Herding in emerging stock markets: Evidence from Casablanca Stock Exchange

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Abstract: This paper aims to examine the existence of herding behavior in Casablanca Stock Exchange for the period 2007-2017. We analyze the existence of herding behavior in the overall market and in each one of the four portfolios created according to firms' capitalizations. We also estimate the impact of liquidity, volatility and asymmetric market states on herding behavior. Results obtained show the existence of herding behavior in the overall market and in all size-based portfolios. Also, results show that the increase of liquidity and volatility increases herding behavior for the four portfolios and for the overall market.

Keywords: Herding behavior; Herd; Morocco; Casablanca Stock Exchange; Volatility, Liquidity, Cross Sectional Absolute Deviation

1. Introduction

Since 1863, several authors agreed that stock market movements followed a random walk and were therefore unpredictable (Regnault 1863, Bachelier 1900, Cowles 1933, Working 1934 and Kendall 1953). Fama's works (1965, 1970) permitted a shift from a descriptive analysis to an explanatory analysis of stock prices variations with the development of the Market Efficiency Hypothesis, which is based on arbitrage and investors' rationality.

However, the inability of the Market Efficiency Hypothesis to explain some financial variations and investors' behavior in the financial markets led to the development of the behavioral finance. Based on investors' psychology and limits of arbitrage, behavioral finance aims to explain variations and crashes that are not explained by the Market Efficiency Hypothesis. One of the key concepts of the behavioral finance is the herding behavior.

Based on definitions proposed by different authors (Banerjee 1992, Bikhchandani and Sharma 2001, Hwang and Salmon 2004), we define herding behavior as "*the situation where investors are influenced by others' actions, leading to a change of their behavior and thus to imitation, even if this change oppose their expectations or private information*". In stock markets, it implies that stock movements correlate with market movements.

Acting as a herd is, for several animals (fishes, dogs, wolves…), an instinct behavior that allows protection (reduce threats) or help for hunting (increase opportunities). In financial markets, the purpose of herding is the same. Indeed, herding behavior may lead to a reduction of risks of acting alone and contrary to the market or to the increase of chances of making profits. Herd behavior can explain some behaviors during financial crises such as bank runs.

There are two types of herding: true (or intentional) herding and spurious (or unintentional) herding. True herding is the result of the imitation by investors of others' actions and it is divided into rational herd behavior and non-rational herd behavior. The former may be caused by imperfect information (called information-based herding or information cascades, it arises from informational differences; Bikhchandani and Sharma, 2001), concern for reputation (called reputation-based herding or career concerns, it arises because of the will of conformity with other professionals, due to the uncertainty about manager's skills; Scharfstein and Stein, 1990) or compensation structures (called compensation-based herding, it arises when investment manager's compensation depends on the comparison of its performance with other managers performance; Bikhchandani and Sharma, 2001) while non-rational herd behavior is the situation where investors imitate others' actions blindly ignoring all rational analysis (Devenow and Welch, 1996). Regarding spurious or unintentional herding, investors don't imitate but their reactions and decisions, facing public information and similar problems, are similar. It should be noted that, empirically, the distinction between true and spurious herding is impossible since investment decisions depend on a multitude of factors (Bikhchandani and Sharma, 2001).

The study of herding in stock markets gained in interest during last years. Thus, Christie and Huang (1995) found no evidence of herding in daily and monthly US stock markets returns. Tan *et al.* (2008) and Chiang *et al.* (2010) found significant evidence of herding in Chinese stock markets while Demirer and Kutan (2006) found no evidence of herding in China. In Europe, Tessaromatis and Thomas (2009), Saastamoinen (2008) and Ohlson (2010) found respectively evidence of herding in Greece, Finland and Sweden. Economou *et al.* (2011) found also significant evidence of herding behavior in Italy and Greece. Regarding frontier markets, Arjoon and Bhatnagar (2017) found significant evidence of herding in the Trinidad and Tobago Stock Exchange. In Africa, Guney *et al.* (2017) studied eight African stock markets (BRVM, Botswana, Ghana, Kenya, Namibia, Nigeria, Tanzania and Zambia) and found significant evidence of herding. Other studies focused on herding in different countries. Thus, Chiang and Zheng (2010) studied 18 countries and found evidence of herding in advances stock markets and Asian markets and no evidence of herding in the US and Latin American markets. Chang *et al.* (2000) analyzed 5 stock markets (US, Hong Kong, Japan, South Korea and Taiwan). They found no evidence of herding in US and Hong Kong and significant evidence during periods of large market movements in South Korea and Taiwan.

