity of the crisis came as a surprise, some stock markets in the region had been signalling caution for some time as can seen from Fig. 1 (using a base of 100 in January 1990). The stock market in Thailand, for example, having risen to a plateau of about 150, began falling in early 1996 so that by early 1997 it was standing below 100. It continued to fall significantly, to around 50. In Korea, the KOSPI index has shown a similar pattern except that the plateau was only about 100 before the fall in 1996 and the collapse in 1997. (By contrast, the Indonesian stock market gave little indication of the coming crisis, rising through 1995 and 1996 to reach a peak of about 180 in mid 1997.)

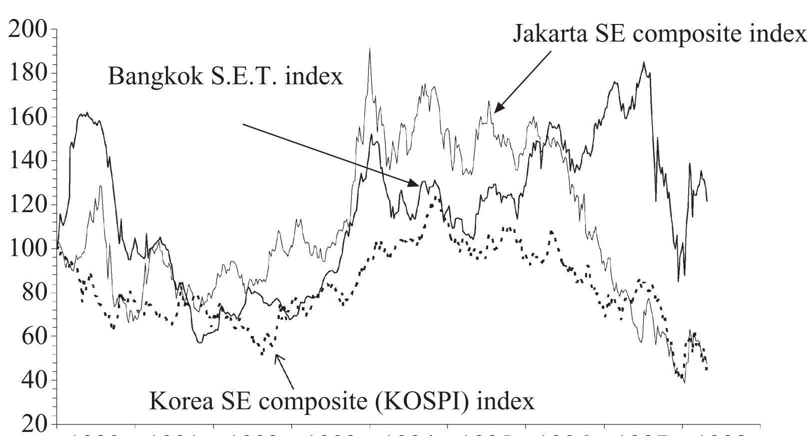

Fig. 1. *Stock Market Indices* (*1/1/90 = 100*)

As shown in Table 1, from 1995 to 1996 the value of property companies (measured in local currency) rose by around 40% in Indonesia but fell about a third in Korea and a half in Thailand. In 1997, property shares in Indonesia lost half their value; and in Korea and Thailand the decline accelerated. By the end of the year, property companies in Thailand were worth only 10% of their value 24 months before.

1.2.2. *Property Markets*

Currency crises have often been preceded by a boom-bust cycle in property prices, and this was true in East Asia. Fig. 2 shows that property prices (measured by prime office capital values) surged rapidly during 1988–91 both Thailand and Indonesia. But since property prices passed their peak, there has been considerable excess supply of office, condominium and residential property in Thailand, for example, as confirmed by high vacancy rates: and prices there fell sharply in 1997.

It is widely believed that, in Thailand as in Japan, falling land prices have played a leading role in the financial crisis. But there are no official series,[4]

Table 1
Share prices for property companies

	1993	1994	1995	1996	1997
Korea	458.0	591.8	430.0	295.3	103.1
Indonesia	n/a	n/a	100.0	143.7	72.0
Thailand	2266.0	1194.7	951.0	523.5	95.6

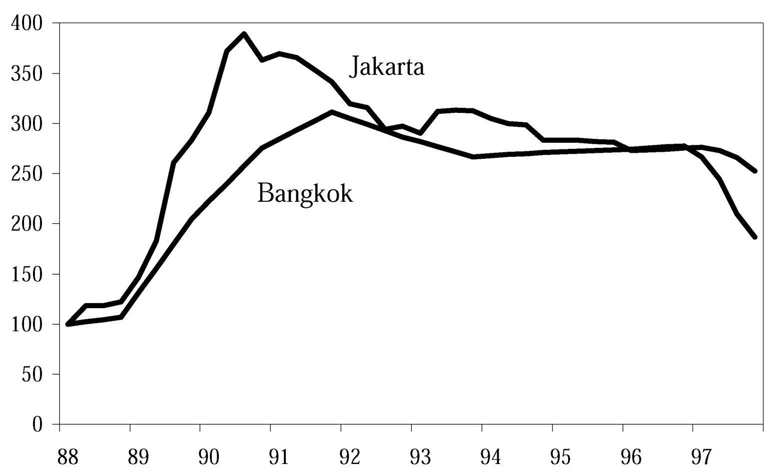

Fig. 2. *Prime Office Capital Values*

[4] The reason why official indices are not available may be that, while transparency is in general desirable, there is a stabilisation gain in not officially posting falling prices if these would trigger land sales and company closure under rules for marking-to-market and collateralisation.

and the available figures do present something of a paradox: if property prices played such a key role, why do the data that are available show less of a fall in land prices than for the stock market and the exchange rate? The answer to be explored in this paper is the role played by crisis management. Drastic stabilisation measures were, in fact, taken to check financial collapse – including, in Thailand for example, suspending the operation of 58 of the 91 finance houses (starting before the currency fell) and implementing radical restructuring of the entire financial system within a year of baht devaluing. (In Section 4, we use the framework of the KM model to analyse how such measures might prevent collapse.)

1.2.3. *Foreign exchange market and short-term currency exposure*

Until 1997, macroeconomic management in most emerging markets – including the KIT economies – involved effectively pegging the exchange rate against the US dollar (even though, as the dollar appreciated against the yen,[5] this led to an increasing loss of trade competitiveness and export shares). In response to capital inflows during the 1990s, central banks intervened to prevent exchange rate depreciation; and later, when capital flows reversed themselves, central banks used their foreign exchange reserves to resist downward pressure on the exchange rate – as long as reserves lasted.

Table 2 shows the stability of the nominal exchange rates prior to 1997 and the dramatic depreciations since then, which roughly doubled the local currency cost of the dollar by the end of the year. As most of the short-term borrowing was not hedged, the 100% rise in the price of the dollar meant a sharp rise indebtedness, threatening many firms with insolvency.

The overall extent of foreign currency exposure in the KIT economies is given in Table 3. At the end of 1996, for example, Korean short-term debt was twice the level of the country's reserves, while official reserves in Thailand almost matched short-term debt. (Note, however, that these published reserve figures can be highly misleading when there are substantial official operations in a forward market: net of the forward position, reserves in Thailand were effectively zero just before the crisis in mid 1997.)

Table 2
Movement in exchange rate (end-of-period per US$)

	1991	1992	1993	1994	1995	1996	1997	1996–7 % change
Korea	765.3	791.5	811.3	792.7	775.8	847.5	1695.0	100.0
Indonesia	2000.0	2070.4	2112.0	2202.6	2289.0	2361.0	5650.0	139.0
Thailand	25.3	25.5	25.6	25.1	25.2	25.7	46.8	82.4

[5] From mid 1995 to end 1997, the dollar appreciated by 50% against the yen.

Table 3
External (foreign currency) debt and foreign exchange reserves
(US$ billion, end year)

	Avg. 1991–1995	1996	1997*e*	1998*f*
Korea				
Total external debt	66.5	131.6	144.8	141.2
Short term	28.7	87.7	52.8	45.9
International reserves	21.9	34.0	21.1	43.1
Indonesia				
Total external debt	96.4	127.6	133.4	144.3
Short term	19.4	41.3	36.8	29.0
International reserves	15.8	24.0	20.5	20.5
Thailand				
Total external debt	57.9	94.7	96.0	92.2
Short term	26.5	38.0	28.3	21.3
International reserves	25.5	37.7	26.2	31.2

Note that '*e*' indicates 'estimate' and '*f*' represents forecast.
Source: IMF *International Financial Statistics* various issues and JP Morgan World Financial Markets 1998Q3 Report.

