

ANATOMY OF STOCK MARKET BUBBLES

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György Komáromi



ICFAI BOOKS

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Author: György Komáromi

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DEDICATION

To my wife and my daughter

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Dr. György Komáromi is Assistant Professor of Finance at CEU Business School in Budapest and College Professor in Finance at International Business School, Hungary. He teaches different courses in Finance in under- and postgraduate programs. He is currently working on the research project titled "Economic role and importance of the stock exchange in Hungary between 1864 and 2005" supported by OTKA (Hungarian Scientific Research Fund). His research interests also include behavioral and experimental aspects of financial decisions. He was educated at University of Miskolc (Hungary), Graduate School of Management of Rouen (France), and Pannon University (Hungary), where he received his PhD in Management and Business Studies in 2005. He has been full-time Assistant Professor in Finance at Management Development Centre of Budapest Corvinus University (1999-2001), and at Pannon University (2001-2006). He taught as a visiting lecturer at Budapest University of Technology and Economics (2004-2005) and has been ERASMUS exchange professor at University of Paris and Rovaniemi Politechnique, Finland (2002). He published several articles on topics such as Behavioral Finance, Corporate Finance and Institutional Economics and was awarded the Earhart Scholarship (USA) in 2003. He is a regular participant in international conferences and workshops.

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György Komáromi.

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PREFACE

“We know there are bubbles but we cannot even demonstrate their existence (our indicators are not up to the task). We know that given specific circumstances, bubbles «burst» but we cannot yet define necessary and sufficient conditions.”

Csontos L., Király J. and László G. (1999. p.586).

Economists often use the term “stock market bubble” to back up their market analysis or explain past and present events. It is part of the professional jargon, one of the colorful, emotionally charged expressions used in economics. But what exactly is a bubble?

I have first heard about the notion during my university studies, mentioned by a professor in a course about capital markets. The spectacular rise of the Hungarian stock exchange during the 1990s fascinated many a university student (including me), who became personally involved as well, standing in queue for shares of privatized state companies. At the time, technical issues regarding

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the stock exchange looked more relevant than any financial theory because seemingly everybody could profit from buying shares. Stock market analysis became part of the daily routine.

I have considered claims like “shares are considerably overvalued and a market correction is inevitable” to be superficial and far from the realm of real finances; explanations like “prices are blown like bubbles” seemed empty to me. The theory of efficient markets, based on the simplifying but apparently valid presumption of rational investors, was a milestone inasmuch as it carried the message that any future return on my investment in shares was only a matter of luck. I have also realized that “the starting point [of pricing financial assets] is the fact that we cannot beat the market using any mathematical model” (Medvegyev 2002, p.597), and I grew skeptic towards those who attributed their stock market profits to their personal abilities.

I was impressed by Burton Malkiel’s book, *Random Walk Down Wall Street* (1990), which reinforced my belief that “there is no such thing as a stock market guru” and future returns of shares are basically unpredictable. But additional questions kept coming up. How and why do large-scale stock exchange *hausses* and *baisses* form? Are there always economic reasons behind them, or could there possibly be some other explanations?

During my university years there were three books contributing to an impression I had: “strict” financial theories were skirting the important question of what causes a wild fluctuation and eventual collapse of share prices? André Kostolany’s book *Kostolany’s Börsenpsychologie* (1991) emphasized the irrationality of human behavior. During our long telephone conversations he himself made the point that “he who is studying modern economics will never understand the true driving force behind share price

fluctuations”. John Kenneth Galbraith’s satirical essay *A Short History of Financial Euphoria* (1994) supplied historical examples for the recurring and predictable commonalities arising from folly and complacency. Still, it was the chapter titled *The State of Long-term Expectations* in John Maynard Keynes’ *General Theory* (1936) that provided me with a scientific foundation for the „workings” of capital markets as well as for investor psychology and behavior, having the most significant impact on my thinking, inspiring the commencement of writing of this work. I will continue to refer to these books in the following chapters.

The scientific question comes from the opening quote: how and why do price bubbles form and burst, and what are the necessary and sufficient conditions? There are several studies in the literature dealing with these questions, and from the 1990s on we could come across an increasing number of scientific and pseudo-scientific articles and studies on stock market price changes. Examples of the former: Brunnermeier (2001), Shiller (2000), and articles in the 1990/4 issue of the *Journal of Economic Perspectives*. The contradicting results and not easily substantiable conclusions of a wide-ranging research activity even cast a doubt on whether bubbles actually exist at all. This suggests that economists are using the concept for lack of anything better as they cannot make scientifically valid claims about the underlying events.

My objective is to point out weaknesses in the main theories and I also attempt to integrate the interpretation of stock market bubbles into a valid conceptual framework. This essay based on my dissertation (Komáromi 2004) seeks to provide an answer to when we can term a stock market phenomenon as a bubble.

The Subject and Structure of the Book

There exists no uniform economic theory to explain stock market bubbles. The first chapter of the essay outlines competing explanations which can be classified into three main schools of thought: the mathematical and empirical approach and that of literary economics.

Studies classified by this distinction as mathematical use the rational equilibrium price as their starting platform. The first subgroup consists of studies that analyze share price development in the presence of symmetric and asymmetric information assuming rational expectations. We will take closer look at the most important conclusions of these models, like the issue of fundamental value or “herding”. The other subgroup is the field of behavioral finance, which is based on psychological characteristics supported by the findings of empirical research and observable during investment decision making. We will examine these behavioral patterns and the role they play in triggering price changes, also commenting on the predictability of the collapse of bubbles. Further clarification is needed because necessary and sufficient conditions for the formation and bursting of stock exchange bubbles, also useful in practice, cannot be provided within the framework of mathematical economics.

After this we will present the achievements of empirical economics. Stock exchange simulations carried out in laboratories support some conclusions of the previously discussed theories, but they also provide further insight regarding the phenomenon. When assessing bubbles examined in documented laboratory experiments we face the problem of not knowing exactly to what degree experimental circumstances distort results.

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Although literary economics of a mostly historical-logical approach does not belong to the arsenal of mainstream economics, for better understanding of bubbles a recapitulation and analysis of historical financial case studies and intuitive examples and conclusions is evidently necessary. We will analyze the “Dutch tulip mania”, the stories of the Mississippi and South Sea companies as well as 20th century stock exchange booms and busts using Kindleberger’s definition (1991). The discussion of these cases, traditionally classified as bubbles, will make clear that characterizing them as “excessive speculation” obfuscates the distinction between bubbles and other financial market phenomena.

Repeated, cyclical upsurge-downfall scenarios, however, bear several common traits that differentiate bubbles and shed more light on their economic and behavioral background. Leverage, the comovement of various “trust-based” speculative assets, government intervention, media, and faith in the “new economy” all play a role in the formation and persistence of bubbles and in the extent of post-collapse macroeconomic repercussions. Studying the latter is indispensable because without such repercussions the concept of bubbles would become empty. Traditional analyses focus on negative macroeconomic impact, but in the discussion of our examples we will also take note of the positive impact of stock exchange bubbles, being inseparable from negative effects. Within the framework of literary economics the general characteristics of stock exchange bubbles can be listed with the capacity to foretell that stock prices are going to reach a ceiling. When this happens a crash ensues, being the most important quality of a bubble.

The second chapter of this paper will examine speculative decisions – the role of so-called noise traders. These are market

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actors who base their investment decisions not on relevant information but noises (irrelevant information). Still, their behavior cannot be considered fully irrational. Following this, we will analyze overconfidence and the resulting “illusion of knowledge”. Besides leverage, this “illusion” may be the chief reason why “noise trading” becomes periodically dominant on stock exchanges where, as a result, prices may collapse without any relevant new public information. We believe the analysis will make good use of the conceptual framework, whereby noise trading will become periodically dominant on stock markets reflected by a change in the behavior of market actors. Among others, the unreasonable comovement of shares might be a signal of this, the degree and change over time of which can be monitored using an indicator. At the end of the chapter we will reformulate previous criteria, providing a valid and practicable definition for stock market bubbles as well as their characteristics.

The third part of the book explores the Hungarian stock market in light of the new bubble criteria and characteristics. Special attention will be paid to large-scale booms and busts which occurred in the Budapest Stock Exchange (BSE) at the end of the 1990s, analyzing the underlying reasons. Finally, we aim to provide an answer to the question whether, assessing the last 8 years of the Hungarian stock exchange, can we talk about a stock market bubble?

I

Different Aspects of Bubbles

“Economics is a set of tools, from which the economist has to select the appropriate tool or model for a given problem”.

Charles Kindleberger (2000. p.220).

The phenomenon of stock market bubbles is explained in a number of ways by economists of different approaches, depending on whether they explore it using the tools of mathematics or literary schools of economics. Although the theses and conclusions of these two approaches do overlap in many aspects, it is still notable that there is hardly any substantial cross-referencing between representatives of the two sides. While the term *asset price bubble* is used in the mathematical context, analyses of literary economics prefer the unqualified form of *bubble*. For this reason, the financial encyclopedia *The New Palgrave Dictionary of Money and Finance* provides two sharply different, unrelated definitions. Asset price bubble refers to the discrepancy between the real value and actual listing of a share (Gilles and LeRoy 1992), while bubble in the literary economist's interpretation is a broader economic phenomenon where the continuous rise of share prices is fueled by

the investors' expectations of further increase. This interpretation also assumes macroeconomic consequences (Kindleberger 1991). Although used in different context, the same phenomenon is found in the background of both definitions, namely the unlinking of share prices and economic fundamentals.

After looking at the two-fold definition of bubbles, we will examine the conditions for their formation and collapse, also observing the degree to which previous research is applicable in an analysis of stock market events.

1.1 Asset Price Bubbles in a Mathematical Approach

If interpreted for the price of a single share, a bubble is called an asset price bubble. The mathematical definition of an asset price bubble uses the fair price of a financial asset as its starting point. This theoretical price is the present value of the future cash flow of the asset. The equilibrium condition of asset pricing models is

$$p_t = E_t(d_{t+1} + p_{t+1})/(1+r) \quad (1.1)$$

where d_t is dividend, p_t is the price of the asset at t time, and $E_t(\cdot)$ will provide the expected value of the expression based on the information available at t time. If the interest rate (r) is considered constant throughout the whole period, then share price at t time (p_t) in a general form can be given as follows:

$$p_t = \sum_{j=1}^{\infty} E_t(d_{t+j})/(1+r)^j + b_t, \quad (1.2)$$

The first factor on the right side of this formula, which is the discounted present value of dividends, will provide the fundamental value of the share (p_t^*). The remainder (b_t) is a deterministic or

stochastic component satisfying the condition $b_t = E_t(b_{t+1}) / (1 + r)$, which is the asset price bubble itself.

Regarding stock investments, Keynes' *General Theory* makes a distinction between an *enterprise* that has the objective of predicting the return of a capital asset during its full lifetime and *speculation* that is an activity to predict the psychology of the market (Keynes 1936). The former definition therefore refers to the reservation price of enterprising investors with a buy and hold strategy. This is the fundamental price of the share

$$p_t = P_t^* + b_t, \quad (1.3)$$

and if $p_t \neq p_t^*$ then in the mathematical sense an asset price bubble is formed, where p_t^* is the fundamental value.

This definition, however, needs some refinement. Formula 1.3 is not valid for any and all parameters. It has to be taken into account, for example, that the price of a financial asset cannot be negative. Since $d_t \geq 0$ and $r \leq 0$, it is obvious that p_t^* will not be negative, so we have the option of either not to interpret negative bubble ($b_t \geq 0$) or to stipulate that $b_t \leq p_t^*$. Similarly to the majority of models, at this point we exclude the existence of negative bubbles. We will get back to the theoretical possibility of such bubbles in Chapter 1.3.

1.1.1 Rational versus Speculative Bubbles

Econometric models assuming rational behavior on the part of market actors divide bubbles into two sets. We are talking of a rational bubble when the market price of an asset is higher than its fundamental value, but rational expectations of market players may justify such a price. In this event, the actual price uses fundamental value as an anchor (Sornette 2003) staying attached to it. On the

other hand, it is a matter of speculative bubble if market price and fundamental value diverge “too much” and there can realistically be no dividend income that may support current market price (Gilles and LeRoy 1992; Brunnermeier 2001). This detachment usually means that the b_t bubble component in Formula 1.2 grows faster than the interest rate. It is a question of vital importance whether we can clearly find a separating condition for these two types of bubbles i.e., the critical degree of divergence from fundamental value.

Asset price bubbles form in the presence of rational expectations only when shares do not have a definite maturity, since in this case rational actors could calculate the current price of the share from its maturity price. Given such circumstances, the actual quotation of these financial assets would always be equal to their fundamental value. The first condition, therefore, is for the financial asset to be without maturity, which does apply to shares. If share price diverges from fundamental value only temporarily, then, using Blanchard’s (1979) term, a rational bubble forms. Blanchard’s (1979) model assumes rational expectations and a lack of arbitrage. In such a setup, market actors recognize the divergence from fundamental value but they expect further price increase. As in the market there never is a guarantee for the eventual offset of prices, the bubble keeps swelling until, within a definite time frame, it implodes and the process starts again. The model of Froot and Obstfeld (1989) demonstrates using the US stock market data that price fluctuations can mostly be traced back to internal factors (dividend volatility) but there is no method for predicting the discrepancy. That article also underlined the theoretical problem that, in the presence of infinite term arbitrage and completely rational actors, bubbles cannot form.

Rational bubble models determine an infinite number of equilibrium points and fundamental equilibrium is only one of them. It is impossible, however, to identify the type of current market equilibrium (Weller 1992). In fact, it is impossible to determine what the conditions for the formation and collapse of rational bubbles are. Tirole's (1992) study showed that, assuming rational expectations and a finite number of participants, in a market equilibrium a bubble cannot exist. If any one market actor recognizes that current share price differs from fundamental value, the only complete rational strategy is the immediate selling of the share. However, if there is a finite number of market players, it is not possible for everyone to leave the market at the given price level, so either the immediate drop in the share price will eliminate the bubble or there will inevitably be people "stuck" with their investments. The latter happens when a market actor will not liquidate his investment at the current price preferring to keep the asset infinitely. However, the finite number of participants in the market also implies a limit for market demand. If this knowledge is shared by all players, a bubble will not form, or will quickly dissipate. In the context of a complete market and rational stock market bubbles cannot exist.

The weakness of the approach presented above is the implicit assumption of complete information supply. This aspect (the issue of information) needs further examination because the cases discussed above have not supported the possibility of bubble formation and subsistence.

Up to this point in our discussion, the existence of a bubble was common knowledge for market players, which also implied that they could access the same amount of (symmetrical) information. If we lift this restriction, market actors still remain

rational but they base their decisions on differing (asymmetrical) information. The model of Allen, Morris and Postlewaite (1993) prefers to distinguish between expected and strong bubbles instead of rational and speculative ones on the basis of the gap between current price and fundamental value. This means no substantive difference in terms of classification.

An expected bubble is to be construed as a scenario where actors recognize that the price of a share is higher than its fundamental value but they expect further increase. Brunnermeier (2001) emphasizes the difficulty of defining fundamental value in this case; however, compared to the previous distinction here we can identify additional separating conditions. The first condition for the formation of an expected bubble is that the market is not in a *Pareto-optimum*, i.e., further transactions can improve asset allocation. As the second condition, Allen, Morris and Postlewaite (1993) stipulate that market actors must have a *short sale constraint* in the future. These two conditions are both necessary and sufficient for the formation of an expected bubble (Tirol 1992; Brunnermeier 2001).

We are talking of a strong bubble when there can be no future dividends justifying the current price. This condition, however, is difficult to translate into practice since corporate earnings are usually not possible to forecast precisely. Assuming the possibility of estimating future dividends, a strong bubble might form when actors sense the excessive rise in prices but they believe this is not common knowledge. The necessary condition following from this is that market actors must have private information, and this applies when we can at least state that they do not know all transactions. Brunnermeier (2001) also mentions there must be at least three players in the market.

If, however, a market actor does not possess information in sufficient quantity or quality, a herding effect may emerge even in the presence of rational expectations, resulting in the detachment of share price from fundamental value. If market actors base their decisions on the earlier decisions of others instead of their own private information, it may set off an informational cascade. In Banerjee's (1992) model, if the first two participants make the same decision, the optimal decision for the other actors is to imitate their behavior. If the original decision is based on false signals received by the players, the crowd starts off in the wrong direction (Brunnermeier 2001), while the opposite is true in case of correct signals. In the model of Cont and Bouchaud (1998), where players make their decisions simultaneously, herding works the same. Their study relates this effect to the so-called fat-tail distribution characterizing stock market returns. Herding effect applies when market actors do not reckon with the fact that the decisions of others are informational externalities for them. Complete rationality on part of the participants would still arrest the formation of a bubble. This would also require the assumption that market actors are not imitating the decisions of other market actors, not even those with high professional reputation. In other words, this requirement means that there are no stock market *gurus* whose decisions influence market behavior regardless of their performance. As long as an investor will make his decision not entirely independently from other investors, herding will inevitably occur. That way individual decision remains rational but the sum of them will be irrational behavior (see also Le Bon 1982). The degree to which one will imitate other investors is also a function of the confidence in the person's own capacities and information as well as those of others. To examine this, however, it is essential to analyze the behavior of market actors, since herding cannot be deduced from rational behavioral patterns. Chapter 1.1.3 will discuss the influence of these factors.

Assuming rational expectations, therefore, share price will fluctuate around the fundamental value, which means asset price bubbles will form. There is, however, a practical difficulty regarding the applicability of the concepts of expected and strong bubbles. The above models indicate that both expected and strong bubbles (which are not really distinguishable) are created on a recurring basis. It is a rare occasion, and an occasion not even possible to spot, when the price of a share equals its fundamental value. As we have seen, market price may well be higher than this value with perfectly acceptable reason. This means that, based on the formula for share price (1.3), the market price of a share always contains a bubble component, which, in turn, may lead us to the conclusion that the analysis of asset price bubbles is irrelevant, all previous prices being justifiable in hindsight (Garber 1990, 1992, 2000; Flood and Hodrick 1990).

Until now we have focused on the internal causes of bubble formation, realizing that internal instability is inevitable when market actors possess differing information. Still, the existence of rational bubbles cannot be deduced from this without contradictions. External uncertainty factors, collectively called *sunspots*, however, do have the potential to provoke high fluctuations in fundamental value. Sunspots are external events with no effect on an investor's preferences, informational supply or capacities, but as signals being received by all market actors, they will affect individual convictions about the behavior of fellow players (Brunnermeier 2001). In the model of Allen, Morris and Postlewaite (1993) external uncertainty caused by sunspots will push the economy from one equilibrium position to the other. Similarly to other approaches, however, this model has the drawback that, while providing a valid explanation for bubbles using the assumption of rational expectations, accepting the existence of sunspots weakens

the economic practicability of models integrating them, because sunspots do not lend themselves to detailed analysis.

