Financial bubbles

> "The a priori assumptions of rational markets and consequently the impossibility of destabilising speculation are difficult to sustain with any extensive reading of economic history. The pages of history are strewn with language, admittedly imprecise and possibly hyperbolic, that allows no other interpretation than occasional irrational markets and destabilising speculation: *manias … insane land speculation … financial orgies … frenzies … feverish speculation … epidemic desire to become rich quick … wishful thinking … intoxicated investors … turning a blind eye … people without ears to hear or eyes to see … investors living in a fool's paradise … easy credibility … overconfidence … overspeculation … overtrading … a raging appetite … a craze ... a mad rush to expand*." (Kindleberger, 2000:24-25, original emphasis)

> "Before economists relegate a speculative event to the inexplicable or bubble category, we must exhaust all reasonable economic explanations … the business of economists is to find clever fundamental market explanations for events; and our methodology should always require that we search intensively for market fundamental explanations before clutching the 'bubble' last resort … from our current perspective, [the] "irrational" speculation [of 1719-1720] probably looked a lot like a normal day in a pit of the Board of Trade " (Garber, 1990:35)

1. Introduction

The purpose of this chapter is to make the case for an alternative, Post Keynesian, perspective on a topic in financial economics of considerable research interest and policy relevance, namely the 'financial bubble'. The evident tension between the two opening quotations, in their contrasting views of the nature and significance of bubbles, demands explanation. The source of their conflict is profound, and corresponds ultimately to different conceptions of the role of time in economic theory. This fault-line in economics was first identified by Keynes in *The General Theory* (1973 [1936], CWVII, hereafter *GT* in chapter and page references) and is also reflected in many of the other chapters of this book. This chapter is accordingly meta-theoretical, in concentrating on this core difference between theoretical approaches; and also methodological, in examining what the difference means for the interpretation of the empirical evidence. The analysis leads in turn to a consideration of Keynes's distinctive approach to policy on speculation.

The chapter does not offer a detailed survey of particular theories or empirical investigations, nor of the rich literary evidence surrounding some of the most

dramatic episodes in economic history, all of which can be found elsewhere[1]. Other chapters in this book address financial, including banking and currency, crises and we touch only lightly upon the relation between financial bubble and financial crisis. The limitation of scope to *financial* bubbles precludes consideration of crises of industrial production in the form associated with Marx and Schumpeter.

Section 2 offers a theoretical critique of the concept of fundamental value and the related 'efficient markets hypothesis' (EMH), drawing upon Keynes's analysis of the state of long-term expectation and arriving at a formal expression of his concept of conventional valuation in terms of his theory of probability. The discounted cashflow method of valuation appropriate for fixed annuities cannot properly be extended to equity shares in a world subject to unforeseen change, and the concept of expected value upon which 'rational expectations' depend is open to serious challenge. Orthodox theory makes too easy a division between the rational and the irrational in terms of fundamentals, obscuring the truly irrational behaviour of the bubble.

Section 3 considers the evidence from statistical analysis and experimental psychology against the EMH and notes the practical neglect of fundamentals in empirical finance work. Secondly, the historical record provides evidence, not yet accommodated by statistical and psychological models, that conspicuous consumption and credit are vital to the 'take-off' of a bubble through their effect on expectations and a transition in conventions from those of 'normal times'.

Section 4 considers the implications of bubbles for the real economy and supports the present pragmatic policy of isolation and containment through effective regulation, while noting that Keynes's original policy proposals for high stamp duty and radical reform in the ownership of investments address the causes of bubbles at their source and remain relevant in a modified form. Section 5 summarises and concludes, *pace* Garber, that the concept of fundamental value is positively misleading for the understanding of financial bubbles, while recognising, *cum* Kindleberger, that in normal times markets behave as rationally as the knowledge of our ignorance of the

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[1] A good starting point, in addition to the references cited in the text, is Camerer (1989) and the Symposium on Bubbles in the *Journal of Economic Perspectives* (1990,vol. 4, no. 2), updated by Malkiel (2003) and Shiller (2003).

future permits. When prices are based on conventional valuation, it is only rational to speculate.

2. Questioning the fundamentals

The division between the currently orthodox and the Post Keynesian alternative views of financial bubbles centres on the concept of 'fundamental value', or just 'fundamentals' for short. Orthodox theory depends on fundamentals, even when they serve only as a benchmark for departures from rational behaviour, and the very notion of rationality is bound up with them. So fundamental (!) is this issue that, with apologies to the reader more interested in the historical cut and thrust of bubble and crash, a fairly abstract preliminary discussion is necessary if we are to make sense of the competing and contradictory claims about bubbles that abound in the literature.

Clarity of thought in this matter is best arrived at, I suggest, by distinguishing the market price of an investment or financial claim q_t from its fundamental value in prospect (*ex ante*) q_t^* and its fundamental value in retrospect (*ex post*) q_t^{**}. This taxonomy will prove helpful in discussing, on the one hand, theories of departures of market prices from fundamental value, and on the other, the nature of fundamental value itself. Note that both the market price q_t and the *ex post* fundamental value q_t^{**} are observable: it is in the nature of financial assets that they are traded on well-organised markets with well-defined competitive prices, so that q_t can easily be observed. *Ex post* fundamental value q_t^{**} can also in principle be observed, although it is a subject for accountants, and even then, only for those with a peculiarly academic and historical bent. For it is in principle possible, if of little or no commercial importance, to determine the market interest rates and the money yield of an asset over the course of its economic life, and so the price q_t^{**} that would have warranted the holding of the asset at any time in preference to a debt. By contrast, the *ex ante* fundamental value q_t^* is intrinsically unobservable, except in the case of fixed annuities, and we shall find in due course that this unobservability presents an insuperable problem.

2.1 Fixed annuities

We set out from common ground, the case in which $q_t = q_t^* = q_t^{**}$. The market price in equilibrium of a claim to a series of fixed future money receipts (a 'fixed annuity') is the net present value of the series, which can be expressed as:

$$q_t = q_t^* = q_t^{**} = \sum_1^N d_{t+i} \frac{1}{(1+R_{t+i})} \tag{1}$$

where N is the number of discrete time periods over which the series extends, d_{t+i} is the receipt due at time $t+i$, and R_{t+i} is the interest on a loan of a unit of money at time t for i periods. The three q's, with and without asterisks, are equivalent because both d_{t+i} and R_{t+i} are known at any time, given a market for debts of comparable maturities. Equation (1) can be simplified by the assumptions that the stream of future receipts is a perpetual annuity growing in each period at a constant rate g and that the rate of interest in each period is a constant r, to give:

$$q_t = \frac{d_{t+1}}{(r-g)}, \text{ such that } (r > g) \tag{2}$$

which looks very much like the standard dividend discount model for the valuation of equity securities. However it is a considerable leap from the equilibrium price of fixed annuities to the market prices of financial assets in general, and the various assumptions required by such athletes represent the heart of the controversy.