2. Kiyotaki and Moore's Model of Credit Cycles

In this paper, we adopt the 'credit-constrained' framework of Kiyotaki and Moore (1997), hereafter KM, to analyse elements of the East Asian crisis. Before using it to show how the ending of an asset bubble and a sudden devaluation of the currency can easily lead to financial collapse, we provide a simple linear quadratic formulation of their model and extend it to include margin requirements.

2.1. *The Basic KM Model*

There are two sectors: first, the credit-constrained sector whose land holdings are largely financed by short-term borrowing. We refer to these borrowers as 'property companies' (which correspond to KM's 'farmers'). The second sector is a consolidation of the lending institutions and all other land owners: it is not credit constrained and its holdings effectively determine the price of land. For convenience, we refer to these lenders/owners as 'finance houses' (corresponding to KM's 'gatherers').

In the absence of surprises, the quantity of land held by the property companies, denoted k_t, is determined as follows. We begin with their – slightly simplified – budget constraint:

$$q_t(k_t - k_{t-1}) + Rb_{t-1} = \alpha k_{t-1} + b_t \tag{1}$$

LAND ACCUMULATION + DEBT REPAID = INCOME + BORROWING

where b_t is the amount of one-period borrowing, repaid as Rb_t (where R is one plus the one-period interest rate), q_t is the price of land, and α measures the productivity of land used in this sector.

To motivate the credit constraints, it is assumed as in KM that the owner/manager of each company in this sector uses an 'idiosyncratic technology'[6] (and retains the right to withdraw labour). This means owners/managers may credibly threaten creditors with repudiation, and puts a strict upper limit on the amount of external finance that can be raised as 'debt contracts secured on land are the only financial instruments investors can rely on' KM (1997, p. 218). The rate of expansion of the highly-leveraged, credit-constrained property companies is thus determined not by their inherent earning power but by their ability to acquire collateral. These are strong assumptions – and, for property companies which raise equity finance, clearly too strong: and some of the results obtained later may be qualified accordingly. (Note, however, that the manner in which Long-Term Capital Management was rescued in 1998 supports the notion of an idiosyncratic technology – at least for hedge funds: the reason why the existing management was not replaced was that only Nobel Prize winners could understand the contracts!)

Assuming that borrowing gross of interest is chosen to match the expected value of collateral implies

$$b_t = q_{t+1} k_t / R. \tag{2}$$

After substitution in (1), one obtains

$$(q_t - q_{t+1}/R) k_t = \alpha k_{t-1} \tag{3}$$

where the LHS measures the net-of-borrowing cost of acquiring land k_t and the RHS measures the net worth[7] of the firms at beginning of the period. As KM (1997, p. 220) remark, the firms use all their 'net worth to finance the difference between price of land, q_t and the amount they can borrow against a unit of land, q_{t+1}/R. This difference $q_t - q_{t+1}/R$ can be thought of as the down payment required to purchase a unit of land'.

The arbitrage condition for *other* users of land, the 'finance houses', assumed not to be credit constrained, implies

$$f'(\overline{k} - k_t) + q_{t+1} - q_t = (R-1) q_t \tag{4}$$

where $\overline{k}$ is the total amount of land in the economy, $f'(\overline{k} - k_t)$ is the marginal productivity of land used in the *unconstrained sector*. Or, as KM put it,

$$(q_t - q_{t+1}/R) = f'(\overline{k} - k_t)/R = u(k_t; \overline{k}) \tag{5}$$

where $u(\cdot)$, (the discounted marginal productivity of land in the unconstrained sector) is referred to as the 'user cost' of land in what follows.

[6] Idiosyncratic in the sense that once production has started at date t, only s/he has the skill necessary to produce output at $t+1$, i.e., if s/he were to withdraw labour between t and $t+1$, there will be no output at $t+1$, only the land k_t.

[7] By definition, the net worth of property companies at the beginning of date t is the value of tradable output and land held from the previous period, net of debt repayment, i.e. $(\alpha + q_t) k_{t-1} - R b_{t-1} = \alpha k_{t-1}$.

Equating the down payment required to purchase a unit of land to the user cost, i.e. substituting (5) into (3), gives

$$u(k_{t;}\overline{k})\,k_t = \alpha k_{t-1}. \tag{6}$$

For simplicity of exposition, we assume that the user cost is proportional to k_t, specifically:

$$u(k_t) = \frac{A - \beta(\overline{k} - k_t)}{R} = \frac{\beta}{R}k_t \tag{7}$$

where β corresponds to the second derivative of the production function in the unconstrained sector, i.e. measures the rate of decline in the marginal productivity of land used by the finance houses, and the discount factor $1/R$ reflects one-period lag in production and $A - \beta\overline{k}$ is set equal to zero for convenience. (Note that – on the assumption that total amount of land is fixed in supply – the user cost (i.e. the discounted marginal product) is for convenience expressed in (7) as an *increasing* function of land held by *property sector* – instead of a decreasing function of land used by finance houses themselves.)

Combining (6) and (7) yields a non-linear difference equation which can be written:

$$k_t = \sqrt{\frac{R\alpha}{\beta}}k_{t-1}^{1/2}. \tag{8}$$

and the dynamics of land accumulation in the absence of shocks is shown in Fig. 3, where the top panel plots k_t as the non-linear function of k_{t-1} given in (8) above. There are evidently two equilibria, one at zero and the other at $k^* = R\alpha/\beta$; the latter is stable while the former is not.

The path of convergence to k^* from an initial value of $k_t < k^*$ is also shown in the lower panel where the vertical axis measures its productivity in the small business sector and the user cost of land (its discounted productivity in the other sector). As (6) requires αk_{t-1} (i.e. net worth) be set equal to $u(k_t)\,k_t$ (today's holdings times the user cost), the points labelled A and B must lie on the same rectangular hyperbola, labelled HH in the figure. This illustrates how to find k_t given k_{t-1}. (On the same principle, land holding in period $t+1$ can be found by shifting the hyperbola to the right as shown.) Note that the net worth of property companies (αk_{t-1}) increases as k approaches k^*. This is because, with credit rationing, the productivity of land in this sector is higher than the user cost.

