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Analysis of the Behavior of Amateur and Professional Investors' Impact on the Formation of Bubbles in Tehran Stock Market

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Abstract

The presence of bubbles in the markets and its formation has been regarded by economists and they have been looking to develop methods that can be recognized by using appropriate method for the formation of bubbles. In this paper, first, the formation of bubbles is tested using the new unit root test known as Phillips test (Generalized Sup ADF test) for 50 companies in the Tehran Stock Exchange during the period of August 2011 to March 2013, and periods of bubble is shown by one and zero if otherwise. Then, the behavior of amateur and professional investors' impact on the probability of the formation of speculative bubbles in the Tehran Stock is investigated and estimated using Panel Data Models for Binary Choice (Logit) model. Phillips test shows that 49 companies from 50 samples of Tehran Stock Exchange at different periods of time have experienced price bubbles. The results of the Panel Logit regression model indicate that the impact of trading amateur investors on the probability of the formation of speculative bubbles is different from the behavior of institutional or professional investors. That purchase and sale of amateur investors, with respect to trading of professional investors, increases the probability of bubble formation and it can be one of the main factors affecting the formation of bubbles in the stock market. Also, the results show that the P/E ratio and speed of turnover also increases the formation of bubbles, while company size as an index scale enterprises, leading to decline the possibility of a bubble in the stock market.

Keywords: Behavior of investors, GSADF test, Panel logit, Price bubbles,.
JEL Classification: C16, C12, G23

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1. Introduction

The intense fluctuations of price in capital markets has been an issue from long ago, damaging some of the agents in the market. These fluctuations generally cause an undesirable status which reduces the buyers' trust for quite some time and can be a cause of crisis shift from financial sector to the actual sector of the economy.

The concept of bubbles was introduced to the literature in the 17th century. Nevertheless, price bubbles were not studied until the late 20th century. Since introducing the concept of bubbles in Iran's capital market in 2003, every rapid increase of prices is mistakenly considered as bubbles, which is not the case since bubbles occur when speculations in a particular market tool (e.g. stocks) result in price increase, and this in turn results in more speculations. In this setting, market price comes to a completely irrational level. Bubbles often come with a sudden decrease of prices which is called market fall. The term "bubble" is used due to the increase of prices like bubbles and then blowing like bubbles and coming down instantly. Bubbles are often created from an actual growth in the efficiency and profitability of a firm or industry, but history has shown us that investors exaggerate the capabilities of such an economy in these situations.

The behavioral finance is a new subject which is brought up by some of the financial intellects in the last two decades and has become an interest for the teachers and experts of the field throughout the world, eventually evolving into an independent branch of studies in finance. The "rationality" assumption about the investors as a simple model of human beings is a fundamental basis in classical finance and almost all of the classical financial theories, like portfolio, efficient capital market, capital asset pricing model, representation theory, and their sub-theories, are affected by this assumption. In a behavioral finance perspective, this assumption is unable to explain the behaviors of the investors because of unreality.

Considering the short life of behavioral finance in the world and in Iran, and the expansion of capital market in Iran in order to attract the investors, the necessity of behavioral finance studies, especially concentrating on identifying the investors, types of investors, and estimating their possible mistakes as a fundamental pillar of capital market in a systematic and scientific way is doubled. Such studies will help enriching the science and making it functional. Hence, this article seeks to examine the existence of multiple bubbles and their creation and elimination in Tehran Stock Exchange. To do so, after the introduction, theoretical fundamentals and studies related to bubbles are reviewed. In the third part, methodology and the data are introduced and in the fourth part, experimental results, both

explanatory and analytical, are presented. The discussion and conclusion are presented in the final part.

2. Empirical studies

Increasing the profit and decreasing the loss are principal measures for decision making in all kinds of markets. Nevertheless, sometimes there are certain behaviors in investments markets which are not in accordance to any of the fundamentals governing the markets. In these situations, the "instant and collective" actions of the investors for buying or selling stocks would have an impact on the stock price without any financial or rational justification. This phenomenon is called "price bubbles in stocks". In Iran, the fall of Tehran Stock Exchange in 2004 happened right after a boom and raised a lot of questions, for example, whether this was a result of bubbles being present in Tehran stock exchange. The most principal characteristic of bubbles is distrust and indifference among the participants during the formation of bubbles. Note that it is a difficult task to determine when the participants leave their rational and regular methods for assessment of stocks and become profit-minded, but there will be signals.

