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BUBBLES, MONETARY MANAGEMENT AND THE ASIAN CURRENCY CRISIS

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We propose a life cycle of bubbles (from a quiescent stable state to a bubble to its collapse) where the role of monetary management is crucial. We claim that the policy of liberalizing short-term capital and private foreign borrowing (which was in effect a non-inflationary expansionary monetary policy with stable (pegged) exchange rates) combined to precipitate and deepen the Asean bubbles and create unsustainable short- and unhedged forex exposures.

1. Introduction

Bubble theories abound. The usual common ingredients are (i) contagion or recruitment or herding or flocking among agents (see e.g., Shiller, 1986; Kirman, 1993), (ii) two types of agents: smart vs. feedback traders (Black, 1988; Sentana and Wadhwani, 1992), fundamentalists vs. chartists (Frost and Frankel, 1986), sophisticated vs. noise traders (De Long et al, 1991), α- vs. β-traders (Day and Huang, 1990), (iii) the dynamics given by a price difference equation loaded with expectational (speculative) concerns, and (iv) how various investor types persist, i.e., why "sheep investors" do not metamorphose into "smart investors" or why some remain smarter than others. In most of these, (v) market behavior (stable/convergent, unstable/explosive, oscillatory, chaotic) is derived keeping "all parameters constant." Day and Huang (1990) argue this as allowing "the consideration of market behavior in relation to its pure speculative forces and price adjustments." An enduring issue here is (vi) whether the price spirals are due to irrational (non-smart) speculation ("true bubbles") or to market fundamentals (Garber, 1990; Flood and Garber, 1980).

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In this paper, our chief concern is the role of the monetary and credit authority in the life cycle of bubbles. Thus, the bubble model proposed is as simple as possible. We will handwave the types of agents issue by saying that fundamentals information is costly and only α-(nee, fundamentalist, smart, sophisticated, professional) investors can afford to acquire them. On the other hand, price movement information is free and β- (nee naive, noise, sheep, feedback) investors depend on this. The demand function is augmented by a price expectation which is adaptive, i.e., the expected next period price change is proportional to this period's price change. β-investors do not track the fundamental price and are solely concerned with recent past price trend. The crucial link between bubbles and monetary and credit policy locates in how β-investors finance their purchases. In this paper, the financial sector provides the wherewithal.

Our thesis which we share with Minsky (1975, 1982) and Kindleberger (1978) is that while bubbles can arise at anytime, its persistence and virulence (and cost to the economy) ultimately depends on the monetary and credit authorities. A corollary is that short-term (substantial) α-investment even when in pursuit only of pure dividend opportunities when coincident with complacent or ignorant monetary authorities can be very harmful.

The model we propose is not conventional in that the regime shift that generates the bubble is mediated by a (endogenous) "parameter shift." The response of β-investors is reflected by the sudden appearance of the heretofore absent expectational (speculative) pressure in the demand function. The life-cycle of a bubble involves a quiescent stable state which gets transformed into an explosive bubble state and which in turn eventually collapses. In the latter, we use the notion of "financial distress" in the Kindleberger (1978) and Minsky (1975).

One of the wellsprings of the East Asian currency crisis which prominently featured property and stock market bubbles (see, e.g., Davies, 1998; Neiss, 1997) was the discovery by the monetary authorities of a noninflationary monetary expansion in the guise of private foreign borrowing. East Asian monetary policy has in the past been very conservative and geared towards low inflation to simultaneously foster export competitiveness and support a pegged exchange rate. But

foreign inflows is peculiar in that it allows monetary expansion without inflation—a kind of having one's cake and eating it too. The willingness of foreign banks to lend, fueled as it was by the very real success of the region, bordered on religious zeal. Unfortunately, the incentive structure had by then become too skewed in favor of bubble-prone sectors and activities. The bubbles, precipitated by portfolio investment, thanks to the liberalization of capital account, soon grew by sucking up these borrowed resources. The stage was set for a fall.