In these circumstances, the value of land is given by the present discounted value of user costs i.e.

$$q_t = \sum_{s=0}^{\infty}\frac{u(k_{t+s})}{R^s} \tag{9}$$

where these are measured along the path towards equilibrium. In numerical examples below, we approximate this by the linear function

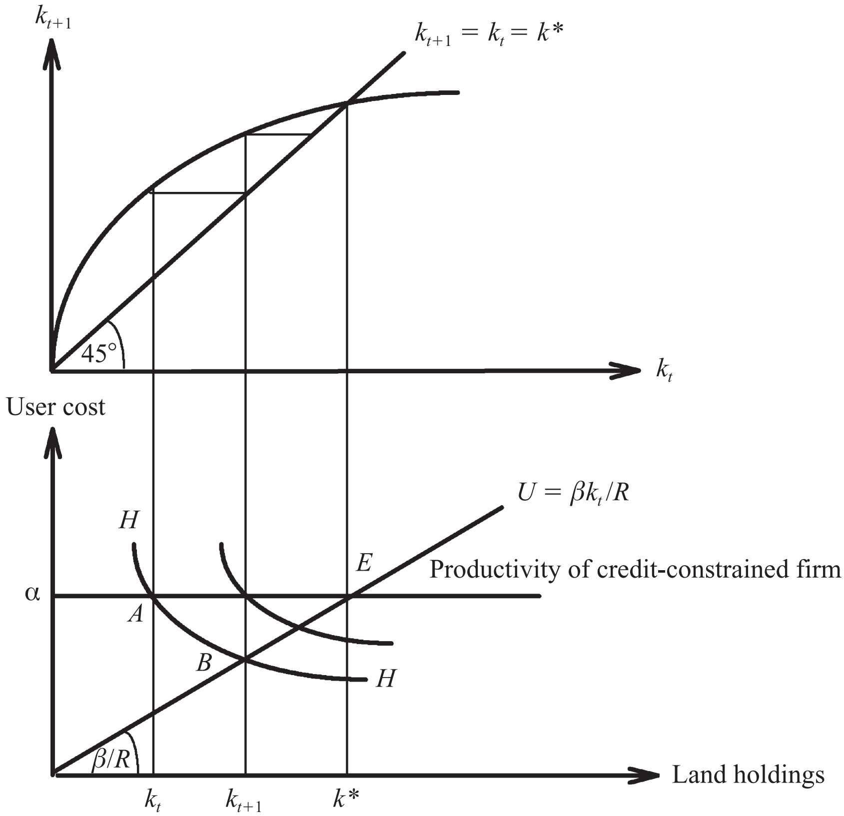

Fig. 3. *Dynamics of the KM model with No Surprises*

$$q_t - q^* = \theta(k_t - k^*) \tag{10}$$

where $q^* = R\alpha/(R-1)$ and θ, which measures the sensitivity of land prices to land sales, $= \beta/(R - \phi/2)$, and the autoregressive coefficient of land accumulation, $\phi = (R\alpha/\beta)^{1/2}$; so $\theta = \beta/(R - 1/2)$ where $\phi = 1$.

Before adding extra features to their model, KM use it to study the effects of a temporary productivity shock which unexpectedly raises the parameter α by $\Delta\alpha$ for one period only; and they show that because the small business sector is credit-constrained, this has effects on the value and allocation of land which persist beyond one period. They emphasise that this unexpected rise in productivity not only eases the borrowing constraint on small businesses *directly* by raising α in (6), it also helps *indirectly* by raising the price of their land, which (because debt is not indexed) raises their net worth. In the face of a one-time positive productivity shock, which occurs when the system is in equilibrium, (6) needs to be recast as:

$$u(k_t)\,k_t = (\alpha + \Delta\alpha + q_t - q^*)\,k^* \tag{11}$$

where $\Delta\alpha$ is the 'direct' effect of the productivity gain and $q_t - q^*$ is the 'indirect' effect due to the rise in land prices. (Note that, in the KM model, credit-constrained land users have an incentive to hold more land than in the market equilibrium as it yields them a non-marketable product γ which makes its total productivity $\alpha + \gamma$.)

Much more important for our purposes, which is to look at contractions, is what would happen if the productivity shock were negative. It might appear from Kiyotaki and Moore's assumptions that (11) would not apply in that case, as any unanticipated fall in land prices would lead borrowers to negotiate debt write-downs. If all unanticipated capital losses have to be borne by the lender, this would buffer the system against negative shocks, though it would undermine the use of land as collateral. But this is not true if, as they indicate in KM footnote 13 (p. 224), the unexpected shock takes place after the labour supply decision has been taken, see Fig. 4. For, in this case, borrower can no longer costlessly repudiate the debt contract: to walk away would be to lose all of his/her net worth.

2.2. *The Introduction of a Margin Requirement*

If fully-leveraged, credit-contrained businesses have to absorb losses, the model is very fragile. They have very little net worth (actually only αk^* in equilibrium, i.e. one period's flow of income): so, if land prices drop unexpectedly by a small fraction, they are wiped out. We reduce the fragility of the model by limiting the leverage taken on by the property companies.[8] We assume that lenders impose a margin requirement on borrowers requiring owners/managers to hold a margin of m and they lend only the fraction $1 - m$ of the value of land. One motivation for this is suggested by KM (1997, p. 221), namely the cost of liquidation: if legal and other costs were expected to be the fraction m of land values, then bankers looking for complete collateralisation would need to constrain their lending appropriately.

While this does probably account for some fraction of observed margin requirements, it is 'prudential factor' which seems to be more relevant here,

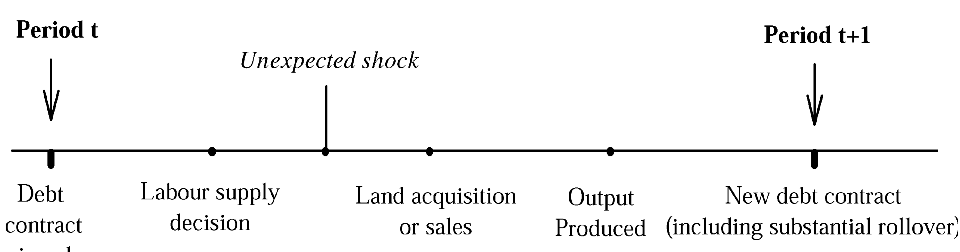

Fig. 4. *The Timing of Events*

[8] Kiyotaki and Moore introduce various mechanisms which have the effect of damping the response to exogenous shocks.

i.e. to prevent borrowers going bankrupt too often.[9] Before the crisis, major banks in Thailand, for example, were willing to lend up to 70–80% of value of collateral. After the crisis, however, margin requirements increased sharply with lending limited to between 50–60% of the value of collateral, i.e., m has been increased from 0.2/0.3 to 0.4/0.5, (*Business Day*, financial section, 20/2/98). In the light of these figures, we set m equal to 0.3 in simulations below.

The detailed implications of introducing a margin requirement are discussed in Luangaram (1997). With a margin requirement or loan-to-value ratio denoted m, the borrowing constraint becomes

$$b_t = \frac{(1-m)\,q_{t+1}\,k_t}{R}. \tag{12}$$

Substituting (12) into the budget constraint, (1), and re-arranging yields

$$u_t k_t = \alpha k_{t-1} + m q_t k_{t-1} - \frac{m q_{t+1} k_t}{R} \tag{13}$$

or

$$\left[q_t - \frac{(1-m)\,q_{t+1}}{R}\right] k_t = (\alpha + m q_t)\,k_{t-1}. \tag{14}$$

Solving the linearlised difference equations for land holdings and the price of land, assuming $\phi = (R\alpha/\beta)^{1/2} = 1$, one obtains the following expression for the slope of stable path

$$\theta' = \frac{\beta}{R - \left[\dfrac{1 + \frac{Rm}{(R-1)(1-m)}}{2 + \frac{Rm}{(R-1)(1-m)}}\right]}. \tag{15}$$

Increasing the margin requirement makes land prices more sensitive to land holdings – i.e., θ' is increasing in m (see below for numerical examples). This is because a higher margin requirement slows the speed of adjustment of land holdings (as well as increasing the long run equilibrium).