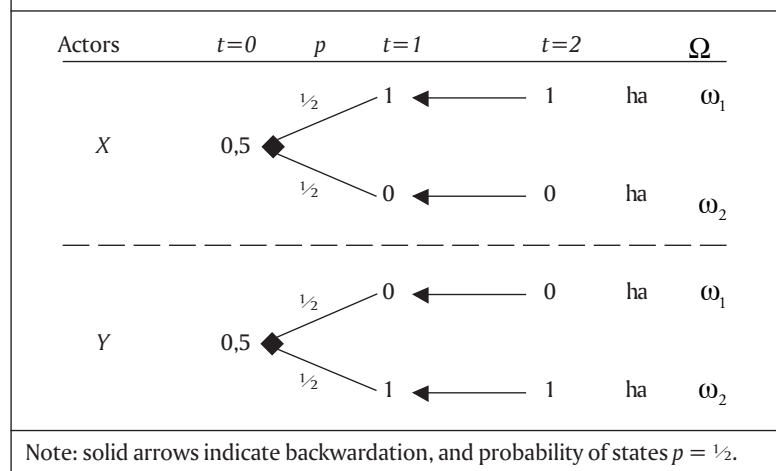
Studies assuming rational behavior teach us two important lessons. First, short sale constraint is a prerequisite for the formation of rational bubbles. Stock owners will someday have to sell their shares, so they will inevitably re-enter the market as sellers. This infers that nobody can, and will, hold his shares indefinitely, therefore, no liquidity constraint is created, triggering an infinite rise in prices. This raises the question whether in our analyses we can reasonably use fundamental value, which is, after all, a concept assuming infinite possession of the share (what we have called a “buy and hold” strategy). To address this concern, the next section explores the issue of fundamental value.

1.1.2 The Problem of Determining Fundamental Value

As it was shown, the fundamental or internal value of a share, which is the point of reference for identifying bubbles, is determined by future dividends. However, this starting point has a logic flaw since the definition of fundamental value provided in formula (1.1), based on a “buy and hold” strategy, fails to account for trading motives other than speculation (i.e., risk-taking in hope of extra return) after buying an asset. In complete markets, where no informational problem exists, every player can assign a payoff to possible future positions and make a hedge, thus ensuring Pareto-optimal allocation. If the market is incomplete, it is possible to conceive a position to which individual actors cannot assign a payoff. In such cases, either information is asymmetrical or there is a lack of priors, so only trading the exchange of stocks will ensure a Pareto-optimality. Here trading is not speculative and on the basis of the definition for fundamental value an asset price bubble inevitably forms.

Brunnermeier (2001. p.49) uses the following example to illustrate why liquidity and free trading in shares may elevate share price (see Figure 1.1). Two types of actors in an economy (X and Y) $t=0$ and $t=1$ each owns a risky asset, which pays d_T dividend at the end of the second period ($t=2=T$) in an economy being in ω state. We assume $\omega \in \Omega = \{\omega_1, \omega_2\}$, i.e., the whole set of states consists of two states. The probability of these two states is equal and the actual state becomes known before the $t=1$ trading period. The X type actor values $d_T(\omega_1)$ dividend equal to 1 unit in state ω_1 and 0 unit in state ω_2 , with opposite preference for Y type actors. If we disregard the time value of money, it is deducible that actors will value the dividend at 0,5 unit in period ($t=0$) if they hold on to their shares until dividend payments (i.e., the second period).

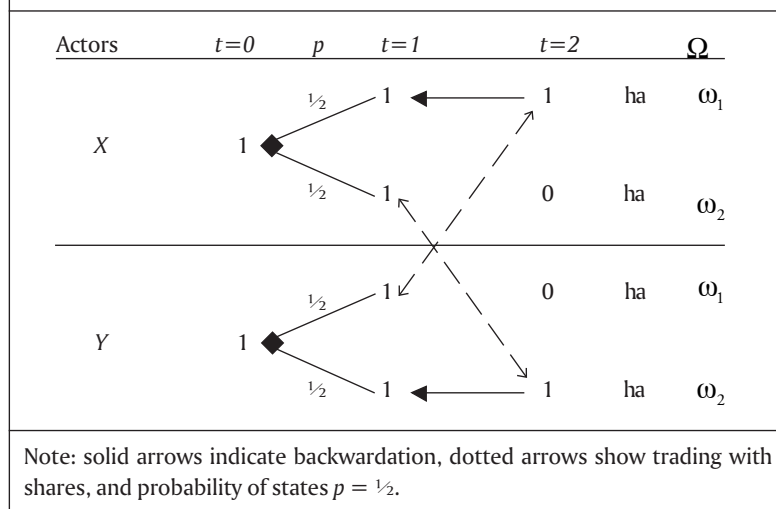
Figure 1.1: Stock Value if There are no Trading Opportunities



If, however, they have a theoretical opportunity to trade at the end of the first period ($t=1$) and, according to the above condition, the actual state of the economy becomes known prior to this, then the value of the dividend may be 1 unit in the zero period, because

trading allows the type of actor having a higher evaluation to buy the share (see Figure 1.2). If state ω_1 turns out to be the fact, X type actors will pay 1 unit for the shares of Y type actors (dotted arrow in Figure 1.2). Of course, trading might occur at a different price, but for the sake of simplicity we assume that the buyer offers the highest price. If the actual state of the economy is ω_2 , trading will occur in the opposite direction. Different *a priori* opinions will make it possible for the actors to value the dividend at 1 unit from the beginning, since they have different evaluations of the dividend in the same state of the economy. This special case, therefore, provides for an immediate bubble depending on the share structure because not all shares with optimal payoff for market actors are available in the market.

Figure 1.2: Stock Value if There are Trading Opportunities



Brunnermeier's (2001) explanation: through this mechanism investors are completing the market by achieving a payoff not available to them without trading. In this way the trading space

expands and the new equilibrium point will be Pareto-optimal. This example demonstrates that trading may have a motive other than speculation. In practice, the two motives are indistinguishable from each other since in an incomplete market both can be a source of trading, reflected in market liquidity.

One of the main functions of the secondary market is providing liquidity, which invariably elevates share price. Let us assume a public company is about to raise capital and has two alternatives. One is to target a narrow investor group with the new shares, which will be issued privately and only later listed in the stock exchange. The other is to offer common shares for a wide investor group, listing them immediately in the stock exchange. In these two cases, the issue price will be different due to different liquidity. If we are thinking in terms of a “buy and hold” strategy then fundamental value is the same in both cases and liquidity affects price. (We will get back to the question of how risk affects fundamental value.)

Silber (1992) classifies the scientific answers given to the question of what return market liquidity offers. Liquidity characterizes trading but it does not only refer to sheer volume. Liquidity means more or less that the given asset can be sold quickly and simply while market equilibrium price changes only slightly. A liquid stock market is deep because sell and buy offers are close (bid-ask spread is small) and even high volume sales do not influence price significantly. In studies, the most widely accepted method is to analyze the impact of two internal components: bid-ask spread and the development of the price carrying a liquidity premium (Schwartz 1992). Several studies about these two components lead to similar conclusions: capital cost for a company is undoubtedly reduced if the stock has a liquid secondary market. It has been proved that publicly offered stock without any limit on trading is

worth more than illiquid stock, which, on average, has a price 30% smaller than listed shares with similar business risk and shareholder rights (Silber, 1992).

The argument above shows the economic return provided by stock markets through improving capital allocation. We could also see that this increases the price of the financial asset. Previously, judging from the Keynesian definition of enterprise, the objective of possessing shares and the fair value attached to this possession could seemingly be defined in terms of future dividend income. Speculation was set apart as a necessary evil causing instability in the market. Keynes even suggested in his *General Theory*, referring to the consequences of the 1929 stock market crash, that the prohibition of buying investments might have cured some actual problems, because it would have forced investors to focus on long-term prospects (Keynes 1936). But the *General Theory* also argues that the illiquidity of investments may restrain new investments as well, and this would evidently result in a price depressing effect. This means speculation (secondary market-based trading) has undisputable benefits besides the damage caused by instability. The two effects are both inherent to stock markets, and this is the only way to broadly share and spread risk.

Tirole (1992) defined four benefits of speculation in accordance with the argument laid out in this chapter. First, we can mention the insurance opportunity emphasized by Keynes (1936) and Hicks (1946), which is utilized by a company when it offers stock in the primary market. This is practically a hedge transaction where the enterprise sells a part of its future profit to new shareholders while spreading (sharing) its risks. Primary markets, therefore, help the growth of companies because the issuer parts with a portion of its expected profit in exchange for reducing business risk. The second

share price-enhancing benefit of speculation is the above discussed secondary market liquidity offering shareholders the opportunity to sell their risks to other investors (speculators), who willingly take it in hope of future profits. The third benefit is that the continuous market presence of speculators provides a way for investors to sell their shares if they value the attached income to be smaller than current price – thereby providing a put option. If there were no investors in the market with speculative intentions, trading would most probably be minimal (Black 1986) or non-existing. The fourth benefit comes from the speculation (risk-seeking) of financial intermediaries or portfolio managers, which will have a positive return for other market players. If only one share is traded, then, in theory, this can be interpreted as reduced risk for market players resulting in the increase of price and fundamental value. Weil (1990) deduced this way that price can lower fundamental value, which also implies, however, the mutual dependence of dividend and price. Assuming investor rationality, we can again conclude in this case that bubbles do not exist.

Speculative stock market is often compared to a financial Ponzi-scheme. This refers to an investment scheme whose workings make it impossible for all players to reap monetary rewards but every player is sure that he still entered the game in time. This characterized the pseudo-enterprise originally started by Charles Ponzi in the 1920s, which aimed to realize a profit on the “arbitrage” resulting from the difference between exchange rates and between the fixed European and the US prices of international postal reply coupons. The profit promised by Ponzi, however, could not have been achieved even if the enterprise sells all the reply coupons in the world (Shiller 2000. pp.65-66). In the case of a listed company, however, rarely can an obvious profitability limit be given, and this is even more so in the case of a new industry promising cost

efficiency and tangible benefits in production, services and sales. In case of borrowing, a Ponzi-scheme can be recognized if the net cash flow of the investment is not enough even for interest payment (Tarafás 2001) but the game will not collapse as long as new loans (new investors) provide funds for immediate cash flow needs. This is the case of blank credit. When turning to the stock exchange, we cannot speak of Ponzi-financing because share price increase is equivalent of dividend payment for shareholders. If the company makes investments with a positive net present value, share price will theoretically rise, and only in hindsight, in light of the failure of the investment we can be absolutely sure that the fundamental value of the share offers no collateral for capital re-payment in the form of dividends. This means fundamental value cannot be determined in advance. In other words, our analysis has no use for the concept of fundamental value.

This chapter reviewed the theoretical problem that dubious definitions for fundamental value and asset price bubble strongly reduce the practical relevancy of models. This is the biggest obstacle in the way of empirical tests for speculative bubbles (Flood and Hodrick 1990), which means the existence of asset price bubbles in the stock market cannot be verified within the framework of mathematical economics. In the following chapters we will broaden the framework of the analysis to include not only mathematical tools but also methods of a psychological approach. The question of stock pricing can also be analyzed by taking into account the specifics of investor behavior and its effects, confirmed by empirical studies.

1.1.3 Behavioral Finance on Bubbles

So far we have assumed rational behavior from market players and took it for granted that prices reflect all public and private information. This can be re-phrased as, based on available

information, “shares are priced correctly”. The basis for the Efficient Market Hypothesis (EMH) is that the price of a financial asset is affected by unpredictable future information. Therefore, if prices reflect available information then they will also be unpredictable, following random walk. Barberis and Thaler (2002, p.4) illustrate the two approaches as:

“prices are right” $\Rightarrow$ “there is no free lunch”

“there is no free lunch” $\nRightarrow$ “prices are right”.

In an efficient capital market the two statements follow from each other, but in other cases the validation of the latter does not necessarily mean the validity of the first statement. This means the fact that there is no investment strategy ensuring a return beyond what is the compensation for increased risk does not prove correct pricing.

In the past two decades several studies pointed out the theoretical weaknesses of EMH. The paradox of Grossman and Stiglitz (1980) states that if a capital market is efficient then gathering information is in nobody’s interest. Therefore, it is necessary for information gathering to be costly. Shiller (1981), and Grossman and Shiller (1981) claimed, on the basis of empirical data, that dividend volatility alone does not explain the fluctuation of share prices, which means share price fluctuation is not closely related to fundamental value. This contradicts the findings of Froot and Obstfeld (1989), whereby price fluctuation can rationally be supported by the fluctuation of dividends. Shiller (2000) says co-movement of dividend and price does not mean a rational behavior because both might reflect the irrational behavior of the market. Shiller (1991) investigates an alternative explanation for the problem which he could not confirm eventually whether the volatility of expected returns may account for excessive price

volatility. Analyzing the future prices of orange juice, Roll (1994) concluded that prices are not moved by news, which is not consistent with the assumption of rational investor behavior (i.e., appropriately reacting to information).

The validity of EMH has been the focus of another field of research, known today as Behavioral Finances (BF), which is one of the most important branches of finance in the last one and a half decades. Instead of assuming rational expectations, BF explains share price fluctuations with the regularities and psychological patterns of investor behavior. A large number of empirical research found anomalies weakening the practical validity of EMH.

BF research concentrates, therefore, on why incoming information is not integrated correctly into prices and what the reasons behind incorrect pricing are. If two shares are fundamentally identical and their market prices differ, the strategy of a rational investor would be the following: open a short position for the higher-priced and a long position for the lower-priced share. If market players are completely rational, this opportunity for arbitrage disappears immediately following from the identical decision of players. The arbitrage based on the relation between the fundamental values of two shares is similar. In the stock market, however, no perfect arbitrage can be done in either case. Arbitrage over time is always costly and risky (Barberis and Thaler 2002), as there is no guarantee for the equalization of the two prices within a relatively short term. The reason behind this is that non-rational investor behavior might play a decisive role in price development during a longer period.

Non-rational investors are in fact following typical behavioral patterns, so their decisions are not entirely wrong (i.e., irrational),

rather quasi-rational (Thaler 2000), because the sources of guiding patterns can be identified. Our decisions are usually helped by certain “rules of thumb” in choosing the most effective (i.e., quickest and most precise) option. The literature of BF does not yet offer a uniform map of psychological factors because there are overlaps. The most important characteristics, however, are excessive confidence and optimism, heuristics, anchoring and conservatism, framing and cognitive dissonance. Based on comprehensive studies on BF (Barber, Odean and Zhu 2003; Barberis and Thaler 2001; Shleifer 2000) as well as Komáromi (2002a, 2003c), these patterns and their practical effects are summarized in Table 1.1.

BF does not focus directly the emergence of bubbles because it examines prices in terms of how much they reflect available information. It traces the digression from fundamental values, which, as seen earlier, is an asset price bubble from the mathematical point of view, back to typical investor behavior. Incorrect market

Table 1.1: Main Behavioral Patterns in Investors' Decisions

Behavioral patterns	Effects
Optimism – overconfidence in abilities/information	Investors are more active, volume increases
	Overreaction to news
Representativeness	Overreaction to rare events
	Wrong and overreaction because similarity
Conservatism – Anchoring	Underreaction because investors do not update their beliefs
Framing	Risk attitude, direction of decision depend on the interpretation of the news, situation
Cognitive dissonance	Investors tend to follow trends: “herding”.
<i>Source: Odean (1999), Shleifer (2000), and Shiller (2000).</i>	

pricing can be recognized empirically and confirmed from the psychological side. For example, the model of Barberis, Shleifer and Vishny (1998) illustrates the phenomenon that investors underreact information in the short run and overreact in the long term. This can be traced back to two factors included in Table 1.1. At first, the new information regarding the given share does not change previous conceptions enough as investors are conservative, “anchoring” their decisions to their former point of view. This leads to an underreaction to the news in the short term, because fresh news are weighted less in investor decisions. Later, a series of good or bad news might cause investor opinion to follow a characteristic heuristics, resulting in an extrapolation to the future and a long-term overreaction to the news.

In the model of Daniel, Hirshleifer and Subrahmanyam (1998), trust in private information grows if it coincides with public information, and weakens if they contradict. The short and long term fluctuation of market prices can be deduced from this. In this model, the change of trust in information and personal capacities can be explained by cognitive dissonance. Every private decision invokes doubt on the part of the actor about whether he has made the right decision; therefore, his attitude will not be consistent with his behavior. This doubt, or inconsistency, is cognitive dissonance itself, the reduction or elimination of which is a natural human reaction. Investors try to justify their buying or selling decisions in hindsight. According to the above model, if a later published information confirms earlier private information of an investor, his self-esteem will grow, his cognitive dissonance decrease.

The two basic models of behavioral finances discussed above, however, do not explain the general phenomenon that, based on 50-70 years of data from US stock markets, shares follow previous trends for a couple of month (momentum effect) then they will

revert to the average in subsequent years (reversion effect). To sum up what we have examined so far: BF describes reality more precisely than EHM because it takes behavioral specifics into account. Now we see that the formation of a bubble strongly depends on how investors perceive and to what degree use new information, and what psychological patterns are observed during their decisions. Still, the definition of fundamental value as a benchmark is a weak point of these models. With the help of assuming limited arbitrage, we obtain an explanation for why the price of two fundamentally identical financial assets might diverge, like the share price of a closed-end fund and the value of the stock portfolio managed by the fund. However, with the examination of the interrelation of financial assets, BF partly circumvents the issue of fundamental value, not providing the necessary and sufficient conditions for the formation of a bubble. BF still proves that psychological characteristics can partially explain share price development, but further thought needs to be devoted to what role investor behavior may play in the formation of bubbles. We revert to this in Chapter 2 where we discuss two phenomena: overconfidence and the illusion of knowledge.

Unfortunately, BF models do not offer an answer to the question as to whether we can differentiate between a large aberration from fundamental value and a smaller bubble. Furthermore, BF literature explores the development of most of the psychological characteristics only in general terms, so we cannot tell whether investor behavior changes from one period to the other. We are not able to compare behavioral characteristics of market actors at the beginning of a boom with those during a market crash. Psychological patterns laid out by BF, therefore, cannot explain the formation or collapse of bubbles directly.

1.1.4 The Predictability of Crash

The introduction of the mathematical approach to bubbles would not be complete without answering the question whether the bursting of asset price bubbles is predictable. The models shown above sought to find an answer to how a bubble forms, in what circumstances, and if it can be explained by rational or irrational behavior. According to EMH, share price fluctuation is unpredictable, and although empirical research related to BF did find some past information which might make prices more or less predictable, this does not modify the message of EMH significantly (Komáromi 2002a). If share price diverges too much from fundamental value, all of the above models assume that it will return to it. However, this cannot be proved in practice, in fact, not even whether a change of fundamental value justifies a previous price change. Approaching the problem from a purely mathematical-statistical point of view, it can be stated that the distribution of stock returns has fat tails regardless of whether we examine the possible evolution of theoretical value or actual stock market data. This brings about the natural instability of market prices. A stock market is more unstable compared to other complex systems because decisions here are made by individuals whose personal considerations multiply the number of factors to be reckoned with.