If, as an alternative to holding the claim to maturity, an investor can transfer the claim at an earlier date (including the next period), the relation between the present and future market prices q_t and q_{t+1} is, in equilibrium, given by the 'no arbitrage opportunity' condition:

$$q_t = \frac{d_{t+1} + q_{t+1}}{(1+R_{t+1})} \tag{3}$$

where today's asset price equals the net present value of the sum of tomorrow's dividend and tomorrow's asset price. Of immediate relevance to bubbles is the possibility that market prices q_t may not represent fundamental value in the sense of equation (1) even though equation (3) holds, so that we can have $q_t \neq q_t^* = q_t^{**}$ if $q_{t+1} \neq q_{t+1}^* = q_t^{**}$. This situation arises because equation (1) is not the only solution of the first order difference equation (3), since the general solution is:

$$q_t = \sum_{1}^{N} d_{t+i} \frac{1}{(1+R_{t+i})} + B_t = q^* + B_t = q^{**} + B_t \qquad (4)$$

where B_t is of the form $B_0(1+R_{t+i}), B_0 > 0$, a 'bubble term'. Equation (4) describes a 'deterministic bubble' which implies prices rise *ad infinitum*; any sustained departure from the *ex ante* fundamental value q_t^*, i.e. for $B_{t+1} > 0$, requires a departure from 'rationality' to extrapolate from any initial 'displacement' to indefinite future growth.

The South Sea Bubble of 1720 (Carswell, 1960) appears broadly to conform to the model of equation (4). Unlike the case of John Law's Mississippi Bubble, the commercial rights to the South Sea trade were rendered of no immediate value from the start by the Spanish War of 1718. The core of the South Sea scheme was the offer to privatise the National Debt, by swapping a variety of existing forms of government debt (fixed annuities) trading at a heavy discount in poorly organised markets, for a single class of equity shares trading in a unified market. The resulting improvement in liquidity might fairly be expected to provide a one-off gain in value; the Bank of England itself competed unsuccessfully to offer the Treasury a similar scheme. The progression from this initial gain to a bubble followed a well-documented combination of greed, ignorance and bad faith, including insider trading, the payment of dividends from capital, and the purchase by the company of its own shares financed partly by the note issue of the connected Sword Blade Bank.

2.2 Rational expectations and the efficient markets hypothesis

It is a small but significant step from (3) to the 'rational expectations hypothesis' and the claim, which arose out of experience with inflation expectations in the 1970s, that rational, well-informed agents do not make systematic errors in forming their expectations. This is expressed by incorporating into (3) an expectations operator (to be scrutinised closely in the next section):

$$q_t = \mathrm{E}_t\left[\frac{d_{t+1} + q_{t+1}}{(1+R_{t+1})}\right] \qquad (5)$$

and by substitution and the use of the 'law of iterated expectations', that $\mathrm{E}_t[\mathrm{E}_{t+1}[q_{t+2}]] = \mathrm{E}_t[q_{t+2}]$, one solution of the first order difference equation (5) in q_t looks very like equation (1) with the addition of the expectations operator:

$$q_t = q_t^* = \mathrm{E}_t\left[\sum_1^N d_{t+i}\frac{1}{(1+R_{t+i})}\right] \qquad (6)$$

Equation (6) states that q_t^* is the expected value of the prospective yield, in turn assumed to be a stochastic variable with a random disturbance term. This crucial assumption takes the only source of uncertainty to be the disturbance term, of which the expected value is zero, so that equations (1) and (6) are otherwise equivalent. If the disturbance term is normally distributed, uncertainty becomes synonymous with variance or 'volatility'. Equations (1) and (6) are indeed equivalent in the case of a fixed annuity, where $\mathrm{E}_t[d_{t+i}] \equiv d_{t+i}$ and $q_t^* = q_t^{**}$.

The general solution of equation (4) also includes the stochastic 'rational bubble':

$$q_t = \mathrm{E}_t\left[\sum_1^N d_{t+i}\frac{1}{(1+R_{t+i})}\right] + \mathrm{E}_t\left[\frac{B_{t+1}}{(1+R_{t+1})(1-p)}\right] = q_t^* + \mathrm{E}_t\left[\frac{B_{t+1}}{(1+R_{t+1})(1-p)}\right] \qquad (7)$$

where p is the (frequency) probability of the bubble bursting in the next period. Continued equilibrium requires that B_t grow at an ever increasing rate, as the frequency probability of the bubble surviving to period n, $(1-p)^n$, tends to zero as $n \to \infty$. In the case of a fixed annuity, uncertainty applies only to the duration of the bubble, so that in equation (7) $q_t^* = q_t^{**}$: there is no uncertainty about the value of the annuity $d_{t+1\,..\,t+N}$, or the discount rate.

In the absence of a bubble, equation (6) represents the efficient markets hypothesis (EMH) that $q_t = q_t^*$, i.e. observed prices in competitive financial markets represent fundamental values[2]. Behavioural finance and complexity theory (see below) identify investor psychology and the limits of arbitrage as systematic sources of divergence from fundamental value, but the critique now offered here, following Keynes, raises

[2] The reference here is to the 'strong' EMH (where prices reflect all information available). The 'semi-strong' EMH (where prices reflect all information available to the market) allows for asymmetric information between insiders and outsider, and the possibility of insider trading profits; while the 'weak' EMH holds only that prices already reflect the information embodied in past prices, leading to a random walk in prices, since new information ('news') is unpredictable.

the prior question whether market prices of assets other than fixed annuities can ever represent fundamentals.