The present paper aims to examine the existence of herding behavior in Casablanca Stock Exchange for the period January 2007 - December 2017.

Established in 1929, the Moroccan Stock Exchange, officially known as the Casablanca Stock Exchange or CSE, is considered as one of the most dynamic stock markets in Middle East and North Africa region (MENA) and part of the MSCI Emerging Markets indices (Ferrouhi and Ezzahid, 2013). The Moroccan Stock Exchange is the third largest African stock market (after Johannesburg and Lagos Stock Markets).

Thus, we apply herding behavior tests to our sample composed from the major 39 Moroccan stocks. We analyze the existence of herding behavior during the period of the study and estimate the impact of liquidity, volatility and asymmetric market states on herding behavior.

This paper is organized as follows. Section 2 presents methodology and data used in this paper. Results obtained are presented in section 3. Finally, section 4 offers conclusions.

2. Methodology

The existence of herd behavior in stock markets implies that stock movements correlate with market movements. Thus, dispersion seems to be the adequate measure of herd behavior, as it measures the average proximity of individual stock returns to the market return.

The first measure of herding behavior was proposed by Lakonishok, Shleifer and Vishny (1992). LSV measures herding as the average tendency of a group of many managers to buy (sell) particular stocks at the same time, relative to what could be expected if money managers traded independently. However, LSV measure has two main limits: it uses only the number of investors on the two sides of the market without regard to the amount of stock they buy or sell, to assess the extent of herding in a particular stock and it don't allow the identification of intertemporal trading (Bikhchandani and Sharma, 2001).

Christie and Huang (1995) proposed Cross Sectional Standard Deviation (CSSD) as a measure of average dispersion and thus as a measure of herd behavior in stock markets. This measure was extended by Chang *et al.* (2000) who used Cross Sectional Absolute Deviation (CSAD) as a measure of dispersion and established a non-linear relationship between dispersions and the overall market return.

Based on the model of Chang *et al.* (2000), we use Cross Sectional Absolute Deviation as a measure of dispersion:

$$\mathrm{CSAD_t} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i=1}}^{\mathrm{N}} \left|\mathrm{R_{i,t}} - \mathrm{R_{m,t}}\right| \qquad (1)$$

where N is the number of stocks, $\mathrm{R_{i,t}}$ is the return of stock i at day t, and $\mathrm{R_{m,t}}$ is market return (equally weighted) on t.

Following the approach used by Arjoon and Bhatangar (2017), we first begin by the detection of herding behavior in the overall market and in each one of the portfolios created (according to stocks annual capitalizations) as defined below. We then estimate the impact of liquidity, volatility and asymmetric market states on herding behavior. Finally, we check the robustness of results obtained.

To detect herding behavior, Chang *et al.* (2000) propose to estimate the following equation:

$$CSAD_t = \phi_0 + \phi_1 \left|R_{m,t}\right| + \phi_2 R_{m,t}{}^2 + \phi_3 CSAD_{t-1} + \varepsilon_t \qquad (2)$$

In this paper, as proposed by Xie *et al.* (2015), we replace $R_{m,t}$ by $(R_{m,t} - \bar{R}_{m,t})^2$ to avoid multicollinearity that could exist between $R_{m,t}$ and $R_{m,t}{}^2$. Thus, to detect herding behavior in Casablanca Stock Exchange, we estimate the following equation:

$$CSAD_t = \phi_0 + \phi_1 \left|R_{m,t}\right| + \phi_2 (R_{m,t} - \bar{R}_{m,t})^2 + \phi_3 CSAD_{t-1} + \varepsilon_t \qquad (3)$$

where $CSAD_t$ is defined by equation (1), $\left|R_{m,t}\right|$ is the absolute value of equally weighted return of the market on day *t*, $\bar{R}_{m,t}$ is the arithmetic market return on day *t*. ϕ_2 allows the detection of the existence of herding behavior in our time series. Thus, A significant negative value of ϕ_2 indicates the presence of herd behavior.

To analyze the impact of the market environment on herd behavior in Casablanca Stock Exchange, we analyze the influence of liquidity, volatility and the state of the market.