As can be seen from (14), a margin requirement implies that the 'down payment' must exceed the user cost of land. How this affects the adjustment can be seen in Fig. 5, constructed along the same line as Fig. 3. With no margin requirement and starting at point L, where $k = k_{t-1}$, land purchases would take land holdings to k_t where the net worth, shown as HH, matches the user cost schedule, $u(k_t)$, at point N. With a margin requirement of 50%, the down payment is shown by the curve D, equal to half of the linear function $u(k_t)$ *plus* half $q_t(k_t - k_{t-1})$, the money needed for new land holdings (an approxi-

[9] Another reason for increasing participation of owners/managers is to combat a form of moral hazard not included in the KM model, namely the incentive that low capitalisation give to them to invest in high-variance projects – the well-known incentive to 'gamble for resurrection'. See, for example, Dewatripont and Tirole (1994, chapter 8) for a demonstration that ' shareholders bias toward risk is stronger, the lower the bank's solvency'.

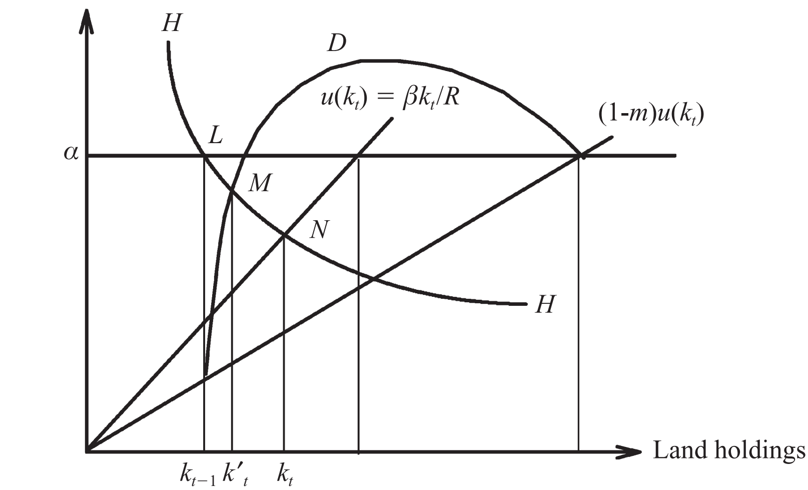

Fig. 5. *Dynamic Adjustment where* $m > 0$

mately quadratic function of k_t). As is evident from the figure,[10] the requirement to find half of the money for new land purchases out of current profit slows the expansion, to k'_t less than k_t.

3. Bursting Bubbles and Escalating Debts

Land prices in Thailand fell more than a quarter in 1997 and the baht lost half of its value against the dollar. How do credit constraints operate if a property price bubble bursts (or there is a sudden increase in debts due to unhedged foreign currency borrowing), so liabilities are no longer fully collaterised? Lenders try to protect themselves from repudiation of debts backed by 'inalienable capital' by lending only on the security of marketable collateral. But where is their protection when collateral values fall with the bursting of a property bubble? In reality, lenders will be protected by the cushion of borrowers equity (and their willingness to inject new capital): and this can be seen in the almost complete collapse in the share value of property companies in Thailand for example. But if this is insufficient, then lenders will have to face the consequences.

On the strict timing assumptions of the KM model (see Fig. 4), there can be no write-down of uncollateralised lending: it will instead be recalled. The formal reason for this is that by deciding to supply labour before the shock comes, borrowers have forfeited their bargaining strength. In practice, borrowers in Thailand were unable to negotiate a prompt write-down because

[10] It appears that the high margin requirement raises the equilibrium level of land holdings. Note, however, that, in the KM model, the original equilibrium is sub-optimal because it takes no account of the production of non-traded goods.

their losses exceeded the capacity of the lenders to pay: finance houses could only have paid if they themselves were bailed out, but that would have posed a severe problem of moral hazard – as the IMF was quick to point out. (The IMF blamed implicitly-insured financial institutions for the asset price bubble and would not have approved of government subsidies for this purpose.)

With finance houses unable to absorb the capital losses, their efforts to recall loans (a 'squeeze') runs a considerable risk of simply driving borrowers into bankruptcy as sales of land push down land prices: and the alternative of lenders rolling-over loans may be undermined by 'free-riding', i.e., those who roll-over will be undermined by those who go for the cash. So later we look at how a complete freeze on lending can solve this collective action problem and stabilise property prices.

3.1. *A Squeeze–Loan Recalls*

Allen and Gale (2000) derive a simple theory of bubbles based on an agency problem. Investors use borrowed money to invest in assets. Risky assets are relatively attractive because investors can default in low payout states so their price is bid up. Krugman (1998) describes how such an asset price bubble will end if financial guarantees are withdrawn following an unfavourable outcome. As incentives in lending institutions are not modelled in this paper, we simply assume that they are willing to gamble financial resources on speculative bubbles which take asset prices above equilibrium.[11]

Consider specifically the unstable path leading directly upwards from equilibrium at E in Fig. 6 and assume that lenders effectively ignore the probability of the bubble bursting. (On such a dynamic path, asset prices which begin above equilibrium will keep growing at a speed given by $q_{t+1} = Rq_t - \beta k^*$.) Say the bubble were to burst when land values reach q^b. If lenders were willing to absorb all the losses as asset prices drop to q^*, then there would be a prompt return to equilibrium at E. If not, loans will be recalled because of inadequate collateral, leading to 'fire-sales' of land and depressed land prices; the fall in land prices will 'overshoot' equilibrium.

Will the loans get repaid, or will the squeeze be counter-productive – driving borrowers bankrupt? To find out we solve for first period equilibrium by putting the bubble, $q^b - q^*$ into (11); so k_t and q_t are implicitly defined by

$$\frac{\beta(k_t)^2}{R} = [\alpha + (q_t - q^*) - (q^b - q^*)]k^* = (\alpha + q_t - q^b)k^* \qquad (16)$$

together with (10) above. (The LHS of (16) is the total net-of-borrowing cost of holding land k_t and the RHS measures the net worth of the firms at the end of period $t-1$, after bubble has burst.) This is analogous to procedure

[11] These speculative bubbles will have different time-series properties from the 'Pangloss' value discussed by Allen and Gale (2000) and Krugman (1998). How the latter may be incorporated within the framework used here is discussed in Milnes (1998).