About a decade ago, the first articles written by physicists pointing to regularities in the chaos of stock market decision-making were published. It has been proved that the distribution of stock returns within a monthly (or shorter) period differs from normal distribution and their deviation cannot be given (they have stable Lévy-distribution). Farmer (1999) also argued that for longer periods, normal distribution is a good approximation, where the second momentum can be calculated. Moreover, it can be shown

that, examining a large amount of data, these returns have asymptotical power law characteristics. Sornette's (2003) comprehensive study tried to apply techniques borrowed from the science of physics to capital markets, emphasizing the imperfections of their predictive power. In his research, he determined the critical time when prices begin to fall by using linear and non-linear equations. Fifty percent of the case studies listed in his work contain false predictions, which may even be considered significant depending on one's approach, but definitely not economically relevant from our point of view.

Farmer (1999) stresses that such research does not yet have a sound economic background but it undoubtedly points out some regularities. For the time being, however, the use of past prices to predict future ones provides contradictory and irrelevant results. For instance, Lo, Mamaysky and Wang (2000) found some patterns of the technical analysis in US financial data but without any significant explanatory power. All we get here is technical analysis with a theoretical coating, instead of economic or behavioral regularities. One dynamically developing branch of the physical approach, the science of networks, cannot be applied to stock market analysis efficiently, but a subdomain of it, research on not-random networks shows promise in terms of mathematical modeling of collective decision-making (e.g., Barabási 2002).

1.1.5 Conclusions

The previous subchapters discussed asset price bubbles from the theoretical and practical point of view but we were left facing several problems. Exact model-making is both the advantage and disadvantage of the mathematical approach because although this presents several market characteristics, limiting conditions make it valid only in some specific context. This is the conclusion of a study

by Flood and Hodrick (1990): asset price bubble models have an interpretation problem making the verification or discarding of an asset price bubble difficult.

In spite of such contradictions the examination of asset price bubbles offers several insights. First is the demand-side limit on liquidity, which is trivial, still it is the most important condition for the formation of an asset price bubble. Tirole (1992) compares shares to “hot potato”, passed from one player to the other, with the last one unable to get rid of them. This means there will always be players stuck in their investments, which is equivalent to what Keynes (1936) expressed that there is no such a thing as liquidity of investment for all the market players. However, even if the investor cannot sell his share, he receives dividends so it is not a Ponzi-scheme in the classical sense, only if there is no fund for dividends. Or to put it more precisely, the value of corporate assets and the present value of the future return on investments do not justify shareholder expectations in hindsight. There may be two reasons for this, the first being the information problem.

Market actors do not make their decisions based on complete information. So there is a high probability of a strictly interpreted bubble in the case of any given share. In light of what has been said so far, a rational (expected) bubble is not distinguishable from an irrational (strong) one. In the latter, case we could put forward the criterion that no future dividend income can justify the current price. The only problem here is that the correctness of predictions regarding corporate profits is only confirmed *ex post*, as it is hard to define a clear limit in advance. Such an exceptional case is the Ponzi-scheme but this is uncharacteristic of stock market investments so it is not applicable for the explanation of bubble formation and collapse. Section 1.3 uses the historic point of view of literary

economics to expand on this issue because it is easier to explore the problem in specific cases. Another issue with regard to “unrealistic” return expectations is the principal-agent problem, i.e., the role of management in shaping expectations. This important aspect will also be the topic of Section 1.3.

Investors will invariably sell their shares in the future (short sale constraint) and so they cannot be divided into entrepreneurs and speculators in the Keynesian sense. These two groups of shareholders are only separated by differing investment periods. During the examination of bubbles, therefore, the question is, why do they act as sellers in the market in a given moment? The second chapter explores the factors which imply a ceiling for further price rise and the short term inevitability of a crash.

The second consequence was highlighted by the literature of BF: recognizing and validating the fact that there is no perfect arbitrage in the market. This inevitably implies that the price of a particular financial asset will rarely match its fundamental value. Fundamental value cannot be used as a benchmark because price fluctuation is mainly a function of investor behavior. Changes in the latter will be examined in Chapter 2 with regard to overconfidence.

The next section presents the phenomenon of asset price bubbles from a different angle, through the prism of empirical economics.

1.2 Asset Price Bubbles in Laboratory

Empirical economics enriched the science of economics with a wholly new approach. It directly examines the factors influencing investor behavior in laboratory experiments with specific, pre-defined conditions. One arm of this approach is the creation of artificial markets and conducting behavioral simulations in laboratory. The following will summarize the results of such research.

During an experiment, separated participants will buy or sell shares in a given number (usually 15-20) of rounds, determining the price observable in the monitors. The subjects do know the timing and value of dividend payments, and they are aware that prices are determined only by investor decisions. It is common during these experiments to grant the profits to participants, ensuring profit-making motivation. These experiments are repeated at least 20 times to ensure statistical validity or control experiments are conducted to complement the laboratory study.

The article by Smith, Suchanek and Williams (1988) presented the classical standard for the following capital market experiments, where the share paid a given amount of dividend after a pre-defined number of rounds. Subjects, therefore, knew the fundamental value of the asset, still prices at first usually went up during trading then sank, and although they never detached themselves completely from fundamental value (preserving the validity of the condition of rational expectations), in the mathematical sense an asset price bubble was formed. The experiment also showed that participants could forecast next-round price with only a small degree of precision. During price increases, they usually underestimated future prices and vice versa. Trading volume was significantly influenced by price fluctuation: the activity of participants was higher in times of price increase, and smaller when prices fell. The most important result presented by the authors was the realization that the size of an asset price bubble was dependant on the experience of participants. If they have taken part in several experiments previously, then divergence from fundamental value was significantly smaller, even if it did not disappear entirely. They believe the reason behind the formation of a bubble is the diversity of experiences and capacities of participants, in spite of their common knowledge about dividends.

Stanley (1997) explored further the possibility of irrational bubble formation during laboratory experiments. His experiments were different from earlier ones in as much as he did not specify the number of rounds. This increased uncertainty causing a higher divergence of prices from fundamental value and a formation of speculative bubbles in the sense used in previous chapters. He observed a divergence from fundamental value even in those rounds where any further dividend payment was out of question.

Lei, Noussair and Plott (2001) explored the option whether an asset price bubble will form in the absence of speculation. Their experiments also created asset price bubbles which they explained with the constraints on the activities of participants: they could buy or sell shares but could not do any other activity. They had the option not to trade but it is difficult to withdraw from active participation in an experiment (i.e., trading). This touched upon a weak point of empirical economics: experimental circumstances influenced the behavior of participants *per se*, causing them to act differently from how they would react to a real-life investment opportunity. These experiments also offered an answer to another question: if dividend information is common knowledge, why does it not stop bubbles from forming? In an experiment, there are always inexperienced participants who need time to understand the formal and informal “rules”. Similarly to the experiment by Smith, Suchanek and Williams (1988), a bubble does not disappear even with experienced participants, for which they offer the explanation that the rationality of participants is not common knowledge. The hypothesis by Lei, Noussair and Plott (2001) was that participants at first do not assume the others to be rational, which leads to the formation of a bubble. As soon as the rationality of all players is evident, prices begin to fall and the asset price bubble disappears.

The previous studies concentrated on whether asset price bubbles form and if they do, are they caused by rational or irrational behavior. The validity of these experiments is undermined by the fact that during such experiments participants expect bubbles to form simply based on the specificity of the situation, and usually rightly. This inevitable experimental flaw can be circumvented by checking, *ceteris paribus*, the change in probability of bubble formation and in bubble size depending on the modification of one particular condition. So far, two factors have been identified as causing a large divergence from fundamental value: participants with limited experience, and the lack of certainty about the number of rounds in the experiment. Caginalp, Porter and Smith (2001) demonstrated the effect of other factors which are summed up in Table 1.2 along with the previous ones.

Table 1.2: Factors Determining the Extent of Price Bubbles in Laboratory Experiments

	Great price bubble	Small price bubble
1.	Subjects have less experience	Subject have more experience
2.	Number of rounds are not known in advance	Number of rounds are known in advance
3.	High cash	Low cash
4.	Dividends are paid immediately	Dividends are paid with a delay
5.	No information about the transactions	Information about the transactions

Source: Smith et al. (1988), Stanley (1997), Caginalp et al. (2001).

The effect of the first three factors is stronger and better validated from a statistical point of view. The first factor increases uncertainty as participants are less certain about the outcome of the experiment and they expect (speculate) that the others will not decide rationally. The second factor also increases uncertainty because the time frame

of the experiment is not known; the participants have no information about the number of trading rounds. The third factor verifies the role of liquidity in bubble formation. Caginalp, Porter and Smith (1988) recognized that if a new experiment provided one dollar more per share for the participants, the maximum price of the share was more than one dollar higher in most cases. The latter two factors have a smaller explanatory power, nevertheless they influenced the size of the bubble in many cases. If dividend received during the rounds was credited only at the end of the experiment, liquidity effect reduced bubble size compared to immediate payments. It also became clear that publishing direct information on transactions (price, volume, time) decreased the probability of bubble formation.

1.2.1 Conclusions

The most important result of stock market experiments conducted in laboratories is that during such an experiment trading conditions (cash, number of rounds and participants, etc.) can be specified and the impact of changing them can be tracked.

Although experimental circumstances may distort the observations, they do confirm some of the factors determining bubble formation. The first such factor is uncertainty implying a bubble, which can be countered by providing the participants with additional information, like publishing trading data or the number of rounds. From among the propositions of mathematical models the importance of liquidity is also confirmed by these experiments, one method of which is the postponement of dividend payment. Another statistically significant finding is that an increased initial amount of cash leads to a relatively larger bubble.

A previously unexplored factor, the experience of participants also influences laboratory bubble formation. The more games the

participants took part in, the smaller the bubble. It is important to note that the involvement of relatively more experienced participants still did not exclude bubble formation entirely, the reason for which is not clear. It could be the distorting effect of the experiment, or more experienced subjects have less illusion about their capacities to beat the market. If in such cases, a bubble would disappear within a couple of rounds, that might signal an effective market where given the available information share price does not detach itself from fundamental value. A positive asset price bubble does not disappear in most cases, but trading can sometimes happen even below fundamental values (Srivastava 1992). This contradicts earlier assumptions about the impossibility of negative asset price bubbles, though the reasons behind their emergence in laboratory circumstances are still unclear, perhaps being simply the distortional effect of the experiment. Another result not coinciding with earlier mathematical models is the fact that a lasting bubble may form even when the maturation date is known. This means investors make a mistake in determining the price (i.e., during discounting), which may imply not every decision of the participants is rational. The fact that such lab asset price bubbles do not work off quickly shows participants are aware of the existence of irrational decisions.

At the beginning of Chapter 1.1 a distinction was made between bubble and asset price bubble. Mathematical models and laboratory experiments examine the latter, which is a divergence from fundamental value. Necessary and sufficient conditions can be determined, but their validity is undermined by their generality. Using the strict definition we could almost always register an asset price bubble. The above discussed approaches do not offer an adequate method to distinguish between speculative and rational (expected) bubbles, either. The single-most important unanswered question with regard to experimental capital markets is the

interpretability of their findings, the connection between “real” asset price bubbles in real-world settings and laboratory phenomena identified as such.

1.3 Literary Economics and Bubbles

Until this chapter, we have discussed the problems of asset price bubbles being defined as a positive or negative difference between actual price and fundamental value of the financial asset. The term “bubble” is a broader concept covering an economically relevant phenomenon affecting the whole of the capital market. While previous mathematical approach explored *how* an asset price bubble forms in the case of an individual share, literary economics sets out to find the answer as to *why* stock market bubbles emerge. The difference in the question is related to the difference in the approach, but they both serve to explain basically the same phenomenon.

The most widely accepted definition of bubbles is given by Charles Poor Kindleberger as: “A bubble may be defined loosely as a sharp rise in price of an asset or a range of assets in a continuous process, with the initial rise generating expectations of further rises and attracting new buyers – generally speculators interested in profits from trading in the asset rather than its use of earning capacity. The rise is usually followed by reverse expectations and a sharp decline in price often resulting in a financial crisis.” (Kindleberger 1991. p.20). This definition is the essence of what Kindleberger drew from the most important tool in literary economics: historical examples and recognizable parallels of them. Hereinafter we are going to use this definition to characterize stock market bubbles, the most important parameters of which are the following:

- 1) *Initial rise, expectations of further rises*: Kindleberger (2000) found the origins of this in an exogenous shock (displacement)

affecting the economy, modifying economic outlook in a positive way. This can be different in different eras; either quantitative, like the discovery of a new continent, or qualitative, like a technical invention enhancing the effectiveness of production.

- 2) *New buyers*: The demand for shares increases; more and more participants take part in trading, and the activity of the players grows.
- 3) *Speculation*: Investors do not buy with the aim of receiving dividend income, rather price gains. Although this definition has weak points mentioned earlier, it will be used as a starting point in our studies, in the sense that the proportion of long-term investors aiming to receive dividend income decreases along with the average investment period.
- 4) *Price decline*: The collapse of prices and the whole of the market may occur suddenly or gradually, with players leaving the market.
- 5) *Financial crisis*: Although Kindleberger did not consider this to be a necessary consequence, the following discussion of historical examples will account for the positive and negative macroeconomic impacts as well, such impacts lending an economic weight to the phenomenon.

Traditional bubbles known by economic history will be presented in light of the above listed five parameters in the following sub-chapter, but the study will be complemented with common traits recognizable in these examples, which may signal a drastic change in investor trust and buying attitude.

1.3.1 A Classic Example: Dutch Tulip Bulbs

Probably the first and most often quoted example in modern-age economic history is the case of Dutch tulip bulb speculation (1634-1637), which is considered by finances literature as a classic bubble. Even though tulip is not a financial asset, the accompanying speculation, similar to one in a capital market, is an archetype in economic tradition. Shiller (2000) mentions other documented speculation from earlier centuries, for example in Far-East spices. We believe, however, that in order to speak of speculation, a developed market and a large number of participants is necessary, which were out of question previously. That is why the case of Dutch tulip bulbs may be considered as the opening chapter of a new era in economic history as well as a permanent reference point. A problem arises from the fact that the “yield” of a tulip (i.e., the value of its beauty or the envy of the neighbors) does not correspond to the dividends of a share. Still, the phenomenon referred to as tulip mania is so much the part of the framework around economic debate on bubbles that its analysis cannot be shunned.

17th century Netherlands was a center of international commerce and finances of the era. The two flagships of the flourishing industry and the fast developing economy were the Dutch East India Company (founded 1602) conducting trade with Asia, and the West India Company (founded 1622) conducting the American slave trade. The ports of the country were a focal point in the trade of many commercial goods, one of them being tulip bulbs of Turkish origin. Market liberalization happened in 1634 (Garber 2000) allowing tulip bulb trade for everyone. Its market was, from the technical point of view, very similar to the already very advanced financial markets where, in addition to prompt transactions futures, contracts and options were also traded. The latter were, however, not regulated in a strict legal way and fulfillment was not entirely protected legally.

The first four parameters in Kindleberger's bubble definition can be interpreted in the case of Dutch tulip bulb speculation as follows. Initial displacement was the economic impact received by the Dutch economy at the beginning of the 17th century, even though the social and political environment was not nearly as favorable with a plague epidemic and a war waged against the Spanish. Still, economic outlook was bright, mostly because the leading role in international commerce was already consolidated. The arrival of new buyers was thanks to the abolishment of trade restrictions on tulip bulbs. Starting in 1634, therefore, a new market was born. Speculation was given a further push by the palpable increase in demand for special, rare tulips, the new symbols of richness, in France from the beginning of the 30s (Garber 2000). The exclusivity was borne from the fact that, due to a virus infection, tulips with special patterns appeared, becoming a fad among increasingly affluent citizens.

Although the tulip bulb case is usually mentioned as an example of irrational pricing (Kindleberger 2000; Galbraith 1994), determining fundamental value does pose a problem. As we said above, the internal value of a tulip, the "fundamental value" of its beauty cannot be specified. Average prices went up 5-10 times between 1622 and 1637, and, even though the degree of price increase was dependant on the species, the co-movement of prices was recognizable: the price of ordinary tulip bulbs followed the same upwards trend. The bulb of the most famous and exclusive tulip, the *Semper Augustus*, was bought for 6290 guildens in February 1637, which was a small fortune at that time in the Netherlands. Galbraith (1994) relates one of the best-known economic anecdotes, in which a trader invited a seaman for dinner, and when he was looking for his tulip bulb the end of the feast, it turned out to be eaten by the guest as a garnish to the herring. The trader's loss was

indisputably huge, but even such argument (see Galbraith 1994) does not prove the price of *Semper Augustus* was irrationally high at the zenith of speculation. At today's prices, one bulb was worth about 50.000 USD (calculated with average gold price in 2003), but those who bought at this point was only miscalculating the tulip bulb fad and market demand. We can bring up the example of modern-day trade of artworks, where even million-dollar purchases are not considered irrational, simply a result of current fashion, which can even be seen as an investment. It is not possible to find, even as a reference point, an internal value of the tulip bulb for *Semper Augustus*, either. A price of 1000 or 3000 gulden is no more "realistic" than 6290. During a speculation, which is actually part and parcel of every market, there will always be participants who get "stuck" in their investments, or to put it in another way, the market is not liquid for everybody at the same time (Keynes 1936). Therefore, we cannot talk about irrational pricing, only the bad luck of those buying (or not selling) at a high price. Although the number of those who bought a tulip bulb for its beauty was probably higher at lower prices, it was evident only in hindsight that the scope of people only motivated by "fundamental value" did not expand.

In the case of Dutch tulip bulbs there were a couple of factors, from which price collapse is not directly deducible but which were nevertheless indicators of an impending crash. In early 17th century Netherlands many started to deal in two increasingly popular financial transaction types: derivatives and mortgages. Although exact numbers are not available, historical economic data implies their rising popularity. Even though futures contracts were forbidden by effective Dutch law, around this time the enforcement of such rules was gradually weakening because of the interests of market players. Of those who entered into futures or options

contracts, or borrowed money in order to trade in tulips, most were presumably not interested in the bulb fad, rather in making a profit from trading. There was an increasing risk that bulbs bought from loans would appear in the market. Both Galbraith (1994) and Bácskai (2003) identified leverage as a common denominator of financial bubbles. This coincides with the above argument saying the increase of such financial transactions may signal the “excessive” rise of speculation.

The other phenomenon becoming recognizable in spite of spotty data is that a rise in prices and speculation was not only observable among rare and exclusive tulip bulbs but, with a delay, among ordinary ones as well as the shares of the two international trading companies. This co-movement of speculative assets cannot be analyzed for lack of detailed data but the phenomenon is identifiable in the other examples to be discussed. Shiller (2000) mentions an accompanying feature of the tulip bulb speculation, which was the increasing number of articles and commentaries in the newspapers starting to circulate at that time in the Netherlands. The opinion forming impact of the media cannot be considered as the direct cause of speculation but it did contribute to attracting new investors to the opportunity of making money on tulip bulbs. After the zenith of speculation, *February 1637*, prices of both exclusive and ordinary tulip bulbs began to fall back to 1-5% of previous values. An adequate time series cannot be created from the available data because we have no pricing information from the post-crash period; nevertheless, a traditional collapse scenario is likely.