In order to give a clear definition of bubbles in stock markets, we use the theories of the economist and Nobel Laureate, Robert Schiller, about the formation of bubbles. Schiller uses a historical discussion about bubbles and their constitution in 1990s in United States and the bubbles in stock and housing markets between 2003 and 2007 to point at 14 fundamental factors which play a role in assets' markets and especially stock and housing markets. These factors are increased tendency for investment, increase in volume and quantity of common investment funds, increased presence of retirement funds, increased volume of online deals, increased news about stock market in the media, increased risk-taking in the society, nominal interpretation of the index, shocks in the economy, increased attention of the state to stock market, changes in the structure of deals, amateurs being present in the market, increased quantity of daily deals in the market, and considerable increase of market's current value compared to GDP.

McQueen et al. (1994) examined bubbles in markets and their results showed that there are 4 types of bubbles in financial markets:

1. **Rational Bubbles**: a situation where the stock's price goes away from fundamental values, without the investors' behaviors being irrational. In a rational bubble situation, investors stay in the market in spite of knowing that the fundamental value of the market is higher, because they believe the bubble will grow more.
2. **Intrinsic Bubbles**: intrinsic bubble depends on fundamental factors

and grows with the growth and improvement of these factors and spreading their news. A basic characteristic of this bubble is having a longer life compared to rational bubbles. Another characteristic is rapid reaction to news concerning fundamental factors.

3. **Fads Bubbles**: these are related to psychological issues and happiness of the public. Collective thinking helps with these issues.
4. **Informational Bubbles**: if the price does not reflect the information completely, prices get away from fundamental values and an informational bubble is formed.

Blanchard's theory of rational bubbles (1994) shows that even with rational expectations, there is a possibility of deviation from fundamental values. The growth of rational bubbles reflects the presence of self-rising expectations due to future increase of asset's price. These bubbles are features of the market, such that buying an asset by an investor is because he predicts that he can sell it with a higher price to another investor buying it for the same reason.

Larsen (1997) examined the price bubbles in Norway's Stocks and their impact on the country's economy from 1997 to 1982. Using West's identification test (1987) and Schiller's Variance test (1981), he rejects the null hypothesis of the absence of price bubbles in the period.

Lamont (1998) used the extension of Fuller's test to examine the United States stocks' profit from 1947 to 1994 and could not prove the hypothesis of inflation bubbles.

Engsted et al. (2001) examined the stock market of US and Britain from 1919 to 1999 with a new identification method. Using their innovative method, they rejected the absence of rational inflation bubbles.

Lindblom's results (2002) from IT companies in 1990s show that the behaviors of agents in the bubble period was somehow irrational and the combination of investments is changed due to the existence of bubbles. In the period of increasing the value of markets in stocks, the information published by companies was the most important factor affecting the professional and amateur investments.

Cristophe (2003) proved the existence of rational inflation bubbles from 1871 to 2001 in the United States and from 1995 to 2002 in France using Blanchard-Watson test (1992), but rejected the existence of long-term rational inflation bubbles for the same periods using MTAR model.

White (2004) used Schiller's test to examine the crisis of the United States' stock market in 1929 and suggested that the price fluctuations and stocks profits was a result of structural changes.

Beltratti and Morana (2006) showed that mode is a reason behind

bubbles. Mode is the deviation of base price from current price which tends to zero gradually and over time.

Nanzo D. A. Silva (2007) used ordinary accumulation and threshold accumulation to examine the existence of rational bubbles in 18 stock markets. According to the results of both models, there are blasting bubbles in Chile, Indonesia, Korea, and Philippines and fading bubbles in China, Brazil, Venezuela, Colombia, Chile, Indonesia, Korea, and Philippines.

Lin et al. (2009) used the self-compatible LPPL model for rational financial bubbles of S&P500 index from January of 1950 to November of 2008. Results showed that LPPL model could predict the critical moments in October 1987, October 1997, and August 1998 and the elimination of ITC bubbles in the first quarter of 2000.