2. The Model Preliminaries

The market for x consists of a cobweb-type supply function

$$x_t^s = c + d\,P_{t-1}, \qquad c,\, d > 0 \tag{1}$$

where x_t^s is supply of x at time t, and P_{t-1} is the price of x in the previous period $(t-1)$. The demand function has an orthodox and a speculative component, i.e.,

$$x_t^D = a - b\,P_t + \beta\Delta P_{t+1}^e, \quad a,b,\beta>0, \quad d<b \tag{2}$$

where x_t^D is the demand for x at time t, P_t is its price at t and ΔP_{t+1}^e is the expected price change in the next period $t+1$. The effect of $\Delta P_{t+1}^e > 0$ if $\beta > 0$ is to raise the demand for x. The reason is simple: if price is expected to rise in the next period, the demand for x will include a speculative component, i.e., purchases this period for the purpose of resale in the next period. This is the speculative component and $\beta > 0$ corresponds to what Kindleberger (1978) calls the market's "propensity to speculate." The expected price change is defined naively as:

$$\Delta P_{t+1}^e = \rho\left(P_t - P_{t-1}\right), \quad \alpha>0 \tag{3}$$

so that the expectation of a price increase in the next period follows this period's price increase. With (3), the demand function becomes

$$x_t^D = a - b\,P_t + \beta\rho(P_t - P_{t-1}). \tag{4}$$

Note that (4) can be written as $x_t^D = a + (\beta\rho - b)P_t - \beta\rho P_{t-1}$. If $\beta\rho > b$, we have an upward sloping demand curve with the speculative component swamping the normal component. This is akin to Day and Huang's (1990) strong flocking case. Equating x_t^D and x_t^s and rearranging gives the first order linear difference equation

(5) $$P_t = A\,P_{t-1} + B,$$

where

(6) $$A = -(d + \beta\rho)/(b - \beta\rho),\ B = (a - c)/(b - \beta\rho).$$

The solution to (5) is of the form:

(7) $$P_t = A^t(P_0 - P^*) + P^*,$$

where $P^* = B\,[1 - A]^{-1} = (a - c)/(b + d)$ equates permanent x_t^D and x_t^s. The dynamics of (7) is dictated by the sign and absolute value of A, which in turn depends crucially on the size of "$\beta\rho$." A conventional way of writing (7) is

(8) $$P_t = P_{t-1} + A^{t-1}\,(P_0 - P^*)\,(A - 1)$$

which gives the evolution of price from one period to the next. For the stability of the reference regime, we assume $d < b$, i.e., the slope of the supply curve is less than that of the demand curve. We have the following cases for a given value of β:

(i) $\beta = 0$ so $A = -(d/b) < 0$ and $|A| < 1$. Thus, P_t converges to P^* in an oscillatory manner any time that $P_t \neq P^*$. Any random shock will dissipate and over time, barring other shocks, P^* will hold. This case (i) is the initial stable stage of the life cycle which we envision here.

(ii) β is large enough so that $(b - \beta\rho) < 0$. This results in $A > 0$. If (a) $A > 1$, P^* is unstable and any shock that results in $(P_0 > P^*)$ will push P_t progessively to infinity.

(iii) β is such that $b = \beta\rho$, $A = \infty$ and P_t spikes to infinity ($P_0 > P^*$). We ignore the possibility.

(iv) β is small enough such that $(b - \beta\rho) > 0$ and (a) $A < 0$ and if $|A| > 1$, P_t will oscillate around P^* in an increasingly divergent way; (b) if $|A| < 1$, the oscillation around P^* is convergent and P_t returns to P^*. This resembles case (i).

(v) β is such that $(d + \beta\rho) = (b - \beta\rho)$ or $(b - d) = 2\beta\rho$. Then $|A| = 1$ and with $P_t \neq P^*$, P_t will oscillate around P^* forever.

For given β, the above cases also apply to variations in ρ. In this case, it is the price expectation that drives the dynamics of the system. It could, of course, also be both together. However, our story will dwell on shifts in the propensity to speculate β.

