Sectoral Herding: Evidence from an Emerging Market

Esin Cakan
University of New Haven, ecakan@newhaven.edu

Aram Balagyozyan
University of Scranton

Sectoral Herding: Evidence from an Emerging Market

Esin Cakan
University of New Haven

Aram Balagyozyan
University of Scranton

This study examines herding behavior in all industrial sectors of the Turkish stock market. Applying the methodology of Chang et al. (2000) to the Turkish sectoral daily stock prices from 2002 to 2014, we found strong evidence of herding. This evidence did not disappear even after we controlled for market regimes and firm fundamentals. Investor herding is asymmetric in all sectors; even though herding is prevalent in both rising and falling markets, it is more pronounced in rising markets. In the financial, services, and technology sectors herding is detected only in the highly volatile markets. In contrast, in low-volatility markets we confirm herding only in the services sector.

INTRODUCTION

Herding behavior among market participants has attracted much attention in the literature and been studied extensively, particularly when markets experience extreme movements up or down. The financial literature defines 'herding' as the behavioral tendency of an investor to follow the actions of others (e.g. Bikhchandani and Sharma, 2001). Herding can generate persistent deviations of asset prices from their fundamental values leading to asset price bubbles and sudden crashes. Since herding distorts the risk-return distribution in asset markets, it also has important implications for asset pricing models.

Several previous studies have examined herding behavior among mutual fund and pension fund managers (see Andronikidi and Kallinterakis (2010), Ben-David et. Al (2010), Billio et al. (2012), Lakonishok et al. (1992); Grinblatt et al. (1995); Wermers (1999); Wylie (2005); Andreu et al. (2009); Huang et al. (2010)) and financial analysts (see Trueman (1994); Graham (1999); Hong et al. (2000); Welch (2000); Gleason and Lee (2003); Clement and Tse (2005) ; Lin et al. (2011);Wen et al. (2011); Guo and Shih (2008)). Lakonishok et al. (1992), for example, found that money managers did not exhibit significant herding behavior. Grinblatt et al. (1995) found low levels of herding behavior among fund managers. Only few studies, however, have investigated herding behavior among investors in emerging markets (Chang et al., 2000; Demirer and Kutan, 2006; Tan et al., 2008; Demirer et al., 2010). In this study, we utilize some existing tests to look for traces of investor herding behavior in daily returns on stocks traded in Borsa Istanbul (BIST) between 2002 and 2014. Stocks that we investigate represent four Turkish industrial sectors: financials, industrials, services, and technology.

There are several reasons why we believe that the exercise we undertake in this paper and our exclusive focus on the Turkish stock market will provide further insight on the driving forces behind herding behavior. First, over the last decade, Borsa Istanbul has experienced significant growth in market size and depth, thanks to booming economy with impressive GDP growth rates during 2000's. The share of stocks held by foreign investors is about 63%. Furthermore, a large share of stocks traded on Borsa Istanbul belongs to foreign institutional investors. Institutional investors are more sophisticated and thus more informed than individual investors. One may think that because of this they are less likely to herd. However, Nofsinger and Sias (1999) found that the degree of herding of institutional investors is actually greater than that of individual investors. Since Borsa Istanbul is dominated by institutional investors, its stock price movements can provide new evidence on the balance of these two competing hypothesis. Moreover, as Neaime (2012) notes, starting from 1989 Turkey has never implemented any restrictions on the trades of foreign investors. This implies that the Turkish stock market provides us with an opportunity to document the true behavior of foreign investors, free of any restrictions and post-liberalization effects. This lack of trading restrictions applies to both foreign and domestic investors and is the partial reason why foreign investors came to dominate Borsa Istanbul. Even though foreign investors hold portfolios longer than domestic investors, who mostly trade daily, the volume of trades conducted by domestic investors is actually lower. Thus, trades executed by domestic investors do not necessarily cause significant price movements.

Second, our study examines investor herding patterns in different traded industrial sectors. As Choi and Sias (2009) claim, investors usually base their trade decisions on sector-specific information as money managers often make portfolio recommendations only at the sector level. Therefore, sector-specific market data form a natural ground for testing of herding behavior.