Jiang et al. (2010) used LPPL to identify price bubbles and to predict the consequent fall of the market for Shenzhen and Shanghai indices in 2005 to 2007 and 2008 to 2009. They could predict the existence of bubbles and their critical date and also the time of their fall.

Phillips (2011) used supADF to identify multiple bubbles and estimate the start and end of bubbles using GSADF. Results show that this new approach can correctly identify all the famous historical crises and SADF and CUSUM methods are more conservative and predict fewer events.

Phillips et al. (2012) suggested another test based on their previous test and used it to identify multiple bubbles. The problem with the previous method was that it could not present satisfactory results in presence of multiple bubbles in asset markets. Thus, they tried to solve this problem in the new test. The innovation in this method is that in forward iteration, not only the frame gets larger but it moves forward and hence can identify multiple bubbles.

Pele and Marinescu (2012) examined the bubbles' behavior in Bucharest stock market using LPPL. They used daily data of BET-FI index in 2001 to 2008 and concluded that LPPL is a helpful tool for identifying bubbles' behaviors and can predict the critical point.

Ma'dalat (2002) used the space-state method to determine the actual changes in stock index and to examine the existence of bubbles in Tehran stock exchange during 1998 and 1999. Estimates show that the bubbles were evident in 1994 to 1997 and 1997 to 1999. In fact, unexpected changes in prices had doubled the possibility of bubbles being present. Although part of the boom can be assigned to factors including managerial transformations, regional stock exchanges, and so on, but a considerable amount is due to the existence of bubbles in this market.

Baba'ee Samiromi (2005) examined the existence of rational inflation

bubbles in 1961 to 2003. In this research, two hypotheses are considered as money supply not being exogenous with respect to inflation using Granger test and the absence of rational inflation bubbles using West (1987). According to the results, money supply is exogenous with respect to inflation an there was rational inflation bubbles in the considered period.

Godari (2006), in his study about price bubbles in Tehran stock exchange during 2004-2005, defined bubbles as an intense and continuous increase in the price of an asset or a series of assets. The early increase in price is due to the price expectations caused by attracting more buyers. This increase is often accompanied with a series of reverse expectations and intense decrease of prices which leads to financial crises. This thesis has examined bubbles in the stocks' price of 23 active companies.

Alipoor (2007) examined the existence of rational price bubbles in Tehran stock exchange from 2000 to 2007. He used the unit root test, accumulation test, and additive-subtractive test to prove the existence of bubbles in Tehran stock exchange.

Soltani (2007) examined the bubbles in Tehran stock exchange for 70 active companies from 1991 to 2005. He used the accumulation test to identify the bubbles. Using the accumulation of the actual stock price for each company and the actual stock profit for each stock and using Johansson's accumulation test, he tried to find the bubbles in stock prices. The results showed that in a confidence level of 95%, 55 percent of the companies have bubbles in their stock prices. Furthermore, he used Fischer's test to find the relation between price bubbles with the size of companies, price fluctuations and the type of industries. Results showed that stock price bubbles and the size of companies have a meaningful relation, but the relation between the type of industries and stock price bubbles was not proven.

Samadi et al. (2007) examined the impact of oil and gold prices on the price indices of Tehran stock exchange. According to their results, gold price had a bigger impact on stock prices of Tehran stock exchange compared to oil price.

Va'ez and Torki (2008) examined the presence of price bubbles in Iran stock market using RALS technique and Monte Carlo simulation method. Their results showed that the stock price is deviated from its long-term equilibrium; therefore the existence of bubbles is proven.

Qolipoor (2010) tried to examine the impact of institutional investors on the formation of price bubbles in particular companies and found that all of them had bubbles.

Zare' (2011) suggested a model for predicting price bubbles in Tehran

stock exchange and examined the price bubbles in specific companies. He showed that there were bubbles in Tehran stock exchange in 2004 to 2009.

Eshghi (2012) examined the existence of bubbles in Tehran stock exchange. He used four main indices of the market - price index, total index, industrial index, and financial index - on a monthly and daily basis from 2001 to 2005. His test, using monthly data, showed that there were not any bubbles in any of the indices which was a result of omitting fluctuations during the month.

