Speculative trading: the price multiplier effect

B.M. Roehner[a]

L.P.T.H.E., Université Paris 7, Tour 24, 2 place Jussieu, 75251 Paris Cedex 5, France

Abstract. During a speculative episode the price of an item jumps from an initial level p_1 to a peak level p_2 before more or less returning to level p_1. The ratio p_2/p_1 is referred to as the amplitude A of the peak. This paper shows that for a given market the peak amplitude is a linear function of the logarithm of the price at the beginning of the speculative episode; with p_1 expressed in 1999 euros the relationship takes the form: $A = a \ln p_1 + b$; the values of the parameter a turn out to be relatively independent of the market considered: $a \simeq 0.5$, the values of the parameter b are more market-dependent, but are stable in the course of time for a given market. This relationship suggests that the higher the stakes the more "bullish" the market becomes. Possible mechanisms of this "risk affinity" effect are discussed.

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1 Introduction

Are the mechanisms of speculative trading basically the same in their different manifestations, that is to say whether one considers stocks, property values, diamonds, futures contracts for commodities, postage stamps, etc.? Econophysicists are probably inclined to answer affirmatively and to posit that all speculative markets are alike. Professor Stauffer recently told me that he had not read in the econophysical literature any statement to the contrary. Yet, economists generally hold the opposite view; as a matter of fact most of them would even found that question somewhat weird. In any case little statistical evidence has so far been produced in support of one or the other claim. One earlier attempt in that direction was a paper that pointed out that the shape of the price peaks belong to the same class of functions [11]. In the present paper I analyze a specific feature of speculative trading which will be referred to as the price multiplier effect and I show that it can be observed in various speculative markets for which adequate data exist, particularly in real estate, diamond and stamp markets.

Before coming to this let us briefly discuss the following question: Why, instead of concentrating on just one market, is it important to consider different speculative markets? After all understanding the stock market already poses a formidable challenge and it could seem a good strategy not to disperse efforts. The point is that once we know that speculative attitudes are basically the same in any market the model we will build for the stock market will not be the same as if we had limited our knowledge

to that market alone; common factors will be emphasized while idiosyncrasies will be discarded. As a matter of illustration remember that historically it made a big difference to realize that the fall of an apple, the "fall" of the moon and the rising/falling of the tides are different facets of the same phenomenon. Similarly if one can prove that the mechanisms of speculation are basically the same everywhere this has far reaching consequences. One of them is the idea that the phenomenon of speculative trading is a sociological rather than a purely economic phenomenon.

2 The price multiplier effect

2.1 Position of the problem

The crucial question regarding speculation can be formulated as follows: suppose you have bought diamonds worth one million euros two years ago, assume that in the meanwhile their price has risen by 360%, but that in recent weeks there was a sudden 25% fall. Will you sell, or keep your holding until the price goes up again or even buy more diamonds? In the second and last cases speculation will be fueled and will continue at least for some time, with the result that prices will rise to even higher levels. On the contrary if you sell, and if other traders react similarly, the bubble is likely to burst.

The relevance of the previous question is further emphasized by the following observations:

(i) the above question is not a mere "Gedanken experiment", it is based on the speculative episode

[a] e-mail: `roehner@lpthe.jussieu.fr`

that seized the diamond market in the late 1970s; naturally, it can be rephrased in similar terms for any other speculative item;

(ii) economists would claim that the above question can be answered by relying on the standard principle of expected revenue maximization. While it can be argued that future revenue of a stock is to some extent determined by the growth perspectives of the company, this is much more questionable for diamonds. As a matter of fact it is precisely to stress the fragility of the fundamentalists' argument that we picked up that example;

(iii) numerous computer simulations of the stock market have been proposed either by econophysicists or by economists; in that respect one should mention the following works [2,3,5–8,10,13]. Often these simulations are based on astute mechanisms such as minority games or Ising type interactions. Yet, one would be on much firmer ground if these simulations could be built on realistic attitudes at the micro-economic level. Models in statistical physics are successful to the extent that their assumptions about atomic or molecular interaction are not too unrealistic.

To the above question the present paper provides the following answers:

(i) the behavior of a speculator (A) who speculates on items worth 10 000 euros is not qualitatively different from that of a speculator (B) who speculates (on the same market) on items worth 100 euros. This is reflected in the fact that the curves in Figure 1 have the same shape: same timing, same relaxation time; only the amplitudes are different;

(ii) speculator A is significantly more "bullish" than speculator B. More specifically the amplitude of the bubble (defined as the ratio between peak and initial price) is more or less proportional to the initial price.