The last parameter to be examined in the definition of a bubble is the negative macroeconomic impact. Although the above phrase from Kindleberger mentions the outbreak of a financial crisis only as a possibility, we believe the definition of a bubble becomes weightless without this criterion. This is confirmed by related

literature, which touches the subject always in context of negative effects. In the case of the tulip bulb speculation, however, this condition is hard to verify. Some of the literature (Kindleberger 2000; Galbraith 1994) suggests that the Netherlands have been struck by an economic crisis or at least economic decline from the middle of the 1600s because of the tulip bulb speculation. Although there are not much reliable contemporary data to speak of. It is likely that the economic growth of the Netherlands indeed slowed down resulting mainly from the depression in trading activity. However, there are no hard facts supporting the idea that this was the direct or indirect consequence of the tulip bulb speculation. The previously mentioned Thirty-year War, which ended in 1648, could play a role as well as the plague epidemic killing about 15 percentage of the population. We cannot ignore the fact that it was actually not a decline, only a slowdown and a gradual falling behind England, which was to become the leader in maritime commerce. Furthermore, Garber (1990, 2000) emphasizes that the only primary source used in the literature is the collection named *Conversations of Gaergoedt and Waermont*, published in 1637, which was a pamphlet with a moral tendency. In line with the intentions of the government, the writing pilloried speculation, particularly future contracts, with an emphasis on providing a moral to the story. The source of the previously mentioned sailor-story is a log written seventy years after the events whose references are of limited trustworthiness.

The most often quoted case of speculation in economic history: the Dutch tulip bulb is put down by most economic analyses as a craze, mad or irrational investor behavior. The above argument, however, shows that the parallel drawn with capital market assets is questionable to begin with, because it is impossible to specify

a fundamental value for those bulbs. The explanatory power of the example is further weakened by the fact that no complete data are available about the event and research was based on one-sided, moralizing sources. Of the five Kindleberger-criteria, negative macroeconomic impact is the most controversial to prove, primarily for lack of information of adequate quality and quantity. We must note that the macroeconomic consequences of non-stock-market speculation similar to the tulip bulb one are difficult to substantiate. Secondary trading is practically a zero-sum game where one's loss is another one's gain. This basically means a reallocation of wealth without an effect on its quantity. Still, prices of the secondary stock market will influence primary market parameters, namely corporate capital cost, which, in turn, might influence economic growth in an unfavorable way. In the case of tulip bulbs, however, the possible backlash hitting tulip growers could not bring about serious macroeconomic consequences. Another aspect of the problem is whether the uncertainty caused by the tulip bulb speculation was affecting other markets, most importantly the stock market? There is no definitive answer to this question because of the lack of sufficient data.

A parallel between the Dutch tulip bulb case and capital market assets is one to draw with a caveat but it is certainly useful for illustrating the phenomenon of speculation. The overpricing or irrational pricing of tulip bulbs cannot be proven but there are signs of "dangerous" speculation and trading here, like the increased risk resulting from leverage or the conceivable co-movement of different speculative assets. We cannot analyze the impact of newspaper articles of the time, still we can assume they had played an indirect role in attracting masses to speculation. However, negative macroeconomic impact of speculation, the most important bubble parameter, cannot be verified in this case.

1.3.2 The First Stock Market Bubbles: Mississippi and South Sea Companies

The first large-scale stock market speculations of a new era of economic history, capitalism based on free-for-all entrepreneurship, were happening simultaneously in France and England: those regarding the French Mississippi Company and the English South Sea Company. These cases, described as the first major stock market bubbles, are characterized by the emergence of three new factors. The first new factor was, as opposed to earlier cases, the wide availability of issued shares. Secondly, state debt financing lay in the background of both enterprises. Thirdly, these bubbles were strongly connected to government activity and signs of fraud and deception were recognizable in both of them.

Instrumental behind the phenomenon known as the Mississippi-bubble was John Law, for whom this enterprise was the practical implementation of one of his financial theories. Law founded *Banque General* in 1716, winning the right to issue bank notes. This was secured theoretically by the gold and silver reserves of the bank, the volume of which was, however, much smaller than the nominal value of bank notes issued. These notes were freely convertible to gold and as the bank and Law enjoyed general trust, these paper notes became widely popular. Trust was fuelled mainly by the prospects of *Compagnie d'Occident*, a company law was founded in 1717. This company, known as the Mississippi Company in economic history, was based originally on the monopoly of trading with the French colony Louisiana and the trade in Canadian beaver. It was renamed in 1719 to be *Compagnie des Indes* after the French East-India, Singalese and China companies were merged into it. The company thus became the sole agent of French trade outside Europe. In the meantime, *Banque General* was nationalized as *Banque Royale* and from then on bank note convertibility was

guaranteed by the state. This, however, did not mean increased security for investors. Investor trust and optimism was strengthened only by a closer tie between the bank and the Mississippi company. The company continued to widen the scope of its activities. For example, it has bought the exclusive rights to exploit the precious metals of Louisiana. Later it acquired the rights to collect direct and indirect taxes, where law saw profit potential in a more efficient arrangement of the process. The capital necessary for growth, more precisely the price of financial licenses, was raised from continuous issues of increasing price. The issue price of company shares increased tenfold from the initial 1000 *livres tournois* by the end of 1719. Demand for the shares was huge, fuelled by not only the exploitation of gold reserves but also the upsurge in commercial activities and agricultural development in Louisiana.

Money from the issue was, however, almost entirely financing a huge state debt instead of the economic activity of the company, as *Banque Royale* increased the emission of bank notes at the same time. The foundation for Law's financial system was the assumption that future dividend coming from the activities of the Mississippi Company would in the long run exceed interest payment on state debt. This meant investment for dividend income, i.e., possessing company shares in a long-run was "rational" – and actually, investors interested only in dividend income were considered by Law to rational and he was against speculative share purchases. As we have seen in Chapter 1.1, distinguishing between shareholders on the grounds of dividend or capital gain motivation leads to false conclusions. In case of a public company, only a limited circle of owners can be considered to be interested solely in dividend income, such as the founders, strategic partners and large professional investors. A majority of the owners can, however, be expected to sell their shares at any time. What is more, the economic activities

ensuring profit for the company were not stable, either. Limited information was available as to the actual economic or agricultural potential of Louisiana and the existence of large gold reserves was not verified.

A stock selling surge began at the end of 1719 and investor started to demand gold for their bank notes. The regent exercising the infant ruler's rights conceded full power to Law over state finances. Law was criticizing sellers as "ignorant" and he made administrative measures, e.g., restricting the conversion of high nominal value *livres* to gold, as well as other, quite unorthodox ones. Galbraith (1994) and Strathern (2001) quotes a story where, in order to regain investor trust, Law summoned all Parisian beggars and marched them through the streets of Paris dressed as diggers setting out to Louisiana. Kindleberger (2000) believes the Mississippi Company is not a case of fraud, but is rather the result of Law's wrong financial theory. The question obviously lingers, to what degree was Law aware of the workings of the company, can we speak of deception? Although Garber (1990, 2000) and Kindleberger (2000) identify excessive investor optimism and trust (i.e., a natural tendency to speculate) as the main reason and they argue Law was involved mainly in financing the company, all this does not absolve him of the moral responsibility for deceiving investors, which, depending on the definition, can be considered as fraud. The financial-economic system created by Law reached its zenith in 1720 and in May of that year the *livre tournois* had to be devalued; its gold-denominated value lowered due to inadequate cover. The share price of the company started to nosedive as a consequence of this, by 70 percent until the end of the year. By September 1721 the price fell to 500 *livres tournois* which was half the original issue price.

The scenario for bubble formation and collapse, serving as a framework for our analysis, was now practically completed. First, a positive displacement took place, caused by the expectations about Louisiana's economic potential, the profit of international monopolistic commercial rights and the benefits of more efficient tax collecting in France. Secondly, new investors were drawn into the company. The third parameter is also there: the dangers of an "excessive degree" of speculation, not motivated by dividend income, were signaled by leverage, which was, in this case, the financing of state debt. Even investor deception belongs here as an attempt at preserving trust. We can also identify a phenomenon similar to the co-movement of financial and speculative assets seen in the Dutch tulip bulb speculation. The value of *livre tournois* issued by *Banque Royale*, i.e., the trust in its convertibility into gold, was closely connected to the price evolution of Mississippi shares. Excessive monetary expansion, the issue of bank notes without a gold backing, caused a multiplication of the price of food, houses and real estate in Paris (Kindleberger 2000), and this can be attributed to the financial system created by Law, based on mutual interdependence.

The negative macroeconomic impact following the collapse of the Mississippi Company allows, however, for different interpretations. Kindleberger (2000) stresses direct effects, like a general inflationary rise, an increase in state debt and a contraction of enterprise opportunities caused by the lack of trust. Garber (2000) believes, however, that the overall impact of the Mississippi speculation was clearly positive as it revived the French economy through financial innovation and the reform of state finances. Neither of these arguments can be unequivocally verified – there were probably positive and negative effects both in the short and the long run. The contradiction between these points of view arises presumably from the different weighting of speculation and the

basic characteristics of the stock market. The enterprises started by the Mississippi Company, primarily an attempt at more efficient tax collection, undoubtedly had a positive effect. Even “testing” the joint-stock format could be considered as a long-term benefit.

Investing in a new enterprise based on the promise of future success is speculation itself, which, if proving to be a failure, can cause other enterprises to stall. Speculation may also prompt investors draw their conclusions about the consequences of overconcentrated, interrelated and non-transparent economic influence (Garber 2000), which can be considered as a “proof of sobriety”. It cannot be confirmed that French economy entered a crisis because of the Mississippi bubble; in fact, the collapse could just as well point out the weaknesses of a rigid economic system. The opinion of contemporary reports (see Kindleberger 2000) is similar to the moralizing seen during the tulip bulb speculation and no factual conclusion can be drawn from such statements with regard to economic or social impact.

Simultaneously with the speculation in Mississippi shares, a speculation in the shares of the South Sea Company took place in England, in many ways similar to the above discussed issues. The company was founded in 1711, headed by John Blunt, primarily with the aim of taking over state debt accumulated during the war of the Spanish Succession. This technique was not unique in the history of England because the Bank of England and the New East India Company were founded in a similar form and with the same intent in 1694 and 1698, respectively (Neal 1992). The company was entitled to a 6 percent interest and a share issuance right in return for the debt takeover. Its business was more transparent and simple compared to the Mississippi Company; it was limited to trading with the American Spanish (collectively named South Sea)

territories. In practice, this meant one commercial trip every year as the trade monopoly was reserved for Spain.

Still, by the end of 1719 the Company managed to take over one-fifth of the state debt amounting to 50 million pounds. At the beginning of 1720, it has acquired the rights to manage another 31 million pounds of debt, because its 7,5 million pound bid was better than the offer from Bank of England. The company made a series of large volume share emissions, in the process of which share price went up tenfold from 100 pounds by July of that year.

The popularity of the shares of the company was undiminished in spite of the fact that it conducted no actual economic activity. This “blind” trust was fuelled by the fact that many stakeholders of the company had a seat in Parliament, who, with the help of John Blunt’s informal connections and slush funds, promoted South Sea shares while receiving share issuance rights. Such funds paid to members of parliament and influential officials constituted the single biggest expense of the company exceeding 2 million pounds (Garber 1990). The success of the share issues of June and August 1720 was partly attributable to the possibility of leverage: subscribers did not have to put up cash for the entire amount but pay the remainder (80-90 percent) in 6-month installments.

Trade in the shares issued by the company was suspended for the time of dividend payment due in the summer. During this period, on August 18, 1720, Parliament ratified the Bubble Act restricting the foundation and expansion of joint-stock companies similar to the South Sea Company (Neal 1992). Although apparently the Act was designed to stop the spread of enterprises based on dubious ideas, qualified as “bubbles”, most of the literature agree that its real objective was to ensure other enterprises, whose spiking share price also began to attract investors, not draw speculative capital from the South Sea Company.

Following the next capital issue, trading was resumed with the old shares on August 31 and the price fell from 775 pounds to 290 during the next month. Investors lost faith in the South Sea Company and an increasing number of investors liquidated their positions, perhaps due to international events, among them being the collapse of the Mississippi Company. By December, shares were only worth 140 pounds. The Bubble Act, which filtered out enterprises based on quixotic ideas (like building a perpetuum mobile or turning mercury into a forgeable metal), also restricted the foundation and functioning of other companies created in a joint-stock format up until 1824. This can probably be considered as the long-term, harmful economic consequence of the case.

The two previously discussed examples presented basically all parameters of a stock market bubble, but the weakness of the Kindleberger-framework, the criterion regarding speculation, was again highlighted. We can calculate that the highest market value for the South Sea Company was 164 million pounds. If we deduct interest payment in return for state debt takeover and cash claims from postponed subscription payment, we are left with approximately 60 million pounds, the cover for which would have been the profit on future business (Garber 1990, 2000). As the South Sea Company did not conduct actual economic activity, we can speak of pure speculation for trading gains. However, when a company conducts actual business, like the Mississippi Company, such buyers cannot be distinguished from dividend-oriented investors. In such cases a price decline is not the result of overvaluation, rather a change in investor trust, and due to a natural feature of secondary markets, restricted liquidity, a collapse is inevitable.

Regulation similar to the Bubble Act of 1720, trying to weed out “unstable” companies, is practically impossible to draw up

because “there is no basis for distinguishing bubbles from other types of financial assets” (Gilles and LeRoy 1992:74).

Hereinafter we are not going to focus on speculation *per se*, rather on parameters which may not causally imply bubble formation or bursting but which may signal a change in the confidence, share-buying attitude and capacities of market players. These are: leverage, co-movement of asset prices, state intervention and managerial action aimed at investor deception.

1.3.3 The Crashes of 1929 and 1987

A recurring phenomenon of stock markets is when investor attention turns to specific companies or industries, widespread speculation ensues, and the process runs full circle with a significant price decline. Of such declines, the US stock market crashes of 1929 and 1987, and the so-called Dotcom speculation connected to the latest technological revolution are the examples remembered most vividly in economic circles. The following two chapters will present the characteristics of these cases, and the contradictions of their economic evaluation.

The US economy experienced technological and structural changes in the middle of the 1920s. American companies started to adopt mass production, manufacturing a broad scale of products with increasing efficiency. Consumer habits were changing, too. More and more inventions took their place domestically and electricity started its conquest of the US cities and homes (Shiller 2000). A wave of corporate capital issue began, and share prices in the most influential US capital market, Wall Street, started to surge. Already palpable investor optimism found new momentum after the Florida real estate boom and the subsequent huge price decline, which sent a new army of speculators to stock markets. New financial

enterprises emerged: firms with professional investment activity also involved in capital market consultancy and share trading; and companies bought shares and issued shares to refinance (Kindleberger 2000). The first were the predecessors of today's investment bank, the second were the forerunners to modern closed-end funds. Popular types of financial transactions included investment formats where private individuals borrowed against shares bought from the loan. In some cases, a 10 percent margin was enough for a stock purchase with the rest lent by a bank. The sale constraint caused by leverage was therefore present in the decision-making of market players, leading to a shortened investment period, increasing the "danger" of a potential large-scale price fall.

Share prices soared almost universally throughout 1928. In March 1929 the Federal Reserve Board hiked rates but this caused only a minor slowdown in an upward trend. Still, it became increasingly clear that the government actively attempts to put a brake on share prices. Friedman and Schwartz (1963) identifies this mistake of monetary policy as the cause of the eventual collapse. Galbraith (1994), however, compares the growing stock market speculation to mass delusion, coming to an end in the autumn of 1929. There was an average price decline of 12.34 percent on October 28, followed by another 10.16 percent the next day and 9.92 percent on November 6 (Schwert 1992. p.577). The crash ending stock market speculation for years to come was underway.

The US stock market speculation of the 1920s displays several characteristics of a bubble. Liquidity expansion resulting from leverage was not necessarily a driving force behind the boom because only 5 percent of all public shares were financed from loans (Cecchetti 1992). Broker credits required a 200 percent cover

(Cecchetti 1992), although sale constraint was often an additional factor in a price decline due to smaller margins. Leverage produced by broker credits added to the number of future sale offers but this involved only a fraction of the entire stock volume suggesting it was not the most important factor behind the collapse. In the case of banks offering financial services, the moral hazard presented by the action of investment agents could contribute to the crash.

Galbraith (1994) brings up the examples of United Founders Corporation and Goldman Sachs Trading Corporation, where a shadow of suspicion might arise about inadequately informing investors of transactions and the effect and risks of leverage. The share price of these funds was 30 percent higher than the value of financial investments providing the bulk of assets. Still, this alone does not prove that public companies in general were overvalued. White (1990) analyzed corporate quarterly dividend data and could find no proof of “artificial” share price influencing on the part of managers by pumping up dividends. Signs of large-scale speculation do pop up but this does not necessarily imply unrealistic prices. The output and profitability of companies did not decline in this period (Friedman and Schwartz 1963) though the growth rate of dividend payment was lagging behind the rate of share price rise. This, however, was more a result of managerial pessimism than deteriorating economic outlook (White 1990). Technological and structural changes influenced investor expectations in a positive way. The crash was primarily not a consequence of deteriorating fundamentals. The 30 percent devaluation resulting from the share selling surge can even be deemed a negative bubble (Shiller 2000).

According to Cecchetti (1992) and Friedman and Schwartz (1963) price decline was due to government intervention, the shortcomings of monetary policy. The Federal Reserve Board increased interest rates

three times during 1928, with brokerage credits increasing concurrently. Risk premium attached to brokerage credits was fluctuating but here, too, an upward trend is recognizable implying that credit expansion was not a significant driving force behind capital market rise (White 1990). Whether intervention from the Federal Reserve Board was necessary continues to be a subject of debate. It is a fact that not only monetary authorities but also the government was committed to act against stock market phenomena seen as negative. Cechetti (1992) quotes the following note from the memoirs of Herbert Hoover, was elected as the US president during the month of March of that year: "To create a spirit of caution in the public, I sent individually for editors and publishers of major newspapers and magazines and requested them systematically to warn the country about the unduly high price of stocks." Besides direct influence, therefore, the government tried indirect methods to cool stock market speculation. Of course, the media published not only a negative outlook but also articles promoting the stock market, starting columns on the subject, quoting experts forecasting a lasting boom. Galbraith (1994) and Sornette (2003) quote the case of Irving Fisher, a respected Yale professor, who said 14 days before the crash: "In a few months, I expect to see the stock market much higher than today". Analyzing news from October 1929, Shiller (2000) could not find an explanation to what the direct cause of the collapse might have been.