3. Methodology

This is a useful research using analytical and explanatory method. The sample used in this research is a selection of 50 active companies in Tehran stock exchange from August 2001 to February 2004. The data, such as stock's final price index, price to profit ratio, deals speed, and company size, is taken from Tehran stock exchange organization.

First, using Phillips et al. (2012), we have tried to find the exact time of bubbles formation and then we have focused on examining the role of investors' behaviors in the formation of price bubbles.

3.1. Identifying bubbles using Phillips test

Phillips et al. (2011) used a right tail unit root test which its null hypothesis was the existence of unit root and the alternative was the existence of a root bigger than 1. To do so, a regression is considered which its sample starts from r_1 section of the whole data and ends on r_2 section, and $r_2=r_1+r_w$ where r_w is the size of the regression window. The formula is:

$$\Delta y_t = \alpha_{r_1,r_2} + \beta_{r_1,r_2} y_{t-1} + \sum_{i=1}^{k} \psi^{i}{}_{r_1,r_2} \Delta y_{t-i} + \varepsilon_t$$

where k is lag length and $\varepsilon_t \overset{iid}{\sim} N\left(0, \sigma^2_{r_1,r_2}\right)$. The numbers of regression data is $T_w = \lfloor Tr_w \rfloor$ where T is the total number of observations and $\lfloor . \rfloor$ is the floor function (giving the integer part of the argument). The ADF statistic (t-ratio) based on this regression is denoted by $ADF_{r_r}^{r_2}$.

The SADF test relies on repeated estimation of the ADF model on a forward expanding sample sequence and the test is obtained as the sup value of the corresponding ADF statistic sequence.

In this case, the window size r_w expands from r_0 to 1; so that r_0 is the smallest sample window width fraction (initializing computation) and 1 is the largest window fraction (the total sample size) in the recursion. The starting point r_1 of the sample sequence is fixed at 0, so the end point of each

sample (r2) equals rw, and changes from r0 to 1. The ADF statistic for a sample that runs from 0 to r2 is denoted by $ADF_0^{r_2}$ and SADF statistic for this test is shown as $\sup_{r_2\in[r_0,1]} \mathrm{ADF}_0^{r_2}$.

Phillips et al. (2012) introduced a new test called GSADF. The GSADF test continues the idea of repeatedly running the ADF test regression on subsamples of the data in a recursive fashion. However, the subsamples used in the recursion are much more extensive than those of the SADF test. Besides varying the end point of the regression r_2 from r_0 (the minimum window width) to 1, the GSADF test allows the starting point r_1 to change within a feasible range, i.e. from 0 to r_2 - r0. The GSADF statistic is defined to be the largest ADF statistic overall feasible ranges of r_1 and r_2, and we denote this statistic by GSADF (r_0):

$$GSADF(r_0) = \sup_{\substack{r_2\in[r_0,1]\\ r_1\in[0,r_2-r_0]}} \left\{ADF_{r_1}^{r_2}\right\}$$

The difference of iterations in these two tests is shown in Figure 1.

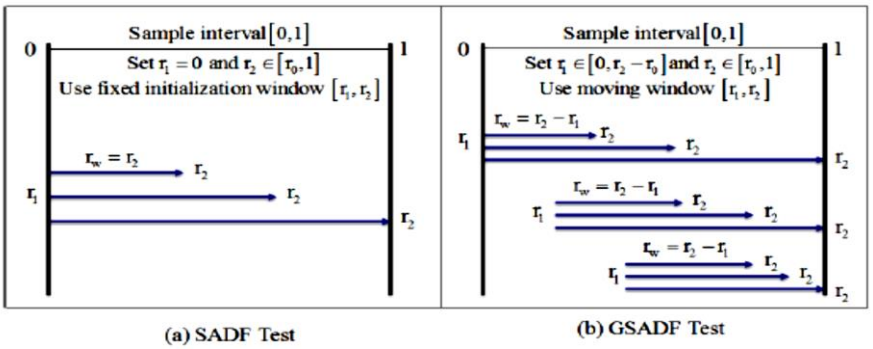

Fig. 1. Sample sequences and window widths of the SADF and GSADF test
Source: (Phillips et al. 2012)

