STOCK MARKETS AND BUBBLES

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1. Introduction

The analysis of stock prices dynamics has always been a field of scientific controversies. Mainstream economists have usually defended a specific version of the Present Value Model (PVM), according to which stock prices can be considered rational forecasts of discounted future dividends (for a survey, see Campbell et al. 1997). However, since the publication of Shiller's (1981) volatility tests, various empirical rejections to PVM convinced economists to re-examine its basic hypotheses.

In order to defend the idea that stock prices correctly reflect fundamentals it has been said that PVM still holds if the hypothesis of a constant discount rate for future dividends is substituted by the assumption that it can change over time because of modifications in agents preferences or behaviour towards risk (Campbell et al. 1997). On the other side, the critics of PVM interpreted its empirical rejections as a proof of the existence of speculative bubbles, i.e. systematic price deviations from effectual dividends. We can distinguish at

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least two different theoretical supports for bubbles. The first one was developed by Blanchard and Watson (1982). They removed the transversality condition from PVM in order to admit "rational bubbles", that is price deviations deriving from rational behaviour. The second one can be seen as a conventional interpretation of the old heterodox view according to which agents are not able to predict future dividends because they are influenced by "irrational waves" (Galbraith 1972, Minsky 1982, Kindleberger 1989). Sometimes, neoclassical economists have tried to give a formal expression of this view simply eliminating two basic PVM hypothesis: rational expectations (REH) and efficient markets (EMH).

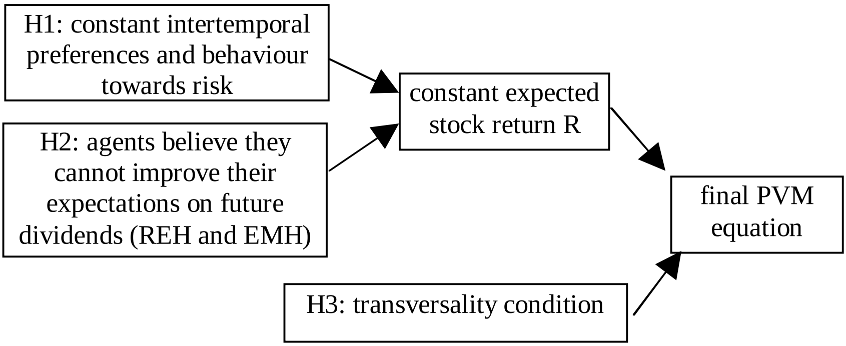
It is important to specify that the removal of both the transversality condition and the hypotheses of rational expectations and efficient markets do not imply a rejection of the mainstream neoclassical model (which is the theoretical foundation of PVM). In this work, after a short review of these different interpretations of Shiller's findings, we propose a third kind of theoretical support for bubbles. It is based on a model of "classical-circuit" type and aims to represent a theoretical alternative to mainstream analyses of stock markets.

2. Behind the Present Value Model

According to the present-value model prices can be considered rational forecasts of discounted future dividends (Campbell et al. 1997). Let us start from the following definition: stock returns R_{t+1} are given by capital gains (P_{t+1} - P_t) plus dividends D_{t+1}, all divided by current prices P_t:

$$(1) \qquad R_{t+1} = \frac{P_{t+1} - P_t + D_{t+1}}{P_t}$$

This is only an accounting definition. However, it is possible to give theoretical support to this definition in order to determine the final PVM equation. This diagram provides the steps followed by neoclassical economists:



At the basis of this sequence there is the standard New Classical Macroeconomics model. Hypothesis H1 indicates that preferences about consumption, savings and wealth allocation do not change over time, which implies a constant equilibrium level of the discount rate R. According to hypothesis H2 it is not excluded that actual dividends may diverge from agents expectations;[1] H2 only considers these deviations ex-ante unpredictable. In other words changes in R are ex-ante random, which is why agents can only assume that R will remain constant on average. Hypothesis H2 is a consequence of two assumptions: rational expectations (REH) and efficient markets (EMH). EMH admits that agents do not have the same information set $I_{t,}$. However, it provides that nobody will be able to make profits exploiting his own informative advantages because market prices immediately tend to reveal and diffuse them. REH means, in this context, that agents manage their information sets in the same, best way according to the “right” model of the economy.[2] A first result of EMH and REH is that agents tend to have the same expectations on future dividends D_{t+i}. A second result is that unexpected changes in D (and consequently in R) will depend only on changes in the information set from I_t to I_{t+1} (with $I_t \subset I_{t+1}$). It is clear that these changes are unpredictable in t: this is the reason for which future changes in R can only be considered random.

So, given H1 and H2 we can write:

(H1, H2) $$E_t[R_{t+1}] = R$$

Given (H1, H2), after few steps (1) becomes:

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[1] This implies that actual R will deviate from its expected value until expectations remain wrong; that is, until P reflects the new dividends path.