In a theory of competitive equilibrium, the prospective yield of a capital-good represents a set of expected equilibrium prices and outputs reflecting supply and demand at future dates. To sustain the EMH requires one of two assumptions, either

EMH-A *the world behaves as if complete futures and insurance markets extend to the horizon of long-term expectation; or*

EMH-B *a process of trial and error leads to a convergence of expectations on their equilibrium values.*

EMH-B implies EMH-A; while EMH-A is sufficient on its own, if no more than an assertion, given the absence of the required markets. It is an understanding that the world is such that both these assumptions are invalid that leads Keynes to write

> "Or, perhaps, we might make our line of division between the theory of stationary equilibrium and the theory of shifting equilibrium - meaning by the latter the theory of a system in which changing views about the future are capable of influencing the present situation. *For the importance of money essentially flows from its being a link between the present and the future.* We can consider what distribution of resources between different uses will be consistent with equilibrium under the influence of normal economic motives in a world in which our views concerning the future are fixed and reliable in all respects; - with a further division, perhaps, between an economy which is unchanging and one subject to change, but where all things are foreseen from the beginning. Or we can pass from this simplified propaedutic to the problems of the real world in which our previous expectations are liable to disappointment and expectations concerning the future affect what we do today." (*GT* 294, original emphasis)

Keynes draws a sharp distinction between the states of short-term and long-term expectation, which govern production and investment decisions respectively. He is quite prepared to accept the two EMH assumptions as complements in the case of short-term expectation: in practice, entrepreneurs correct their expectations by trial and error in circumstances which are usually stable over short production periods (EMH-B); and thus for analytical purposes (as I have elsewhere argued to be the case in *GT* Chapter 3, see Hayes, 2005) it is acceptable to assume rational short-term expectations (EMH-A):

> "Entrepreneurs have to endeavour to forecast demand. They do not, as a rule, make wildly wrong forecasts of the equilibrium position. But, as the matter is very complex, they do not get it just right; and they endeavour to approximate to the true position by a method of trial and error. Contracting where they find that they are overshooting their market, expanding where the opposite occurs. It corresponds precisely to the higgling of the market by means of which buyers and sellers endeavour to discover the true equilibrium position of supply and demand. …The main point is to distinguish the forces determining

> the position of equilibrium from the technique of trial and error by means of which the entrepreneur discovers where the position is. … *Ex ante* decisions may be decided by trial and error or by judicious foresight, or (as in fact) by both." (CWXIV, pp. 182-183)

By contrast, 'it is of the nature of long-term expectations that they cannot be checked at short intervals in the light of realised results" (*GT* 51). The long-term durable nature of capital assets is precisely the problem; if the expectations upon which the investment was based prove mistaken, it is not possible, either to reverse the investment today, or to go back in time, adjust the original investment decision, and then check the revised results in the present. It is only in a stationary state that adjustments made today might (given stable dynamics) be expected to have the same effect in the future as the same adjustments, made in the past, would have had today. So the convergent feedback mechanism necessary to generate in practice a set of long-term equilibrium prices as the basis of prospective yield is absent in any economy subject to unforeseen change, such as the one we inhabit. It cannot be emphasised enough that it is simply not legitimate to model the real world in terms of long-term equilibrium, because of the physical nature of time.

A stationary state with the addition of a stochastic disturbance term can be described as an 'ergodic' system (Davidson, 1996). The ergodic hypothesis was originally conceived by Boltzmann in developing the kinetic theory of gases in physical chemistry, to explain the behaviour of macroscopic volumes in terms of the Brownian motion of individual particles. The EMH can be understood as taking markets to generate equilibrium prices in the same way that equilibrium temperatures and pressures are generated by the random collisions of myriads of gas molecules in a closed vessel with a fixed volume. However, the real world is far from stationary, even in a stochastic sense. As Keynes puts it eloquently:

> 'The outstanding fact is the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made. Our knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible. If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; or even five years hence." (*GT* 149)

> 'By uncertain knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject in this sense to uncertainty…Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest 20 years hence, or the obsolescence of a new invention, or the position of private wealth owners in the social system in 1970. About these matters there is no scientific

basis on which to form any calculable probability whatever. We simply do not know." (CWXIV: 113-114)

According to Fama (1970:389), the EMH emerged as a theoretical response to the empirical evidence that stock market prices follow a 'random walk'. A random walk (which also describes Brownian motion) can be expressed as:

$$\mathrm{E}_t[q_{t+1}] = q_t + \varepsilon_{t+1} \text{ where } \varepsilon \text{ is a random disturbance with zero expected value} \qquad (8)$$

This must be carefully distinguished from a process which represents a disturbance about the equilibrium value (note the asterisk):

$$\mathrm{E}_t[q_{t+1}] = q_t^* + \varepsilon_{t+1} \qquad (9)$$

If the EMH is to be based on the discovery of the equilibrium position by trial and error (EMH-B), equation (9) alone is the appropriate description, and this can be relevant only where q_t^* is fixed or predictable in an ergodic system. For the EMH to be consistent with the random walk of equation (8) requires perfect foresight of future equilibrium prices, not as a complement or analytical representation of trial and error, but as an independent condition (EMH-A). For if market prices always represent *ex ante* fundamental equilibrium values i.e. $q_t = q_t^*$, then a random walk may (perhaps) be expected as a result of unpredictable shocks to the endowment, technology and tastes which are taken to determine future equilibrium prices. Thus although the EMH purports to explain the empirical evidence of a random walk in prices, that evidence cannot itself support the EMH, since that evidence is inconsistent with the stationary (ergodic) state required by EMH-B and can represent a shifting equilibrium only on the prior assumption of complete futures markets (EMH-A), which patently do not exist. The random walk cannot itself be offered as evidence in support of EMH-A.

To summarise the argument so far, it is plausible that in competitive equilibrium the market prices of fixed annuities (q_t) represent *ex ante* their fundamental values (q_t^*). Equally, the fundamental value of any past investment can be determined *ex post* at the end of its economic life (q_t^{**}), permitting an historical judgment of the profitability of the initial investment decision. However, the physical nature of time in a world subject to unforeseen change presents insoluble ontological obstacles to the extension of the concept of *ex ante* fundamental value (q_t^*) beyond fixed annuities to

financial assets in general. In order to progress further without invoking this concept, we must consider Keynes's understanding of the nature of long-term expectations.

2.3 The state of long-term expectation

Keynes's approach to long-term expectation is informed by his understanding of probability. He treats classical frequentist probability theory (implicit in the rational expectations hypothesis) as a special case within a branch of philosophical logic that deals with arguments that are doubtful, but neither certain nor impossible. He understands probability as an argument or logical relation between one set of propositions (the conclusions) and another set (the evidence). Mathematics deals with analytic relations between propositions that must be either true or false. In matters of metaphysics, science and conduct, an argument is considered 'probable' to the extent that it warrants a degree of rational belief. Such a probability relation is objective, in the sense that any rational judge would reach the same conclusion upon the same evidence. Probability is not in general numerical, as in frequentist theory, but arguments can be, and often are, compared. An archetypal case is the verdict reached in a court of law.

Although Keynes treats investors as forming single-valued expectations of prospective yield, these estimates bear a complex relation to the 'bundle of vague and more various possibilities which actually make up their state of expectation when they reach their decisions' (*GT* 24, fn 3), a relation which cannot be reduced to 'actuarial' calculations based on relative frequency. The following paragraphs endeavour to express in the symbols of Keynes's *Treatise on Probability* (1973, CW VIII) the substantive content of section II and the first paragraph of section IV of *GT* Chapter 12 (*GT* 148-149, 152), with a view to clarifying precisely the nature of the flaw in the concept of *ex ante* fundamental value.