3.2. Research model

As mentioned before, after identifying bubbles for each active company in Tehran Stock Exchange, periods with and without bubbles are identified for each company and are classified with a binary code, such that for periods with bubbles the corresponding value is 1 and otherwise the value is zero. Then, the effects of amateur and professional investors' behaviors on the probability of price bubbles appearance in the stocks is analyzed using Logit discrete model. Thus, the behaviors of amateurs and professional investors according to their buying and selling are considered in the two following models. In this paper we propose that individual (actual) investors are busy at work during the week and consider trading decisions (either buy or sell)

mainly amateur. Professional and institutional (legal) investors sometimes use weekdays to plan for trading:

First model (volume of sell trades):

$$bub_i = \beta_1 + \beta_2 pe_{it} + \beta_3 lspeed_{it} + \beta_4 lsaleh_{it} + \beta_5 lsalea_{it} + \beta_6 lsize_{it} + U_{it}$$

Second model ((volume of buy trades):

$$bub_i = \beta_1 + \beta_2 pe_{it} + \beta_3 lspeed_{it} + \beta_4 lbuyh_{it} + \beta_5 lbuya_{it} + \beta_6 lsize_{it} + U_{it}$$

bub (dependent variable): a two-value integer indicating the presence or absence of bubbles in the corresponding company which is identified by Phillips test.

Pe (P/E ratio): shows the market's expectations from the future profitability of the market and is obtained from dividing the current stock price with predicted net profit of each stock.

Lspeed (speed of turnover): shows the liquidity status of a company and is obtained from dividing the total trade of the company to average market value of stocks.

Lsize (company size): a measure for identifying the size of companies. Indices like assets value, sales, stock market value, and stock quantity can be used to calculate this measure. Company size is used in this research.

Lsaleh (trades professionals' volume of sell trades): a measure for professional investors' behaviors after supply. Professional investors are banks, insurance companies, holdings, investment companies, retirement funds, and so on. Given that legal investors are companies and have experts in this field, we can consider this type of investors as professionals.

Lsalea (amateurs' volume of sell trades): a measure for individual investors' behaviors after supply. By individual investors we mean individuals who lack an expert knowledge compared to professional investors, hence we can consider them as amateurs.

Lbuya (amateurs' volume of buy trades): a measure for amateur investors' behaviors after demand.

Lbuyh (professionals' volume of buy trades): a measure for professional investors' behaviors after demand.

3.3. Research model estimation method: Logit model

Logit and Probit models are used when the dependent variable is hidden. In these cases, dependent variable shows up as a dual choice. Here we used Logit model which follows logistic regression. In a multi-variable regression, the coefficients of independent variables are estimated but their function is completely different. In a multi-variable regression, the method

of least squares is used. In this method, the sum of the squared difference between actual and predicted values for the dependent variable is minimized. Due the non-linearity of logistic transformation, maximum likelihood method is used.

Logistic models follows logistic curve, hence is fitted based on actual data. Actual data of the dependent variable takes a value of 0 or 1, if the phenomenon has happened or not, so the data is either below or above the plot. The occurrence of the phenomenon is determined according to different levels of linear combinations of independent variables. The advantage of logistic regression is that single information is sufficient for determining the 0 and 1 values. Therefore, we can use this dependent variable to estimate the occurrence of the phenomenon. If this probably is estimated to be bigger than 0.5, the phenomenon is considered to be certain and otherwise uncertain. The additive logistic distribution function of the research model is:

$$p_i = E\left(y = 1 \middle| x_i\right) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 pe_{it} + \beta_3 lspeed_{it} + \beta_4 lsaleh_{it} + \beta_5 lsalea_{it} + \beta_6 lsize_{it} + U_{it})}}$$

where e is natural logarithm base. For convenience, we rewrite this as:

$$p_i = \frac{1}{1 + e^{-z_i}}$$

where

$$z_i = \beta_1 + \beta_2 pe_{it} + \beta_3 lspeed_{it} + \beta_3 lspeed_{it} + \beta_4 lsaleh_{it} + \beta_5 lsalea_{it} + \beta_6 lsize_{it} + U_{it}$$