Thus, to analyze the impact of liquidity on the herding behavior, we estimate the following equation:

$$\mathrm{CSAD_t} = \alpha + \phi_1 \left|\mathrm{R_{m,t}}\right| + \phi_2(\mathrm{R_{m,t}} - \bar{\mathrm{R}}_{\mathrm{m,t}})^2 + \phi_3 Liq_t(\mathrm{R_{m,t}} - \bar{\mathrm{R}}_{\mathrm{m,t}})^2 +$$
$$\phi_4 Liq_t + \phi_5 \mathrm{CSAD}_{t-1+}\,\varepsilon_t \qquad (4)$$

where Liq_t is the volume traded. If the value of ϕ_3 is statistically representative, it means that a variation of liquidity influence herding behavior on the CSE. A statistically significant negative value of ϕ_3 indicates that the increase of liquidity increase herding behavior.

The impact of volatility on herding behavior is estimated using the equation (5):

$$\mathrm{CSAD_t} = \alpha + \phi_1 \left|\mathrm{R_{m,t}}\right| + \phi_2(\mathrm{R_{m,t}} - \overline{\mathrm{R}}_{\mathrm{m,t}})^2 + \phi_3 \,\mathrm{Vol_t} * (\mathrm{R_{m,t}} - \overline{\mathrm{R}}_{\mathrm{m,t}})^2 + \phi_4 \mathrm{Vol_t} + \phi_5 \mathrm{CSAD_{t-1+}}\, \varepsilon_t \qquad (5)$$

where $\mathrm{Vol_t}$ is the volatility, measured by daily the GARCH (1,1) variances.

To study the herding behavior under asymmetric market states, we estimate the following equation:

$$\mathrm{CSAD_t} = \alpha + \phi_1\, \mathrm{D} * \left|\mathrm{R_{m,t}}\right| + \phi_2\, (1 - \mathrm{D}) * \left|\mathrm{R_{m,t}}\right| + \phi_3\, \mathrm{D} * (\mathrm{R_{m,t}} - \overline{\mathrm{R}}_{\mathrm{m,t}})^2 + \phi_4\, (1 - \mathrm{D})\left(\mathrm{R_{m,t}} - \overline{\mathrm{R}}_{\mathrm{m,t}}\right)^2 + \phi_5 \mathrm{CSAD_{t-1}} + \varepsilon_t \qquad (6)$$

where D, a dummy variable, is equal to 1 when the market decreases ($\mathrm{R_{m,t}}<0$) and 0 otherwise (when the market increases).

To check the robustness of results obtained, we estimate the equation (7):

$$Herd_t = \alpha + \phi_1\, R_{m,t} + \phi_2\, Liq_t + \phi_3\, Vol_t + \phi_4 Herd_{t-1} + \varepsilon_t \qquad (7)$$

where $Herd_t$ reflects the daily herding behavior measured by time varying herding parameter ϕ_2, $R_{m,t}$ is the market return, Liq_t is the volume traded and $\mathrm{Vol_t}$ is the volatility measured by the daily GARCH (1,1) variances.

Regarding data, we select stocks that exist for the period of the study (2007-2017) and we retain 39 stocks (Table 1). These stocks represent the main Moroccan companies and they perform in different sectors. Data is obtained from Casablanca Stock Exchange database.

We use daily returns for each common stock listed on the CSE. We choose this sample size as we deem it sufficiently long to capture a true picture of herd behavior on the CSE and how it evolves over time.

Stocks' returns are calculated as:

$$R_t = [log(P_t) - log(P_{t-1})] * 100 \qquad (8)$$

where P_t is the closing daily price of stock i at day t.

To examine the existence of herding behavior in the Moroccan Stock Exchange for the period 2007-2017, we first consider herding at the overall market level. Second, We divided stocks retained into four quartiles according to their annual market capitalization. Portfolio 1 is the largest size portfolio and portfolio 4 is the smallest one. The aim is to consider herding throughout four quartiles and to examine the impact of portfolios' size on herding behavior.

These portfolios are created according to firms' capitalizations for each year. Equation 3 is calculated for each portfolio with $R_{i,t}$ is the return of stock i at day t, and $R_{m,t}$ is daily return of each stock in the portfolio (equally weighted) on t.