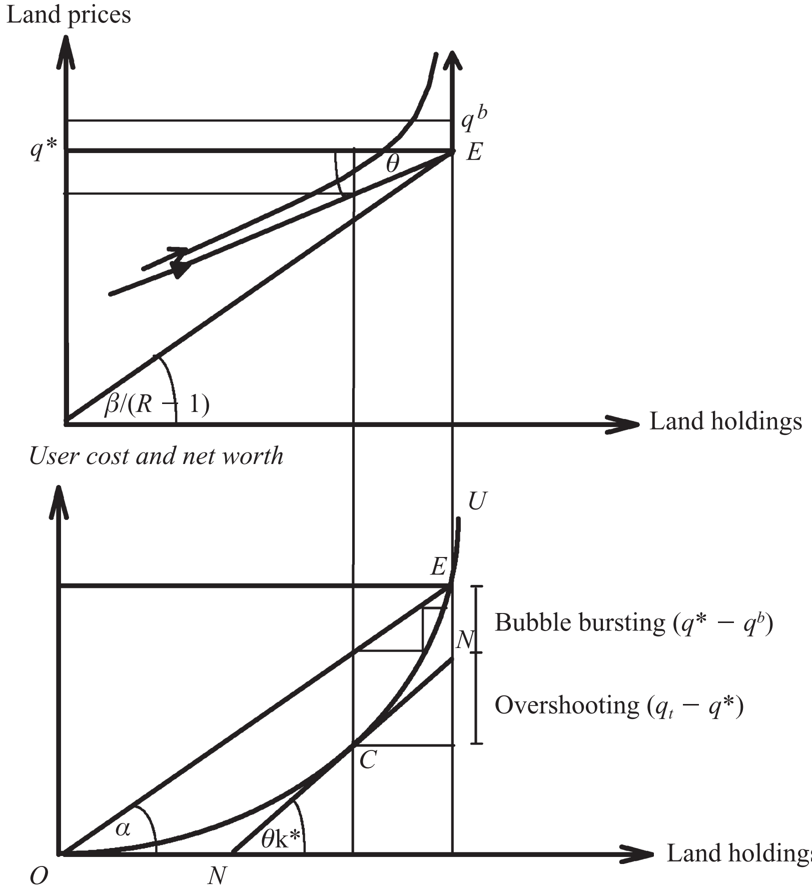

Fig. 6. *Adverse Shocks and Land Price 'Overshooting'*

described above to determine the initial effects of an unanticipated productivity shock, with $q^* - q^b$ replacing $\Delta\alpha$.

To check the solutions of (16) we plot the two sides separately, see the lower panel of Fig. 6 where the LHS, shown as the quadratic function OU, is the user cost of land (with equilibrium at point E where the OU crosses the line αk_t); and the RHS, labelled NN, gives the net worth of all property companies after the bubble has burst (and appears as a linear function of k with slope θk^*, once $q_t - q^*$ has been replaced by the approximation, $\theta(k_t - k^*)$). First-period equilibrium is where the two curves intersect.

The net worth of property companies falls for two reasons: first the impact of land prices dropping to long-run equilibrium at q^* (shown by the distance EN in the figure); and, in addition, the 'overshooting' due to forced sales by property companies – what KM (1997, p. 212) refer to as the 'knock-on effect'. (It is because the latter depends on the volume of disposals, that the net worth function NN slopes downward to the left in the figure.) We illustrate the case where OU and NN intersect at a unique equilibrium point, C, where the net worth of all property companies is just sufficient to provide the down payment of land holdings, k_c. In the absence of further surprises, the net worth of these property companies will recover towards equilibrium at E, following the dynamic path sketched in the figure (analogous to that appearing in Fig. 3).

This unique equilibrium is a special case: there may be multiple equilibria or none. A smaller shock, which leaves the net worth schedule above NN, yields two equilibria (above and below k_c); while a larger shock, with a net worth schedule below NN, rules out any intersection, i.e., the credit-constrained firms go out of business. Hence the distance EN, which measures $(q^b - q^*)k^*$, indicates the size of the largest adverse shock consistent with survival of the property companies.

By finding numerically the largest shock (the 'maximum bubble') consistent with a return to equilibrium, one can see how vulnerable these highly-leveraged companies are to adverse shocks, see Table 4. (The figures are purely illustrative and may exaggerate the fragility of equilibrium as, in their simulations, KM assume user costs and land prices are much less sensitive to land sales than assumed here: the elasticity they use is only 0.1).

The parameters used to generate the figures in Table 4 are $R = 1.01$, $\beta = 1$, $\alpha = 1/1.01$, which, with full leverage $(m = 0)$, give equilibrium values $q^* = 100$ and $k^* = 1$. In the table, we show land prices and land holdings by property companies before and after a crash which involves the largest shock consistent with their survival.[12] Results are shown for a margin requirement of 30%, i.e. $m = 0.3$. (Fully-leveraged property companies $(m = 0)$ turned out to be incredibly fragile; they are unable to withstand any significant adverse shocks.[13])

Table 4
Measuring the Impact of Adverse Shocks: Some Examples

User cost elasticity	1	2/3	2/3	2/3
Margin requirement (m)	30	30	40	50
Land holdings				
– Before crash	1	1	1	1
– After crash (k_c)	0.52	0.27	0.26	0.25
Land prices (% fall)				
(i) initial shock	3	6	13	23
(ii) Overshooting	15	19	25	30
(iii) Total crash	18	25	38	53

[12] Once $q_t - q^*$ is replaced by $\theta(k_t - k^*)$, equating the LHS and RHS of (16) defines a quadratic equation in k, given the parameter θ which is obtained as a slope of the stable path of the dynamic system linearised around equilibrium. The size of the largest bubble is the value of q^b which sets the discriminant equal to zero, and k_c is associated value for k.

[13] We found the maximum bubble was practically zero. This is because the net worth of these companies is only 1% of land value and the knock-on effects are extremely large relative to the initial shock – around 200 times; so the maximum bubble is less than 1/200 of 1%!

The first column shows that *when leverage is 30%, the maximum sustainable shock is only 3%*. (Given a 'knock-on' effect of about 15%, this means the biggest overall crash in land values which can be sustained without wholesale liquidation is a little under a fifth.) The remaining columns illustrate how robustness is increased when the user cost elasticity falls, and when the margin is increased. Very high margins can absorb big crashes (see Appendix 2 for more discussion).

In an open economy setting, where unhedged short-term borrowing in foreign currency is a significant source of finance for land holdings, the financial sector is highly exposed to exchange rate movements. Let f be the fraction of total borrowing in foreign currency loans and δ, the unexpected devaluation; as this raises local currency value of total borrowing by $(1-m)f\delta\%$, it will have the same effect on the property market as a $(1-m)f\delta\%$ collapse in land prices.

The clear message emerging from these results is that, while cash can be squeezed from firms with big margins, highly-leveraged firms are very vulnerable to asset price shocks.[14] It is partly for this reason that authorities in Thailand opted to freeze the finance houses rather than squeeze property companies. (Other reasons were to check moral hazard in the lending institutions and to prevent contagion spreading throughout the entire banking system.)

