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Financial Crisis, Ownership Effect and Investors Sentiment: Empirical Evidence from the Banking Sector in Greece.

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Abstract:

According to financial theory, in an efficient market investors reflect fully and instantaneously all relevant information on security prices in a way consistent with the economic theory. Empirical research on market efficiency investigates if there is past available information which can help to predict future returns profitably, as well as if factors not related to rational economic behaviour, influence stock prices. Financial manias and panics are examples which serve as obvious evidence against the efficient market theory. This study investigates the stock price behaviour of a number of listed banks prior and during the financial crisis of 2008-2009. Banks under investigation were separated into two categories i.e. large banks and small banks. These two categories behaved differently under the crisis. We have serious reasons to believe that the different behaviour was not due to different performance or risk exposure but due to different ownership structure. Big banks, with high institutional participation indicated stock price dynamics during the crisis, possibly because of the fact that institutional investors were affected by correlated negative sentiment or mimicking minimising loss strategies irrespectively of the quality of the banks' assets. Thus, the ownership structure of an asset may be of importance to its stock price behaviour contrary to the prediction of the efficient market theory.

Key Words: *International Efficiency, Institutional Investors, Investors' Sentiment*

JEL Classification*: G14*

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1. Introduction

According to the Efficient Market Hypothesis (EMH), Fama (1970), (1976), asset prices reflect fully and instantaneously all relevant available information in a rational, i.e. in accordance with economic theory, manner and factors not linked with economic theory, like investors sentiment, should not affect asset prices. In an efficient market, past information is of no use in predicting profitably future asset returns, since it has been already fully reflected on asset prices by a number of competing, profit maximizing investors. An efficient market should react only to new information, but since this is unpredictable by definition, asset price changes or asset returns cannot be predicted. Thus, the empirical research for market efficiency investigates if there is past available information which can help to predict future returns profitably, but also investigates if non economic factors like investors' psychology influence asset prices.

In this study we will examine the stock price and trading volume behaviour of the banking sector in Greece, before and during the recent financial crisis which started in 2008. Analytically, we will examine the possibility of "causal" relationships between stock returns and stock returns and trading volume. The existence of such dynamics may give support to the view that asset prices during the crisis were heavily influenced by psychological factors and not only by negative news. We chose the banking sector because is representative for the Greek market but also it is preferable for investing by the majority of the institutional investors, both domestic and foreigner; and in the international literature there is growing evidence that institutional investors may herd due to psychological reasons opposite to the prediction of the Efficient Market Hypothesis, Choe, Kho and Stulz (1999), Kim and Wei (2002), Bowe and Domuta (2004), Pucket and Yan (2007), Tan, Chiang, Mason and Nelling (2008).

In our study, section two (2), presents the relevant theory, section three (3), presents the data sets and the methodology, section four (4) presents data and the empirical results and finally, section five (5) concludes.

2. Theoretical Framework and Related Literature

Under the Efficient Market Hypothesis the Fair Game[2] model holds for stock price changes and consequently for stock returns:

$$E[\ P_t-(P^*_t/I_{t-1})]=0 \quad \text{or} \quad E(r_t/I_{t-1})=0 \qquad (1)$$

[2] The Fair Game model is derived from the Martingale model: E(Pt/It-1)=Pt-1. According to the Martingale model, if the price of a stock, is a Martingale the best forecast of price Pt that could be constructed based on the available information set It-1, would just equal Pt-1, assuming that Pt-1 is in It-1.

where I_{t-1} is the information set available at time t-1, P_t is the actual price at time t, P^*_t is the expected price which is based on the information set I_{t-1}, and $P_t-P^*_t$ is the forecast error which is uncorrelated with variables in the information set I_{t-1}. Similarly, r_t is the stock return which is uncorrelated with variables in the information set $I_{t-1,}$ Le Roy (1989, 1990). According to Samuelson (1965), under the assumption of a non zero equilibrium return and assuming that agents have constant and common time preferences, common probabilities and are risk neutral, then if all assets are to be held willingly, as must be the case for equilibrium, all should therefore earn the same expected rate of return, equal to the equilibrium return.