[2] This is a specific way to conceive rational expectations, generally associated to New Classical Macroeconomics (see Lucas 1972, Sargent 1976): it holds in case REH is associated with the hypothesis that there is just one representative flexprice model of the economy, which does not move from the unique walrasian equilibrium path.

(2) $$P_t = E_t\left[\frac{P_{t+1} + D_{t+1}}{1+R}\right]$$

Seen that $P_{t+1}=E_{t+1}[(P_{t+2} + D_{t+2})/(1+R)]$ and applying the Law of Iterate Expectations,[3] we obtain:

(3) $$P_t = E_t\left[\sum_{i=1}^{k}\left(\frac{1}{1+R}\right)^i D_{t+i}\right] + E_t\left[\left(\frac{1}{1+R}\right)^k P_{t+k}\right]$$

From equation (3) we learn that despite a constant R and just one expected temporal path for D, there is still more than one solution for P_t. In fact, P_t also depends on P_{t+i}, that is on its own temporal path. As a consequence P_t may grow simply because an increase in the future P_{t+i} is expected, without any regard to D.

The only way to eliminate this "bubble" is the introduction of hypothesis H3, the transversality condition:

(H3) $$\lim_{k\to\infty} E_t\left[\left(\frac{1}{1+R}\right)^k P_{t+k}\right] = 0$$

[3] Given the information set $I_t \subset I_{t+1}$, an agent cannot predict what will be his t+1 expectation about P_{t+2}. He can only forecast P_{t+2} according to his current information I_t. This means that $E_t[E_{t+1}[P_{t+2}]]= E_t[P_{t+2}]$. See Campbell et al. (1997).

which holds when dP/dt < R. Given (H3), equation (3) becomes:

$$P_t = E_t\left[\sum_{i=1}^{\infty}\left(\frac{1}{1+R}\right)^i D_{t+i}\right] \qquad (4)$$

This is the final PVM equation: current stock prices are rational forecasts of future dividends, discounted at a constant rate R.

2. Empirical rejections to the Present Value Model

Equation (4) has been subjected to many empirical tests, in order to check to what extent stock prices reflect real dividends. For this purpose, we can define P "volatile" if it (the left-hand side of (4)) fluctuates too much in comparison with dividends (the right-hand side of (4)). If volatility is high, we could reject the idea that current prices reflect real future dividends. In order to estimate price volatility Shiller proposed a solution which became a framework for subsequent analysis. Shiller stated that if prices are driven by other determinants besides future dividends, they should vary even when dividends do not change (Shiller 1981).

Shiller test is based on a comparison between real stock prices P and a theoretical stock price P', calculated ex-post on the basis of actual registered dividends. Shiller stated that PVM equation (4) can be accepted only in case P' variance exceeds P variance. The reason is that being only a prediction of P', P cannot incorporate "suprises"; so, it should move less than P'. But the empirical results contradicted this theoretical conclusion: with reference to S&P stock price data between 1871 and 1980, Shiller found that VAR(P)/VAR(P') was more than 5, revealing that prices seem to be highly volatile in comparison with real dividends (that is, too much volatile to reflect only fundamentals). This result has been substantially confirmed by subsequent, more powerful tests.[4]

Given these results, the only way to reconcile data and theory was to change the latter, re-examining the hypotheses behind equation (4). As we will see, economists decided to change H1, H2 or H3 depending on their different views on stock markets and PVM.

3. In praise of PVM: time-varying R

The supporters of PVM stated that volatility tests should be rejected being based on an unrealistic constant R (hypothesis H1). According to this view, R changes over time because of modifications in fundamentals, like preferences and behaviour towards risk (Campbell et al. 1997, chap. 8). If H1 is rejected, Shiller empirical results can be explained by changes in R instead of P volatility. Obviously, in this case R would change ex-ante and not ex-post: in other words, modifications in R would be a cause instead of a consequence of changes in P.

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[4] See for example Campbell et al. (1997, chap. 7), Blanchard and Fischer (1989, chap. 5).

4. Bubbles

A different line of research interprets volatility tests as a clear evidence that stock prices are dominated by speculative bubbles. The term "bubble" describes a situation in which current prices are no longer justified by future dividends.

There are many ways to explain the origin and the growth of bubbles. According to the traditional heterodox view on stock markets, bubbles develop because, especially during what has been called the "euphoric" phase of stock markets (Minsky 1981, Kindleberger 1989), agents tend to overestimate future dividends. In other words, their behaviour becomes "irrational". Neoclassical economists interpreted this expression in the following way: irrational bubbles appear because agents do not know the "right" model of the economy. This means that irrational bubbles clash with hypothesis H2: its removal implies that even in case a single equilibrium path for D exists, there is no reason to be sure that agents will be able to forecast it.