If Pi is the probability of an event, (1-pi) which is the probability of that event not happening is:

$$1 - p_i = \frac{1}{1 + e^{z_i}}$$

Thus we have:

$$\frac{p_i}{1 - p_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i}$$

Now, $\frac{p_i}{1 - p_i}$ is simply dividing the event probability on its alternative. If we take logarithms on both sides we will have this interesting result:

$$l_i = Ln\frac{p_i}{1 - p_i} = z_i = \beta_1 + \beta_2 pe_{it} + \beta_3 lspeed_{it} + \beta_4 lsaleh_{it} + \beta_5 lsalea_{it} + \beta_6 lsize_{it} + U_{it}$$

In other words, the logarithm of L is not only linear with respect to variables, but also is linear with respect to parameters. L is called Logit. Since we use the data of 50 active companies from 2001 to 2004 on a monthly basis, Logit panel model is selected to estimate the research model.

4. Model estimation and analyzing the results

4.1. Identifying bubbles by Phillips test

The main approach of this research for examining bubbles is using GSADF unit root test. Figures 2 and 3 show the results of GSADF test for identifying bubble periods for Sina bank and Mapna group as a sample of the 50 companies examined. The blue line shows the calculated value and the red line shows the critical value. In these plots, when the estimated value goes higher than the critical value, we have bubbles in market status or the stocks and it has a blasting growth.

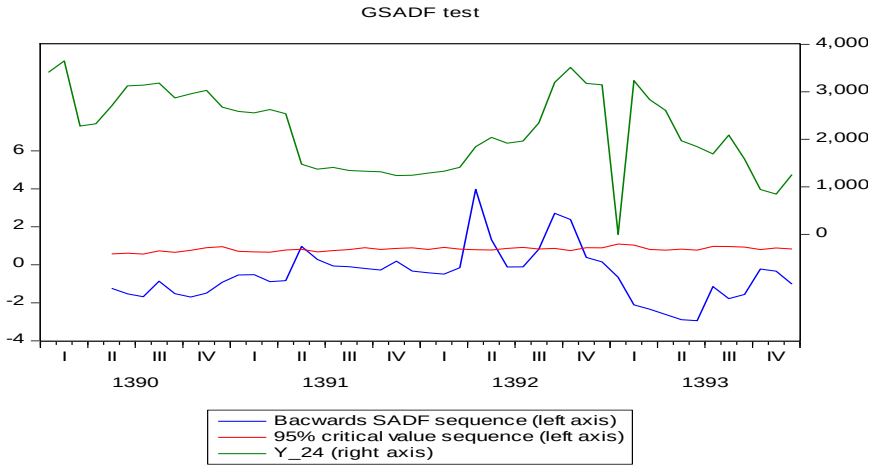

Fig. 2. GSADF test for Sina bank

Table 1. GSADF results for Sina bank

		t-Statistic	Prob.*
GSADF		3/973909	0/048
Test critical values	99% level	6/698277	
	95% level	3/943486	
	90% level	3/071586	

*Right-tailed test

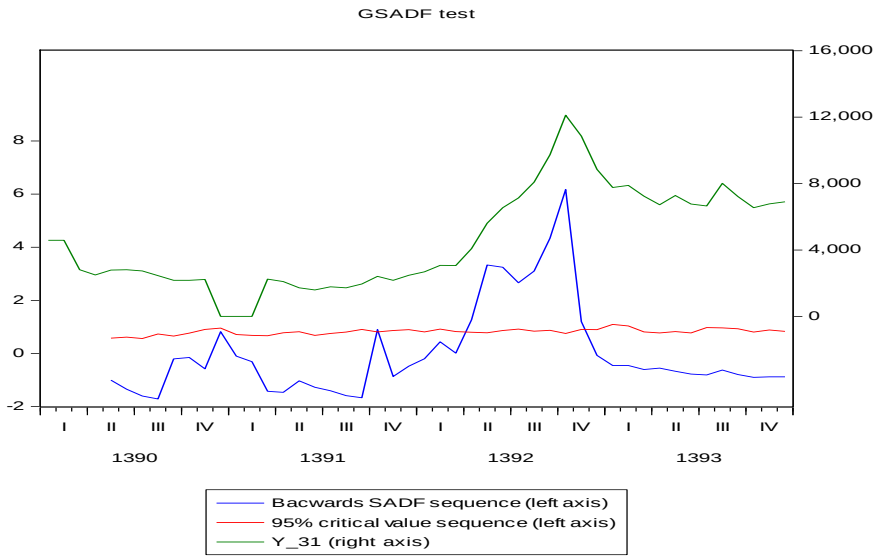

Fig. 3. GSADF test for Mapna group

Table 2. GSADF results for Mapna group

		t-Statistic	Prob.*
GSADF		6/169084	0/013
Test critical values	99% level	6/698277	
	95% level	3/943486	
	90% level	3/071586	