Third, there is very little literature investigating herding behavior in the Turkish stock market based on sectors. Among the few, Solakoglu and Demir (2014) who search for sentiment herding by using BIST 30 and Second National Market (SNM) data. They find sentiment herding only in SNM, where the investors are mostly domestic investors. However, these studies did not classify traded firms by their industry/sector. Since herding is more prevalent within a sector than across sectors, we expect to reach more reliable conclusions by considering data that are stratified by industry. Balcilar and Demirer (2014) examine the role of global risk factors on investor behavior in BIST 100 and four sectors by employing a Markov-Switching model that allows different volatility regimes. They find presence of herd behavior in high and extreme high volatility regimes. Cakan and Balagyozyan (2013) analyze the banking industry in BIST and find higher presence of herding behavior in rising markets.

The present study extends the literature in one more important dimension: we use a superior metric of herding behavior proposed by Chang et al. (2000). Our results indicate prevalence of significant degree of herding in all industrial sectors. These results are robust after controlling for the effects of market and firm fundamentals, such as the risk-free interest rate and the price-earnings ratio. Moreover, herding in the financials, services, and technology sectors is fairly asymmetric, being stronger during the periods of rising markets. We do not, however, observe the same asymmetry in the industrial sector.

The remainder of this article is organized as follows. Section 2 presents the methodology used to detect herding behavior among investors. Section 3 describes the data. Section 4 reports evidence of herding behavior in the model. Section 5 concludes.

METHODOLOGY FOR DETECTING HERDING BEHAVIOR

Chang et al. (2000) conjecture that the investment decision-making process depends on the overall market conditions. They propose that during the periods of extreme price movements, investors tend to abandon their own beliefs and base investment decisions on what others do. In line with this idea, Chang et al. (2000) use swings in market returns to gauge herding. They propose the following model:

$$CSAD_t = \alpha + \gamma_1 \left| R_{m,t} \right| + \gamma_2 R_{m,t}^2 + \varepsilon_t \qquad (1)$$

The left-hand variable, $CSAD_t$, is a measure of return dispersion measured by the cross-sectional standard deviation (SD) of market returns:

$$CSAD_t = \sqrt[2]{\frac{1}{(N-1)}\sum_{i=1}^{N}(R_{i,t}-R_{m,t})^2} \tag{2}$$

where N is the number of firms in the portfolio, $R_{i,t}$ is the return of stock i at time t and $R_{m,t}$ is the simple average of all stock returns in the portfolio, as seen in Christie and Huang (1995).

The specification in Equation (1) is motivated by the capital asset pricing model (CAPM) and other rational asset pricing models that imply a linear relation between the dispersion of individual asset returns and the return on the market portfolio. Under the assumption of rationality, if all stocks in the portfolio have different betas, the cross-sectional dispersion of stock returns should increase during extreme market movements. If herding is present, on the other hand, during extreme market movements traders tend to suppress private information and follow the consensus. Stock returns under these conditions tend to converge and become more correlated, causing the return dispersion to either decrease directly or if already increasing, then to do so at a decreasing rate. Therefore, Chang et al. (2000) propose a testing methodology based on a general quadratic relationship between the return dispersion and market return. As a result, if herding is present, the nonlinear coefficient, γ_2, must be negative and statistically significant; otherwise, a statistically positive γ_2 would indicate no evidence of herding.

DATA

The data used in this study consist of daily closing prices for all listed stocks on Borsa Istanbul (BIST) and earnings per share obtained from Datastream for the period between January 3, 2002 and June 24, 2014. These data contain 3,256 daily observations. All listed firms belong to one of the four industrial sectors: financials, industrials, services, and technology. We use the Turkish 3-month Treasury bill rate as a proxy for the risk-free rate. Stock returns R_t are obtained by taking the log difference in stock prices: $100\times(\log(P_t)-\log(P_{t-1}))$.