Fama (1970), rejected the hypothesis that returns themselves are a Fair Game and proposed the following definition of market efficiency, which makes the EMH a joint hypothesis:

$$Z_t = r_t - E(r_t / I_{t-1}) \qquad (2)$$

with:

$$E(z_t) = E[r_t - E(r_t/I_{t-1})] = 0 \qquad (3)$$

In economic terms z_t is the return at time t, in excess of the equilibrium expected return projected at time t, on the basis of the information set I_{t-1}. With the additional assumption that the equilibrium return is constant through time[3], then returns themselves are uncorrelated with variables in past information sets.

Research conducted in '60s and '70s generally supported the market efficiency but recent evidence however does not support the same conclusion. The evidence now suggests, contrary to the prediction of the efficient market model, that most fluctuations in stock prices can not be traced to changes in rational forecasts of future dividends. The recent evidence arises from two areas of research. First, analysts came to realise that stock returns display a variety of systematic patterns, some kind of anomalies, which are difficult to be explained by the Efficient Market Hypothesis. Second, analysts realised that the same models which imply that returns should be unforecastable also imply that asset prices should have a volatility which is low relative to the volatility of dividends. The excess price volatility can be explained from the fact that investors could be reacting to information which is irrelevant to stock prices and that forces other than rational forecasts of future dividends may influence stock prices. Roll (1988) found that irrelevant information appeared to be of dominant importance since economic factors were able to explain only a small fraction of the variance in stock prices. Almost at the same time, Cutler et al (1989) provided evidence that stock returns are unrelated to news. Prior to Roll and Cutler, Black (1986), in his presidential

[3] The assumption that the equilibrium return is constant through time is crucial for empirical tests because as Leroy (1989) noted, *"On Fama's definition any capital market is efficient and no empirical evidence can possibly bear the question of market efficiency."*

address in the American Finance Association used the term "noise" as a large number of small events which is often a causal factor much more powerful than a small number of large events. In this context, psychological factors may be considered as "noise" and psychology driven investment decisions as "noise trading". Since "noise" may influence investors' decisions, it is realistic to assume that there may be a segmented asset market. Smart money i.e. investors who act under rational expectations may be one group; and noise traders i.e. investors who are influenced by factors not related to economic theory, like psychology, may be another group. It is also plausible to assume that the characteristics and interaction of these two groups may affect asset price behaviour, De Long et al (1990[a,b]).

Herding defined as the act of bringing individuals together into a group (herd), maintaining the group and moving the group from place to place, or any combination of those, has been recognized in financial markets as an important factor of psychology based investing. It also recognized the fact that herding affects both groups of investors, noise traders, mostly represented by individual investors, as well as smart money, represented by institutional investors. Of special interest is whether investment decisions are correlated among institutional investors as well as the nature of possible factors which would make institutional investment decisions to be correlated. In this framework it is possible that institutional investors may herd with observable effect on stock prices. Research evidence based on herding measures, show that institutional investing follow such a herding behaviour, Lakonishok, Shleifer, and Vishny (1992) and Wermers (1999), Sias (2004).

A category of herding models imply that institutional investors receive correlated information or assume information from each others' trades Froot, Scharfstein, and Stein (1992) and Hirshliefer, Subrahmanyam, and Titman (1994). When institutional investors, after some trading, conclude that information is fully reflected on stock prices, the observed herding behaviour will pause. The above behaviour leads to a stock returns continuation pattern. The above herding behaviour, i.e. informational herds, contributes to market efficiency since allows stock prices to reflect quickly information and force them to converge to their intrinsic values, Nofsinger and Sias (1999), Wermers (1999), Sias (2004).