The *ex ante* expected value q_t^* of the *ex post* outcome q_t^{**} is the value of q_t^* which satisfies:

$$\left(q_t^* \geq q_t^{**}\right)\Big|\Omega_t = \left(q_t^* \leq q_t^{**}\right)\Big|\Omega_t \qquad (10)$$

where this expression means that the probability that the expected value q_t^* lies at or above the actual value q_t^{**} equals the probability that it lies at or below, given the

available evidence Ω_t, including relevant propositions for and against each conclusion[3]. Ω_t is a subset of $\overline{\Omega}$, the complete 'perfect foresight' information set from which q_t^{**} might be known with certainty, i.e. $q_t^{**}\left|\overline{\Omega}\right. = 1$.

The expected value $\mathrm{E}[x]$ of classical probability theory is the 'centre of gravity' of the population probability density function $\varphi(x)$ such that:

$$\mathrm{E}[x] = \int_{-\infty}^{+\infty} \varphi(x)dx \tag{11}$$

whence it follows that:

$$\int_{-\infty}^{\mathrm{E}[x]} \varphi(x)dx = \int_{\mathrm{E}[x]}^{+\infty} \varphi(x)dx = 0.5 \tag{12}$$

Equation (12) is the classical equivalent of (10), in that q_t^{**} is as likely to fall above $q_t^* = \mathrm{E}_t\left[q_t^{**}\right]$ as below it, with the difference that, if we *know* $\varphi\left(q_t^{**}\right)$, we *know* that, in the limit, half the 'drawings from the urn' will fall on one side or the other of q_t^*. In Keynes's terms, $q_t^*\left|\varphi\left(q_t^{**}\right)\right. = 1$; the expected value (although not the actual q_t^{**} itself) is known as soon as the probability density function is known, since the conclusion follows from the evidence as a matter of strict logical implication: expected value is simply a mathematical transformation of the probability density function. By contrast, in equation (10), the information set Ω_t does not allow conclusive determination of the expected value q_t^* (let alone, *a fortiori*, the actual value q_t^{**}); or put another way, the two sides of equation (10) do not 'sum' to unity (although strictly the probabilities are not in general of the numerical form necessary for addition).

While each side of equation (10) depends on the balance of the evidence for and against each conclusion, the weight of the argument for the expected value q_t^* depends on the relation between the available information Ω_t and the complete information $\overline{\Omega}$. Although no numerical comparison is possible between Ω_t and $\overline{\Omega}$, it

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[3] Glickman (1994) notes the need to distinguish the 'propositions' included in Ω_t from 'events' or raw information which are significant only when interpreted. The term 'information set' must be understood accordingly.

is clear that if Ω_t is very scant, little confidence will be placed in the expectation; while if $\Omega_t = \overline{\Omega}$, there will be complete certainty and therefore absolute confidence.

The rational expectations hypothesis replaces the assumption of complete foresight with the only slightly weaker assumption of knowledge of an objective probability distribution. If we follow EMH-B, that this knowledge can be acquired by discovery in an ergodic system, every addition to the information set Ω_t will improve confidence in the estimate q_t^*, in the sense of reducing its standard error in accordance with the central limit theorem. In the more general case, an addition to the information set Ω_t need not conform to the distribution of previous information in such a well-behaved manner, so that the expected value may fluctuate dramatically. Even if there is considerable weight behind a given estimate, confidence may be shaken by unexpected bad news; the knowledge that we know so little about the future always haunts us.

In the presence of such fundamental or intractable uncertainty, and in the context of well-organised investment markets, it is only *rational* to pay more attention to tomorrow's market price q_{t+1}, than to tentative and unreliable estimates of fundamental value q_t^*. At this point we must put aside fundamentals and concern ourselves with the proximate determinants of actual market prices. What really matters is not equation (10) but the rather different:

$$\left(q_{t+1} \geq q_t\left(1+R_{t+1}\right)\right)\left|\Omega_t = \left(q_{t+1} \leq q_t\left(1+R_{t+1}\right)\right)\right|\Omega_t \qquad (13)$$

which expresses that tomorrow's price is judged as likely to exceed as fall short of today's price plus interest, or putting it another way, that the bullish tendency is balanced by the bearish (where these tendencies may exist together in the mind of the same investor or separately among different investors). Information in Ω_t which would not be relevant evidence for the purposes of (10), such as the intentions of other investors, must now dominate fundamental considerations. Indeed, the *only* thing that matters (ignoring transactions costs, etc) is the intentions of other investors. If particular investors ('bears') believe the market is over-priced, they should sell today and buy back tomorrow, even if their long-term intention is to hold the asset for its economic life. There may be serious-minded investors in the market whose intentions reflect a model such as equation (2), employing information about current

dividends or earnings together with expected growth and interest rates, yet it is still their intentions that matter, and not the accuracy of their model, which can only be established long after the event. As Keynes points out in detail in *GT* Chapter 12, the real business of the professional investor must, perforce, be the study of market valuation, in which the study of fundamental value is at best a minority option. The solution of equation (13) may thus be interpreted as a 'conventional valuation', the price that balances the bullish and the bearish tendencies in the market as a whole and represents the average opinion or conventional wisdom as to the correct price, given the current information, which therefore should continue to prevail until there is change in the information - or, of course, in average opinion.

In normal times, the conventional view of the proper relation between the market price and the current information experiences discontinuous shifts from time to time, perhaps quite frequently. Market prices fluctuate continually, not only as the information set changes, but in line with such changes in conventional valuation. Speculators may do quite well anticipating changes either in the news or in the psychology of the market, but there is no intrinsic reason why they should expect these changes to move in one direction. With the onset of a bubble, the convention becomes, in effect, that the conventional basis of valuation will continually change one-way, usually upward. As always, it does not matter whether individual rational investors think the new convention is well-founded or insane, provided they believe that it will hold long enough for them 'to beat the gun' and sell before the convention collapses. Nevertheless a sustained bubble seems to involve a process of positive feedback based on either a sufficient number of irrational investors with a simple faith in its continuation; or sufficient fuel, in the form of short-term credit against the collateral of the speculative assets themselves, to allow speculators to play a hard-nosed game of Old Maid among themselves; or most likely, both ingredients together.