*Right-tailed test

The results of Phillips test for all of the companies show that, in general, we have some months– 3, 4, 5, 6, 9, and 10– in 2003 having bubbles in the exchange and the majority of stocks were facing bubbles.

4.2. Unit root test

The unit root test is one of the most common tests used for identifying the stationary of a time series process. Non-stationary in the series used in a model can cause false regression and hence incorrect statistical interpretations. Therefore, we have used Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) tests. The results of Table 3 show that the null hypothesis– having unit root– for all of the variables is rejected. Hence all the variables are static.

Table 3. Panel unit root tests

Variables	LLC	IPS
P/E	-4.46	-6.94
	(0.000)	(0.000)
Speed	-11.36	-10.17
	(0.000)	(0.000)
Lsize	-12.64	-12.28
	(0.000)	(0.000)
Lbuya	-9.83	-8.11
	(0.000)	(0.000)
Lbuyh	-14.78	-20.62
	(0.000)	(0.000)
Lsalea	-9.51	-11.47
	(0.000)	(0.000)
Lsaleh	-16.10	-21.87
	(0.000)	(0.000)

4.3. Panel data models for binary choice

After the final division of companies to bubble-less and bubble-full, independent variables are collected for each company before the period of bubbles and their impact on the dependent variable– which is the probability of bubbles– is tested.

Using Logit model, the possibility of predicting bubbles is examined. As mentioned before, the independent variables used for the estimation of bubbles are *P/E*, company *size*, deals *speed*, and the behaviors of *amateur and professional investors* (amateurs' volume of buy and sell trades and professionals' volume of buy and sell trades). The results of Limber F and Hausman test show that panel data have a fixed effect. So the research model is estimated based on a panel data with fixed effect approach. The result of model estimation in the first stage is shown in Table 4. In a Logit regression with fixed effect, two measures are used for goodness of fit which the most important is LR. This measure acts like the F statistic in a normal regression, where the χ^2 probability is zero. Hence, the hypothesis of the model being meaningless is rejected and the model is meaningful and reliable.

Another measure is Log likelihood. This measure has a negative value and the more its absolute value, the more suitable the model. For the first model, χ^2 value is 186.25 with 5 degrees of freedom, and the probability is zero. Hence the hypothesis of the model being meaningless is rejected and the model is meaningful and reliable. Furthermore, χ^2 value of the second model is 182.25 and its probability is zero. Hence the hypothesis of the second model being meaningless is rejected and the second model is also meaningful and reliable.

Table 4. Results of regressions of first model by fixed effect (amateur and professional sales)

Variables	Coefficient	Standard Error	Z-Statistic	P>|Z|
P/E	0.0022	0.0012	1.86	0.062
Speed	0.0045	0.0026	1.72	0.086
Lsaleh	0.2892	0.0742	3.90	0.000
Lsalea	0.5427	0.0977	5.55	0.000
Lsize	-0.2427	0.1597	-1.52	0.129
LR chi2		186.25 (prob=0.000)		
Number of obs		1830		
Number of group		49		
Log likelihood		-526.6861		
Hausman test		44.83 (prob=0.000)		

Table 5. Results of regressions of second model by fixed effect (amateur and professional buying)

Variables	Coefficient	Standard Error	Z-Statistic	P>|Z|
P/E	0.0013	0.0011	1.17	0.242
Speed	0.0088	0.0029	3.01	0.003
Lbuyh	0.1554	0.0755	2.06	0.039
Lbuya	0.4948	0.0923	5.36	0.000
Lsize	-0.0938	0.1577	-0.59	0.552
LR chi2		182.58 (prob=0.000)		
Number of obs		1842		
Number of group		49		
Log likelihood		-534.7234		
Hasman test		58.24 (prob=0.000)		