3. Results

Table 2 presents descriptive statistics of $R_{m,t}$ and CSAD for the overall market and each size based portfolio, for the period January 2007 to December 2017. As presented above, the four portfolios are creating according to their annual capitalizations. Thus, quartile 1 is the largest size portfolio while quartile 1 is the smallest one.

We remark that, the mean value of market's return and of quartiles 1 (the largest size portfolio), 3 and 4 (the smallest size portfolio) are negative. Their values are respectively -0.005449, -0.000941, -0.001678 and -0.020081. It implies that the Moroccan Stock Exchange performed negatively during last decade. However, the mean value of quartile 2 is positive (0.001356).

Regarding volatility (measured by standard deviation), we remark that quartile 1 (0.570501) is the most volatile while quartile 3 is the least volatile (0.359361). The value of standard deviation of the overall market is 0.291838.

Descriptive statistics of the Cross Sectional Absolute Deviation CSAD show that quartile 2 has the highest mean while quartile 1 has the lowest one. Quartile 1 is the most volatile (0.809693) while and quartile 3 has the lowest volatility as it has the lowest standard deviation (0.438348).

The application of ADF unit root test for the period 2007-2017 reject the null hypothesis of the existence of a unit root for the four quartiles and for the overall market (for both $\mathrm{R}_{\mathrm{m,t}}$ and CSAD).

Table 3 presents results of the estimation of equation (3) for the overall market (CSE) and for each size based portfolio. As suggested by Arjoon and Bhatnagar (2017), we estimate our model using Newey–West heteroscedastic and autocorrelation consistent estimator (Newey and West, 1987).

As presented above, a significant negative value of ϕ_2 indicates the presence of herding behavior. Thus, results show the existence of herding in the overall market and in each one of the four quartiles. Indeed, the value of the estimator ϕ_2 of $(R_{m,t} - \bar{R}_{m,t})^2$ is negative and statistically representative at the 1% level. The convergence of individual stocks returns to market's returns is interpreted by the fact that investors are influenced by others' actions and market variations. These results confirm those of Chiang *et al.* (2010) for Chinese Stock Market, Tessaromatis and Thomas (2009) for Greece, Saastamoinen (2008) for Finland, and Ohlson (2010) for Sweden, Economou *et al.* (2011) for Italy and Greece, Arjoon and Bhatnagar (2017) for Trinidad and Tobacco and Guney *et al.* (2017) for African stock markets.

The analysis of herding behavior on the four size based portfolios allows to define the impact of companies' size on herding behavior. Results show the existence of herding behavior in all size-based portfolios.

The importance of liquidity as a determinant of herding behavior was studied by several authors (Baker and Wurgler, 2006; Brennan and Wang, 2007; Deuskar *et al.*, 2008; Chordia *et al.*, 2008; Tian *et al.*, 2015; and Arjoon and Bhatnagar, 2017). Thus, we analyze the impact of liquidity on herding behavior. As presented above, we include the term $\phi_3 \, \mathrm{Liq}_t(\mathrm{R}_{m,t} - \overline{\mathrm{R}}_{m,t})^2$ in equation (3). Volume traded is used to measure liquidity. A statistically significant negative value of ϕ_3 indicates that the increase of volatility increase herding behavior.

Table 4 presents results of the estimation of equation (4) and shows the influence of liquidity on herding behavior on CSE. Regarding the existence of herding behavior in CSE, results confirm previous results obtained. Indeed, the parameter ϕ_2 is negative and statistically significant at the 1% level for the overall market and for the four portfolios.

As presented above, if the value of ϕ_3 is statistically representative, it means that a variation of liquidity influences herding behavior on the CSE. A statistically significant negative value of ϕ_3 indicates that the increase of liquidity increase herding behavior. Thus, we remark that the estimator ϕ_3 is negative for the overall market (CSE) and for each size-based portfolio. This result means that when liquidity rises, the relationship between $(\mathrm{R}_{m,t} -$

$\overline{R}_{m,t})^2$ and CSAD increases. Indeed, the increase of liquidity, in the overall market and in each one of the four portfolios, increases herding behavior in Casablanca stock exchange.

The impact of volatility on investors' decisions is related to their expectations and reactions regarding new information and new events. Results of the estimation of equation (5) are presented in table 5.