2.4 Conclusions on theory

The concept of *ex ante* fundamental value reaches into every corner of orthodox thinking about financial markets, yet neglects the self-evident facts that time is irreversible and the world is subject to unforeseen change, which cannot be reduced to a frequency distribution. Once it is admitted that *ex ante* fundamental value can have no operational meaning, the concept of rationality must also be reassessed: it has been

too easy for orthodoxy to create a false division between rational (meaning objectively optimal) and irrational behaviour. On the contrary, we have shown that conventional valuation is an entirely rational response to the knowledge of our lack of knowledge of the future, even though conventions must be based on the psychology of the market, and only indirectly, at best, on investors' models of fundamental value. This is by no means to deny the existence of irrational behaviour, but the alternative perspective affects the manner in which we approach the evidence of financial bubbles; the question of methodology.

3. Identifying the presence and causes of bubbles and crashes

We are now in a position to consider the methodology of research into the empirical evidence relating to bubbles and crashes in the light of the preceding *a priori* critique of the concept of *ex ante* fundamental value. Three main approaches to empirical research can be found in the literature, here labelled for convenience as: the dominant 'statistical' method of orthodox quantitative analysis; the newly ascendant 'psychological' approach associated with behavioural finance; and the original 'historical' method. The question of particular interest is whether the presence of a bubble can be detected without the hindsight resulting from a subsequent crash, and whether the causes of a bubble and subsequent crash can be identified.

3.1 The statistical method

As noted earlier, the discovery that equity prices tend to follow the random walk of Brownian particles preceded the development of the EMH as an explanation. The main method of testing the EMH was the 'event study' which analysed the price movement before and after a price-sensitive announcement, such as an unexpected earnings increase or drop. These studies largely corroborated the EMH, although they also provide evidence of specific patterns of psychological response (considered below). Taken together, the evidence of a random walk and that 'news' is rapidly incorporated in the price is consistent with the EMH that prices reflect fundamental value. However this evidence is equally consistent with conventional valuation, if the convention relates not only to the price itself but to the 'model', such as a conventional price/earnings ratio. A change in the news may thus affect the price without a change in convention, and as Keynes points out, 'we should not conclude that everything depends on waves of irrational psychology. On the contrary, the state

of long-term expectation is often steady" (*GT* 162). The conventional valuations of 'normal times' may be fairly robust and bear some steady relationship to the changing information that becomes available.

Perhaps the decisive empirical test which discriminates between these two hypotheses is the variance bounds test (Shiller, 1981, 2003). The logic of this test is that if prices are a good *ex ante* estimate of fundamental value, the volatility of prices should not exceed the volatility of *ex post* fundamental value. Using US data for 1871-1980, Shiller found that price volatility was at least five times the volatility in fundamental value, rather than less, as the EMH predicts. Much ink has been spilt in an effort to overturn Shiller's claim, motivated presumably by the instinct that markets are rational at least most of the time. Yet if price volatility reflects variation in conventions as well as in the news about technology, preferences and endowment, Shiller's result is fully to be expected, since conventions may change frequently without a descent into irrationality. Furthermore, equity prices will follow a random walk, if news is random and *a fortiori* if changes in conventions are also random.

Shiller's test of the EMH is not sensitive to the exact specification of fundamental value, nor does accurate specification matter for his purposes; whereas his critics must produce a model of fundamental value that predicts observed prices. While this is admitted to be difficult enough, an attempt to model conventional valuation in mathematical terms would seem quixotic. In fact the finance literature on the forecasting of volatility, relevant to the pricing of options and other derivatives, makes little or no reference to fundamentals, and employs an essentially inductive method of seeking to predict future volatility from a transformation of past prices (Poon and Granger, 2003). The notion of 'efficiency' is reduced to the weak-form 'no arbitrage opportunity' claim of equation (5), that prices are not systematically predictable, rather than that they reflect fundamental value (Malkiel, 2003). This has not deterred cross-disciplinary research between physics and finance using complexity theory (also known as catastrophe or chaos theory) to model equity prices as the complex outcome of simple processes, popularly illustrated by fractal patterns. These models make no essential use of fundamental values, but depend on 'locally' imitative behaviour by atomistic traders, leading to unplanned emergent outcomes and 'extreme events' such as stock market crashes. This has led to claims of the discovery

of distinctive statistical signatures of incipient crashes (robust log-periodic power-law values), which if valid, would be of considerable predictive value (Sornette, 2003).

The finance literature has in practice abandoned the concept of fundamental value, although it retains the belief that price trends and volatility can be reliably modelled in mathematical terms, given sufficient fire-power. Our *a priori* critique suggests that both *ex ante* fundamental value and inductive mathematical modelling face the insuperable obstacle presented by the nature of time, to which may be added further questions related to human agency and the role of institutions that undermine the atomistic treatment of investors within a stochastic but otherwise deterministic model.

3.2 The psychological approach

'Behavioural finance' theory offers a critique of the EMH on a different tack from the Post Keynesian position advanced here, as well as a positive model of investor psychology that provides an explanation of apparently irrational behaviour. A weakness of behavioural finance is its continued adherence to the concept of *ex ante* fundamental value, if only as a reference point, much as New Keynesians use Walrasian equilibrium. The implication is that any departure from fundamental value is in some sense 'irrational', even though conventional valuation may be the only rational response to an unknowable future.

The behavioural finance critique of the EMH centres on the limits to arbitrage by the 'smart money' (i.e. investors with rational expectations) in offsetting irrational trading by 'noise traders' (i.e. investors who trade on the basis of 'non-news' or 'pricing models' with no rational foundation). Risk-averse arbitrageurs will not be able to hold the market to its fundamental value, partly because there are no substitutes for the market as a whole over time (although arbitrage may be more effective 'across' the market), and also because the noise traders may push the market further away from fundamental value before it reverts, while there are practical constraints on the time horizon of arbitrage operations. Worse still for the purposes of the EMH, the 'smart money' may egg on, rather than betting against, the 'feedback traders' (i.e. a species

of noise trader who buys when prices rise, and sells when they fall), supporting rather than preventing the expansion of a bubble[4].

The positive contribution of behavioural finance theory lies in providing a basis in investor psychology for the behaviour of noise traders. Drawing upon work in experimental psychology, the observed behaviours of trend-following and of under- and over-reaction to news, can be explained in terms of 'conservatism' and 'representativeness' (Shleifer 2000:112-130). Conservatism means that investors are slow to revise their expectations, effectively discounting the relevance of individual news items until they are corroborated. This tendency manifests itself in event studies which show that excess returns are recorded for a considerable period (60 days) after the announcement (under-reaction). Conversely, representativeness means that investors form perceptions of particular shares as 'winners' or 'losers' based on a run of good or bad returns, rather than ascribing the observed sequence to chance, and thus rating the shares higher or lower than the EMH would warrant, manifested in lower or higher future returns (over-reaction). Taken together these two tendencies provide a behavioural foundation for positive feedback, with a run of good returns encouraging bullish expectations, which are then slow to react to disappointment. Behavioural finance theory does not lead to predictive models of stock prices, although simulations can be run which display some of the stylised facts of event studies and historical bubbles (Shleifer, 2000:140-143, 154-174).