3. Life Cycle of a Bubble

The purpose of this section is to propose a mechanism by which a bubble is born, grows and eventually collapses. The initial state is a stable equilibrium where transitory shocks get dissipated. This is case (i) in II above where the demand function is (2) without the speculative factor, i.e., $x_t^d = a - bP_t$. The problem is how the system moves from a stable state to an unstable and then back. We assume that a bubble is inherently an unstable state of the system. Let $P^* = B\,[1 - A]^{-1}$ be the long-run equlibrium price. Thus:

Definition 1: A bubble exists if $(P_t - P^*)$ increases monotonically as t rises.

Remark: By this definition, no bubble can arise in the initial stage since any deviation from P^* will progressively dissipate in a convergent oscillatory fashion.

A Bubble is Born

Let the supply function be given by (1). The genesis of a bubble in this paper locates in the demand side of the system.

Start with period $t = -1$. In this period only (permanent) repeated flows are at work. No news occurs several periods back. So $P_0 = P^*$. The equilibrium price $P_{-1} = P^* = (a - c)\,(b + d)^{-1}$ reigns.

Suppose that at $t = 0$, α-investors enter the market making a placement of α. α-investors are transitory investors out to exploit arbitrage or (P/E) opportunities available in the market. They are dividend-driven investors but are short-term. They stay for one period collecting arbitrage unless a bull run develops. The demand for x rises and price is now $P_0 = (a + \alpha) - bX_0$ and temporary equilibrium at $t = 0$ is $P_0 = (a + \alpha - c)/(b + d) > P^*$. At $t = 1$, α-investors unload so the price oscillates back to P^*. Two cases:

a) No bull run develops: $\beta\rho = 0$.

No other news arrives at $t = 1$ and subsequently. The price at $t = 1$ is:

$$P_1 = A\left(P_0 - P^*\right) + P^*$$

$$\vdots$$

$$P_t = A^t\left(P_0 - P^*\right) + P^*$$

Since $A = -(d/b) < 0$ and $d < b$, $A^t\,(P_0 - P^*) \to 0$ as t rises and $P_t \to P^*$ in an oscillatory fashion. In time, no trace of the α-investor visit is left. The system has "no memory." Notice that $P_1 < P^*$ since $A < 0$. P_0, however, exceeds P^*.

b) A bull run develops: $\beta\rho > b$. Suppose in $t = 1$, another set of α-investors enter the market. Then P_1 will remain above P^*. If $P_1 > P_0$, a price escalation is starting and a bubble may be aborning. β-investors respond to the news of escalating capital gains in the market. The original asset holders realize $(P_0 - P^*) > 0$ at $t = 0$ and $(P_1 - P_0) > 0$ at $t = 1$ which whets the appetite of β-investors. The latter are temperamentally attracted by capital gains, i.e., enjoy gambling, but, unlike α-investors, do not spend resources to track new and relevant information apart from the price. They only follow others deducing their behavior by

the price movement. The flocking fever begins at precisely the end of $t = 1$ since $P_1 > P^*$. Note that P^* is the long term price where initial asset holders realized capital gain. At the start of $t = 2$, they make the plunge. With β-investors flocking, the demand function at $t = 2$ becomes

$$P_2 = a - bX_2 + \rho\beta\,(P_2 - P_1).$$

Note that P^* remains the same, i.e., $(a - c)/(b + d)$. Period 3 and subsequent period prices are now

$$\begin{aligned} P_3 &= A^3\left(P_1 - P^*\right) + P^* \\ &\vdots \quad \vdots \quad \vdots \quad \vdots \\ P_t &= A^t\left(P_1 - P^*\right) + P^* \end{aligned}$$

But now $A = (d + \rho\beta)\,(\rho\beta - b)$. We assumed that $\rho\beta - b > 0$ so that $A > 1$. A^t explodes and $(P_t - P^*)$ rises monotonically as t rises. A bubble now exists.