Regarding the existence of herding behavior in the Casablanca Stock Exchange and in the four portfolios, results obtained corroborate with precedent finding. Indeed, parameter ϕ_2 is negative and statistically significant at the 1% level for the overall market and for the four portfolios. Regarding volatility, a value statistically significant of ϕ_3 indicates that volatility impacts investors' herd behavior. Thus, as ϕ_3 is negative and statistically significant (at 5%, 1%, 10%, 1% and 1% levels respectively for the overall market, portfolios 1 to 4), these results mean that the increase of volatility increases herding behavior for the four portfolios and for the overall market.

Table 6 provides results of the estimation of equation 6 that test the asymmetric herding behavior when market rises (ϕ_3) and when it declines (ϕ_4). As estimators are negative, it implies the existence of herding behavior in the overall market and in the four portfolios. In both up going and down-market, we find evidence of herding behavior as the coefficients ϕ_3 and ϕ_4 are negative, except in the 2 portfolio where we didn't find evidence of herding market in the up-going market. Indeed, investors show herding behavior, during the period of the study, for the overall market. This finding is the same when market rises. However, when market declines, results show herding behavior for portfolios 1, 3 and for 4 while portfolio 2 doesn't show the same behavior.

As presented above, to check the robustness of our results, we estimate equation (7), where $Herd_t$ reflects the daily herding behavior measured by time varying herding parameter

ϕ_2, $R_{m,t}$ is the market return, Liq_t is the volume traded and $\mathrm{Vol_t}$ is the volatility measured by the daily GARCH (1,1) variances.

Table 7 presents results of the estimation of equation 7 for the overall market and for each portfolio. First, our findings show that investors herding is associated with market performance as coefficient ϕ_1 is positive for the four groups (respectively at 1%, 10%, 1%, 1% and 1% levels).

We remark that coefficients ϕ_2 estimated for liquidity are negative and statistically significant at the 1% level for the overall market and for the four portfolios. Thus, the increase of liquidity, in the overall market and in each one of the four portfolios, increases herding behavior in the Moroccan stock exchange.

The coefficients ϕ_3 estimated for volatility are also negative and statistically significant (at the 1% level for the overall market and for portfolios 2 and 4 and at 5% level for portfolios 1 and 3). These results corroborate with previous obtained results. Thus, investors herding increases with the increase of market volatility.

4. Conclusions

The purpose of this paper is to examine the existence of herding behavior in Casablcna Stock Exchange for the period 2007-2017. To do this, we first test herding behavior in data, we estimate the impact of liquidity and volatility on herding behavior, we test the asymmetric herding behavior when market rises and when it declines and finally we check the robustness of results obtained. The analysis of herding behavior allows defining the impact of companies' size on herding behavior. Results show the existence of herding behavior in all size-based portfolios. Regarding liquidity, results show that its growth increases herding behavior in the Moroccan stock exchange. Results show also that the increase of volatility increases herding behavior for the four portfolios and for the overall market. The test of asymmetric herding behavior when market rises and when it declines, in both up going and down-market, we find evidence of herding behavior except in the 2 portfolio where we didn't find evidence of herding market in the up-going market. We conclude that investors in Casablanca Stock exchange show herding behavior during the period of the study.

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Table 1: Presentation of data - Stocks and activities