A second category of herding models assumes that institutional investors trade as a herd because of non informational reasons. Scharfstein and Stein (1990) present a model where institutional investors trade with the herd, mimicking one the other, because they do not want to act differently from other institutions taking the risk to fall behind their peer group. Additionally, institutional investors may herd due to investment fashions or because they portfolio preferences is for stocks with certain characteristics i.e. above average past performance or marketability, Banerjee (1992), Falkenstein (1996), Del Guercio (1996), Gompers and Metrick (2001). Finally, institutional investors may trade in herd because are affected by the same psychological factors, like optimism and pessimism, or even greed and fear. Studies have shown that institutional investors are affected psychologically by past returns and they buy after some price increase (optimism) and sell after some price

decrease (pessimism), DeLong et al (1990[b]). The above behaviour, when corrected, leads to a stock reversion pattern which in some studies is documented to be asymmetric, Puckett and Yan 2007. The above herding behaviour, i.e. psychological herding, under certain conditions may be destabilising and lead prices away from fundamental values, DeLong et al. (1990[b]).

Institutional investing in Greece has increased dramatically over the last decade and especially that from abroad. Foreign Institutions in December 2007 accounted for more than 39% of all ownership among the listed companies in Greece, in comparison to 19% in December 2002, according to data from the Central Depository of the Athens Stock Exchange. The above fact raise the question concerning the effect of institutional trading in the Greek stock market.

In this study, apart from stock prices, in order to detect psychological factors in investment decisions, we will use trading volume since it has been recognized by economists as an important factor indicating investors' interest. In some empirical tests for market efficiency, price changes are interpreted as the market evaluation of new information, while the corresponding trading volume is considered as an indication of the extent to which investors disagree about the meaning of the information, Karpoff (1987), Hiemstra and Jones (1994). Also, some researchers argue that trading volume may provide insights regarding the quality of trader information that cannot be obtained from price statistics, and the joint analysis of past price and volume data can prove useful in providing information about future price movements, Blume et al (1994).

Early studies of the price – volume relationship discerned no relation of the variables under examination, Godfrey, Granger and Morgerstern (1964), Crouch (1970), or a contemporaneous relationship, Ying (1966), Rogalski (1978), Harris and Garel (1986). Nevertheless, recent international evidence, and especially evidence from emerging markets, gives support for "causality" relationships between stock returns and trading volume, but the evidence is not clear in terms of the involved dynamics, Moosa and Al-Loughani (1995), Silvapulle and Choi (1999), Lee and Rui (2000), Chordia and Swaminathan (2000),Chen et al. (2001).

3. Data sets and methodology employed

In this analysis we used daily observations i.e. closing prices and trading volumes of shares for the banking sector of the Athens Stock Exchange. Analytically, we used data for the following banks: Agrotiki Bank, Alfa Bank, Aspis Bank, Attikis Bank, Cyprus Bank, Emporiki Bank, Ethniki Bank, Eurobank, Geniki Bank, Piraeus Bank, Marfin Popular Bank, Post Office Bank. Data cover the time span March 2007 to March 2009; a total of 495 observations covering the period of the crisis March 2008-March 2009 and an equal period before the crisis, March 2007-March 2008. Stock prices are adjusted for dividends, stock splits and reverse stock splits. Finally, in all cases the logarithmic transformation of the original series was used. Based on Table I and according to criteria like, assets

value, share capital, revenues and capitalization we split the banks set into two categories: Big Banks (Alfa Bank, Cyprus Bank, Ethniki bank, Eurobank, Piraeus Bank and Marfin Popular Bank) and Small Banks (Agrotiki Bank, Aspis Bank, Attikis Bank, Emporiki Bank, Geniki Bank and Post Office Bank). In addition, we examine these two categories for a period before the financial crisis and a period during the financial crisis. From Table II, (see APPENDIX) based on data from the Central Depository of the Athens Stock Exchange, it is obvious that the Big Banks category has a much higher institutional participation. Finally, in order to perform aggregate analysis we constructed Big and Small Banks indices defined as the aggregate price and trading volume of the two categories under examination.

A very popular way to test the existence of any temporal statistical relationship, in terms of prediction, between two variables is the Granger "causality" test, Granger (1969). Granger's tests for "causality", in the sense of precedence, are based on the following statistical reasoning: if we consider two time series as Y_t and X_t, the series X_t fails to Granger cause Y_t, if in a regression of Y_t on lagged Y's and lagged X's the coefficients of the latter are zero. The presence of "causality" obviously implies market inefficiency: Under the Efficient Market Hypothesis (EMH), it is true that past information is of no use in predicting future stock price movements, that is stock price changes and consequently stock returns should be unpredictable in an efficient market.