EMPIRICAL RESULTS

Evidence on herding

Table 1, Panel A reports the regression coefficients of Equation 1 estimated for each industrial sector. Recall that a negative value of the coefficient γ_2 is consistent with herding. The results indicate that γ_2 is negative and statistically significant for all sectors, suggesting that herd behavior is present in all market sectors. As a robustness check, we control for the global financial crisis in 2008 by adding a dummy variable DM_t, resulting in the following specification:

$$CSAD_t = \alpha + \gamma_1|R_{m,t}| + \gamma_2 R_{m,t}^2 + \gamma_3(R_{m,t}^2) * DM_t + \varepsilon_t \tag{3}$$

where the dummy variable DM_t is equal to one between 15 September 2008 and 15 June 2009 and zero otherwise. Table 1, Panel B indicates that except for the financial sector the new coefficient γ_3 is not statistically significant in this model. This suggests that except for the financial industry, herding behavior was not significantly influenced by the crisis.

Hwang and Salmon (2006) suggest that stock returns and herding are affected by both market and firm fundamentals. They consider the dividend-price ratio, the T-bill rate, the term spread, and the default spread in their analysis of herding in the United States, United Kingdom, and South Korean equity markets. To control for fundamentals, we add to the basic specification the Turkish Treasury bill rate and each firm' s earnings yield (calculated as earnings per share divided by the share price). As reported in Table 1 (Panel C), the estimated coefficient γ_2 is still negative and statistically significant. Thus, we still find evidence of herding.

Another potential cause of concern for us is whether the herding coefficient γ_2 is capturing the relation between idiosyncratic risk and market returns, as documented by Goyal and Santa-Clara (2003). It is possible to control for the impact of idiosyncratic risk and volatility by adding a conditional variance term to the mean equation. To achieve this, we specify a GARCH (1,1) in the mean model as follows:

$$CSAD_t = \alpha + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \theta_1 (RF)_t + \theta_2 (EPS)_t + \theta_3 \sigma_t^2 + \varepsilon_t \tag{4}$$
$$\sigma_t^2 = \omega_0 + \omega_1 \varepsilon_{t-1}^2 + \omega_2 \sigma_{t-1}^2 \tag{5}$$

Here, σ_t^2 is the conditional variance of the residual of $CSAD_t$.

As the numbers in Table 1 (Panel D) demonstrate, although all new coefficients (θ_1, θ_2 and θ_3) are mostly statistically significant, the coefficient γ_2 remains negative and statistically significant in all four sectors. For this reason, we retain the specification in Equation 1 for further analysis.

Asymmetric herding behavior

In this subsection we investigate whether prevalence of herding behavior that we documented above for all sectors varies with market conditions. Specifically, we look for possible asymmetries in the tendency to herd as the trading environment (characterized by different regimes of market returns and return volatility) changes. We, following Christie and Huang (1995) and Chang et al. (2000), note that herding behavior may be more pronounced during the periods when the market is stressed. Return and return volatility may help capture such periods and thus we use it as an additional control to understand the asymmetric nature of herding behavior under different market conditions.

Asymmetric effects of market return

Consistent with the above remark, we would like to investigate whether herding behavior varies with market conditions. We estimate the same base model in Equation 1 but separate the cases for positive and negative market returns, as follows:

$$CSAD_t^{UP} = \alpha + \gamma_1^{UP} |R_{m,t}^{UP}| + \gamma_2^{UP} (R_{m,t}^{UP})^2 + \varepsilon_t, \quad \text{if } R_{m,t} > 0 \tag{6}$$

$$CSAD_t^{DOWN} = \alpha + \gamma_1^{DOWN} |R_{m,t}^{DOWN}| + \gamma_2^{DOWN} (R_{m,t}^{DOWN})^2 + \varepsilon_t, \quad \text{if } R_{m,t} < 0 \tag{7}$$

where $R_{m,t}^{UP}$ and $CSAD_t^{UP}$ include only those days when the market rose ($R_{m,t}^{UP} > 0$). Similarly, variables with superscript DOWN include only those days when the market declined. Table 2 reports the results of this model. The coefficient γ_2^{UP} in panel A is significantly negative in rising markets in all sectors except industrials. However, γ_2^{DOWN} in panel B is statistically significant only in the services industry. This result suggests that in our sample herding is asymmetric in the financials and technology sectors. In the services sector herding occurs in any type of market.