No.	Stock	Ticker	Activity	No.	Stock	Ticker	Activity
1	AFRIQUIA GAZ	GAZ	Oil & Gas	21	IB MAROC.COM	IBC	Materials, Software & Computer Services
2	AGMA LAHLOU-TAZI	AGM	Insurance	22	ITISSALAT AL-MAGHRIB	IAM	Telecommunications
3	ALUMINIUM DU MAROC	ALM	Construction & Building Materials	23	LAFARGEHOLCIM MAROC	LHM	Construction & Building Materials
4	ATTIJARIWAFA BANK	ATW	Banks	24	LESIEUR CRISTAL	LES	Food producers & Processors
5	AUTO HALL	ATH	Distributors	25	LYDEC	LYD	Utilities
6	AUTO NEJMA	NEJ	Distributors	26	MAGHREB OXYGENE	MOX	Chemicals
7	AXA CREDIT	AXC	Investment Companies & Other Finance	27	MAGHREBAIL	MAB	Investment Companies & Other Finance
8	BALIMA	BAL	Real Estate	28	MANAGEM	MNG	Mining
9	BCP	BCP	Banks	29	MAROC LEASING	MLE	Investment Companies & Other Finance
10	BMCE BANK	BCE	Banks	30	MED PAPER	MDP	Forestry & Paper
11	BMCI	BCI	Banks	31	NEXANS MAROC	NEX	Electrical & Electronic Equipment
12	BRASSERIES DU MAROC	SBM	Beverages	32	OULMES	OUL	Beverages
13	CDM	CDM	Banks	34	REBAB COMPANY	REB	Mining
14	CENTRALE DANONE	CDA	Food producers & Processors	35	SMI	SMI	Mining
15	CIH	CIH	Banks	36	SONASID	SID	Construction & Building Materials
16	CIMENTS DU MAROC	CMA	Construction & Building Materials	37	SOTHERLA	SOT	Pharmaceutical Industry
17	COSUMAR	CSR	Food producers & Processors	38	UNIMER	UMR	Food producers & Processors
18	CTM	CTM	Transport	39	WAFA ASSURANCE	WAA	Insurance
19	DIAC SALAF	DIS	Investment Companies & Other Finance	40	ZELLIDJA	ZDJ	Holding Companies
20	EQDOM	EQD	Investment Companies & Other Finance				

Table 2: Descriptive statistics of the data - CSE and the four portfolios

	Variables	Mean	Median	Std. Dev.	ADF	Jarque-Bera	Observations
CSE	$R_{m,t}$	-0.005449	0.008317	0.291838	-30.58618*	303513.8*	2738
	CSAD	0.522716	0.483888	0.358259	-16.08867*	5396893.*	2738
Portfolio 1	$R_{m,t}$	-0.000941	0.019252	0.570501	-32.57630*	3253341.*	2738
	CSAD	0.475003	0.413782	0.809693	-28.67979*	26738239*	2738
Portfolio 2	$R_{m,t}$	0.001356	0.011493	0.523887	-34.54115*	3793832.*	2738
	CSAD	0.578762	0.528278	0.688920	-26.84918*	27375910*	2738
Portfolio 3	$R_{m,t}$	-0.001678	0.003331	0.359361	-48.95458*	5342448.*	2738
	CSAD	0.488394	0.467877	0.438348	-32.87362*	87269797*	2738
Portfolio 4	$R_{m,t}$	-0.020081	-0.007657	0.420392	48.39594*	6808302.*	2738
	CSAD	0.548706	0.515192	0.556152	-33.13600*	56380716*	2738

Variable statistically representative at the: * 1% level, ** 5% level and *** 10% level

Table 3: Regression estimates of herding behavior on CSE and each portfolio size based

	$\left\|R_{m,t}\right\|$	$(R_{m,t} - \bar{R}_{m,t})^2$	$CSAD_{t-1}$	Adj-R^2
CSE	1.2006*	-0.0105*	0.4004*	0.5034
Portfolio 1	1.0011*	-0.1383*	0.0743***	0.8556
Portfolio 2	1.2472*	-0.0261*	0.1823*	0.7966
Portfolio 3	1.4070*	-0.0959*	0.1887*	0.6942
Portfolio 4	1.4159*	-0.0532*	0.1887*	0.7612

The estimated equation: $CSAD_t = \phi_0 + \phi_1 \left|R_{m,t}\right| + \phi_2 (R_{m,t} - \bar{R}_{m,t})^2 + \phi_3 CSAD_{t-1} + \varepsilon_t$ (3)

Variable statistically representative at the: * 1% level, ** 5% level and *** 10% level

Table 4: Impact of liquidity on herding behavior

	$\left\|R_{m,t}\right\|$	$(R_{m,t} - \bar{R}_{m,t})^2$	$Liq_t(R_{m,t} - \bar{R}_{m,t})^2$	Liq_t	$CSAD_{t-1}$	Adj-R^2
CSE	1.1699*	-0.1439*	-8.94E-08*	3.47E-11*	0.3906*	0.5143
Portfolio 1	0.9828*	-0.1534*	-3.12E-11*	2.97E-11*	0.0708***	0.8572
Portfolio 2	1.2503*	-0.0295*	-2.39E-11*	4.38E-11*	0.1724*	0.8013
Portfolio 3	1.3717*	-0.1377*	-1.69E-10*	3.35E-11*	0.1864*	0.7006
Portfolio 4	1.3902*	-0.0633*	-1.61E-11*	4.11E-11*	0.1822*	0.7660