The standard Granger "causality" tests are usually performed on stationary data. Nevertheless, the first difference transformation, which is often used to attain stationarity filters out low frequency (long run) information. Cointegration reintroduces in a statistically acceptable way, the low frequency information. The basic idea of cointegration is that when two or more series move closely together in the long run, even though the series themselves are trended, the difference between them is constant. We may regard the cointegrating series as defining a long run equilibrium relationship and the difference between them to be stationary. The term equilibrium in this case suggests a relationship which, on average, has been maintained by a set of variables for a long period, Engle and Granger (1987), Johansen and Juselius (1990)**.** Cointegrated variables in the bi-variate case must possess temporal "causality" in the Granger sense, in at least one direction, since for a pair of series to have an attainable equilibrium, there must be some causation between them to provide the necessary dynamics.

4. Results

The basic statistics of the series under examination are presented in Tables Ia and Ib (see APPENDIX). Tables IIa and IIb (see APPENDIX) presents the unit root test results. Analytically, we performed the Augmented Dickey -Fuller test. For the case of the stock prices, it is clear from the table that the null hypothesis that any of the series have unit roots cannot be rejected. This is confirmed by the statistics which test for unit roots in the first differenced series. In each case the null

hypothesis is easily rejected. Together with the results in the level series, it strongly implies that each of the stock price series are integrated of order one, I~(1). The unit root test statistics for the case of the trading volume series indicated that these are stationary at their levels i.e. they are integrated of order zero, I~(0)[4]. Based on the above results, the Granger "causality" tests can be performed on the first logarithmic difference of the original series.

The results obtained from the standard Granger "causality" tests are presented in Tables IIIa, b, c and d. The lag selection in the above tests ensured white noise residuals but also the Akaike information criterion was taken in to account. The relevant F statistics indicate that the lagged price changes of the Big Banks category can help to predict the change in trading volume, with marginal statistical significance only in the case of the crisis period.

Finally, cointegration tests, presented in Tables IV a, b, c and d (see APPENDIX) indicate that cointegration exists between the prices of the banks of the Big Banks category and only for the period of the financial crisis. The above result, lead us to conclude that there is a long run statistical equilibrium between the examined series i.e. individual big bank prices, during the crisis period.

5. Conclusions

The concentration of institutional ownership in equity markets raises important questions concerning its impact on securities prices. International evidence suggests that institutions herd together particularly over short time periods, and that such trading behaviour may affect stock market price formation. Using data, (stock prices and trading volumes) for the banking sector of the Athens Stock Exchange, for a period before the financial crisis, which started in 2008, and during the crisis, we examine the existence of institutional investors correlation by investigating the behaviour of a group of companies with low institutional participation (Small Banks category) and a group with high institutional participation (Big Banks category). Our results indicate that there is a low frequency correlation phenomenon based on stock prices dynamics and stronger deviations from the Efficient Market Hypothesis during the period of the crisis and for the group of firms with high institutional participation.

One angle to explain the results is the following. When institutional investors construct their portfolios, the decision to buy a particular security, out of a large number of possibilities that exist, is likely to convey positive firm-specific information which is largely uncorrelated among different firms. Alternatively, when institutional investors hold a number of securities in their portfolios, and when short sales are constrained, as it was the case during the financial crisis period in

[4] The stationarity results of the unit root tests were confirmed be a visual inspection of the series and the behaviour of their sample autocorrelation function.

Greece, face a limited number of alternatives when deciding to sell, Chan and Lakonishok (1993). As a result, there are many reasons why institutional sales may not necessarily be driven by negative firm-specific information but are influenced by general factors as demand for cash, Campbell et al (2007), or negative sentiment. The later implies that institutional investors' decision making is influenced by emotions like greed and fear.