But the rejection of H2 is not the only way to admit bubbles. By relaxing H3 (transversality condition) a more recent line of research has developed the concept of "rational bubble" (Blanchard and Watson 1982). Without H3 stock price equation is (3), which can be rewritten in the following form:

(3.1) $$P_t = E_t\left[\sum_{i=1}^{\infty}\left(\frac{1}{1+R}\right)^i D_{t+i}\right] + Bt$$

where $$Bt = Et\left[\frac{B_{t+1}}{1+R}\right]$$

Equation (3.1) states that the additional term B appears just because it is expected to appear in the following period. This can be defined a rational bubble for the following reason. Agents are able to distinguish between fundamentals (i.e. future dividends) and the bubble component B. However, it is rational for them to enclose B in the determination of prices simply because it is expected to persist in the future. The conclusion is that given infinite possible paths for B we have infinite paths for P, partly independent from fundamentals D.

Sometimes economists have tried to propose "mixed" interpretations of bubbles. For example, those who generally refuse H2 tend also to offer some arguments against H1: a typical link is the idea that if agents are euphoric, not only they tend to overestimate dividends, but also they reduce risk-aversion (Minsky 1982). Others see in Kindleberger (1989) an implicit admission of typical rational bubble behaviours ("when the rest of the world is mad, we must imitate it in some measure"). Furthermore, by removing H2 it would be possible to provide some explanations for the beginning and the burst of rational bubbles, which Blanchard and Watson, in their famous 1982 contribution, did not give. These sort of merges between rational and irrational views have been highlighted also by Shiller (2000). He has recently provided a collection of arguments in support of his volatility tests. According to Shiller, stock prices dynamics is basically dominated by irrationality, fashions, misleading interpretations of events, etc. In such a context even those agents who perceive the overestimation of future dividends will prefer to adequate their behaviour to the dominant trend, maybe trying to exploit the bubble until it bursts. This interaction between irrational and rational behaviours, Shiller says, is at the basis of the strong divergence, from 1994 to 2000, between the Dow Jones Industrial Average (+200%) and dividends (only +60% during the same period).

5. A possible alternative view on bubbles

It is difficult to say whether the current mainstream interpretations of bubbles can represent a real development in comparison with the old view of heterodox economists. To this regard, it should be remembered the controversy between rational and irrational bubbles theorists. For example, Kindleberger (1989) defined rational bubble models "a useless mathematical ceremonial"; on the other hand, Blanchard counterattacked criticising the "anecdotal methodology" of the old theorists. Probably, a good way to better distinguish this views is to offer a stronger theoretical basis for heterodoxy. First of all, let us examine in more detail the neoclassical foundations of PVM. For simplicity, we consider a one-sector model. Equation (1) can be derived from the typical own rate of return:

$$(5) \qquad 1 + r = \frac{P_t^{'}}{P_{t+1}^{'}}$$

where *P'* are relative prices, respectively given by monetary prices *P*:

$$P_t^{'} = \frac{P_t(1+i)}{P_{t+1}} \quad ; \quad P_{t+1}^{'} = \frac{P_{t+1}}{P_{t+1}}$$

and i is the usual monetary interest rate on a risk-free asset. Then, we can rewrite (5):

$$(5.1) \quad 1+i = \frac{(1+r)P_{t+1}}{P_t}$$

If we consider $R=i$, and $D_{t+1} = r\ P_{t+1}$, equation (5.1) is equivalent to (1). Now, in a neoclassical context, the term i is strictly connected with the fundamentals of the model. In fact, monetary prices are given by money supply. Furthermore, in equilibrium we have:

$$1+r = \frac{U'(C_t)}{U'(C_{t+1})}(1+\sigma)$$

where U' are the marginal utilities deriving from consumption C and σ is the usual subjective rate of discount.[5] In this theoretical framework it is then clear that stock returns can be easily determined. Apart from monetary shocks or changes in the utility function and other fundamentals, there is no reason to consider the term i unpredictable. So, with the exception of their rational version, in this context bubbles cannot persist.

However, it is possible to interpret equation (5.1) in a totally different way. By substituting the neoclassical

[5] See Blanchard and Fischer (1989).

framework with a model of "classical-circuit" type, it is possible to define $i = \gamma r$, where (see Brancaccio 2005):

$$\gamma = \frac{1}{r}\left[\frac{u}{\delta_{t-1}}\left((1+r)-(1-\delta)\frac{f(k)}{k}\right)-1\right]$$

In this context becomes much more difficult to make a correct prediction of stock returns. In fact, in a classical-circuit framework r (which also determines the technical choice k) is a "normal" profit rate and is given by the state of social relationships. The terms u and δ indicate respectively the deviations from the "normal" utilization rates of machinery and "normal" prices. They are given by the decisions of capitalists and political authorities about production and demand. It would be hard to consider these variables as "steady pivots" analogous to neoclassical fundamentals. It would be also difficult to distinguish, in this context, between rational and irrational behaviours. For these features, classical-circuit analysis may be considered a promising alternative framework for the study of speculative bubbles.

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