4. Financial Stabilisation

4.1. *A Freeze–Loan Roll-overs*

By driving down property prices and causing bankruptcy, lenders trying to recall loans impose externalities on others willing to roll-over or write-off debt. A freeze is one way of solving this collective action problem. How is it put in place? Once again, we take Thailand as example. There the operations of the finance houses who provide credit to property companies were temporarily suspended, in some cases from a date preceding the devaluation of the baht. During the freeze, no loans are recalled and any arrears of interest are rolled up, so there need be no 'fire-sale' disposals of land and prices can fall to equilibrium without overshooting. Current lenders have to provide 'temporary financing' over and above what the rules of collateral would allow, so they are collectively forced to act as lenders of last resort. (See Appendix 3 for details.)

Note that if forced land sales are to be avoided, i.e. $k_t = k^*$, lending must be determined not by the value of collateral but by the requirement that

$$b_t = Rb^b - \alpha k^* = (q^b - \alpha) k^* \tag{17}$$

i.e., new lending must exceed the principal of outstanding loans as interest payments are partly rolled up. (This follows from the budget constraint for the period after the bubble has burst which can be written

[14] Note, however, that the liquidity problems facing the credit-constrained firms in this model would be greatly reduced if debt were indexed to price of land, as Gabriella Chiesa has pointed out.

$$q_t(k_t - k^*) + Rb^b = \alpha k^* + b_t$$

where $b^b = q^b k^*/R$, i.e. the inherited level of borrowing reflects over-valued land prices.)

4.2. *Financial Restructuring–Loan Write-downs*

A financial freeze may prevent a collapse in land prices, but property companies cannot continue rolling up interest in this fashion forever. (Asymptotically, their debt would expand at the rate of interest, which violates the intertemporal budget constraint.[15]) Debt write-downs and/or capital injections are required. But in Thailand the write-downs needed exceeded the capital of the finance houses, so the authorities had to step in with public money. For obvious reasons of moral hazard, IMF conditionality ruled out using public funds to keep finance houses going under existing management. (The main piece of evidence is the IMF-enforced closure of 56 out of the 91 finance houses, whose assets have been taken over by the government for later disposal.)

The resolution of property crisis in Thailand has so far seen a freeze, followed by the closure of most finance houses: the next step will be a debt write-down for the property companies, together with capital injections mostly from foreign firms. This – the Thai solution – is illustrated in Fig. 7. Let the initial adverse shock reduces net worth almost to zero before any knock-on

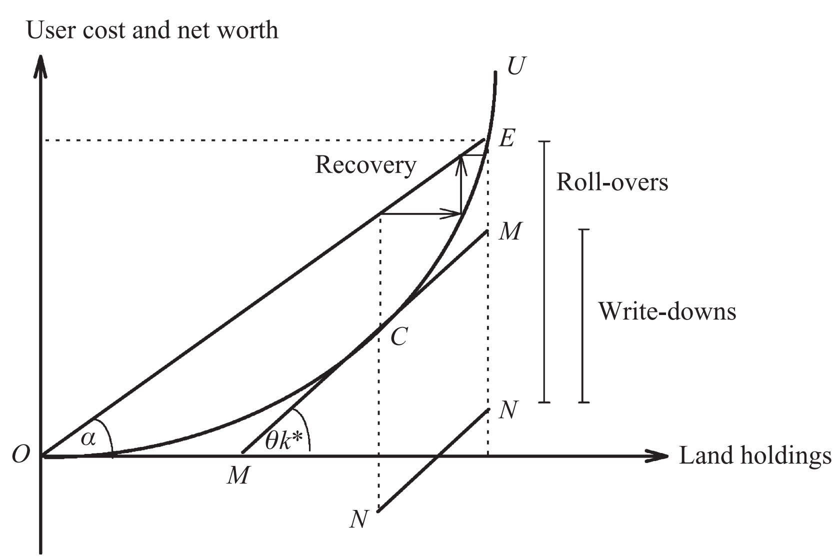

Fig. 7. *The Thai Solution: A Freeze Followed by Financial Reconstruction*

[15] On the other hand, disposals which temporarily reduce the price of land reduce average costs faced by property companies and help to restore their net worth, as previously pointed out.

effects are taken into consideration, see the net worth schedule *NN*. By providing *roll-overs* of *EN*, a freeze shifts the financing constraint to *OE* and maintains a temporary equilibrium at *E* without any land sales; but net worth would inevitably fall to zero if fire-sales take place when the freeze ends. *Debt write-downs* of value *MN* will stabilise situation: the net worth of the property companies after reconstruction is shown by *MM* with temporary equilibrium at point *C* (i.e. landholdings of k_c) and subsequent *recovery* to equilibrium at *E* as indicated in the figure.

Our exposition has focused on debt write-downs, $\Delta b < 0$; but in Thailand, for example, the market also expects cash injections from foreign companies tempted by low land prices and the cheap baht to take equity stakes in the property sector, as indicated by the term Δc above. In the KM model where all land is used to collaterise loans, equity participation is actually ruled out because there is no credible residual value for shareholders (see KM, 1997, p. 218, footnote 8). With margin requirements and debt write-downs, however, there could well be some residual value to re-assure equity investors (though equity financing is not something we formally analyse in this paper).

Algebraically, the minimum amount of financial reconstruction required to avoid wholesale bankruptcy can be determined from the condition that

$$\frac{\beta(k_c)^2}{R} = [\alpha + q(k_c) - q^b - \Delta b + \Delta c]\, k^* \qquad (18)$$

where k_c is the 'unique' first-period equilibrium shown in Fig. 7, $-\Delta b$ is a debt write-down and $\Delta c (< mq_{t+1} k_c)$ is a capital injection.

5. Financial Contagion

Even for companies in the same sector, there are in practice, of course, wide differences in terms of risk exposure. In adversity, fire-sales by high risk companies can pose a threat to their lower risk counterparts, so intervention may be needed to limit these negative externalities, as the rescue of LTCM in late August 1998 dramatically illustrated. In this section, using the KM model with differences in margin requirements to capture differences in exposure, we sketch[16] the possibility of 'domino effects' and the role of 'lifeboats'.

5.1. *Domino Effects*

Let there be two types of property companies, *prudent* operators who are partially leverage and the *imprudent* who are fully leveraged. Because of their leverage, imprudent firms face bankruptcy even in the face of a small shock. Thanks to their reserves, prudent companies should be able to survive the capital losses directly attributable to the initial shock. But they also have to cope with the fall in land prices stemming from the liquidation of imprudent

[16] This is only a sketch; in a more fully developed analysis of heterogeneous borrowers, there should be an interest surcharge to companies with high risk exposure.

firms; and this may prove impossible if the proportion of prudent companies is sufficiently small. This can generate a 'domino' effect where the collapse of the highly-leveraged companies triggers a fall in asset values sufficient to overwhelm the defences of the prudent firms and forces them into liquidation. Unchecked, this could lead to the collapse of land prices and all property companies.

We can illustrate the nature of these financial 'avalanches' with the help of Fig. 8 and calculations like those reported earlier. At point E in the figure, property companies in total hold k^* of land, with half held by imprudent companies, k_I, and half by prudent companies, k_P. Let the shock be an asset bubble bursting at q^b, which is above the sustainable level for imprudent firms but not for prudent firms. The former will go out of business: what about the latter? As shown in the figure, the value of land relative to future equilibrium at k^* (where prudent firms hold all the land) is given by the schedule EA whose slope θ depends on the speed of adjustment of the prudent firms. For $m = 0.3$, we find $\theta = 31.2$, so the land values would fall by 15.6% at point A relative to equilibrium at q^*. Together with an initial bubble of say 3% this gives the total fall of *over* 18% from the bubble plus land sales by the imprudent companies.