$CSAD_t = \alpha + \phi_1 \left|R_{m,t}\right| + \phi_2(R_{m,t} - \bar{R}_{m,t})^2 + \phi_3 Liq_t(R_{m,t} - \bar{R}_{m,t})^2 + \phi_4 Liq_t + \phi_5 CSAD_{t-1+} \varepsilon_t$ (4)

Variable statistically representative at the: * 1% level, ** 5% level and *** 10% level

Table 5: Impact of volatility on herding behavior

	$\lvert R_{m,t}\rvert$	$(R_{m,t} - \bar{R}_{m,t})^2$	$Vol_t * (R_{m,t} - \bar{R}_{m,t})^2$	Vol_t	$CSAD_{t-1}$	Adj-R^2
CSE	0.3707*	-0.035975*	-0.0878**	0.0299*	-0.5551**	0.0755
Portfolio 1	1.0009**	-0.138427***	-0.0833*	0.0267**	-0.0742*	0.8557
Portfolio 2	0.4435**	-0.028945**	-0.0734***	0.0950*	0.4180***	0.1703
Portfolio 3	0.3671*	-0.025803*	-0.1415*	0.5891**	0.4627*	0.3578
Portfolio 4	0.5601*	-0.068539*	-0.0909*	0.0686*	0.3934*	0.2864

The estimated equation: $CSAD_t = \alpha + \phi_1 \lvert R_{m,t}\rvert + \phi_2(R_{m,t} - \bar{R}_{m,t})^2 + \phi_3 Vol_t * (R_{m,t} - \bar{R}_{m,t})^2 + \phi_4 Vol_t + \phi_5 CSAD_{t-1+} \varepsilon_t$ (5)

Variable statistically representative at the: * 1% level, ** 5% level and *** 10% level

Table 6: Herding under asymmetric market states

	$D * \lvert R_{m,t}\rvert$	$(1 - D) * \lvert R_{m,t}\rvert$	$D(R_{m,t} - \bar{R}_{m,t})^2$	$(1 - D)(R_{m,t} - \bar{R}_{m,t})^2$	$CSAD_{t-1}$	Adj-R^2
CSE	1.238058*	0.949449*	-100.2439*	-1208.659*	0.405532*	0.518636
Portfolio 1	0.502794***	1.142356*	-664.0438*	-356.1491	0.154544**	0.725871
Portfolio 2	2.117291*	1.252398*	-125.8894*	5041.607*	0.229488*	0.391420
Portfolio 3	1.511012*	1.197557*	-77.69472*	-217.5985	0.296681**	0.098418
Portfolio 4	1.556576*	1.338717*	-111.9603*	-444.4976	0.297864*	-0.021664

The estimated equation: $CSAD_t = \alpha + \phi_1 D * \lvert R_{m,t}\rvert + \phi_2 (1 - D) * \lvert R_{m,t}\rvert + \phi_3 D * (R_{m,t} - \bar{R}_{m,t})^2 + \phi_4 (1 - D)(R_{m,t} - \bar{R}_{m,t})^2 + \phi_5 CSAD_{t-1} + \varepsilon_t$ (6)

Variable statistically representative at the: * 1% level, ** 5% level and *** 10% level

Table 7: Determinants of herding dynamics

	$R_{m,t}$	Liq_t	Vol_t	$Herd_{t-1}$	**Adj-R²**
CSE	1.238058*	-0.949449*	-100.2439*	0.405532*	0.518636
Quartile 1	0.502794***	-1.142356*	-664.0438*	0.154544**	0.725871
Quartile 2	2.117291*	-1.252398*	-125.8894*	0.229488*	0.391420
Quartile 3	1.511012*	-1.197557*	-77.69472*	0.296681**	0.098418
Quartile 4	1.556576*	-1.338717*	-111.9603*	0.297864*	-0.021664

The estimated equation: $Herd_t = \alpha + \phi_1 R_{m,t} + \phi_2 Liq_t + \phi_3 Vol_t + \phi_4 Herd_{t-1} + \varepsilon_t$ (7)

Variable statistically representative at the: * 1% level, ** 5% level and *** 10% level