Regardless of the cause, the US stock market indices kept on falling until 1932, losing, on average, 70 percent of their value. The 1929 crash ushered in the Great Depression hitting not only the US but world economy in general. The US production was down 50 percent compared to pre-collapse levels. The stock market crash undoubtedly had negative macroeconomic consequences, mainly in the form of increasing income insecurity. Cechetti (1992) states the demand for non-perishable consumer goods was dramatically

down as a result of the stock market crash and consumer indebtedness dating back to before the collapse. The latter was directly affected by the crash as the Federal Reserve Board did not give up its strict monetary policy curbing demand in the long run. Another result of the crash was a transformation of financial regulations. The Glass-Steagall Act ratified in 1932 separated classic banking activities from investment banking and the Security Exchange Commission was formed.

While many see the 1929 crash as the direct result of doggedly restrictive monetary decisions on part of the Federal Reserve Board, 58 years later another famous collapse, the 1987 crash, was traced back to altogether different factors. The economic background behind the boom of the 1980s was Ronald Reagan's tax-cutting economic policy which induced growing consumption and increasing corporate output (Soros 1994). The engine of economic growth was the government spending and foreign capital flocking to the US. The corporate sector was flourishing: a merger wave began, encouraged by favorable regulatory conditions. Junk bonds, the name referring to an especially high risk attached, became widespread as a capital market financing method, mainly for leveraged buy-outs. This was helped by the possibility of tax relief for corporate bonds, making buy-outs easier and the number of potential targets higher (Schwert 1992). Stock market prices rose sharply beginning in the middle of the decade, in line with corporate takeovers. Trading volume went up as well, while real estate prices also started to climb. Although Galbraith (1994) in a 1987 article thought an inevitable collapse was predictable, there is no clear, widely accepted explanation for the direct cause of the crash.

On "Black Monday", October 19, 1987, the Dow Jones Industrial Average (DJIA) fell by 23.1 percent while the Standard & Poor's Composite Index (S & P 500) was down 20.4 percent.

A survey of both institutional and private investors prepared by Shiller (2000) stressed “market overvaluation”. Average price per dividend (P/D) and average price per earnings (P/E) reached earlier historical highs recorded in the 1920s, 1930s and 1960s (Schwert 1992). The 1960s boom was, however, not followed by such a drastic price decline, implying other reasons behind this sudden fall (Sornette 2003). So-called programmed trading may have played a role in the large number of sales and record-high trading volume. This type of trading, widely applied ever since, means bids and complex positions are fed into computers and completed automatically in line with conditions set in advance. This method for investors to avoid further losses was rated important in the Shiller-survey. An example for complex positions is portfolio insurance, whereby securities were hedged by short put options or short future sales. So-called stop loss commissions were also spreading which resulted in an automatic sale order when the price of a given share dropped to a pre-specified level. On the day of the collapse, the trading system could not manage large volume sale orders in the prompt market, while futures liquidation happened faster creating losses in the process for portfolio insurance through basis risk.

Two pieces of economic news merit a mention with regards to the crash. Articles appeared in the preceding days about the US budget and trade deficits and their negative economic implications, and these were emphasized by institutional and private investors in the Shiller-survey. Trade deficit hit a new low in October 1987 not seen in a decade, which prompted speculation against the dollar (Soros 1994). Schwert (1992) finds a weakness in this argument: in coincidence with the decline of DJIA and S & P 500, almost every significant stock index started to fall. The fundamental reason being an “excessive” capital inflow bearing a negative impact on

the US economy does not stand, because this may even be favorable for other countries. An important piece of news could have been the admonition by Robert Prechter, an investor known as a “market guru”, who prompted others to sell. The *New York Times* published a price diagram comparing the current boom to that of 1929, raising the specter of a similar collapse, which indeed happened just a couple of hours after the paper went into circulation. The literature is unanimous in concluding that this crash had no long-term negative macroeconomic impact whatsoever and it was not followed by a general liquidity crisis. The Federal Reserve Board relaxed its previous monetary policy, not committing the mistake of 1929. Still, both the US and international stock markets were characterized by uncertainty, and changes in economic policy were inevitable.

A commission was formed, headed by Nicholas F Brady, to identify the reasons behind the stock market crash. The report prepared by the commission listed all the above-mentioned technical reasons, highlighting portfolio insurance and programmed trading, but it failed to mention other factors affecting stock market speculation. As a result of the work of the Brady-commission, regulatory changes took effect, the most important of which was the possibility of trade suspension that automatically applied in the case of extreme price fluctuations. The practical benefit of such trading-related regulation is debatable: to throw “sand” in the wheels of trading to slow down investor reaction is not supportable from the side of theory. Closing a stock market or suspending papers does not influence the degree of fluctuation, and bubbles might form even given high transaction costs, like in the case of the real estate market (Shiller 2000).

Elements of the Kindleberger-definition of bubbles can be identified in the stock market boom of the 1980s but examining

additional features gives a more precise picture of the circumstances of speculation. Besides leverage, discussed as the most important cause by the Brady-report, we cannot lose sight of the impact of governmental economic policy. In contrast to the active fiscal policy of the Reagan era strongly stimulating both supply and demand, as part of its monetary policy, the Federal Reserve Board began to pursue a stricter interest policy from the summer of 1987. This Janus-faced economic policy had, therefore, both positive and negative impact on the stock market, and news on the budget and trade deficit strongly influenced market prices as well as the high interest rate strengthening the dollar. These could play an important role in the crash by orienting and forming investor reaction as external factors. Another characteristic was the high moral hazard carried by the actions of managers in charge of corporate buy-outs. In some cases one could speak of fraud and inadequate disclosure (i.e., investor deception), which were verified afterwards (Galbraith 1994; Kostolany 1991).

The stock market crash of 1987 is interpreted as the end of a positive bubble, where the prices of previously overvalued shares reverted to their economically correct level, or as the beginning of a negative bubble, where uncertainty that resulted from panic caused shares to trade temporarily below their realistic value. Although these two definitions allow for different explanations, we believe neither can be fully confirmed. As soon as we qualified the term “bubble”, further interpretation problems would arise. In our opinion, therefore, the understanding of the bubble phenomenon is aided by the identification of the common roots of the above-discussed stock market collapses.

Putting aside terminological issues, we can be sure of one thing: investor opinions took a huge turn in the course of a couple of

days. The above-mentioned indications might provide the reason for a sudden change in speculator attitudes but we can confirm this only in hindsight, i.e., when the market has already collapsed.

1.3.4 Internet Bubble

The last great stock market boom in economic history, lasting from the middle of the 1990s until the millennium, was hallmarked by the rise of the Internet. This “Internet bubble” burst in 2000, bringing about the crisis of the infotech-sector. Yet again, emphasizing the irrational overvaluation of share offers an inadequate explanation being too vague and hard to support by facts. The large scale rise and sudden fall of information technology, communications and Internet shares can be tied to several different factors. In the following paragraphs, this bubble phenomenon will be analyzed focusing on Internet-related IT-firms.

Having overcome the recession of the early 1990s, the US economy began to grow. General optimism was helped by political events, too: the end of the Soviet Union, the conclusion of the Gulf crisis, and a new era of European unity. Due to the moderate rate of inflation, investor confidence began to climb back with regards to shares following the unpleasant memories of the junk-bond fuelled wave of corporate buy-outs and the Mexican credit crisis of 1995. In addition to this, from the middle of the decade the so-called baby boom started to make its impact. This term refers to the postwar generation causing a demographic boom. Members of this generation entered their 40s and 50s by the end of the 1990s and their saving and spending habits became decisive factors both in stock markets and the markets of products and services. Following the low of 1794.6 points after the 1987 crash, in eight years the DJIA more than doubled to 3839 points (3 January, 1995),

similarly to NASDAQ (National Association of Securities Dealers Automated Quotation) which comprised small-cap shares as well, going up to 744 points.

A drastic change was under way from the middle of the 1990s in the corporate, governmental and domestic use of information technology. The market for personal computers experienced dynamic growth; new companies appeared at the side of long-established IBM, becoming serious contenders in many market segments. A milestone in software development was marked by the launch of the Windows 95 operating system, and later the Internet Explorer, by Microsoft. Corporate application fields for computers also expanded to include internal networks, databases and integrated planning and controlling systems. Companies went head over heels to improve their IT-systems creating strong demand for both hardware and software. This prompted intensive development in such products and by the millennium, the performance of microprocessors, computers and peripherals rose by several orders of magnitude as their price fell to the fraction of previous levels. The other factors influencing the market was the Internet. Besides earlier popular tools (gopher, ftp, e-mail), the emergence of the World Wide Web (WWW), a convenient, graphics-heavy hyperlinked pages brought along qualitative changes. The Internet provided a new channel for companies to their consumers and clients. Full return on related spending was, however, only to be expected in the long run, with initial investment eating up huge amounts of money.

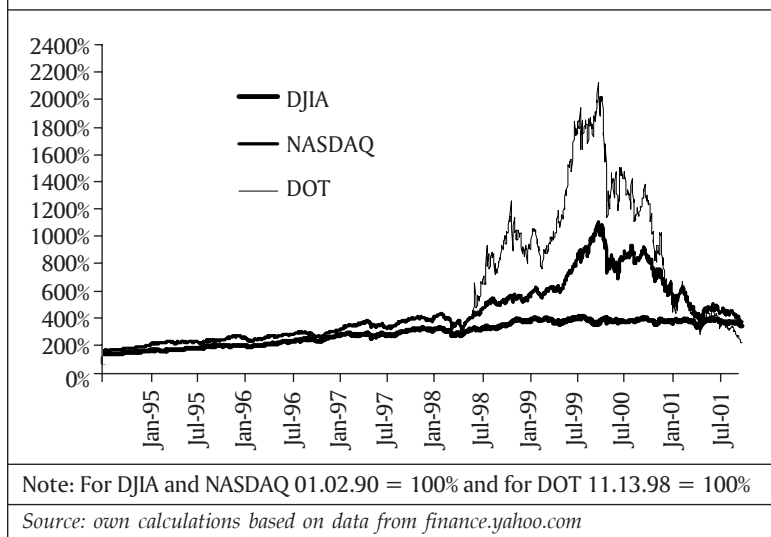
The IT-revolution made its symbolic debut in the stock market in August 1995, when Netscape, the developer of the then market leader browser, was listed. Netscape-shares rocketed from the issue price of USD-7 to 36 on the first day of trading. Later it came back to lower levels but by the end of the year it was traded at almost

100 dollars. 1996 saw a large wave of capital issues, mainly related to the creation of so-called dotcom-companies with an Internet-oriented business model. During initial public offerings, a wide scale of investors had, for the first time, the opportunity to buy a stake in such companies, providing fuel for later trading. In these days it was not uncommon to see share prices multiply on their first day on the floor. In the US capital markets, there were 40 huge IPOs (see details at <http://www.ipoinfo.com>).

Already established IT and communications companies also began to capitalize on the desire of investors to buy into the new industry. These companies used new capital issues to finance the acquisition of smaller dotcom-firms. Another doubling in the value of stock indices took only two years from 1995. After the Russian and Far East crises at the beginning of 1999, the growth rate of indices changed: DJIA rose by another 30 percent in subsequent years, while NASDAQ almost quadrupled during the same period. DJIA reached its maximum on January 14, 2000 at 11.723, and NASDAQ peaked out at 5048.62 on March 10, 2000.

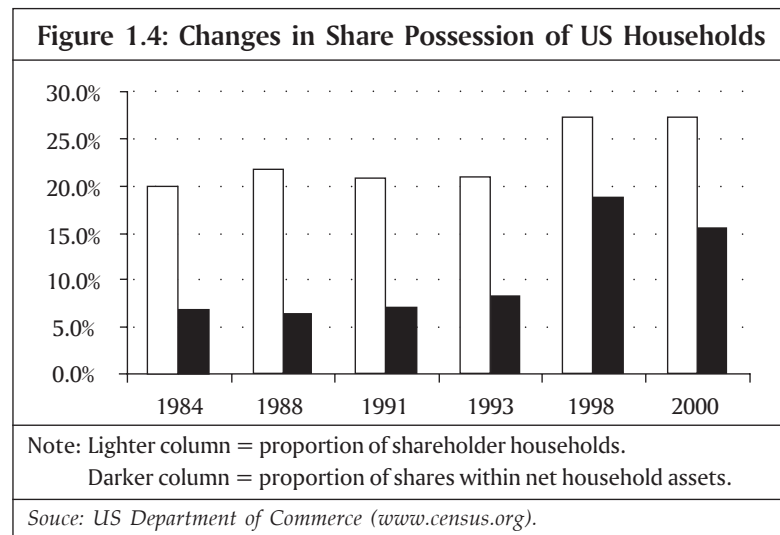
Figure 1.3 shows that these stock indices returned to their 1998 levels by the autumn of 2001, which was still 250 percent higher than in 1990. The rise and fall of dotcom-shares was more drastic. The DOT index, calculated from November 13, 1998, representing the share price evolvement of Internet-related companies, surged from the initial 254 points to 1333 on March 9, 2000, which is a more than five-fold increase. By September, 2001, it was a bit more than one-tenth its peak value, a mere 142 points.

The elements of Kindleberger's bubble scenario are identifiable here, too. The economic push was provided by the increasing role of IT both at the corporate and domestic level as well as by the

Figure 1.3: DJIA, NASDAQ and DOT between 1995 and 2001

emergence of the Internet as a new communication channel. Countries utilizing the benefits provided by these opportunities experienced a huge rise in efficiency. The drawback of all this was the vast capital expenses incurred during the replacement of corporate PC-arsenals, the implementation of the hardware and software infrastructure for online sales and purchases and the acquisition of “one-idea” dotcom firms. A new industry of creating, managing and transferring information was the key to efficiency growth, widely referred to as information economy, e-economy or new economy. Although these terms do not exactly cover the same phenomenon, and it is still a matter of debate whether we can speak of radical changes in economic processes or even in the science of economics, the positive impact on economy is indisputable. Bögel’s (2002) analysis supports the view that the US economic boom and the improvement of its economic indicators (productivity, inflation, unemployment rate) were clearly linked to the emergence

of new technologies. New players were coming from the ranks of the baby boom generation, who increased the proportion of stock investment within their portfolios. This is illustrated by the fact that while in 1984 only 20 percent of the US households possessed shares, in 2000 that number was 27.1 percent. The proportion of shares in the net wealth of households went from 6.8 percent up to 15.6 percent due to rise in volume and prices between 1984 and 2000, with its maximum reached in 1998 at 18.8 percent (see Figure 1.4).



The NASDAQ, which served as a low transaction cost automated secondary market for the US mid-cap shares, played an important role in facilitating the appearance of companies with large growth potential founded in the 1990s. It also provided cheap and easy access to shares for a large number of investors. Thus, the Internet was not only a germinating force for speculation but also a technical stimulant of stock trading through lowering transaction costs. This also led to the transformation of services offered by brokerage firms

and investment banks, because the consultancy role of such companies dwindled due to a warehouse of free investment information and analysis available on the Internet, but at the same time they advanced their online trading facilities (Barber and Odean 2001; Komáromi 2002b).

When a new technology emerges, it is always difficult to predict the future cash flow of a company, the risks of innovation, and the expected yield derived from this, in other words, the fundamental value of a share. An example of valuation uncertainty is the famous statement made by Alan Greenspan, the head of the Federal Reserve Board, in a conference of the American Enterprise Institute for Public Policy on December 5, 1996, in which he used the term “irrational exuberance” to describe stock market events. At the time DJIA was at 55 percent of its future maximum with 6437 points, NASDAQ was at around 25 percent of its subsequent peak with 1300 points. Analyses in *The Economist* began to refer to stock market bubbles a couple of months before the historical maximum of these indices was reached (*The Economist* 1999a-b) comparing the boom of technology shares to famous earlier speculations, showing diagrams of price rise and fall. The upward trend of DJIA and NASDAQ nevertheless continued unimpeded; in March 2000, the indices were still going up.

A mixed picture is painted about what corporate or macroeconomic news formed investor reactions at the time. On March 6, 2000, at the Boston College conference on “New Economy”, Greenspan addressed issues like structural discrepancies in macro-level supply and demand, an overstretched labor market (unemployment hit a 30-year low), inflationary threat and imbalances in the economy. The DJIA, and a day later NASDAQ and DOT reacted to the news with a decline, but, like many times

before, this decline was temporary. Favorable US productivity data were published on March 7, causing the latter two indices to rise to historical highs. DJIA, the representative of the shares of traditional companies (or to use an already widespread term, the “old economy”), was held back by the profit made by the management of Procter and Gamble. Two days later the business media reported temporary profit-taking and a potential trend change after the decline of share prices in the Japanese technological sector. The majority of international stock market analysts forecast further price rise and further divergence between DJIA and NASDAQ. Nikkei 225, the Japanese stock index set a 40-month record and the Beige Book reported robust growth in the US economy. DJIA and NASDAQ were a couple of percentage points down with high volatility.

The antitrust case against Microsoft, potentially unfavorable to the company, was followed closely in the IT-communications sector. This may have changed a role in an apparent change in sentiment, with investors starting to favor old economy shares once again. The media kept uncovering cases of “creative accounting”, irregularities in running the books of companies, prompting inquiries. While NASDAQ lost 10 percent of its value in the course of a couple of days, DJIA kept rising to new highs. The Federal Reserve Board hiked the base rate by 25 percentage points on March 21, to reach 6 percent. Usual quarter-end portfolio reshuffling resulted in further price decline. At the beginning of April, IT-communications sector shares suddenly began to fall both in the US and Europe. NASDAQ dropped 7.6 percent on April 3, losing another 5 percent the next day and falling yet another 10 percent on April 16 to hit 3677 points. The rest of the year saw strong volatility, excessive daily rises and declines in the value of NASDAQ. The trend was clearly downward now and by September 10, 2001, the index

reached 1,695 points, 27 percent of its historic high. DOT was down at 142 points, 11 percent of its peak value.

Important reasons behind the rise and fall of technology shares included not only capital market instability but also institutional factors, market deficiencies and the influence of government policy, forcing IT-communication companies into a monopolistic competition, and thus, drastically squeezing profits, as highlighted by Major's (2003) study. The study brings up examples of overpriced government licences in the telecommunications sector, the purchase of which stretched the finances of companies. With the whole sector slowing down, these businesses inevitably went into the red. Analyzing the IPOs of dotcom companies, Bogan (2003) concluded that high initial quotation was largely due to the specificities of ownership structure. The appearance of institutional investors pushed prices up but this cannot be considered as irrational pricing.

Investor behavior in the secondary market was often characterized as irrational. However, this cannot be clearly supported, either. The average P/E of S & P 500 shares, calculated by Shiller (2000), was 44.3, 30-40 percent over previous highs recorded in 1929 and 1966. Current P/E is in a weak negative correlation to later yields, which means a high P/E forecasts a low or negative average yield in the stock market. To support the argument for overpricing, we could mention that at the millennium average, dividend level was very low in light of historical data. Can we reasonably state that investing in an average portfolio in 2000 was an irrational act? If we consider the correlation between P/E and future yield to be statistically significant, we are faced with the methodological problem of what resemblance the past bears to the future. Negative correlation is valid only in case of unaltered investor behavior, e.g., a constant

stock proportion within financial assets kept. This indicator was, however, significantly changing, as shown in Figure 1.4. Throughout the 1990s, investors were putting an increasing share of their financial assets in stocks, with the enormous savings of the baby boom generation further raising demand for stocks.