It might appear that there is no risk of bankruptcy for the prudent firms, given they hold the margin of 30%. But this leaves out of account the 'knock-on' effect of their own fire-sales triggered by loan recalls from their lenders (bearing in mind that the value of their collateral has fallen sharply relative to borrowing contracted at the land price of 103). Can their balance sheets withstand this multiplier effect as well? In a simulation where prudent property companies start with landholdings halfway below equilibrium, we found that

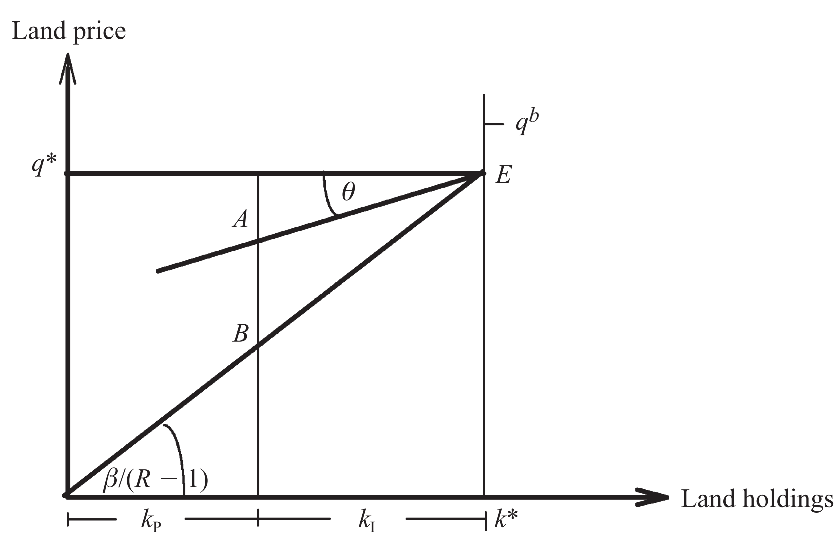

Fig. 8. *The Domino Effect*

the largest 'exogenous' shock to land prices that they can stand is just *less* than 18%. So they will be dragged down along with the imprudent firms. (Reducing the ratio of prudent to imprudent firms in population will, of course, increase the likelihood of this domino effect.)

Domino effects may, of course, operate across sectors as well as within them, and may indeed cross national frontiers. The failure of property companies after a speculative bubble, as we have seen, may put at risk the survival of other financial institutions such as banks and near-banks; if these other institutions are based elsewhere, the contagion will be international.

5.2. *Launching a Lifeboat*

Wholesale liquidation and the collapse of asset prices can be avoided if prudent institutions take over or merge with the imprudent as 'going concerns'.[17] But it may require financial support or regulatory pressure to launch a 'lifeboat' in this way. The regulatory authorities may, for example, need to make cash payments – buy some of the failing institutions (bad) assets at an inflated prices – to facilitate the take-over, Dewatripont and Tirole (1994, p. 68). Alternatively, non-pecuniary methods may be applied, as in the Japanese banking industry where authorities put pressure on healthy banks to merge with their ailing counterparts. But this system of 'mutual insurance' has limitations, as Fries *et al.* (1993) warn:

> 'Such a system may be compared with the informal system of so-called ''lifeboats'' organised in the past by the Bank of England whereby profitable banks would voluntarily participate in rescues. Recently UK banks have shown themselves unwilling to take part in such rescues and the Bank of England has had to rely on liquidations (as in case of BCCI) or on taking over the failing institution itself (as in case of Johnson Matthey). In deregulated markets, mutual insurance arrangements may still work well if placed on a more formal basis. [But] . . . since in Japan there is no formal basis for the effective mutual insurance arrangements, the system depends crucially on the authorities' ability to coerce healthy banks into lending their assistance. As deregulation proceeds, the leverage available to the authorities will inevitably diminish.' (p. 360)

5.3. *Leverage and the LTCM Rescue*

Evidently, the practice of collateralised lending by highly-leveraged financial institutions is not confined to property: it is a characteristic of off-shore investment funds such as Long-Term Capital Management (LTCM), the hedge

[17] Alternatively, the regulator could exercise forbearance (which consists in lowering the capital adequacy requirement or not enforcing it). In our domino example, the combination of a lifeboat and forbearance might be sufficient for the purpose: if the prudent companies took over the imprudent companies and margin requirement were halved, the industry would be solvent and there would be no immediate need for land sales.

fund that was saved from collapse in late September 1998. In that case, the leverage and exposure involved was phenomenal. *The Independent* newspaper (10/10/98) quoted a UBS/North American credit-control department report on LTCM as saying 'leverage was very high: on-balance sheet 27.2 times, off-balance sheet was not disclosed but we assume leverage 250 times': with a capital base of around $4 billion this implies assets under management of $125 billion – and a 'potential exposure' of over a trillion dollars.

Could adverse shocks to the global economy exert powerful effects on asset prices via the mechanisms we have analysed? If so, should monetary authorities take actions to limit the knock-on effects? The near-collapse and officially-orchestrated rescue of LTCM by a lifeboat of private financial institutions in late 1998, led by Goldman Sachs, Merrill Lynch, and J.P. Morgan, suggests affirmative answers to both questions. Why did the central bank intervene? In his Congressional testimony, Federal Reserve Chairman Alan Greenspan (1998) explained that – 'rather than let the firm go into disorderly fire-sale liquidation following a set of cascading cross defaults' – the FRBNY helped to arrange an orderly resolution 'not to protect LTCM's investors, creditors, or managers from loss, but to avoid the distortions to market processes caused by a fire-sale liquidation and the consequent spreading of those distortions through contagion'.

It is also interesting to note that the 'technology' of managing hedge fund is apparently idiosyncratic. As Chairman Greenspan explained: 'The private creditors and counterparties in the rescue package chose to preserve a sliver of equity for the original owners – one tenth – so that some of the management would have an incentive to stay with the firm to assist in the liquidation of the portfolio. Regrettably, the creditors felt that, given the complexity of market bets woven into a bewildering array of financial contracts, working with the existing management would be far easier than starting from scratch.' To keep existing management at work may have solved incentive problems inside the firm, but it surely poses considerable moral hazard problems for the industry if managers of hedge funds can never be fired.

6. Conclusion

A number of economists have blamed the depth and persistence of the Great Depression in the United States on collapsing credit markets. Could similar mechanisms have played a role in ending the East Asian economic miracle – and in creating fragility in global financial markets?

It is widely agreed that the availability of abundant funds with little monitoring led to over-inflated property prices. And it appears that asset sales by credit-constrained firms in response to adverse shocks could greatly amplify their effects. So, without intervention, the sudden ending of an asset bubble (or an exchange rate peg) might lead to financial collapse, where –like falling dominoes – prudent firms are brought down by imprudent firms.