At first sight the first point could seem fairly evident. It would be indeed for items whose prices differ only slightly, but for items whose price differ by a factor of 100 it is no longer obvious that the attitude of the speculators should be the same. Speculator A is probably a professional while speculator B is likely to be a mere amateur. The second point means that speculation will be stronger for 2-carat diamonds than for 0.5-carat diamonds, for 5-room flats than for one-room apartments. How much stronger will it be? This question is answered in the next paragraph.

2.2 Statistical evidence

2.2.1 Qualitative evidence

Figures 1a–1d present the multiplier effect for four different speculative bubbles. Each graph refers to items whose prices are markedly different, the upper curve corresponding to the most costly item. The first figure concerns the price of one-carat diamonds; as one knows the price of a diamond of given size depends upon its color and number of flaws. Colorless diamonds are the most costly, they are said to be of class D; classes ranging from F to Z correspond to diamonds of decreasing quality. The upper curve in Figure 1a corresponds to class D, while the lower is for class G. In normal conditions, that is to say before and after the bubble, there is a ratio two between the prices of D and G diamonds. For these diamonds the peak amplitudes (*i.e.* peak price/initial price) are 6.1 and 5.0 respectively.

Figure 1b describes a speculative bubble for property values in Paris. What is shown is the price per square-meter of apartments in the 7th (one of the most expensive) and 19th (one of the less expensive) districts respectively. Again the amplitude of the peak is larger for the most expensive item: 2.83 against 1.95.

Figures 1c and 1d concern postage stamps. For our purpose postage stamps are of particular interest because their value range form a fraction of euro to several thousand euros. During World War II there was a strong speculative bubble in France. Again we verify that the amplitude of the peak is larger for the item having the highest price; the figures are 5.6 and 1.9 respectively. Figure 1d refers to a speculative bubble for British stamps; again the most costly have the largest peak amplitude: 4.9 for the 5 000 francs stamp against 2.2 for the 275 francs stamp. In this case we included an item for which there seems to be no speculative bubble at all. As a matter of fact in stamp catalogues one reads that speculation only concerned stamps with a high face value. One may wonder why. In our explanatory framework the matter becomes simple: in fact speculation also affected the stamps with a low face value but these stamps being much cheaper their price peak was small to the point of being at the same level as the average price. In the next paragraph we will see that this explanation is not only qualitatively satisfactory but although quantitatively correct.

2.2.2 Relationship between price and peak amplitude

From the above examples it is clear that peak amplitude increases with (initial) price. However to get a more precise idea of that relationship one needs a statistical analysis of a larger sample of cases. The corresponding data are summarized in Appendix A. With A denoting the peak amplitude and p_1 the initial price of the item the relationship can be written in the form:

$$A = a \ln p_1 + b.$$

To give to the values of b an intrinsic meaning one has to make the convention that p_1 must be expressed in a fixed currency. We made the choice to use euros (of January 1999) as our currency scale. To take an example the francs of 1984 used for apartment prices in Paris were transformed in euros through the following steps:

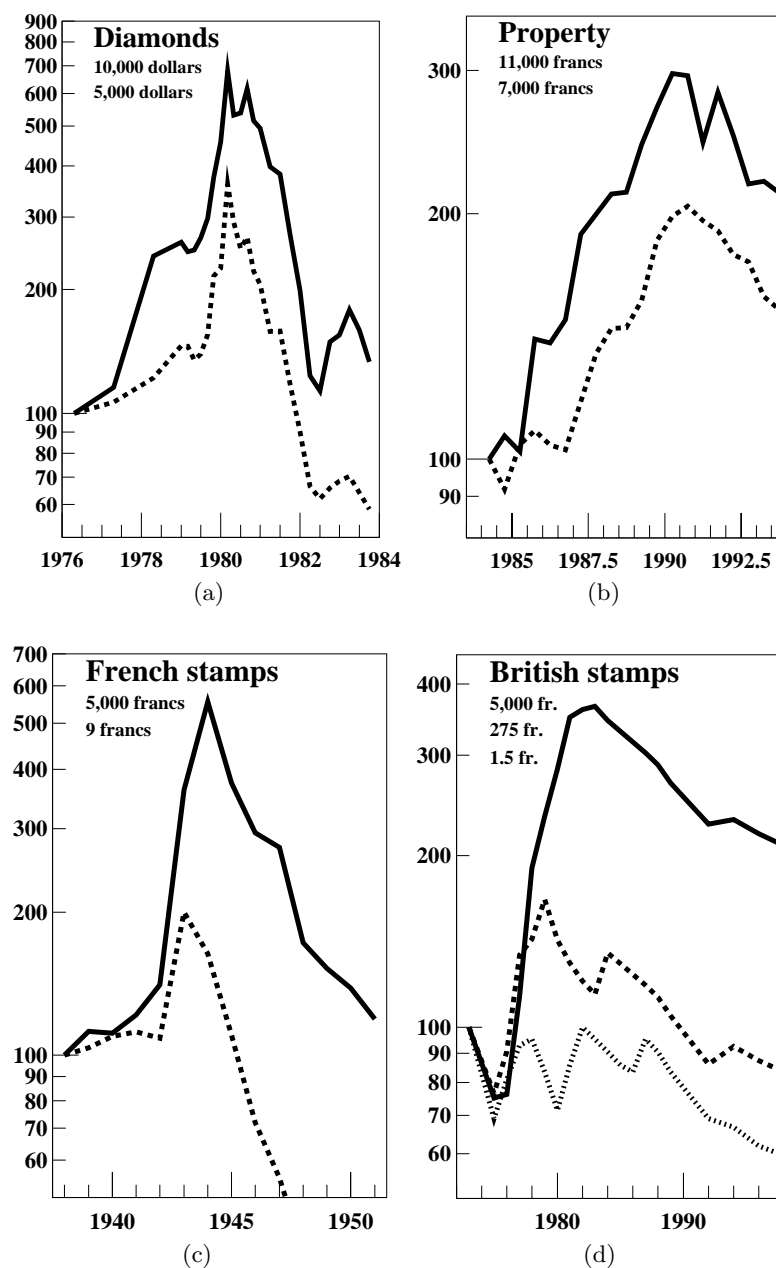Euro = (1/6.56) F1999; F1999 = (982/1408) F1984.

Fig. 1. (a) Speculative bubble for polished diamonds. Solid line: one carat, D clarity; broken line: one carat, G clarity; the price data are deflated prices on the Antwerp market. The two figures under the title give the prices of both items at the beginning of the bubble. *Sources: The Economist, Special report No 1126.* (b) Speculative bubble for property values (Paris). Solid line: price of apartments in one of the most expensive districts; broken line: price of apartments in one of the less expensive districts; the price data are deflated prices per square meter. The two figures under the title give the prices of both items at the beginning of the bubble. *Source: Chambre des Notaires.* (c) Speculative bubble for French stamps. Solid line: price of one of the most expensive stamps; broken line: price of one of the cheapest stamps. The price data are deflated prices. The two figures under the title give the prices of both stamps at the beginning of the bubble. *Source: Massacrier (1978).* (d) Speculative bubble for British stamps. Solid line: price of one of the most expensive stamps; broken line: price of a less expensive stamp; dotted line: price of one of the cheapest stamps; the price data are deflated prices. The three figures under the title give the prices of the three stamps at the beginning of the bubble. *Source: Catalogue Yvert and Tellier.*

Table 1. Estimates for the parameters a and b.

Item	n Number of cases	a	b	r Coefficient of correlation
Apartments in Paris	20	0.60 ± 0.50	-1.7 ± 0.1	0.48
French stamps	6	0.47 ± 0.38	2.2 ± 0.7	0.77
British stamps	13	0.39 ± 0.17	2.3 ± 0.6	0.80

The first equality is the official exchange rate between a franc of January 1999 and an euro of January 1999 while the second is based on a standard annual price index series.

A linear least square fit gives the estimates in Table 1. For diamonds, due to a lack of data, it was not possible to perform a fit for a larger number of cases than in Figure 1a. Two observations are in order:

(i) in each case the correlation is significantly larger than zero;

(ii) the estimates for a are fairly close.

3 Conclusion

We have shown (at least for those markets for which data were available) that the relative amplitudes A of speculative price peaks are larger for more costly items; more specifically the relationship can be written in the form: $A = 0.5 \ln p_1 + b$. Why is this so?