Regime Shift Mechanism

The genesis of the bubble depends on the flocking of β-investors whose role is reflected in the sudden appearance of the heretofore absent expression "$\rho\beta(P_t - P_{t-1})$" in the demand function. This is a "regime shift." How this regime shift occurs is this subsection's concern. The propensity to speculate combines the capacity to finance the purchase of x for resale in some future date with the desire to exploit the capital gains prospect. It is in other words, "effective speculative demand."

Definition 2: The propensity to speculate is $\rho_t = \delta_t C$, where δ_t is the "desire to speculate" and C is the capacity to finance the purchase. If $C > 0$ is such that $\beta C > b$ we have strong flocking.

Definition 3: The desire to speculate is defined as

$$\delta_t = \begin{cases} 1 & W_t > 0 \\ 0 & W_t \leq 0 \end{cases}$$

where

$$W_t = \left\{\left[\hat{P}_t - r_t\right] - \left[\hat{P}_{t-1} - r_{t-1}\right]\right\}\left[\hat{P}_{t-1} - r_{t-1}\right]^{-1},$$

where $\hat{P}_t$ is the asset price inflation and r_t is the prevailing interest rate at t.

Thus, W_t indicates the capital gains in excess of interest rate associated with switching to x. $W_t > 0$ requires $\hat{P}_t > r_t$ given that $P_{t-1} > r_{t-1}$. For this combination, $\delta_t = 1$, i.e., the desire to speculate for capital gains springs to life. If $\hat{P}_t \leq r_t$, $W_t \leq 0$ and $d_t = 0$. In the previous section, we should have $[(P_1 - P_0)P_0^{-1} - (P_0 - P^*)P^{*-1}]\,[(P_0 - P^*)P^{*-1} - r]^{-1}$ where $r_1 = r_0 = r_t$ for $W_1 > 0$. Thus, it is not just an asset price blip but a sustained rising blip that awakens desire.

Definition 4: The capacity to finance C is a function of interest rate: $C(r)$, $C' < 0$, $C(r > \bar{r}) = 0$.

C represents the financial capacity to effect desired speculative purchases. The interest rate reflects the scarcity of credit and the attractiveness of alternative uses. *If on impact of* $W_t > 0$, $r_t = r^*$ *is such that* $A(C(r^*)) > 0$ *and* $A(C(r^*)) > 1$, *a bubble is born.* If $(r > \bar{r})$, then the bubble is still-born. We have the following:

Claim 1: For a system described by (1) and (2) to pass from a stable state ($\beta\rho < b$) to a bubble state ($\beta\rho > b$), it is sufficient to have (i) enough escalating fundamentals purchases for two successive periods to produce $W_t > 0$ and (ii) an interest rate level r_t so that $\beta C(r_t) > b$. (strong flocking)

Bubble Persistence and Collapse

Financial Distress

As the bubble expands, it grabs more and more resources from other sectors and starves other markets of financing. *Financial distress sets in.* Three responses can be adopted by the monetary authorities:

(i) The monetary authorities do nothing and the monetary expansion hinges only on the banks' normal and limited capacity to create liquidity. The interest rate stays low for a while allowing the bubble to grow some but soon the interest rate has to rise and start to squeeze C. At some $r' < r^*$, C is small enough so that $A(C(r')) < 0$ and $|A(C(r'))| < 1$ and the system enters a stable phase with P_t converging to P^* in an oscillatory manner. The end of the bubble starts. Banks may experience a deterioration of the quality of their portfolio.

(ii) The monetary authorities actively oppose the bubble from the start by reducing liquidity thus raising interest rate, reducing C and quickly nipping the bubble in the bud, i.e., accelerating the attainment of the oscillatory convergent phase. The end of the bubble comes quickly. No bubble, no financial distress, no collapse. This is the Greenspan response.