Based on our results we think it would be interesting to examine institutional investors' behavior on a non-aggregate basis. The inclusion of variables like buy and sell orders by institutional investors as well as the stock price performance of other international exchanges would help to understand better how institutional investors trading may affect asset prices. We leave that for future research.

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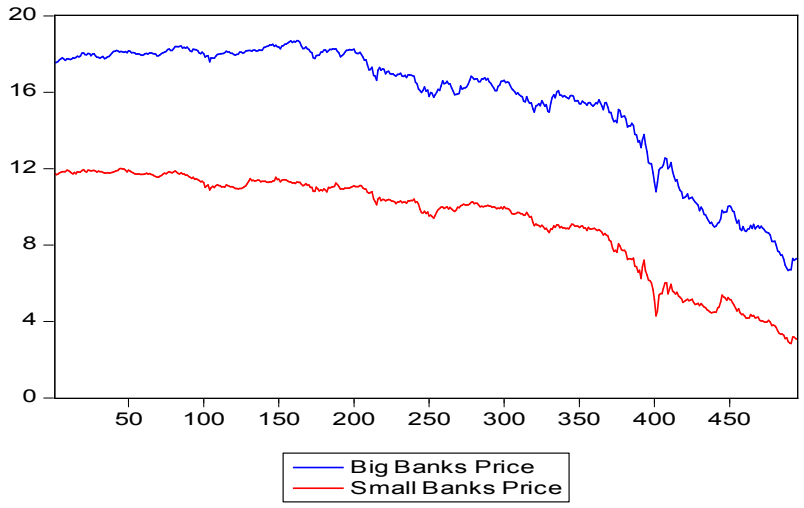
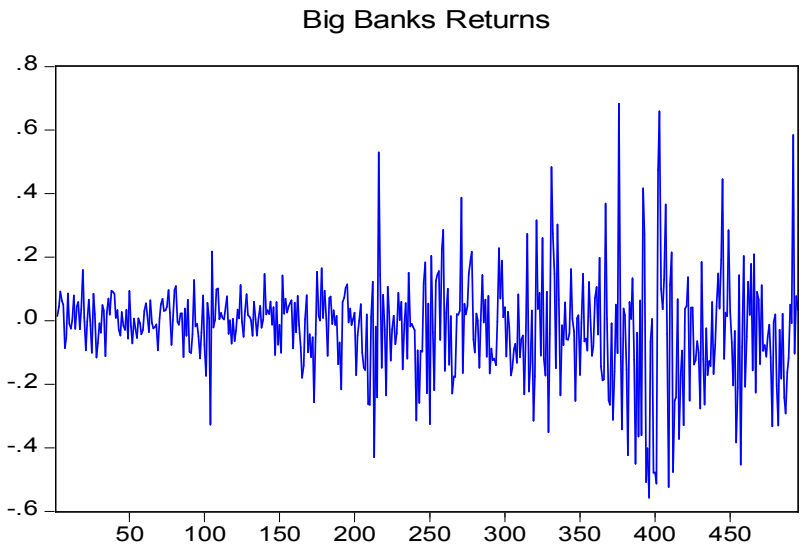
APPENDIX

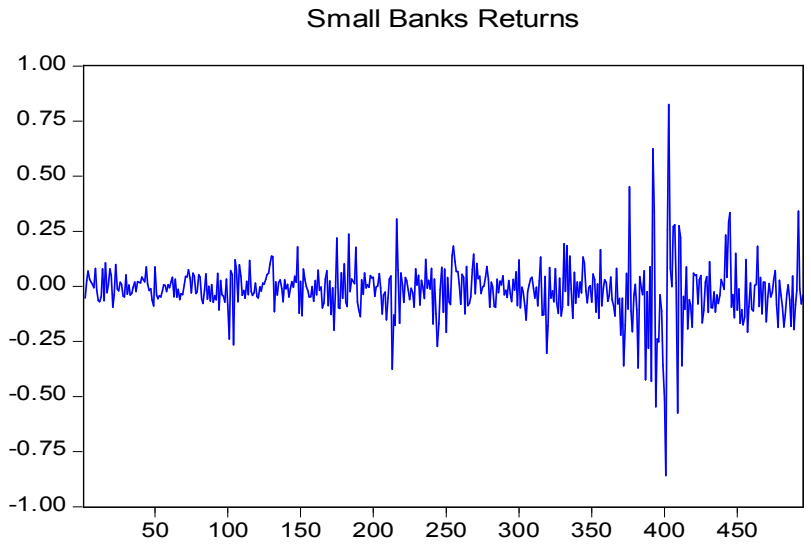
Tables and Graphs

Graph I. Stock Prices (obs. 1-250 before the crisis, obs. 251-495 during the crisis)