Asymmetric effects of volatility

We further examine the potential asymmetric effect of market volatility on herding behavior. We define volatility to be high when the observed volatility exceeds the moving average of volatility over the previous 30 days. Volatility is characterized as low when it is below the 30-day moving average. The asymmetric effects are examined using the following empirical specifications:

$$CSAD_t^{\hat{\sigma}^2,HIGH} = \alpha + \gamma_1^{\hat{\sigma}^2,HIGH} \left| R_{m,t}^{\hat{\sigma}^2,HIGH} \right| + \gamma_2^{\hat{\sigma}^2,HIGH} (R_{m,t}^{\hat{\sigma}^2,HIGH})^2 + \varepsilon_t \tag{8}$$
$$CSAD_t^{\hat{\sigma}^2,LOW} = \alpha + \gamma_1^{\hat{\sigma}^2,LOW} \left| R_{m,t}^{\hat{\sigma}^2,LOW} \right| + \gamma_2^{\hat{\sigma}^2,LOW} (R_{m,t}^{\hat{\sigma}^2,LOW})^2 + \varepsilon_t \tag{9}$$

where the superscripts $\hat{\sigma}^{2,HIGH}$ and $\hat{\sigma}^{2,LO}$ refer to high return volatility and low return volatility, and $\hat{\sigma}^2$ is calculated as the square of the portfolio return in period *t*. Table 3 reports the estimation results of the asymmetric volatility models. Panel A reports the regression results for the four sectors when volatility is high. Consistent with previous findings, all of the estimated γ_2 coefficients are negative and statistically significant for the financials, services, and technology stocks, providing evidence of herding. However, under conditions of low volatility, the γ_2 coefficients of the financials, industrials, and technology are not statistically significant. The only industry that retains a statistically significant negative γ_2 coefficient is services. This suggests that during periods of high volatility in the Turkish equity markets, herding occurs only in the financials, services, and technology sectors. In high volatility markets, herding is not observed in industrial stocks. In low-volatility markets, we observe herding only in the services sector.

CONCULUSIONS

In this study, we extend the existing tests of investor herding behavior in emerging stock markets by using firm-level data on all stocks listed in Borsa Istanbul. Our results indicate that herding behavior is prevalent in all four industrial sectors of the stock exchange. This finding is robust under several model specifications. Our tests for asymmetries with respect to the direction of market returns and volatility reveal that in the financial, services, and technology sectors herding is present only in the rising market. In the industrials sector, herding is not asymmetric with respect to market ups and downs. Herding behavior is asymmetric with respect to different volatility regimes. High volatility leads to herding in the financial, services, and technology sectors. Since foreign investors invest in financial and services stocks more than in industrials, our findings may be suggestive that domestic investors herd less than foreign investors do.

REFERENCES

Andronikidi, A. and Kallinterakis, V. (2010). Thin trading and its impact upon herding: the case of Israel. *Applied Economics Letters*, 17(18):1805–1810.

Andreu, L., Ortiz, C. and Sarto, J. L. (2009). Herding behavior in strategic asset allocations: new approaches on quantitative and intertemporal imitation, *Applied Financial Economics*, 19, pp. 1649–59.

Balcilar, M. and Demirer, R. (2014.) Impact of Global Shocks and Volatility on Herd Behavior in an Emerging Market: Evidence from Borsa Istanbul. *Emerging Markets Finance and Trade, Vol(3), forthcoming.*

Ben-David, I., Franzoni, F., and Moussawi, R. (2012). Hedge fund stock trading in the financial crisis of 2007–2009. *Review of Financial Studies*, 25(1):1–54.

Bikhchandani, S and Sharma, S. (2001). Herd behavior in financial markets: a review, *IMF Staff Papers*, 47, pp. 279–310.