To shed light on the recent (and continuing) financial crisis affecting East Asia, we have applied Kiyotaki and Moore's model of credit cycles to land-holding property companies and analysed how stabilisation policy can prevent financial collapse. Among the drastic policy measures used to protect the financial system examined was a financial freeze, which delays loan recalls, and reconstruction to reduce debt, increase capital and encourage take-overs.

While these may be effective crisis measures, the vulnerability of the financial systems in East Asia suggests the need for prevention, primarily by improved regulation of banks and near-banks so as to nip asset bubbles in the bud. To discourage exposure to unhedged foreign currency borrowing, Chile and Columbia tax short-term external borrowing more than long term, the justification being that they reduce a negative externality, namely systemic collapse. Further research on how highly-leveraged financial institutions function might help explain the vulnerability of the global financial system to adverse shocks – and suggest ways to increase stability.

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Appendix 1: Macroeconomic Conditions in the KIT Economies

Table 5
Economic Indicators

South Korea	Avg. 1991–1995	1996	1997*e*	1998*f*
Real GDP (% change)	7.5	7.1	5.5	−6.0
Consumer price inflation (%)	5.9	5.0	4.4	8.0
Current account bal ($bln)	−4.3	−23.0	−8.6	36.0
% of GDP	−1.2	−4.7	−1.9	11.5
Real exchange rate[1]	93	88	157	–
Memo item				
GDP at market prices ($bn)	354.4	484.6	442.5	–
Indonesia				
Real GDP (% change)	7.1	7.8	4.5	−14.0
Consumer price inflation (%)	8.7	7.9	6.6	60.0
Current account bal ($bln)	−3.9	−7.6	−6.2	3.1
% of GDP	−2.5	−3.3	−2.9	3.9
Real exchange rate[1]	92	80	150	–
Memo item				
GDP at market prices ($bn)	160.9	227.4	214.6	
Thailand				
Real GDP (% change)	9.0	6.7	5.5e	−6.0
Consumer price inflation (%)	4.9	5.8	5.6	10.0

Current account bal ($bln)	−8.4	−14.7	−2.9	14.2
% of GDP	−6.5	−7.9	−1.9	12.0
Real exchange rate*	90.2	80.0	124.0	–
Memo item				
GDP at market prices ($bn)	129.5	181.4	153.9	

* based on WPI; trade-weighted, 1990 = 100.
Note that '*e*' accounts for estimate and '*f*' represents forecast.
Source: IMF Statistics various issues; JPMorgan World Financial Markets 1998Q3 Report and Radelet and Sach (1998).

Appendix 2: Margin Requirements, Land Prices and the Speed of Adjustment

As the margin requirement increases from 0 up to 50%, the parameter θ, which measures the sensitivity of land prices to land sales, and ϕ, the autoregressive coefficient in the process of capital accumulation, also increase as shown in Table 6. If θ rises, this means that land prices are more sensitive to land sales and we observe that θ lies just above the margin requirement. (If m equals 30%, for example, land prices fall below equilibrium by 31.2 times the disposal of land by property companies.) The reason that the higher m increases θ is that the margin requirements make it more difficult for a company to expand (as they rely more internal funds and less on bank finance); this slows the speed of adjustment and moves land prices closer to current user costs. (How markedly adjustment slows down is indicated by ϕ, the coefficient on lagged land holdings, which increases sharply from 0.5 in column one to 0.98 in column two.)

Table 6
Margin Requirements, Land Price Coefficients, and Autoregressive Coefficients

	Margin requirement (%)			
	0	30	40	50
Elasticity = 1				
θ	1.96	31.2	40.9	50.7
ϕ	0.5	0.98	0.99	0.99

Appendix 3: Temporary Finance

Let the lenders – fearful of systemic risk – provide financing F when the shock occurs (to be repaid as RF one period later). If the amount provided is the minimum required to avert collapse, then, as shown in Fig. 9, this extra money would be just sufficient to shift the financing constraint up from NN to provide a unique first period equilibrium at C. The figure illustrates the special case where property companies are able to repay the temporary finance with interest in the very next period: this lowers the net worth constraint (by RF) but the property companies are, nevertheless, able to repurchase some of the land and there is convergence back to equilibrium at E as shown. Of course, property companies bailed out in this fashion will probably not be able to repay temporary financing so promptly – i.e., repayment will take more than

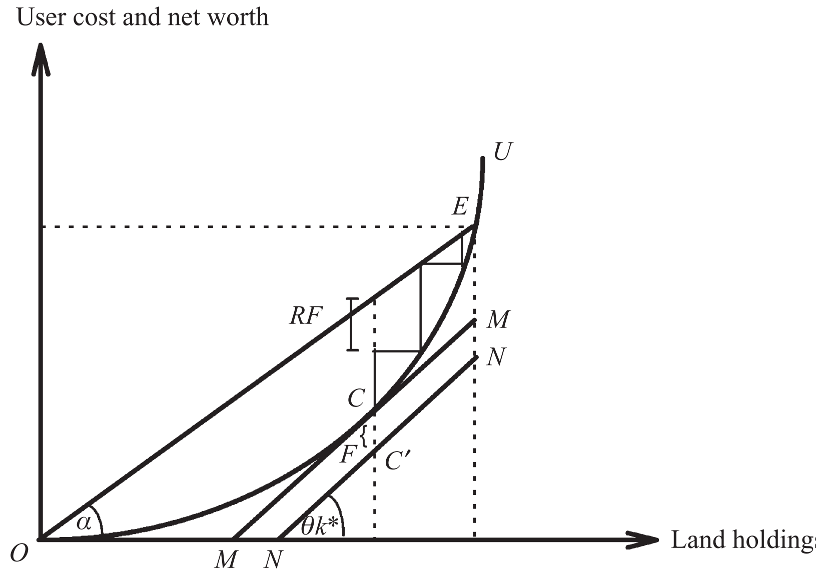

Fig. 9. *Minimum Financing*

one period. Algebraically, the amount of temporary financing required can be determined from the condition that

$$\frac{\beta(k_c)^2}{R} = [\alpha + q(k_c) - q^b]k^* + F \tag{19}$$

where k_c is the unique equilibrium shown in Fig. 9.

The amount of temporary finance provided may well exceed this minimum, shifting the financing constraint above the line MM in the figure and reducing the impact of the shock on land prices. With sufficient finance, there need be no 'fire sale' and land prices can remain in equilibrium. This is the case of the loan freeze discussed above, where the amount of emergency finance provided over and above collateralised lending is

$$F = b_t - b^* = (q^b - \alpha)k^* - q^* k^*/R = (q^b - q^*/R - \alpha)k^* \tag{20}$$

This extra financing yields k^* as equilibrium when substituted into (19) above: so, in terms of Fig. 9, it shifts the financing constraint up to OE.

The effect of finance houses rolling over loans in this way is like having a 'lender of the last resort' in a banking system: so long as borrowers are still solvent after the initial shock, temporary financing can reduce (or avoid) the multiplier or knock-on effects that come from the dumping of assets in a scramble for liquidity and so prevent insolvency. (With the unit elastic user costs assumed in calculating Table 4, land is relatively illiquid, and there is a key role for emergency financing.)

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