Graph II. Stock Returns (obs. 1-250 before the crisis, obs. 251-495 during the crisis)





Graph III. Trading Volume (obs. 1-250 before the crisis, obs. 251-495 during the crisis)

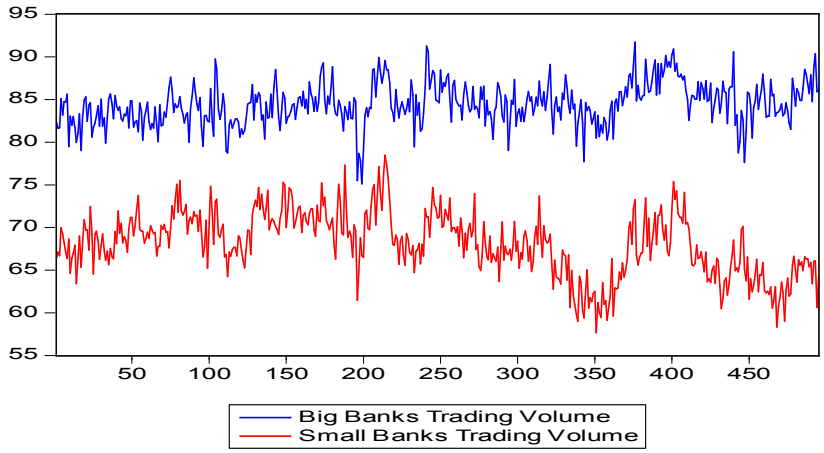


Table I. Big and Small Banks Categorization

Bank Institution		Assets	Rank	Share Capital	Rank	Revenues	Rank	Capitalisation	Rank
Agrotiki Bank	**Small**	6,10%	6	4,91%	7	6,05%	7	5,19%	8
Alfa Bank	**Big**	13,74%	3	13,85%	3	14,25%	3	12,56%	3
Aspis Bank	**Small**	0,74%	12	0,73%	12	0,62%	12	0,23%	12
Attikis Bank	**Small**	0,98%	11	1,03%	10	0,94%	11	1,41%	10
Cyprus Bank	**Big**	7,98%	7	6,47%	6	7,11%	5	7,60%	5
Emporiki Bank	**Small**	6,87%	8	2,87%	8	6,32%	6	6,97%	6
Ethniki Bank	**Big**	22,72%	1	27,56%	1	29,06%	1	32,19%	1
Eurobank	**Big**	17,19%	2	17,29%	2	17,95%	2	14,05%	2
Geniki Bank	**Small**	1,09%	10	0,97%	11	1,08%	10	0,69%	11
Piraeus Bank	**Big**	11,67%	4	10,68%	5	10,41%	4	9,59%	4
Marfin Popular Bank	**Big**	7,60%	5	11,24%	4	4,35%	8	6,70%	7
Post Office Bank	**Small**	3,31%	9	2,41%	9	1,87%	9	2,83%	9

Table II. Big and Small Banks, Institutional Investor Participation

Big Banks	Institutional Participation (approximation)	**Small Banks**	Institutional Participation (approximation)
Alfa Bank	55%	Agrotiki Bank	6%
Cyprus Bank	19%	Aspis Bank	8%
Ethniki Bank	66%	Attikis Bank	1%
Eurobank	33%	Emporiki Bank	21%
Piraeus Bank	53%	Geniki Bank	5%
Marfin Popular Bank	63%	Post Office Bank	30%
Average	48%	Average	12%