A 40+, value of P/E might therefore seem high in historical perspective but in modified investment habits, preference for riskier securities and a stepped-up demand could well explain this level of the indicator. The usefulness of P/E is limited by the fact that profits were zero or negative, especially so in the case of dotcom firms, which strongly dragged average profit per share down. This amplified the natural flaw of averaging, concealing the distribution of individual values. P/E has no limiting value. We can find rules of thumb for expected value depending on the type of share, but this benchmark is impossible to specify in the case of a new, qualitatively different, non-comparable industry. Calculating with 1998 and 1999 results, dotcom shares were characterized by P/E values between 50 and 200. Shiller's (2000) P/E analysis does not infer irrational behavior on part of stock market investors of the millennium. A high P/E might simply indicate that long-term buyers become more scarce, with a dominance of short-term investors. The same can be deduced from low dividend levels as it fails to be a magnet for "lifelong" investors.

Apart from P/E, nothing really indicates an overvaluation of NASDAQ or DOT shares supporting the claim of irrationality. Investing in companies with zero or negative results does not mean an irrational behavior. An investor is not interested in current corporate profits but expecting later profits to be high. The buyer therefore "makes a bet" on the profitability of the industry and the given company within that. Comparing share prices for the new and old economy do not indicate an overvaluation of the former.

For example, the market capitalization of Cisco was seven times higher than that of Ford in 2000, but then again, those buying Microsoft shares in 1986, the year the company was listed, saw their investment multiplying 300 times by 2003, implying they were successfully betting on the future of the company. Those who bought Cisco shares near its maximum cannot be deemed irrational investors as it is a question of years to come whether their optimistic expectations were justified by the success of the firm. Cisco's share price being a fraction of its historical high means only "unfortunate timing" on part of some buyers.

The price rise of a company stock, fuelled by investor demand, is in many ways resembling the previously discussed Ponzi-scheme but it can only be considered irrational if the expected dividend or trading profit is unachievable. This is very rarely the case with stock investments. Dividend payment is not a "must" for companies, in contrast to interest payment on loans or bonds. In the case of most dotcom firms, not paying dividends for many years, owners were well aware that initial corporate investments will turn into profits for the company and dividend for shareholders only later. The success of investments made by the company, and thus their impact on the fundamental value of the share (and the company), will only be evident in hindsight. So looking at stock investments from this angle, most of them cannot be considered irrational.

There is only one case when share price may be clearly overvalued, and this is the case of investor deception on part of managers fully aware of the actual situation of the company. The current situation and future potential of a firm is best judged by the managers who possess most of the relevant information. The relation of owners and managers can be described with the agent-principal problem which occurs because of different information and interests. In line with

the management principle emphasized throughout the 1990s, maximizing shareholder value, corporate management was receiving a large proportion of its compensation in the form of stock options, making their income strongly dependant on share price performance. Apparently, this solved the conflict of interest between the two groups, both being interested in a continuous price rise. However, the agent-principal problem did not go away, because managers were thus prompted to manipulate corporate data if they intended to exercise their options. This could be done by short-term methods, which were coinciding with the interests of shareholders, but informational asymmetry remained as owners did not know how long this level of profitability can be maintained. Cases of “creative accounting” kept surfacing, when managers massaged balance sheets and income statements deceiving investors. In the owner-manager relation characterized by asymmetrical information, dividend plays the role of signal. Dotcom firms, however, did not pay dividend in order to exploit growth opportunities; so remote was even the theoretical possibility of dividend payment signaling financial stress and corporate difficulties. The spread of stock options therefore did not solve the problem. When, throughout the year 2000, suspicion of “creative accounting” was raised in the case of an increasing number of companies. This could also affect, through distrust, the shortening of the investment period. Interestingly, most scandals involved companies of the old economy. The explanation for this might have been that managers of such companies were hard-pressed to keep track of their investors who were flocking to the stocks of the new economy urged by the rise of dotcom shares, which they did by pumping up profit figures. Nevertheless, scandal after scandal did contribute to a shrinking trust in shares of either old or new economy.

From the macroeconomic point of view, the stock market boom of the 1990s was unfolding in the presence of favorable developments.

The US GDP in the second half of the decade was growing at a rate on average 1.3 percentage point higher than before, while average inflation was one percentage point lower than in the preceding four years (see Bögel 2002). Stock market price rise was attracting new buyers to secondary markets but demand for new economy shares was high in the primary markets, too. Internet-related shares promised high profits for investors, significantly influencing capital allocation in the economy. In other words, the fashionable technological sector sucked capital from other industries. Firms receiving “risk” capital made huge IT-investments increasing efficiency and contributing in an important way to the US economic growth. The dominance of a sector may be harmful, driving investors out of other industries, if this is coupled by an interest rate hike i.e., a direct increase in corporate capital cost. Greenspan, as the head of the US monetary policy, was closely followed by the public ever since his previously mentioned “irrational exuberance” speech of 1996. His public speeches and commission appearances as well as the decisions and explanations of the Federal Reserve Board became the most important pieces of the US economic news (Shiller 2000). Fund interest rate was lowered from 5.5 to 4.75 percent in 1998, then in June, August, November, 1999 and February, March, 2000, it was raised by 25 basis point each, to reach 6 percent. Consumer inflation rate did not change much in the meantime, and although rate hikes were routinely accompanied by emphasizing inflationary pressures, the Federal Reserve Board was ultimately pointing out the overvaluation of stock markets. As we could see in the above news analysis, share prices fell significantly in April, 2000, but another rate hike was carried out on May 16, now by 50 basis points, increasing base rate to 6.5 percent. Alan Greenspan was “successful” in the sense that DOT and NASDAQ shares plunged. It is still a matter of debate whether share of some particular sectors were falling to their “realistic” level, and whether the burst of the bubble was indeed inevitable.

The US economic growth was 3.1, 2, 5.2 and 7.1 percent in the quarters of 1999; 2.6, 4.9, 0.6 and 1.1 percent in 2000; however, the first three quarters of 2001 recorded a negative GDP change (−0.6%, −1.6%, −0.3%), which, by definition, signaled a recession. The same was implied by the decline in real asset investments starting from the fourth quarter of 2000, lasting two years. O’Quinn’s (2003) analysis prepared for the US Congress Joint Economic Committee stresses that the 2001 recession, in contrast to post-war crises stemming from declining consumption, was the result of earlier mal- and over-investments, for which he offered examples from telecommunications and media sector companies. Overinvestment was also found in traditional companies investing in e-business or e-commerce; software and hardware developments proved precipitate. One underlying reason was strong competition and the pressure to outbid rivals. With Internet-firms, it was either a case of failed ideas or lagging efficiency in production, commerce and application. Although the rate hikes of the Federal Reserve Board were made on the premise that overpriced shares caused excessive consumption creating an inflationary threat, the real long-term danger was presented by an intergeneration income reallocation and an inappropriate capital allocation threatening economic growth (Baker 2000). When a new industry becomes dominant, as with the technological sector at the turn of the millennium, coupled with a universal stock market boom, conceivably positive effects will outweigh negative ones in the long run. Dollar-billions flowing unchecked into dotcom firms went out the window because innovation financed by them proved to be heading nowhere. A re-examination a couple of years after the collapse of the Internet bubble suggests, however, that the experience of unsuccessful innovations and investments actually did help subsequent advances in productivity and economic growth (Bishop 2003).

The US monetary policy considered the stock market boom of the 1990s to be a bubble, trying to prevent or at least mitigate some of the objectively negative macroeconomic impacts. This does not necessarily mean, however, that dotcom investments were irrational decisions. True, investors did not interpret the message of continuous rate hikes correctly but it was impossible to precisely define the interest rate level which would trigger the crash. As in the previous examples, it is also apparent in the case of the Internet bubble that, sooner or later, the opinion of those in charge of economic policy might prove crucial. If a capital market boom is classified as a “bubble” by the decision-makers of economic policy, a collapse is only a matter of time.

1.3.5 Conclusions

The conclusion made by literary economics about stock market bubbles is that their most important feature is the crash. Economists would hardly speak of a bubble without a collapse of prices. When financial asset prices sink in a gradual, continuous manner, it is presumably not a cause but a symptom of an economic recession or decline. Besides the bubbles presented above, Kindleberger (2000) discusses another 28 financial crises up to and including the 1998 Russian case, which were accompanied by stock market speculation during the last two-and-a-half centuries. Other works on financial history (e.g., Galbraith 1994) also show that the term “bubble” is only attached to events with negative macroeconomic consequences or a crisis. There is no causal relationship, however, between a crisis and the formation and collapse of a bubble. The latter may follow or accompany an economic crisis and in some cases a stock market crash can indisputably deepen a crisis. The identification of a negative impact is indispensable in order to lend weight to a bubble. A widespread speculation is basically a way of wealth reallocation between two investing parties (winners and

losers) but the conservation of a bubble is in the interest of intermediaries (brokerage firms and investment banks), and we may even have to realize that a fourth party, the government, is also a beneficiary of a stock market boom. Ways in which this presents itself include a direct enhancement of economic performance by the investments made or the elevation of potential output level by innovation. In the end, all this may convert into votes in elections. The “moment of truth” following a crash can be a stimulant for beneficial structural changes in the economy. The most important negative economic impact is not direct: it is the deterioration of investor confidence. After a stock market collapse investors lower the proportion of stock in their portfolios causing an increase in the cost of capital for companies.

Traditional analyses, however, often fail to consider that shares of a potentially successful new industry are bought at the beginning of a bubble exactly because this investor confidence is “unduly” high. Even if the benefits of stock market allocation are not clearly supportable in comparison to institutional (banking) allocation (Bácskai 2003), the general trend of securitization does imply that spreading risks among a large number of investors is one such benefit. Another advantageous feature of stock market, is the fact that capital owners renounce their capital “for good” resulting in less restriction and more commitment in the case of bank lending. For innovative enterprises, or where a new industry is emerging with the need for risk capital, a stock market does a better job at financing because the myth of a “new economy” or investors influenced by a “herding effect” will facilitate the capital acquisition of trend-setting. As a negative consequence of this, mal- and over-investment might drag down profitability in the middle run, and run up the cost of capital when disappointed investors turn their back on their previous darling of an industry. The economy of a nation whose capital market is made more unstable by this may,

however, enjoy faster long-term growth because, following a period of possible slowdown, innovative companies will make use of the previously accumulated experience. Szalavetz (2004) believes it is primarily not the US economy that will benefit from the Internet bubble this way. In our view, however, there is nothing to indicate that, recovering from capital market depression, the US economy provides less opportunity for further innovation and IT-communication investment than other developed or developing countries. The commonplace statement “no pain no gain” (like in *The Economist* 2003. p.74) proved to be right in several historic cases discussed above.

Literary economics does not offer an answer to what the necessary and sufficient conditions of a stock market bubble are. Kindleberger’s definition aided us in assembling the typical traits of a stock market bubble but the criterion of “excessive speculation” is inadequate for many reasons. The analyses of stock market examples made clear that investors, analysts and decision-makers of the economic policy will, from time to time, consider some stock market phenomena as “excessive speculation” and qualify them as “bubbles”. In their view, bubbles do exist, and their behavior and reactions can even cause the burst of such bubbles. Lacking a practical definition we cannot provide an acceptable answer to whether, from the scientific point of view, stock market bubbles indeed exist and whether we can distinguish these from other stock market phenomena.

Building upon the conclusions of different economic approaches, in the following chapter we will attempt to create an analytical framework for the phenomena characterizing stock market speculation, according to historical experience and empirical research. These phenomena are indicators of an increasing probability that prices are peaking and the main feature of a bubble, a stock market crash, will ensue.

2

Anatomy of Stock Market Bubbles

“We should answer for a single question: are there more idiots than stocks, or more stocks than idiots?”

André Kostolany (1991. p.34).

As we saw in the previous chapter, there is no entirely valid and practically useful definition either for bubbles or asset price bubbles. Hereinafter, we will narrow the issue down to examining whether a change in investor behavior, sufficient for causing a stock market crash, is recognizable.

A strict definition for a stock market bubble will not be provided by us, either, but, with the help of factors increasing the likelihood of a crash, we aim to give an indirect answer to when we can qualify a stock market phenomenon as a bubble. Then we will list the stock market booms and crashes of economic history using the typical traits.

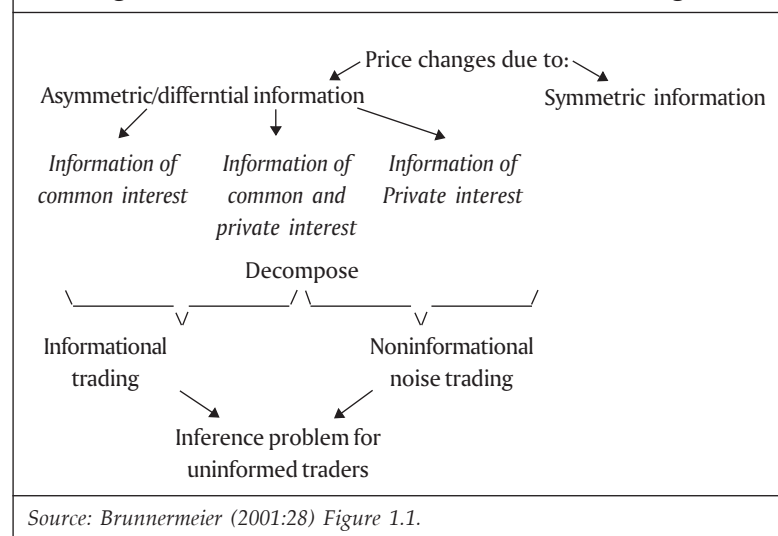
2.1 Investment Decisions and Noise Trading

Investor behavior can indirectly be analyzed with the help of price fluctuations. We set out from the assumption that investors are

making their decisions not randomly but in a conscious manner, based on some information. By information we mean any news related to the particular company or country, result of an analysis, or any reason prompting an investor to modify the composition of his portfolio.

Price may change if information is symmetrical, i.e., available for every investor and interpreted in the same way. For a change in price it is enough, however, if only a portion of the investors receive the news, or if they interpret its impact on share price differently. In such cases, price changes due to asymmetrical or different information can be divided into three types: One is information of general importance (of interest for every investor), like a sudden change in profitability of a given company; the resignation of the board; or a change in country risk. The other extreme is private information relevant only to an individual investor, like the expiration of a stock-covered loan or a private analysis made. Price

Figure 2.1: Inference Problem from Price Changes



change may ensue from information that is both general and private, like positive macroeconomic news modifying an investor's risk preference and causing him to withdraw his bank deposits to increase the proportion of shares in his portfolio. Potential causes of price change are summarized in the upper half of Figure 2.1.

If we classify price changes on the basis of investor decisions, we may distinguish between two types of trading (see Figure 2.1). By information trading we mean investor decisions based on relevant information regarding the fundamental value of a share. Here underlying information can be of general relevance or of both general and private relevance. If quotation shifts because an investor took a decision based on partly or fully private information, it may signal "information-less" or "noise" trading.

There is a problem, however, when other investors try to deduce the reasons behind a price change because in the case of asymmetrical or differently interpreted information, there is no way to deduce whether it is information or noise trading. This so-called inference problem is present even when there is an agreement about the impact of relevant information, i.e., the fundamental value of the share can be given. If we add to our analysis that in most cases a fundamental value of a share cannot be calculated (see Chapter 1), we cannot substantiate the effect of an additional piece of news on share price and we are faced with the deduction problem. This holds not only for asymmetrical but for symmetrical information as well. Noises make it impossible to correctly interpret the correlation between stock market news and share price changes as there is no method by which we can tell if that change was caused by information or noise.

Share price fluctuation or volatility is also influenced by noises. When noise trading heats up as the information content of prices

decreases, volatility might intensify. Groundbreaking studies by Shiller (1981), and Grossmann and Shiller (1981) proved that share price volatility is too high compared to dividend variability. A change in volatility is closely connected to pricing uncertainties. This effect was showed by a study by Eilifsen, Knivsflå and Sætertn (2001), which confirmed with regard to several markets that share volatility is higher before a general assembly resolution about dividends than after. This may be explained as more public information lowers information asymmetry (i.e., uncertainty) displayed in a simultaneously decreasing volatility (see also Komáromi 2002b). The same conclusion can be arrived at from the fact that in the non-trading hours of the day, price fluctuations is far lower than during trading hours. During the latter hours, noise is produced by trading itself as it means more private information (French and Roll 1986).

Our previous analysis based on mathematical and empirical economics showed that the formation of an asset price bubble is strongly related to information supply – the less information investors have (about the number of participants, timing of dividend payment), the more likely an asset price bubble forms. Practically the same was shown by the literary economics analyses, whereby bubble formation was tied to a given macroeconomic shock. Economic circumstances change and new and more efficient production factors make share evaluation more uncertain (it becomes more difficult to estimate future cash flow) because lacking relevant experience and lower quality information is at the disposal of investors. In such cases a logical and rational reaction of investors would be not to trade at all (Black 1986). That would mitigate pricing uncertainties, prices would diverge less from fundamentals, and bubbles would not form. Still, if investors are to make a profit, they have to make decisions in spite of information scarcity in a noisy environment.

Stock market crash may be induced by the dominance of noise trading, the cause of which is pricing uncertainty and a change in investor behavior. In the following, we will provide a possible psychological explanation for noise trading and make an attempt at measuring the change in investor behavior.

2.1.1 Illusion of Knowledge in Investment Decisions

Odean (1999) showed that investors are trading in excess of the information they receive. This happens because investors are overly trusting the accuracy of their information and have a tendency to overestimate their own capacities. This overconfidence fuels the illusion of knowledge. If an investor believes decision-making accuracy is directly proportional to the volume of information, he is trapped in this illusion of knowledge, because even in new pieces of information, investors are seeking out and emphasizing the elements confirming their earlier views.

My earlier study (Komáromi 2002b) showed that not only the absolute but also the relative amount of information is a factor in investor behavior in a simulated market. Those surveyed not only found a more attractive investment in a share with more information supplied, but shareholding increased in general when the length of the share descriptions was different. A market with such an informational structure is more “exciting” thereby more attractive to investors, because it creates the feeling of “something is in the air”. Thus, irrelevant information, which is in no way related to share evaluation, does affect the behavior of economic actors feeding on an illusion of knowledge. This illusion is further enhanced by decreasing transactional costs (Barber and Odean 2001; Komáromi 2002b). An example of this is when investors have the opportunity to borrow for purchasing shares cost-per-share goes down due to leverage.

An economic situation or change of production factors causing a more uncertain pricing does not result in less, but actually more trading. Noise trading not substantiated by relevant information heightens uncertainty and investors are yet again faced with the deduction problem. If a share price goes up, this might be interpreted as a favorable signal and vice versa. This interpretation is usually confirmed by post-event explanations published in the media and *hindsight bias*, a psychological trait characteristic of decision evaluation. If an investor begins to buy following a rise and sell following a decline, he is pursuing a positive feedback strategy. The studies by Shleifer and Summers (1990), Shiller (2000) and Shleifer (2000) confirm that this strategy is popular among investors and its impact is observable in price evolvment. Trend-following behavior from investors applying a positive feedback strategy (equivalent to a herding effect, as formally described by Banerjee (1992)) will, as a result of the deduction problem, generate further noise, i.e., the intensification of noise trading.