3.3 The historical method

Studies of the signs and causes of bubble and crash from a historical perspective have placed emphasis on features of contemporary accounts which have not, so far at least, been accommodated within mathematical or psychological models. Two examples are the spread of a speculative frenzy to groups of people who had not previously invested in shares at all (not even 'noise traders'), and the role of credit both as fuel for the bubble and as driver of the ultimate panic (identified by Minsky, 1983 [1977], although not given this particular emphasis by him). Conventional valuation provides a possible theoretical link between these two neglected factors, through the effect of

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[4] Temin and Voth (2004) provide a fascinating case study of the success of Hoare's Bank in 'riding the South Sea Bubble".

conspicuous realised capital gains on expectations and its unwinding in the free-fall of the crash. The following discussion is intended as an example of how future research might proceed and the challenge, noted by Spotton and Rowley (1998), lies in translating this insight into a testable hypothesis. An alternative hypothesis based on a similar concern with the historical evidence can be found in Spotton-Visano (2002).

Hypothetically, a speculative increase in prices does not necessarily require either trading or cash. If all investors share the same expectations, prices can be marked up without any shares changing hands, so that all make paper profits. If expectations differ, but investors hold only shares and cannot exchange them for other goods (ignoring the question of settlement), speculative trading can take place, prices can rise, and the aggregate portfolio of shares will be redistributed. Traders may gain or lose, but this need not be a zero-sum; on paper there can be an aggregate profit. The point of this hypothetical argument is to illustrate that 'weight of money' arguments, *per se*, are not credible: price movements can be independent of cash flows 'in and out of the market'. However, new money is indeed required if paper profits are to be realised in cash. This new money can come from the sale of other assets by holders of existing shares and by new investors; from new savings; from buy-backs by companies; or from credit.

The historical method identifies the effect on investor expectations of the conspicuous consumption of new wealth acquired more or less overnight by speculation. "Luxurious and showy spending rose sharply. The accepted signs of wealth - coaches, jewellery, new clothes - were all in strong demand and their prices rose. But more important was the demand for the other great symbol of personal status - land. Estates … went to increasingly high premiums." (Carswell, 1960:146). "Speculation on a large scale requires a pervasive sense of confidence and optimism and conviction that ordinary people were meant to be rich" (Galbraith, 1973:174). "There is nothing so disturbing to one's well-being and judgement as to see a friend get rich" (Kindleberger, 2000:15). "Envy of others who have made more in the stock market than one earned at work in the past year …is a painful feeling" (Shiller, 2000:56). "The frenzy …descended to persons in the humblest circumstances, and the farthest removed, by their pursuits, from commercial cares. …Not only clerks and labourers, but menial servants, engaged the little sums which they had been laying up for a provision against old age and sickness" (Bagehot, quoted in Kindleberger, 2000:29).

"Yes, many who trade in tulips are riding a horse, have a carriage or a wagon, and during winter, an ice carriage …" (quoted by Shiller, 2003:93). The mania of the bubble, driven by greed and envy including the simple fear of missing out, has a different quality from the systematic failure to recognise fundamental value, emphasised by behavioural finance. It is tempting to limit the term 'bubble' to describe, not merely a state of speculation or systematic over-reaction, but the peculiar psychological state that characterises relatively short periods such as May-August 1720 and March 1928-August 1929, although this would leave open the categorisation of the longer-term bull markets leading up to 1929, 1987 and 2000/2002.

Although it is a mistake to identify credit as the initial source of a bubble, this argument from conspicuous consumption makes credit in its various forms a key enabler and amplifier, alongside the entry of inexperienced investors alongside seasoned speculators. A positive feedback loop is created between conspicuous realised gains and the increases in credit, or inflow of new investors, required to convert speculative profits from paper to cash. Credit is created by a contract to deliver a specified quantity of goods (usually money), and is not limited to the banking system: this includes barter contracts (1637), bills of exchange (1763), part-paid securities and share subscriptions on credit (1720, 1847), transferable property sale contracts or "binders" (Florida, 1925), broker loans from corporations and individuals, and investment trust bonds and preference shares (1929), and contemporary contracts for differences, spread betting, and other derivatives.

When the bubble bursts, it is a dependence on credit that turns a crash into a panic. "The 'mob' didn't sell, it got sold out" in 1929 to meet margin calls on broker loans (Galbraith, 1973:151). Where banks were involved, in the eighteenth and nineteenth centuries, the crash led to failures and a domino effect where otherwise sound investors and concerns, perhaps not involved in the speculation, found themselves insolvent. The linkage of the South Sea crash to the failure of the Sword Blade Bank in turn led to multiple bank failures (very nearly including the Bank of England), a collapse in confidence in paper money and a sharp reduction in the effective money supply (Carswell, 1960:191-199, 202).

The more recent experience of 1987, 2000, or 2002 is of crash without serious panic (hence the advent of the more neutral term 'correction'). The sharp fall in prices

represents a windfall loss with consequences for the long term, indeed, but without widespread immediate insolvency. This isolation of market crashes is the result of the regulation of banking and financial services, yet regulation has not eliminated the bubbles themselves.

4. Implications of bubbles - do they matter and can they be avoided?

What are the implications of financial bubbles for the economy and for policy in the light of these different perspectives? We look in turn at the implications for the banking sector, for personal savings and investment, and for the production of consumption- and capital-goods. Any case for policy to prevent bubbles must also consider its feasibility and other consequences.

4.1 The banking sector

Banks are torn, more so than other businesses, between the pursuit of profit and the maintenance of solvency, and financial bubbles offer opportunities for profitable lending to speculators as well as the risk of loss for depositors as the value of collateral evaporates in a crash. Modern bank regulators and central banks aim to limit the potential damage from the collapse of a bubble (and other catastrophes, including fraud) to the shareholders alone, and to isolate the losses of a particular bank from its own depositors and those of the banking and payments system as a whole, both nationally and globally. Regulators, like tax authorities, are engaged in a constant game of leap-frog with regulated and (currently) unregulated institutions, driven by profit opportunities continually to create new forms of credit that fall outside regulatory constraints, including 'special purpose vehicles', securitisation and the many forms of derivatives. Legislation has become increasingly sophisticated and widely drawn (e.g. UK Financial Services and Markets Act 2000), as has prudential supervision and regulation, including the concepts of capital adequacy enshrined in the international Basle accords.