Table IIIa. Basic Statistics, period before the crisis

Variable	Mean	St. Dev.	Skewness	Kurtosis
Big Banks (Δ Stock Prices)	-0.007	0.099	-0.369	7.812
Small Banks (Δ Stock Prices)	-0.008	0.079	-0.404	6.233
Big Banks (Δ Trading Volume)	0.024	2.312	-0.081	4.215
Small Banks (Δ Trading Volume)	0.029	2.411	0.065	3.263

Table IIIb. Basic Statistics, period during the crisis

Variable	Mean	St. Dev.	Skewness	Kurtosis
Big Banks (Δ Stock Prices)	-0.034	0.202	0.300	4.157
Small Banks (Δ Stock Prices)	-0.026	0.163	0.007	9.947
Big Banks (Δ Trading Volume)	-0.009	2.324	-0.283	3.578
Small Banks (Δ Trading Volume)	-0.038	2.472	-0.313	2.743

Table IVa. Unit Root Tests, period before the crisis

Variable	Levels	Δ Transformation
Big Banks (Stock Prices)	1.07	-15.46**
Small Banks (Stock Prices)	0.80	-16.66**
Big Banks (Trading volume)	-8.41**	-
Small Banks (Trading volume)	-4.16**	-

Note: Double star(**) indicates significance at 99 % confidence interval.

Table IVb. Unit Root Tests, period during the crisis

Variable	Levels	Δ Transformation
Big Banks (Stock Prices)	0.88	-14.20*
Small Banks (Stock Prices)	0.49	-14.53*
Big Banks (Trading volume)	-2.93*	-
Small Banks (Trading volume)	-3.38*	-

Note: Single star(*) indicates significance at 95 % confidence interval.
Double star(**) indicates significance at 99 % confidence interval.

Table Va. Big Banks
Return and Volume Granger "causality" tests, period before the crisis

Depended Variable: Δ Price	Depended Variable: Δ Trading Volume	«causality» direction
"Causality" statistic:0.74	"Causality" statistic:1.15	No "causality"

Table Vb. Big Banks
Return and Volume Granger "causality" tests, period during the crisis

Depended Variable: Δ Price	Depended Variable: Δ Trading Volume	«causality» direction
"Causality" statistic:0.89	"Causality" statistic:2.62*	Δ Price "cause" Δ Trading Volume

Note: Single star(*) indicates significance at 95 % confidence interval.

Table Vc. Small Banks
Return and Volume Granger "causality" tests, period before the crisis

Depended Variable: Δ Price	Depended Variable: Δ Trading Volume	**«causality» direction**
"Causality" statistic:2.33	"Causality" statistic:0.13	No "causality"

Table Vd. Small Banks
Return and Volume Granger "causality" tests, period during the crisis

Depended Variable: Δ Price	Depended Variable: Δ Trading Volume	**«causality» direction**
"Causality" statistic:1.79	"Causality" statistic:2.34	No "causality"

Table VIa. Big Banks - Stock Prices Cointegration test, period before the crisis
Johansen cointegration statistics

Trace results - Selected lag length, p =4

Ho	Eigenvalue	Likelihood Ratio	5% Critical value
r = 0	0.1377	83.99	95.75

Table VIb. Big Banks - Stock Prices Cointegration test, period during the crisis
Johansen cointegration statistics

Trace results - Selected lag length, p =4

Ho	Eigenvalue	Likelihood Ratio	5% Critical value
r = 0	0.1729	116.46*	95.75

Note: Single star(*) indicates significance at 95 % confidence interval.

Table VIc: Small Banks - Stock Prices Cointegration test, period before the crisis
Johansen cointegration statistics

Trace results - Selected lag length, p =4

Ho	Eigenvalue	Likelihood Ratio	5% Critical value
r = 0	0.1123	81.49	95.75

Table VId. Small Banks - Stock Prices Cointegration test, period during the crisis
Johansen cointegration statistics

Trace results - Selected lag length, p =4

Ho	Eigenvalue	Likelihood Ratio	5% Critical value
r = 0	0.1235	74.62	95.75