The formation of Kindleberger bubbles can thus be amended with the observation that a rise in share prices may lower information content and increase noise trading, which is explained by the illusion of knowledge.

2.1.2 Co-movement of Stock Prices

Traditional pricing models take the effect of noise trading into account only in the rise of volatility, because noise may be equally likely to positively or negatively affect prices, i.e., investor behavior (Komáromi 2002a). However, noise is systematic (Barber, Odean and Zhu 2003) and may be amplified unidirectionally. Although investors usually have heterogeneous opinions and preferences, in a given situation, their opinions may begin to converge due to herding effect and positive feedback.

Can we objectively measure the critical point in the opinion change of market players, the one-sided distortion of their expectations? Robert Shiller prepares the bubble expectations index terminally beginning in 1989 quantifying the expectations of institutional investors using a questionnaire. This index, summarizing short- and long-term investor expectations, did not show a trend in the examined period and its evolution offered no clue as to the future movement of share prices. Shiller's (2000) work provides data culled from other surveys but these are not comparable and not suitable for making general conclusions. There is, however, a method to indirectly track investor opinions by an examination of share price co-movement, and this shows a one-sided amplification of noise.

Share price co-movement may have several reasons in a stock market. The study of Morck, Yeung and Yu (2000) traced the annual synchronous movement of share prices back to structural and institutional factors in an international context. Structural or fundamental factors that can be considered causes for co-movement are ranging from the number of shares listed in the exchange to country size, similarity of business activity, change in profitability, etc. The details of the study offer explanation for a major proportion of co-movement with the help of corruption indices and the legal protection of shareholders. Their main focus was why share price co-movement is stronger in developing countries with lower GDP per capita than in more developed ones. Fundamental and institutional factors (like market size, number of listed shares, corruption index, and minority shareholder protection) all showed that the degree of capital market maturity can mostly explain such co-movement. If a stock market is less developed and segmented, characterized by less institutional investors (investment and hedge funds) and less corporate transparency by Western standards, then

share price is less of a reliable indication for investors. In such countries, we believe the missing factors can be found in the behavior of international investors, their portfolio reallocation principles and rules of thumb. It is because, in spite of the above mentioned features and the increasing uncertainty of pricing, international and domestic investors still have to make decisions, which will inevitably result in the amplification of noise trading.

A study by Barberis, Shleifer and Wungler (2003) showed that the co-movement of the US stocks and the S&P 500 did not depend on corporate news related to the shares but on investor trading habits and, reactions to non-fundamental news. Their empirical research showed that the price of shares would more closely follow the path of the market index after being included in the S&P 500. On exclusion, just the opposite was observable. According to their explanation, investor attitude changed with regards to the particular stocks without any underlying fundamental news. In line with the thinking of this book, we can state that the degree of noise trading increased with the inclusion in the index and decreased on getting out of the S&P 500.

Daily co-movement of share prices has a different background from synchronicity explored in the literature. While the latter can be traced back to fundamental and institutional factors, daily share price co-movement is dominated by trading patterns and psychological motives on part of investors. Next, we will examine co-movement changes over time which may be an indicator of future investor behavior regarding shares that belong to a category of sorts. In order to implement this, we are going to use the mathematical basis laid down in the above-mentioned studies.

To measure co-movement, we will use the average determination co-efficient (R^2) of linear regressive equations determined by the

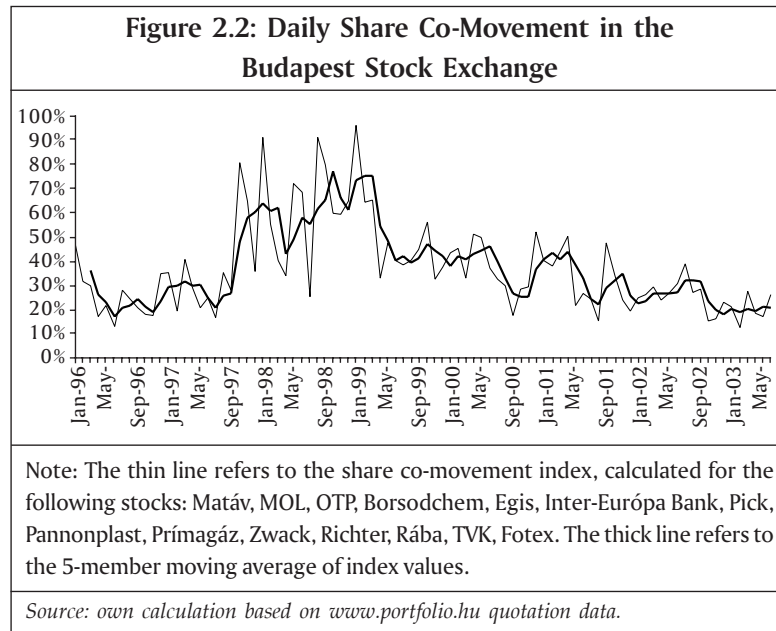
daily market index yield and the daily yield of a specified number of shares:

$$R_t^2 = \frac{\text{cov}_t(r_i; r_m)}{\sqrt{\text{var}_t(r_i)\text{var}_t(r_m)}}, \quad (2.1)$$

where r_i is the daily yield of share i ; r_m is the daily yield of the market index; $\text{cov}(\cdot)$ is the covariance of variables; and $\text{var}(\cdot)$ is the variance of the variable in the t period. The co-movement index gained from Equation (2.1) is divided into non-overlapping equal periods (e.g. one month) and calculate it for several periods ($t=1, 2, 3, \dots$). The time series received this way shows the strength of share co-movement and how it changes from period to period.

The Budapest Stock Exchange is a less developed stock market on many parameters. In many aspects, shares listed here can be considered as belonging to one category which is a prerequisite for characterizing share co-movement with the indicator given in Equation (2.1). Most of the trading in the Hungarian stock market is carried out by foreign investors who are not able to diversify domestically due to the small number of shares listed. While Hungarian shares carry a market risk of 85-85 percent and an individual risk of 5-15 percent, in the case of the New York Stock Exchange this proportion is just the opposite. Due to the low activity of domestic institutional and private investors, prices are determined by the portfolio decisions of foreign investors, which domestic investors may interpret as signals, probably integrating them into their strategies (Pound and Shiller 1986).

Figure 2.2 shows the co-movement index of the 13 highest volume shares listed in the BSE from January 1996 to June 2003. To calculate the determination co-efficient, one-month period was chosen and BUX, the official index of BSE, was used as market index. The average value of the share co-movement index was significantly higher in the



period from September 1997 to April 1999 than in other periods, meaning a high variability in co-movement, the increase of which implies a shift towards noise trading.

We believe the co-movement index calculated above for the Hungarian market is a suitable tool to track noise trading because BSE is characterized by a small number of shares, dominance of foreign investors and little room for diversification. In such cases co-movement index may be a signal of large scale price decline later. The Hungarian example will be explored in a wider context in Chapter 3. For more advanced capital markets, it is necessary to refine co-movement measurement and to create sophisticated indices, which can be an objective of further research.

The price co-movement of stocks, other financial assets and investments not justified by fundamental reasons is a recurring theme

of historical bubbles discussed in Chapter 1.3. Kindleberger (2000), Galbraith (1994) and Shiller (2000) mention several examples where optimistic investors could not distinguish in the course of a stock market boom between realistic enterprises based on well-grounded ideas and companies founded on insecure basis or fraud. As a consequence, all shares of the hyped industry of the era were rising almost continuously. An example of this is Internet- related firms during the dotcom boom at the end of the 1990s and the uninterrupted success of serial capital issues by those dotcom firms.

Henceforth, we will make use of share price co-movement not in a mathematical but a literary analysis, accepting the hypothetical assumption that price co-movement not justified by fundamentals can signal non-information based, i.e., noise trading, forecasting that may result in a future price collapse and a crash.

2.2 How to Distinguish Stock Market Bubbles?

In the following, we will list typical features of bubbles using the elements of the Kindleberger definition, outlining stock market bubble anatomy.

The formation of a bubble starts with the clear and continuous rise of share prices caused by an exogenous shock affecting the economy. This initial displacement influences future outlook in a positive way, generating expectations of further rise. If share prices distinctly begin to rise, uninformed investors, partly due to the deduction problem, take this as a positive signal. Share of particular industries and companies may become popular. New buyers appear in the market and the proportion of shares increases within portfolios causing a surge in trading volume. As many investors are pursuing a positive feedback strategy, this coupled with the lack of relevant information will amplify noise trading.

A stock market boom can be described as a bubble if there is high probability of a large scale fall in share prices. Stock market crash is not triggered by fundamental news or by a certain level of share overvaluation. Instead, it happens because of a drastic change in the behavior of market players. This is why the necessary and sufficient conditions for the bursting of a given asset price bubble, applicable in practice, cannot be provided with the tools of mathematical economics. A market crash will ensue with a high likelihood if noise trading becomes dominant, the signals of which are to be found in the following stochastic factors:

- **Increasing effect of leverage.** As a direct consequence, more money is at the disposal of investors (see previous paragraph). If investors borrow to buy shares, have the opportunity to postpone payment, or making a purchase without full financial cover, it is impossible for them to realize long-term profit on that particular stock, i.e., they are unable to make dividend payment. This means a short sale constraint shortening the average investment period. The due date of debt repayment is private information incurring, on the one hand, deduction problem and noise trading. On the other, if there is an increasing pool of leveraged shareholders, repayment date and a short sale constraint will more likely be due at a given moment, amplifying the degree of the price fall.
- **Increasing activity on part of the economic policy.** Economic policy, and monetary policy in particular, can directly influence the conditions of credit, bond and money markets connected to stock markets, thus making the state a protagonist in the stock market. Intended monetary expansion or restriction is always a signal, as it attempts to stimulate or curb the rise of prices. For example, the frequent

and tendentious revisions of the base rate convey a series of signals towards market players. In theory, the opportunity cost of shares (the rise in bond yields) prompts investors to lower the share of stocks in their portfolios. Sometimes, however, investors are late and inaccurate in integrating signals of the economic policy into their expectations, increasing the volume of noise in the market.

- **Increasing number of corporate scandals, fraud and corruption.** Share price rise augments the power and influence of executives, while directly affecting their wealth through managerial stock options. Information asymmetry enables them to use methods verging on fraud to maintain the trust of owners-shareholders if corporate performance is not contributing positively to the share price. The disclosure of such cases may undermine trust, causing a change in investor behavior and prompting the sales of the shares of other companies.
- **Fundamentally unjustifiable co-movement of share prices.** The co-movement of different shares or investments may signal a dominance of noise trading. When investors do not evaluate a given asset based on its expected future yield, i.e., do not evaluate an enterprise based on the probability of its future success, and instead they make simplifications and use rules of thumb, a fundamentally unjustifiable share price co-movement may ensue. If this co-movement increases, price fluctuation may signal a dominance of noise trading, forecasting a stock market collapse.

The last characteristic of stock market bubbles is that the boom and subsequent crash must have an impact on the economy. Only then will the natural instability of stock markets become a factor affecting economy, without which the concept of a bubble would

be weightless. By negative impact we mean a slowdown in economic growth or a decline in consumption and/or investment. However, a bubble may carry positive impacts as well which display themselves either during the boom or following the crash, in the long run. One such effect is the facilitation of capital issue for a given industry allowing a better financing of riskier solutions and developments. After a crash, the framework surrounding the stock market may also change, bringing about legal, regulatory and institutional evolution as a consequence of the collapse. If a stock market boom has no impact on the economy of a country or on related regulation and institutional structure, we contest such a phenomenon can be called a bubble.

Initial displacement, distinct price rise, new buyers (increasing trade volume) all are direct traits of a bubble, while leverage, the large number of economic policy signals, corporate scandals, fraud and corruption are indirect indicators of the phenomenon. In light of the above description, we sum up in Table 2.1 the most important and the most recent stock market bubbles in economic history, using the studies by Kindleberger (2000) and Shleifer (2000).

Table 2.1: (I.) Characteristics of Stock Market Bubbles in Economic History		
<i>Period</i>	1710-1720	1717-1720
<i>Country</i>	England	France
<i>Speculation on</i>	Stocks of South Sea Company.	Stocks of Mississippi Company.
<i>Initial displacement</i>	New markets, trade with South America. Undertaking and conversion of Government debts.	New market, trade with Louisiana. Conversion and securitization debts.
<i>Fueling investors' positive attitude</i>	Easier public offerings in succession. Support of Government (Bubble-Act).	Easier public offerings in succession. Law's full powers in financing decisions, and absolute support of Government.
<i>Signals for the danger of crash</i>	Insider trading involving MPs, Leverage.	Leverage Critiques on unsophisticated investors (insider information); Administrative steps.
<i>Crash</i>	August 1720	May – December 1720
<i>Macroeconomic / regulatory effects</i>	Bubble-Act made it difficult to found new joint-stock companies.	Reform of finance of State started and came to a sudden standsill after the crash.

<i>Period</i>	1845-1847	1873
<i>Country</i>	England	USA
<i>Speculation on</i>	Stocks of railway companies	Stocks of railway companies
<i>Initial displacement</i>	New, fast and cost efficient way of transport	Expansion after American civil war
<i>Contd...</i>		

<i>Contd...</i>		
<i>Fueling investors' positive attitude</i>	Development of infrastructure by Government.	Large financial government support for railways.
<i>Signals for the danger of crash</i>	Insider trading (connection between London Society and George Hudson). Leverage (dividends are financed by public offerings).	Leverage (short term loans from Europe).
<i>Crash</i>	October 1847	September 1873
<i>Macroeconomic / regulatory effects</i>	Suspension of Banking Act in 1844. Reform in Accounting (dividends can be paid from profits).	Because of development of infrastructure, economic activity increases in western states and trade with eastern states.

Table 2.1: (II.) Characteristics of Stock Market Bubbles in Economic History		
<i>Period</i>	End of 1880s	1920s
<i>Country</i>	England	USA
<i>Speculation on</i>	Stocks of companies interested in agricultural lands in Argentina.	Stocks after IPOs
<i>Initial displacement</i>	Increase in demand of Argentine agricultural products.	End of deflation fears after WWI. Increase in mass production.
<i>Fueling investors' positive attitude</i>	Increase of number of public companies. Political incentive of Argentine state president.	Development of financial services (investment fund). Easier public offerings in succession.
<i>Contd...</i>		

<i>Contd...</i>		
<i>Signals for the danger of crash</i>	Biased analyses (Barings), insider trading.	Leverage, buying shares on margin. Actions of politics and economic policy.
<i>Crash</i>	November 1890	October 1929
<i>Macroeconomic / regulatory effects</i>	<i>Coup d'etat</i> in Argentina. Restriction of foreign investments.	Glass-Steagall Act, "Chinese" wall between (separating) banking and investment services (SEC). Splitting big companies. Deepening economic crisis.

<i>Period</i>	1982-1987	1990s
<i>Country</i>	USA	South-East Asian Countries*
<i>Speculation on</i>	Stocks of reorganized companies	Stocks, Government bonds
<i>Initial displacement</i>	Waves of merger & acquisition because of cost efficiency	Increase of speed of economic growth, cost efficiency of reorganizations. Deregulation, liberalization.
<i>Fueling investors' positive attitude</i>	Government incentives for economic development. Development of financial services, tax-cuts.	Fix exchange rate system Government incentives for economic development (tax benefits).
<i>Signals for the danger of crash</i>	Junk-bonds. Insider trading (management).	Manipulating financial reports. State budget deficit
<i>Contd...</i>		

<i>Contd...</i>		
	Program-trading.	and expansive economic policy.
<i>Crash</i>	October 1987.	December 1997, January 1998.
<i>Macroeconomic / regulatory effects</i>	Changes in trading rules. Brady-Commission. Making buying outs more difficult, less tax benefits.	Domino-effects in emerging security market. Restrictions of capital flows.

Table 2.1: (III.) Characteristics of Stock Market Bubbles in Economic History

<i>Period</i>	1990s	1990s
<i>Country</i>	Russia*	Brazil*
<i>Speculation on</i>	Stocks and government bonds.	Stocks and government bonds.
<i>Initial displacement</i>	Positive signs of economic recovery after collapse of USSR deregulation, liberalization.	Positive consequences of stabilization pack of 1993-94. Deregulation, liberalization.
<i>Fueling investors' positive attitude</i>	Fix exchange rate system. Government incentives for economic development.	Fix exchange rate system. Government incentives for economic development.
<i>Signals for the danger of crash</i>	Large state budget deficit. Corruption and scandals in business and state sectors (e.g., privatization).	State budget deficit and expansive economic policy. Frauds in financial reporting.
<i>Crash</i>	August 1998	January 1999
<i>Macroeconomic / regulatory effects</i>	Domino-effect to Eastern and Central European countries.	Domino-effect to Latin America.
<i>Contd...</i>		

<i>Contd...</i>	
Period	1995-2001
Country	USA and developed countries
<i>Speculation on</i>	Dotcom companies.
<i>Initial displacement</i>	Computerization (PC) in a wide range: Development of Internet households, firms.
<i>Fueling investors' positive attitude</i>	New channels of communication. Cost-efficient and fast trading, marketing, etc.
<i>Signals for the danger of crash</i>	Activity of monetary policy. Frauds and scandals in big firms.
<i>Crash</i>	March-April 2000
<i>Macroeconomic / regulatory effects</i>	After economic recession, robust economic growth. Debates of corporate governance in a wide range. Regulation on more transparent investment decisions.
* Note: Stock market bubbles in Eastern and South Asia, Russia and Brazil were accompanying events of currency crises. In these countries, stock markets do not play a great role like in Anglo-Saxon countries, but the prices of certain shares and market indexes drive investors' attention. There were domino effects in related regions and contagion in other securities. These effects had negative impacts on the FDI to the regions, and worsened investors' appreciation.	
This table consists some quotations from Galbraith (1994) Kindleberger (2000), Shiller (2000) and Shleifer (2000).	

3

The Hungarian Case, 1996-2003

“A change of political system takes 7 month, an economic one at least 7 years. A change in people’s attitude may even take 70 years.”

Árpád Göncz,
(the President of Hungary 1990-2000).