Billio, M., Getmansky, M., Lo, A. W., and Pelizzon, L. (2012). Econometric measures of connectedness and systemic risk in the finance and insurance sectors. *Journal of Financial Economics*, 104(3):535–559.

Cakan, E. and Balagyozyan, A. (2014). Herd behavior in the Turkish banking sector, *Applied Economics Letters*, Vol.21, No: 2, pp. 75-79

Chang, E. C., Cheng, J. W., and Khorana, A. (2000). An examination of herd behavior in equity markets: an international perspective, *Journal of Banking and Finance*, 24, pp. 1651–1679.

Choi, N. and Sias, R.W. (2009). Institutional industry herding, *Journal of Financial Economics*, 94, pp. 469–491.

Christie, W.G. and Huang, R. D. (1995). Following the pied piper: do individual returns herd around the market?, *Financial Analysts Journal*, 51, pp. 31–37.

Clement, M. B. and Tse, S. Y. (2005). Financial analyst characteristics and herding behavior in forecasting, *Journal of Finance*, 60, pp. 307–341.

Demirer, R. and Kutan, A. M. (2006). Does herding behavior exist in chinese stock markets? *Journal of International Financial Markets, Institutions and Money*, 16 (2), pp. 123–142.

Demirer, R., Kutan, A.M., and Chun-Da Chen (2010). Do investors herd in emerging stock markets?: Evidence from the Taiwanese market, Journal of Economic Behavior & Organization, 76, pp. 283–295.

Goyal, A., Santa-Clara, P. (2003). Idiosyncratic risk matters!, *Journal of Finance*, 58 (3), pp. 975–1008.

Gleason, C.A. and Lee, C.M.C. (2003). Analyst forecast revisions and market price discovery, *The*

Accounting Review, 78, pp. 193–225.
Guo, W.-C. and Shih, H.-T. (2008). The co-movement of stock prices, herd behaviour and high-tech mania. *Applied Financial Economics*,18(16):1343–1350.
Graham, J.R. (1999). Herding among investment newsletters: theory and evidence, *Journal of Finance*, 54, pp. 237–268.
Grinblatt, M., Titman, S. and Wermers, R. (1995). Momentum investment strategies, portfolio performance, and herding: a study of mutual fund behavior, *The American Economic Review*, 85, pp. 1088–105.
Hong, H., Kubik, J.D. and Solomon, A. (2000). Security analysts' career concerns and herding of earnings forecasts, *RAND Journal of Economics*, 31, pp. 121–144.
Huang, H. H., Hung, R.-J., Wang, C.-P. et al. (2010). Does fund manager herding vary over the business cycle?, *Applied Economics Letters*, 17, pp. 1531–5.
Hwang, S. and Salmon, M. (2004). Market stress and herding. *Journal of Empirical Finance*, 11, pp. 585–616.
Lakonishok, J., Shleifer, A. and Vishny, R.W. (1992). The impact of institutional trading on stock prices. *Journal of Financial Economics*, 32, pp. 23–44.
Lin, W.-Y., Chen, P.-J. and Chen, S.-S. (2011). Stock characteristics and herding in financial analyst recommendations, *Applied Financial Economics*, 21, pp. 317–31.
Newey, W. K. and West, K. (1987). A simple positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55, pp. 703–708.
Neaime, S. (2012). The global financial crisis, financial linkages and correlations in returns and volatilities in emerging MENA stock markets. *Emerging Markets Review* 13, pp. 268-282
Nofsinger, J. and Sias, R. (1999). Herding and feedback trading by institutional and individual investors, *Journal of Finance*, 54, pp. 2263–95.
Solakoglu, N. and Demir, N. (2014). Sentimental herding in Borsa Istanbul: informed versus uninformed, *Applied Economics Letters*, 21, 14, pp. 965–968.
Tan L, Chiang TC, Mason JR, Nelling E (2008). Herding behavior in Chinese stock markets: An examination of A and B shares. *Pacific- Basin Finance Journal*, 16, pp. 61-77.
Trueman, B. (1994). Analyst forecasts and herding behavior. *Review of Financial Studies*, 7, pp. 97–124.
Welch, I. (2000). Herding among security analysts, *Journal of Financial Economics*, 58, pp. 369–96.
Wermers, R. (1999). Mutual fund herding and the impact on stock prices. *Journal of Finance*, 54, pp. 581-622.