Recent experience suggests that these efforts to confine losses to shareholders and avoid widespread contagion have been reasonably successful. However, the move in the Basle II proposals to allow larger banks to shift from simple and conservative rules on capital adequacy to sophisticated stochastic risk models rings a warning bell, given a Keynesian understanding of probability. Although the intention of the new

proposals is avowedly to detect risks on complex credit instruments that are not covered by the present arrangements, they also allow banks to reduce their capital cover on lending which the models calculate to be 'safer'. As the inappropriately named hedge fund Long Term Capital Management found to its cost, the models can be wrong. Sornette has identified that crashes are statistically 'outliers' that fall well outside the normal confidence limits which underpin calculations of value at risk (VaR), and puts the probability of the 1987 crash at once in 520 million years (Sornette, 2003:16).

Even if banking depositors can be protected, the potential role of banks in promoting bubbles requires scrutiny, if the losses from crashes fall not only upon bank shareholders and their speculative borrowers, but on external bystanders, including personal investors and employees. This is a far more difficult area in which to set and enforce specific rules and there remains much to be said, both on the grounds of externalities and in order to protect depositors against unforeseeable risk, for fire-walls which simply prohibit banks[5] from certain activities in the public interest; although this will invariably be resisted by bank shareholder interests as an interference with free enterprise.

4.2 Personal savings and investment

The historical accounts of the South Sea Bubble and the 1929 Crash contain sorry tales of personal bankruptcy and ruin that may be regarded as an unacceptable social cost of bubbles. Investors, already ruined by the loss of their savings, are more likely to find themselves bankrupt if they have speculated on credit. The main response has been to regulate comprehensively the sale of financial services to the personal sector, since 1933 in the US and since 1986 in the UK. Individual investors are now permitted direct access to the two-edged instruments of speculative leverage such as margin accounts and forward contracts only if they can demonstrate experience and net worth. There is a limit to the extent to which it is possible to protect people from

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[5] This includes differentiating between different classes of bank, such as the US Glass-Steagall division (now dismantled) between commercial and investment banking, and the UK distinction, also now much eroded, between banks and building societies. A comparison of the UK experience with the US savings and loan debacle would be instructive.

themselves, yet recent UK experience (e.g. personal pensions, endowment mortgages, precipice bonds and split-capital investment trusts) continues to suggest they are still not adequately protected from the financial services industry.

The current problems of the UK pensions and life insurance sector are partly the unintended consequences of the shift to a low inflation, low nominal interest rate, environment, as well as of the bull market of the 1990s. Both the US and UK governments have faced the embarrassment of having subsided individual pension provision for demographic reasons, leading to heavy investment in equity markets at bubble valuations and subsequent losses, at the same time as defined benefit schemes have been squeezed by falling nominal interest rates. Leverage has taken its toll on popular and historically 'safe' with-profit funds, several of which have been forced to switch into bonds at what has proved to be the worst possible time in the aftermath of the 2002 crash, to protect their solvency in relation to accumulated guaranteed bonuses.

Shiller (2000) has argued forcefully against current US proposals to privatise US social security (equivalent to the UK state pension) and the tendency of the structure and interests of the financial services industry to steer investors towards the equity market. He believes there is a profound need for investor education to encourage a hedging rather than a speculative attitude towards personal investment. Nevertheless, he advocates a market solution, by encouraging the development of a new range of derivative securities that allow people to hedge their wealth, not only against inflation, but against the risks to income from particular occupations and to local market values of owner-occupied housing.

4.3 The real economy

Galbraith partly attributes the US Depression of the 1930s to the effect on the consumption of the wealthy of the falls in the equity market, also acknowledged by Keynes (*GT* 93). Our analysis suggests that the consumption effects of bubbles are mixed, since the losses of some investors are matched by the realised gains of others, and the net effect depends upon the aggregate propensity to consume. In his famous passage on 'casino capitalism' (*GT* 159), Keynes deplores the effects of speculation on real investment but weighs these against the advantages of liquidity. Keynes may have conceded too much to the view that equity markets play an important role in the

allocation of resources to new investment. The strand of Post Keynesian tradition following Kalecki has emphasised the empirical evidence that real investment is financed by corporate cashflow both directly, and indirectly through corporate borrowing (Meyer and Kuh 1957, Fazzari and Mott 1987, Hayes 2003). New equity issues are dominated by merger and acquisition activity and during bubble periods by sectors such as TMT (technology, media and telecoms) and bio-pharmaceutical. An extensive literature questions the efficiency of the market for corporate control (Tichy, 2001) and the uncritical flood of equity into technology stocks is, just as in 1720, as likely to have encouraged waste and misallocation as to have followed enterprise and innovation.

This line of argument suggests that financial bubbles are no more relevant to real aggregates than the stock market itself. The case for tolerating bubbles on the grounds of efficient allocation is weak, both because of the evidence against the EMH, and because corporate investment is not dependent on equity markets. Nevertheless the case for preventing bubbles cannot be based on a simple adverse relationship with aggregate consumption and investment, but rather on the distributional consequences of bubbles for personal investors and the direct costs of extreme events such as the risk to the payments system.

4.4 Can bubbles be avoided?

The consensus of those charged with maintaining financial stability appears to be that occasional bubbles are inevitable, but that 'the incidence and severity of crisis can be mitigated through public policy actions", through the adoption of sound principles and standards for monetary and financial policy and the protection of the banking system and personal investors through regulation (Clementi, 2000). In favour of this consensus from our perspective is its recognition of the role of credit, and the practical difficulties of distinguishing *ex ante* a speculative bubble from a boom in enterprise. There is no evidence that in the periods ending 1929, 1987 or 2002 monetary policy was unduly lax or contributed directly to the bubble and crash; so that monetary policy appears impotent as far as bubbles are concerned, and is a blunt instrument that affects the real economy more than it does (if at all) the stock market.

Keynes's view was that relatively high transaction costs and stamp duty reduced the influence of the speculative motive on Threadneedle Street relative to Wall Street.

The Tobin tax proposal for currency markets reflects this view, but is open to the criticism that such a tax will not deter the 'one-way bet' characteristic of some attempts to defend fixed exchange rates (Davidson, 1997). It is possible that speculation on equity bubbles is more easily deterred, since it is not a bet against government arbitrage that has known technical and political limits. This provides an argument for at least maintaining, if not increasing, the 0.5% stamp duty on UK share transfers, despite the dubious claim (Cruickshank, 2003) that this would reduce real investment. Furthermore, Keynes would expect the UK move in 1995 from 14 day accounts to 5 day rolling settlement to have reduced speculation as well as settlement risk, although this change did not prevent the 2000 or 2002 crashes.