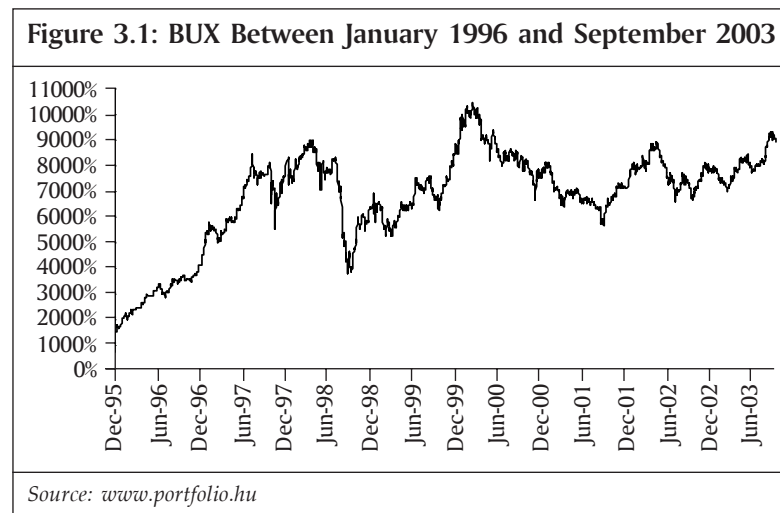
BSE re-opened in 1990 after a 42-year break as one of the crucial institutions of post-socialist market economy. Of East-Central European countries, Hungarian economy was the most open, and as a consequence, domestic securities market began functioning a decade earlier (Rotyis 2001:167). The first, and for some time the only listed company was IBUSZ, which saw its share price multiply in the course of a couple of month and then falling back to its initial issue level. The private sector was active in creating financial institutions: during the first years after BSE resumed, many private companies tried to issue capital through the stock market. At the beginning of the decade, a large number of domestic equity traders and brokerage firms were actively participating in the market as well as an increasing number of foreign companies.

Still, until 1996 we cannot speak of an active domestic stock market because of the low number and low liquidity characterizing

the Hungarian exchange. The period between 1996 and 2003 was more eventful both for BSE and investors, thanks to the privatization and public listing of previously state-owned companies. In the stock market, foreign investors encountered a full liberalization which was soon complemented by the liberalization of the market for derivatives and Hungarian government securities embodying short – and long-term debt. Rotyis (2001) believes that these were the market reasons why the Hungarian securities market became more internationalized than neighboring markets, more closely connecting to foreign stock exchanges.

In the following, we will examine whether the boom and bust experienced by Hungarian shares can be considered a bubble with mostly domestic cause or mostly domestic economic impact.

Figure 3.1 shows the change of BUX, the official index of the BSE between 1996 and 2003. Three distinct periods can be

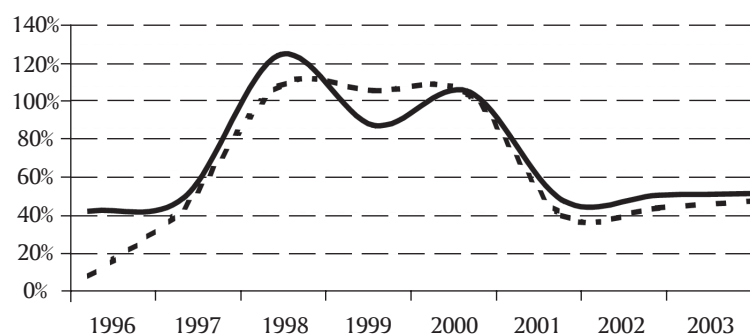


identified during the evolution of BUX. During the first boom, BUX rose from 1,500 points in January 1996 to 9,000 points by

the spring of 1998. This was followed by a fast, 50 percent dive lasting until September 1998. The second boom reached its high in the spring of 2000 with 10,472 points. The third period saw BUX fluctuate in the 6,000-9,000 range. We will now identify the reasons, that are directly related to the Hungarian exchange, behind the rise and fall of BUX in light of the bubble parameters discussed in the previous chapter.

The shock causing the initial displacement was provided by the 1995 Bokros-package and the stock exchange privatization of state companies. Economic stabilization measures lent credibility to economic policy, while crawling peg lowered exchange rate risk of forint. These were prerequisites for the involvement of foreign investors in the stock market privatization of Hungarian firms. Between 1995 and 2000, approximately 40 percent of capital inflow arriving in Hungary was related to companies listed on BSE. Not only foreign, but domestic institutional and individual investors

Figure 3.2: Trade Volume and Turnover Velocity Between 1996 and 2003



Note: Dotted line = trade volume; 1998 = 100%.

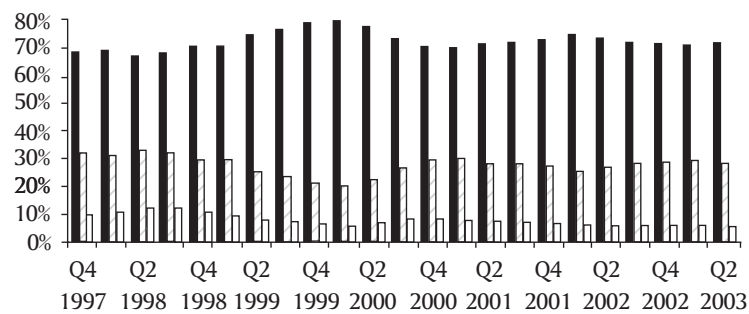
Solid line = turnover velocity (annual volume divided by annual average capitalization).

Source: own calculations based on data from www.bse.hu and www.fese.org.

also had the opportunity to buy shares in companies like TVK, BorsodChem, OTP, MOL, Pick.

In the middle of the decade BSE trading volume grew at an enormous rate in absolute value. The number of listed shares continuously grew until 1998 and reached 50. Trade volume went up even compared to market capitalization, i.e., turnover velocity increased (see Figure 3.2). After 2001 investor activity declined so we definitely cannot speak of a bubble in the third period. Internationally BSE is a small stock exchange and only a segment within the Eastern-Central European market in the eyes of foreign investors. Trade volume rise was largely due to such foreign investors, pulling domestic investors with them until 1998. The first fall in share prices in 1998 was affecting domestic investor more, which is shown by the fact that they owned 30 percent of BSE capitalization in 1997 and less than 20 percent by the end of 1999 (see Figure 3.3).

Figure 3.3: Structure of Share Ownership in BSE Between 1997 and 2003



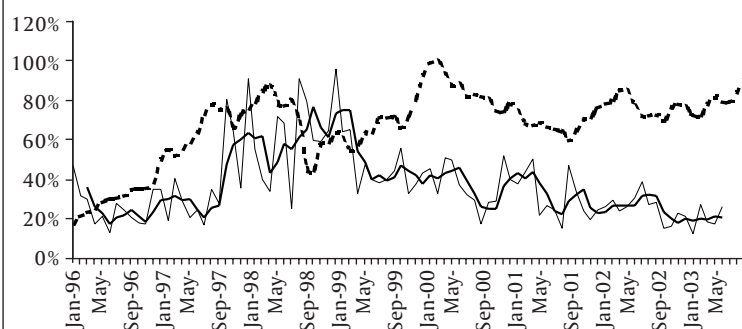
Note: The black, grey and white bars show the proportion of foreign, domestic and individual domestic investor ownership, respectively.

Source: www.mnb.hu

Similarly to the first period, between spring 2000 and autumn 2001, BUX dropped by almost 50 percent. This decline, however, took place during a longer period. The change in shareholder structure (Figure 3.3) shows that the price change of the millennium was in line with a gradual decline in the proportion of foreign investors, which means we can speak of a crash only in the first case, if at all.

Domestic investors suffered heavier losses, not only in prompt trading but also in the ever-more significant BUX futures contracts. Another form of leverage was the loan-based stock buying schemes advertised by securities trading firms, which became very popular with individual investors by 1998. The daily co-movement of share prices indicates that noise trading grew dominant (see Figure 3.4), which suggests that the crash of 1998 could have happened because

**Figure 3.4: Daily Co-Movement of BUX and Shares
Between 1997 and 2003**



Note: Dotted line = BUX (maximum = 100%), Thin line = stock co-movement index, which is the average R2 of linear regression equations of market and individual share daily returns (Matáv, MOL, OTP, BorsodChem, Egis, Inter-Európa Bank, Pick, Pannonplast, Prímagáz, Zwack, Richter, TVK, Fotex). Thick line = 5-member moving average of index values.

Source: Own calculation based on price data from www.portfolio.hu.

of a drastic change in investor behavior. A reasons for this could include portfolio reshuffling on part of foreign investors following the Russian crisis and the defection of individual investors.

The end of 1999, start of 2000 boom and bust already happened at lower investor activity and trading volume. BUX evolution was by then affected only by foreign events, like the burst of the US Internet bubble. BSE trade volume fell dramatically in the second half of 2000 and in 2001 resulting in the further marginalization of the Hungarian exchange.

As an important feature of a possible Hungarian stock market bubble, we have to take note of macroeconomic impact. Examining several factors, however, it seems that in the past period, the Hungarian exchange could not have much macroeconomic impact. Following the 1996 boom characterized by the privatization of state-owned companies, no major public offering happened. After this BSE volume dropped to a fraction of its previous highs, proceeds from privatization, constituting a major part of FDI inflow were probably not dependent on the existence of the stock market even in the first period. This confirms implicitly that the Hungarian exchange did not offer a risk-spreading opportunity for foreign investors because domestic investors' contribution to market liquidity was limited. We can find no other signs, either, suggesting Hungarian economic policymaking was influenced by stock market events.

Companies did not make use of the capital issue opportunities offered by the stock exchange, this being both a cause and an effect of the small economic weight of BSE. The new Securities Act ordering the listing of companies based on some criteria did not bring the intended results, which is again a proof that economic problems often cannot be tackled by legal methods. An attempt on the part of BSE to lower listing costs was not an adequate

motivation for companies. Behind a preference for bond or debt market lay a non-Anglo-Saxon corporate governance style and conscious management decisions. The latter were aimed at the preservation of independence which is only compatible with public offerings if a large number of individual investors can be reached.

In September 1998, stock proportion in household assets was almost 9 percent, gradually declining afterwards. Households keep only a marginal proportion (13 percent), of their assets in securities, and only 2 percent in stocks, in particular. Another 9 percent is in investment funds but only a fraction of this (3 percent) is held in Hungarian shares. This drastic fall in the proportion of shares did not have any significant impact on consumption, because it was this very period in which the gradual indebtedness of Hungarian households began.

The low number of domestic investors, and particularly individual investors, is the main reason behind the lack of continuous liquidity, a staple of a well-functioning market in the Hungarian exchange. Today BSE trade volume sometimes reaches 2000 levels but 90-95 percent of this volume is still attributed to 4-5 shares. There are no new offerings in the Hungarian market but perhaps there would not be much interest in them as the outdated savings structure of Hungarian households shows no evolution. Underdeveloped Hungarian financial culture is the reason why the economic importance of BSE is still marginal. Based on the approach of this book, we argue that the booms and busts experienced in BSE between 1996 and 2003 cannot be termed bubbles.

4

Summary

This book is aimed at providing a definition of “stock market bubble” filtering out the contradictions and weaknesses of relevant theories. First, we presented existing definitions and unresolved contradictions using the tools of mathematical and literary economics. An example of this was the issue of fundamental value and excessive speculation. We summed up investor behavior characteristics diverging from rationality, the diverse results of laboratory experimental economics, and the features of the most important stock market bubbles in economic history.

A typical bubble formation was described as follows:

The emergence of a stock market bubble starts with a robust and continuous price rise usually caused by an exogenous macroeconomic shock. This initial displacement affects expectations regarding the future in a positive manner. Stock market trade volume soars in line with an increase in noise trading. A boom like this can be called a bubble if the probability of a drastic decline, i.e., crash, grows. Only a real macroeconomic or regulatory impact of the crash can lend economic weight to the term “bubble”.

An increasing likelihood of crash is, therefore, indicated by the intensification of noise trading. Signs of such intensification include an increase in the activity of economic policymakers; news related to corporate scandals, frauds and corruption; leverage; and in some cases share co-movement. The final trait of a bubble is the most important one, because this emphasizes the basic wealth reallocation role of stock markets. Stock market instability will inevitably incur boom-bust cycles, of which actual bubbles can be identified using the above criteria, making it a concept with economic relevance.

Stock market bubbles do exist because the term is used by economists to describe certain market phenomena. This book provides a possible answer to what phenomena we can call bubbles i.e., what indicators suggest as a “qualified case” of stock market boom. This answer is only one of many, but we believe it is more accurate and valid than previous ones.

The examination and analysis, in light of this definition, of additional international and domestic cases can be the topic of further research, as well as the assembly of a comprehensive set of causes behind share co-movement, sorting out methodological problems; and preparing relevant comparative studies.

Summarizing the Messages of this Book in Theses

Theses* (1) – (5) summarize and recompose the theoretical, and contradictory results of related literature, which are the basic points of the book. The purpose of my work is to clear these contradictions and to put theoretical problems into a new framework, and finally to give a more appropriate explanations for stock market bubbles. Further propositions comprise the essence of new results and conclusions of the book. Proposition (6) sheds a

* Based on the theses of my dissertation (Komáromi 2004).

light on the relationship between investors' behavior and a stock market bubble, and explains the role of noise trading. Points (7) – (9) summarize the phenomena that may be signals for the dominance of noise trading. Thesis (10) is the main statement of the book, it gives typical features of stock market bubbles. In proposition (11) we express the effects of stock market bubbles on real economy. Propositions (11) – (12) explain the experience of two cases: Dutch Tulip Mania and Hungarian booms and crashes between 1996 and 2003. Each proposition contains references to the chapters of the book in brackets.

- (1) Mathematical economics defines asset price bubble as a positive difference between actual and fair (fundamental) prices of the asset. On the contrary, “bubble” in verbal (literary) economics usually covers (i) a more general, broader economic phenomenon, when asset prices increase significantly and continuously, which is fueled by investors' expectation for further increase, and (ii) it may be accompanied by macroeconomic effects (Kindleberger's definition). The two definitions seem to be different. However, they basically mean the same: stock prices definitely deviate from economic fundamentals. The difference stems from the different sets of tools used by two approaches (mathematical and verbal economics). [1. Introduction; 1.1 Introduction; 1.3 Introduction]
- (2) The strong and irrational deviation of a stock or stocks from fundamental value (overvaluation) cannot be proved. One of its reasons is that it is difficult to give the fundamental value of a financial asset and its change in practice. If there is no doubt that a stock price obviously differs from its fundamental value (e.g., closed-end funds,

twin-stocks), we cannot decide whether we face with over – or undervaluation. [1.1.1; 1.1.2; 1.1.3; 1.1.5]

- (3) In the laboratory experimental simulations, we can directly observe how bubbles occur most of the time, because future dividends are previously given, and selling/buying decisions determine stock prices. On the other hand, in these experiments we cannot filter out the distorting effects of laboratory environment. Even then, when changing the conditions in experiments, we can conclude that the extent of price bubbles depends on the liquidity and the information subjects have. [1.2]
- (4) Investors essentially buy a stock to obtain its future returns (dividends, profits from selling at higher prices). Apart from frauds and swindles, any future dividends can be expected that may justify the actual stock price. In the case of stocks, we rarely face with Ponzi-financing. On the contrary when we have loans, for instance, paying interests can only be financed by other new loans. [1.1.5]
- (5) Kindeberger's definition is not appropriate to differentiate regular fluctuations of stock prices from economic and scientific aspect. The weakness of his argument comes from not giving the standard level of speculation. On the other hand, there is no sense in defining such a level; we have to define bubbles in a different way. [1.3 Intr.; 1.3.5]
- (6) I strongly argue that a stock market bubble should be defined as a consequence of investors' behavior. I disregard other possible economic reasons; their roles are not mentioned in my definition, because in stock markets, prices primarily reflect investors' expectations (see Keynes). In fact, investors just take bets on future prospects of listed firms. Expansions and bursts of bubbles can be traced back

to specific features of investors' behavior, especially overconfidence. "Overconfidence" implies that investors would be better off not trading on the available information, but nevertheless they trade. When it happens, investors have an illusion of knowledge, which is accompanied by increase in public and private information, and irrelevant information (noise). To put it other way, when a stock market bubble occurs, the intensity of noise trading increases too. [1.1.3; 2.Introduction; 2.1; 2.1.1]

- (7) When it is said the economic policymakers become more active, it implies an increase in the noise trading. Different policy actions are signals for the investors, and drive investors' attention, and investors take these signals into account in their expectations but with delay and inaccuracies. Same effect can be found when number of news about scandals, frauds, and corruption increases, and these signals may indicate sales of stocks and not of related firms. [1.3; 2.2]
- (8) Leveraged trading is noise trading in one respect, because finite duration of the particular asset involves short sale constraint, and investors do not trade on public but private information and in consequence of private constraint (deadline of repayment of private loan). Leverage also increases liquidity of investors involved. [1.3; 2.2]
- (9) If stock prices move together, and no fundamental factors justify this synchronicity, it may indicate noise trading. There is no standard level of price co-movement, but if it rises significantly without change of any economic or market factors, it may show that investors' decision-making progress is becoming unsophisticated. To measure price

synchronicity we can take average R-squared between stocks and market index, if the stocks belong to one industry or one well-defined market. In these cases, investors regard the stocks as one bunch, and the increase of co-movement rises to the level of noise trading. [1.3; 2.1.2; 2.2]

- (10) We distinguish bubbles from other fluctuations of stock market with the following feature: (i) A stock market bubble starts with a strong and continuously rising stock prices, mostly due to a macroeconomic shock (ii) This initial displacement positively affects investors' expectations on the future. The volume of stock market also rises significantly, as the noise trading increases. We regard booms as bubbles if the probability of large price drop – market crash – is considerable. (iii) Finally and probably the most important feature of stock market bubbles is the real effect at macroeconomic or regulating level. We distinguish bubbles from regular fluctuations caused by instability of stock markets with the said features. Consequently these characteristics give the economic importance to the term “bubble”. [2.2]
- (11) Trading in stock exchanges is basically a zero-sum game; its role is only to distribute wealth, but indirectly has effects on macro- and micro-economic levels. This is a distinguishing feature of bubbles. There are some negative effects, when stock prices are rising, and firms make over- and mal-investments financed by public offerings. These decisions have repercussions on firms' revenues and cash flows, they also increase investors' risk. Other well-known effect of stock market booms is the wealth-effect. If value of household-owned stocks increases, their consumption

also rises, and it may follow from the foregoing that inflation may accelerate. At micro level, firms may easily obtain quasi-venture capital when market is soaring. In these periods investors make decisions on less information or noise. It may give an impulse to the industry and the economy as well. Another positive output is when market crash forces important changes in regulatory environment, and the efficiency of market may improve. [1.3; 2.2]

- (12) If we use the bubble-description of the book, we cannot classify the Dutch tulip-speculation as a typical bubble. First reason is that there are no reliable data. Apart from missing sources, this speculation could not cause any real effects on the economy or the regulatory environment in Netherlands. [1.3.1]
- (13) Booms at Budapest Stock Exchange (BSE) between 1996 and 2003 are not considered as bubbles. In the Hungarian stock market, some bubble-phenomena (co-movement of prices, leverage) can be seen between 1997 and 2000, but the BSE plays an insignificant role for financing firms or accumulates savings in Hungary. In this period Hungarian firms were not active in raising their capital through public offerings. Other signal that supports the statement above, is that the stock exchange had not been prerequisite for foreign capital inflow to Hungary. Some formerly state-owned companies (e.g., MATÁV, MOL, OTP) became privatized and stakes were sold directly to foreign investors, but insignificant activity of domestic investors did not mean risk-sharing opportunities for them. [3]

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