4.4. Marginal effect analysis

The interpretation of Logit model's coefficients is difficult, since the estimated coefficients are results of a two choice model which can't be interpreted as a final impact on the dependent variable. The final interpretation of xj on conditional probability is determined using:

$$\frac{\partial E(y / x, \beta)}{\partial x_j} = f\left(-x\beta\right).\beta_j$$

where f(x) = (df(x))/dx is the density function of F(X). Since f is always positive, the sign of the final impact is dependent to βj. If βj is positive, increasing xj will result in the increase of the dependent variable's probability (bubble). The results of final impacts are shown in Table 6 and Table 7.

Table 6. Results of marginal effect estimation for the first model (amateur and professional sales)

Variables	dy/dx	Standard Error	Z-Statistic	P>|Z|
P/E	0.0022	0.0011	1.90	0.058
Speed	0.0071	0.0024	2.93	0.03
Lsaleh	0.2857	0.0731	3.91	0.000
Lsalea	0.4881	0.0983	4.96	0.000
Lsize	-0.3382	0.1574	-2.15	0.032
Number of obs		1865		

Table 7. Results of marginal effect estimation for the second model (amateur and professional buys)

Variables	dy/dx	Standard Error	Z-Statistic	P>|Z|
P/E	0.0011	0.00106	1.07	0.284
Speed	0.0102	0.0026	3.90	0.000
Lbuyh	0.1599	0.0729	2.19	0.028
Lbuya	0.4612	0.0927	4.97	0.000
Lsize	-0.0192	0.1552	-1.24	0.214
Number of obs		1876		

It can be seen that for price to profit ratio, deals speed, and buying and selling of amateur and professional investors, the final impact is positive, which means that with a 1 percent increase in each of these variables, the probability of bubbles increase. Namely, with a 1 percent increase in P/E, the probability of bubbles increase approximately 0.2 percent and with a 1 percent increase in deals speed, the probability increase approximately 1 percent. Meanwhile the results show that the company size as an index for company scale reduces the probability of bubbles approximately 30 percent. Furthermore, amateur investors' activities have more impact on bubbles compared to professional investors. A 1 percent increase in amateur buying and selling, increases the probability of bubbles approximately 46 and 49 percent, respectively, and a 1 percent increase in professional buying and selling increases this probability approximately 16 and 28 percent, respectively. This shows that amateur investors have bigger impacts on price bubbles. Therefore, we can conclude that the investors' financial behaviors are a key point in bubble formation.

8. Conclusion and Discussion

Price bubbles and whether the increase in stock prices is due to fundamental factors and the improvement of future economics is a common issue in economic discussions. Furthermore, the reasons behind bubbles and the role of amateur and professional investors is one of the most important subjects. In this research, the presence of bubbles in the period of August 2001 to February 2004 is examined using monthly data. Phillips method was implemented. After identifying the price bubbles for each active company in Tehran stock exchange, bubble-less and bubble-full stocks were classified with 0-1 numbers. In the next step, the impacts of amateur and professional investors were examined using the presented binary Logit regression model. In the end, the optimum model with respect to different measures presented in the methodology was chosen and the results were analyzed.

The results showed bubbles in 49 out of 50 companies. But, the relation between price bubbles and independent variables is different, in other words,

it has a direct relation with variables such as deals speed, price to profit ratio, and the behaviors of amateur and professional investors, while the company size reduces the probability of bubbles.

Thus, according to the results, we can conclude that the behaviors of amateur investors is the most important factor in the formation of bubbles in Tehran stock exchange, so the reason behind bubbles should be sought in the financial behaviors of investors and their expertise level. Similar results obtained from the exchanges of different countries show that the impact of amateur investors is more than professional investors. Hence the authorities and decision makers should focus on the behaviors of amateur and professional investors to prevent the bubbles. According to the subject and the results, decision makers and policy makers of the capital market can create and develop consultation and analysis firms to prevent bubbles and control the emotional changes in stock markets. Furthermore, given the key role of amateur investors in the formation of bubbles, it is advised to have instructional and functional courses to help them get to the professional level.

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