Keynes's tongue-in-cheek solution for stock market bubbles, by 'marrying' the investor to the asset, might be made more workable through a legal requirement that corporate securities listed on recognised investment exchanges could be issued only with a dividend fixed in relation to nominal value (i.e. preference shares), making the equity market only slightly more volatile than the bond market[6]. This would not prevent the issue of ordinary shares as private equity, although the potential gains would be limited to something corresponding to 'fundamental value' rather than being fuelled by public equity issues at bubble prices. Such a restriction would not prevent the issue of preference capital to finance real investment and the emergence of a genuine role for the listed share market in capital allocation. Preference dividends would offer a risk premium over bond interest rates that would make them attractive to long-term diversified investors like pension funds. Although such a proposal would in practice face fierce opposition, the EMH provides no theoretical objection, since it implies that financial structure is a matter of indifference. Furthermore, asymmetric

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[6] This is not the place to develop a detailed proposal, but some obvious objections can be anticipated. The restriction might not be absolute, but linked to the privilege of incorporation, so that the option to issue listed ordinary shares remained if investors were prepared to forego limited liability. The restriction might apply only to the underlying securities and not to derivatives, so that hedging operations would not be prevented. The linkage of dividends or redemption value to a price index or basket of commodities or assets (perhaps particularly relevant to property companies) would not seriously undermine the proposal, since bubble valuations always part company from any reasonable measure of asset value.

information theory claims that 'risky debt' of this sort is the optimal form of capital security (Townsend, 1979). Utopian as this reform might appear, it might lead to greater efficiency and permit less extensive and expensive regulation.

5. Summary and conclusions

The concept of *ex ante* fundamental value is central both to the efficient markets hypothesis (EMH) and as a reference point for behavioural finance theory, despite Keynes's critique in *The General Theory*, which remains unanswered. The *ex post* fundamental value of any past investment can in principle be determined in retrospect, and it is plausible that in competitive equilibrium the market prices of fixed annuities represent their prospective *ex ante* fundamental values (the South Sea Bubble notwithstanding). However, the physical nature of time in a world subject to unforeseen change presents insoluble ontological obstacles to the extension of the concept of *ex ante* fundamental value from fixed annuities to equity shares. For the concept to be operational would require either (A) that the world behaves as if complete futures and insurance markets extend to the horizon of long-term expectation; or (B) a process of trial and error leads to a convergence of expectations on their equilibrium values, the ergodic hypothesis rejected by Keynes. The evidence of a random walk in equity prices is consistent with the EMH only on assumption (A), which is no more than an assertion.

Underlying Keynes's critique of *ex ante* fundamental value is his logical theory of probability, which treats classical frequency theory as a special case. The frequentist notion of expected value, upon which the rational expectations hypothesis depends, replaces the assumption of complete foresight with the only slightly weaker assumption that events follow an objective probability distribution. If we assume that knowledge of this distribution can be acquired by discovery in an ergodic system, every piece of news should improve confidence in the estimate of fundamental value. In the more general case, confidence may be shaken by unexpected bad news; the knowledge that we know so little about the future always haunts us. In the presence of such fundamental uncertainty, and in the context of well-organised investment markets, it is only *rational* to pay more attention to tomorrow's market price than to tentative and unreliable estimates of fundamental value. Expected value becomes

dominated by the intentions of other investors, and the balance of the bullish and bearish tendency, or average opinion, determines a conventional valuation.

In normal times, the conventional view of the proper relation between the market price and the current information experiences discontinuous shifts from time to time, perhaps quite frequently. Market prices fluctuate continually, not only as the information set changes, but in line with such changes in conventional valuation. With the onset of a bubble, the convention becomes, in effect, that the conventional basis of valuation will continually move in one direction. *A priori*, a sustained bubble seems to require a process of positive feedback driven by naïve investors and speculators.

The hypothesis that prices reflect *ex ante* fundamental value faces strong statistical evidence of excess volatility, consistent with conventional valuation but not the EMH. Despite rear-guard attempts to produce better models of fundamental value, the finance literature now concentrates on inductive mathematical models of price volatility, along with some interest in econophysics, the application of catastrophe theory to financial markets. All such models face the criticism of being closed, ultimately determinist, systems with no room for human agency or institutions.

Behavioural finance theory offers a critique of the EMH based on the limits to arbitrage in the presence of noise traders, and positive evidence from experimental psychology to explain empirical phenomena such as over- and under-reaction and conservatism. The weakness of behavioural finance is its continued adherence to the concept of *ex ante* fundamental value, if only as a reference point, much as New Keynesians use Walrasian equilibrium. The implication is that any departure from fundamental value is in some sense 'irrational', even though conventional valuation may be the only rational response to an unknowable future.

The advantage of the historical method of research is its ability to take into account features which do not (perhaps cannot) fit into formal models. The examples of the spread of the mania to naïve investors and the role of speculative credit suggest a possible theoretical link through the effect of conspicuous consumption on expectations and its unwinding in the free-fall of the crash. Credit also appears to be the historical link between crash and panic, and the absence of serious panic in recent crashes suggests that financial services regulation has succeeded in isolating the immediate damage from crashes, although not in eliminating the bubbles themselves.

The case against bubbles and crashes hinges upon their distributional consequences for personal investors and the risk they pose to the banking system. A Keynesian understanding of probability suggests the market-driven move towards stochastic modelling of value at risk under the Basle II capital adequacy standards may be vulnerable, and the historic method of erecting fire-walls may prove more robust to extreme events. Although there are limits to how far personal investors can be protected from themselves, there is still room for improvement in their protection from the financial services industry. Even when the best interests of investors are observed, bubbles continue to undermine personal provision for pensions and other long-term needs. The public interest may be better served by adopting Keynes's prescription of higher stamp duties and radical reform in the ownership of investments, addressing bubbles at their source as an alternative to further extensive and expensive regulation.

In conclusion, Keynes wrote that 'we should not conclude that everything depends on waves of irrational psychology. On the contrary, the state of long-term expectation is often steady" (*GT* 162). Both the EMH and behavioural finance theory treat any departure from fundamental value as irrational, and do not discriminate between the rational but conventional valuation of normal times and the mania of the bubble (*cf* Garber, 1990). The concept of fundamental value is positively misleading for the scientific analysis of financial bubbles, which must be regarded as still at an early stage. Without structural measures such as higher stamp duty and radical reform of securities listing rules, it is impossible to eliminate bubbles completely, since, as we know our ignorance of the future, speculation in some degree must be the normal activity of an equity market and not an aberration. In the absence of a political consensus for more radical reform, the incremental and pragmatic regulation of financial services will no doubt continue in its attempts to restrain financial institutions from encouraging speculative bubbles and (so far with greater success) to isolate the consequences of their bursts. Meanwhile, it is only rational to speculate.

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