(iii) The monetary authorities accommodate the bubble by raising money supply, i.e., easing credit or if this option is bottled due to inflationary fear or an IMF ceiling, by allowing access to foreign borrowing (implying an effective massive monetary expansion, with very low effective interest rate if the exchange rate is stable). This has an intrinsic attraction since the inflation would now be even pulled down which monetary authorities celebrate. The latter is what happened in the Philippines and in the Asean. This response by the monetary authorities prolongs and fuels the bubble's virulence. This in turn starves other sectors via a Dutch Disease effect. Banks and private businesses incur foreign debts. But this eventually leads to other forms of financial distress. The domestic currency appreciates and trade deficit begins to grow. This was the first sign of the problem. The banking sector's forex exposure escalates and foreign creditors may become cautious and begin to raise interest rate on shorten maturity. The share of short-term forex liabilities rises and creditors become even more tight-fisted. As C is choked, the flow of new investment trickles and the price spiral reverses. The system reverts to its downward convergent phase as δ_t shuts off and $\beta = 0$. The bubble's collapse is now a reality but the consequences for the economy is now disastrous. Banks are saddled with heavy short-term forex liability and deteriorating asset holdings.

α-Investors Flee the Coop

The α-investors notice the financial distress and unload to avoid losing capital gains. $\alpha = 0$ hastening $\left[\hat{P}_t - r_t\right] < 0$ and $W_t < 0$ and if so $\delta_t = 0$ implying $\beta = 0$ once again. The system now converges back to P^*. If α-investors are foreign investors, this puts pressure on the exchange rate to rise. The latecoming β-investors who are caught in the downward oscillatory price spiral keep hoping the trend will reverse with each upswing and accumulate losses.

Claim 2: For the system described by (1) and (2) in a bubble state ($\rho\beta > b$) to switch to a convergent oscillatory stable, it is sufficient that r rises to a level r^* so that either (i) $\beta C(r^*) < b$ or (ii) α-investors observing the emerging financial distress unload sufficient placements so that $\left(\hat{P}_t - r_t\right) < 0$ forcing $\delta_t = 0$ and $r_t = 0$.

Aftermath

The banks experiencing a double squeeze of rising forex-related liabilities and a rapid deterioration of collateral asset values begin a defensive posture. A liquidity crunch engulfs the economy. Thus, the latter response (i.e., allowing foreign borrowing) by the monetary authorities is the worst and is largely responsible for the depth of the currency crisis and the erosion of competitiveness. This is partly what happened in the Philippines and in the Asean.

4. How Zero Portfolio Balance Harms

In this model, we explicitly recognize the presence of naive traders operating alongside sophisticated traders. In the case of many LDC's, the latter represents (a) foreign hedge fund and portfolio investors with richly financed local subsidiaries dedicated solely to sniffing for arbitrage possibilities and detecting distress signals. These investors parlay resources out of proportion to small LDC markets hence $\left[\hat{P}_t - r_t\right] > 0$ and their agents either are or hobnob with people with sensitive information. Their global reach means that a fairly quiescent LDC market from local bifocals may prove very attractive due variously to cheaper bor-

rowing source, deteriorating competing markets elsewhere where they also have exposures, or reduced risk thanks to new derivative market instruments. Some movement towards currency convertibility and capital deregulation is all they need to move in. This set of sophisticated traders are motivated by "short term" fundamentals (by which we mean normal relative (*P/E*) in the case of shares or normal appreciation in, say, property value or interest differential). Any bubble that results from their entry is gravy.

This set may also include "muscle speculators" whose motivation is solely capital gains and who are willing to trade a large probability of a small loss on short term fundamentals in exchange for a small probability of a large profit if a bull run is achieved. They make large gains only if a bubble starts. These are the "ugly" speculators against whom Mahathir Mohammad riles. George Soros protests his being counted in their rank.

Among the naive speculators are many local traders who, not being possessed of relevant and timely information, only "do what the Romans do." They watch other people (who incidentally may be watching others). Their signal is the asset price escalation. Early spectacular gains or rumors thereof set them buzzing and the buzz becomes a roar by contagion. Soon, borrowing to finance speculation from banks becomes the norm. Banks, feeling fully covered by the value of the purchase and collateral, get sucked up by the exuberance (Bank officers may lend surreptitiously to themselves to join the frenzy). Other legitimate activities go begging for funds.