Different mechanisms can be imagined. We will in this empirical paper refrain from proposing a detailed model; this will be done in a subsequent paper. Nevertheless it can be of interest to review some of the ideas on which such a model could be based. For the sake of illustration let us consider for instance the real estate market. We assume that there are two types of operators:

(i) residents who buy and sell apartments for personal usage; we call them users;

(ii) speculators and property developers who make money by selling and buying property.
Such a distinction is in essence similar to the one made between "fundamentalists" and "noise traders" in the paper by Lux *et al.* [6]. Now, it is not unreasonable to assume that having limited means the users will be deterred by too high prices. On the contrary for someone who buys in order to sell 6 months later the price makes little difference; only profit matters. For instance if the price of one-room apartments doubles users would still be able to afford them; on the contrary if the price of 5-room apartments doubles they will become far too expensive. Consequently, one can expect that for costly goods the proportion of speculators in the market will be larger. The dynamic

pricing behavior of speculators being more aggressive one should not be surprised that these markets show greater amplification factors.

It is possible to check that scenario empirically at least to some extent. In a separate paper [12] we tried to estimate the proportion of speculators in different districts of Paris; for instance for the two districts considered in Figure 1b namely the 7th and the 19th one gets 18% and 11% respectively; for all the districts the percentage of speculators varies from 10% (2th district) to 36% (15th district). To get these estimates we used the fact that on average, *i.e.* for all the 20 districts, the proportion of speculators is about 20% (La Vie Française 18 April 1998). The regression between peak amplitudes and fraction of speculators f_s reads: $A = 1.02 \ f_s + 2$, the correlation being equal to 0.28.

This test is not completely satisfactory because both the peak amplitudes and the proportions of speculators varied within too narrow limits: from 1.95 to 2.83 for the amplitudes and from 0.10 to 0.36 for the proportion of speculators. It will be the purpose of a subsequent paper to perform similar tests in other markets. The main difficulty in that matter is to find adequate statistics.

As a last point one could wonder what (if any) are the implications of the multiplier effect for stock markets. In this case one should of course not reason in terms of share prices (these are of the order of 60 euros and are not very different from one stock to another) but in terms of share packages. For example, some small investors, called "odd lotters" in the jargon of finance, trade small portions of stocks, typically under one hundred at a time. Around 1955 odd lotters were known to be responsible for around 15% of stock trading on the New York Stock Exchange; today they account for less than 1% [15]. In order to test the price multiplier effect one would need more detailed statistics about the size of transactions on given stocks. Once again finding adequate data turns out to be a major obstacle.

Appendix A: Statistical data

In this appendix we give the detailed data for each of the cases considered above. The peak amplitudes are always computed from deflated prices.

A.1 Real estate bubble in Paris

Apartment prices in 1984 are expressed in thousand French francs per square meter.

District number	(6)	(16)	(7)	(8)	(5)	(15)	(4)	(14)	(1)	(17)
Price in 1984	11.6	11.1	10.3	10.1	9.71	9.60	9.45	8.81	8.03	7.91
Peak amplitude	2.47	2.51	2.83	2.78	2.38	2.02	2.43	2.03	2.71	2.31

District number	(12)	(2)	(13)	(3)	(19)	(11)	(9)	(20)	(18)	(10)
Price in 1984	7.85	7.37	7.19	6.99	6.49	6.45	6.35	6.11	5.90	5.51
Peak amplitude	1.96	2.19	2.18	2.63	1.95	2.16	2.36	2.05	2.05	2.27

A.2 French stamps

The stamp identification numbers refer to the Cérès catalogues. The 1938 prices are expressed in current French francs.

Stamp number	(2)	(31)	(30)	(32)	(11)	(16)
Price in 1938	5 000	400	350	250	60	9
Peak amplitude	5.56	2.78	2.64	4.07	3.70	1.93

A.3 British stamps

The stamp identification numbers refer to the Yvert and Tellier catalogues. The 1975 prices are expressed in current French francs.

Stamp number	(90)	(46)	(89)	(156)	(105)	(183)	(155)
Price in 1975	13 500	8 000	6 000	2 250	1 500	1 400	300
Peak amplitude	4.87	2.84	5.47	4.33	5.05	2.74	5.44

Stamp number	(286)	(238)	(355)	(239)	(106)	(512)
Price in 1975	275	90	3	1.75	1.50	1.35
Peak amplitude	2.19	2.85	0.36	0.76	0.86	1.31

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