The distress signals first staunchly denounced by the authorities and investors alike creep up slowly on sophisticated investors' consciousness before they are recognized as financial distress signals. The system is going through a homeostatic discomfort not unlike the early febrile state of the body. Some shananigans or secondary pyramids may collapse, get investigated and trigger a paradigm shift. Then a sprinkling of sophisticated investors unload, followed by others and the stampede is on. Sophisticated investors fly to foreign shores with considerable capital gains financed by latecoming locals' capital losses. The domestic economy is left to sort out a financial mess that includes a painful liquidity crunch. Through all this, the balance for portfolio investment may be near zero or even negative.

The oft repeated position that zero net portfolio balance means zero net effect on the exchange rate is not accurate. The claim is based on the portfolio inflow raising the supply of $ and its equivalent outflow reducing the supply, i.e., shifting the supply curve leftward by the same amount. If, however, this portfolio inflow leads to a bubble, i.e., $W_t > 0$, where substantial local resources are wagered, the accommodating monetary expansion may dwarf the original forex inflow accommodation and this leads to a considerable real appreciation of the local currency for the duration of the bubble. To assuage early financial distress, foreign borrowing may be allowed. But banks and firms with $ access may themselves find it immensely profitable to use the $ to ride the bubble. Uncovered $ exposure rises and the economy is being set up for a crash.

This scenario appeared to have occurred in the Philippines and the Asean. The trigger of stock and property frenzy were foreign investors, many of them East Asian. After them came the portfolio investors. With the bubble on hand, the tradeable sector complained loudly that credit was hard to come by despite phenomenal growth in credit. By 1995, manufacturers, especially exporters, were accusing the property sector of cornering credit with the eager collusion of the banking sector. When the central bank responded by allowing access to $ loans, banks, especially property-related ones, incurred $ loans. This deepened the bubbles.

5. Summary

In this paper, we present a plausible bubble life cycle from a quiescent stable equilibrium to an unstable explosive (bubble) state to the collapse of the bubble and the return of the system to a stable state characterized by a downward spiral towards the long-term equilibrium. The first switch comes about due to the entry of substantial α-investments at $t = 0$ and $t = 1$ attracted by short term fundamentals (P/E ratios, interest differential). The capital gains they trigger precipitate a flocking by β-investors at $t = 2$ who changes the character of market demand to one where it is dominated by purchases for resale. They enter when the price is in the upswing and price is above long-run equilibrium.

The flocking of β-investors is a function of two events: the birth of the desire to speculate δ and the capacity to finance the desired purchases C. The desire to speculate is triggered by observed capital gains at $t = 0$ and $t = 1$. The capacity to purchase is a decreasing function of the rate of interest. If the rate of interest is not so high, both conditions can simultaneously be met, and a bubble can ignite.

The success of the bubble now begins to cause credit scarcity elsewhere. In East Asia, the monetary authorities in an effort to ease the scarcity allowed firms to borrow dollars from the outside in effect causing a dramatic fall in the interest rate and expanding credit. But the presence of the bubble only gobbled up new borrowed resources further fueling the bubble. Financial distress barred from taking the usual form of a BOP deficit, inflation and fiscal deficits, turned up as current account deficit. When the size of the latter deficit became news, creditor banks started to worry and credit started to slow down. The flocking of β-investors began to trickle as their capacity to purchase diminished. α-investors flee the coop and the reverse spiral (collapse) begins. The system now enters an oscillatory phase convergent to the initial equilibrium. The system is engulfed in a liquidity crunch.

The role of monetary management is crucial in this story. The monetary accommodation of the bubble by allowing foreign private borrowing was the principal mistake that made what would have been simple adjustment slowdown into a financial collapse. This was, however, precipitated by the liberalization of short-term capital traffic which triggered the bubbles in the first place.

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