TABLE 1
ESTIMATION RESULTS FOR HERDING IN ALL SECTORS

Panel A: Regression results for CSAD for all sectors

$CSAD_t = \alpha + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	2.15	2.00	2.1	1.16
	0.035)***	(0.025)***	(0.032)***	(0.038)***
γ_1	0.6	0.49	0.66	0.514
	(0.028)***	(0.029)***	(0.032)***	(0.03)***
γ_2	-0.016	-0.028	-0.048	-0.025
	(0.004)***	(0.0024)***	(0.005)***	(0.004)***
n	3256	3256	3256	3256
Adj. R^2	0.22	0.20	0.17	0.145

Panel B: Regression results for CSAD and global financial crisis in all sectors

$CSAD_t = \alpha + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \gamma_3 (R_{m,t}^2) * DM_t + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	2.14	2.00	1.16	1.16
	(0.035)***	(0.027)***	(0.038)***	(0.038)***
γ_1	0.62	0.49	0.515	0.515
	(0.028)***	(0.029)***	(0.04)***	(0.04)***
γ_2	-0.015	-0.029	-0.025	-0.025
	(0.003)***	(0.004)***	(0.004)***	(0.004)***
γ_3	-0.03	-0.012	-0.004	-0.004
	(0.007) ***	(0.0065)*	(0.006)	(0.006)
n	3256	3256	3256	3256
Adj. R^2	0.23	0.15	0.23	0.20

Panel C: Regression results for CSAD and fundamentals in all sectors

$CSAD_t = \alpha + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \theta_1 (RF)_t + \theta_2 (EPS)_t + \theta_3 \sigma_t^2 + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	2.04	1.878	1.91	1.18
	(0.069)***	(0.036)***	(0.056)***	(0.04)***
γ_1	0.54	0.47	0.589	0.51
	(0.028)***	(0.029)***	(0.032)***	(0.031)***
γ_2	-0.032	-0.026	-0.042	-0.025
	(0.004)***	(0.004)***	(0.005)***	(0.004)***
θ_1	0.017	0.0061	0.014	0.003
	(0.0009)***	(0.001)***	(0.010)***	(0.001)
θ_2	-0.029	-0.002	-0.013	-0.0007
	(0.005)**	(0.0003)	(0.002)**	(0.0003)**
n	3256	3256	3256	3256
Adj. R^2	0.16	0.24	0.15	0.147

Panel D: Regression results for CSAD and fundamentals with GARCH(1,1)

$$CSAD_t = \alpha + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \theta_1 (RF)_t + \theta_2 (EPS)_t + \theta_3 \sigma_t^2 + \varepsilon_t$$

$$\sigma_t^2 = \omega_0 + \omega_1 \varepsilon_{t-1}^2 + \omega_2 \sigma_{t-1}^2$$

	Financials	Industrials	Services	Technology
Mean				
γ_1	0.46 (0.025)***	0.463 (0.03)***	0.46 (0.028)***	0.39 (0.020)***
γ_2	-0.029 (0.003)***	-0.025 (0.005)***	-0.027 (0.004)***	-0.015 (0.0027)***
θ_1	0.014 (0.0009) ***	0.006 (0.0007)***	0.0126 (0.0008)***	0.0014 (0.0007)
θ_2	-0.026 (0.004)***	-0.000214 (0.0005)	-0.0126 (0.002)***	-0.00036 (0.0003)
θ_3	0.29 (0.04)***	0.37 (0.29)	0.48 (0.12)***	0.96 (0.11)***
Variance				
ω_0	0.023 (0.003)***	0.04 (0.011)***	0.243 (0.023)***	0.243 (0.023)***
ω_1	0.068 (0.005)***	0.0013 (0.0006)***	0.196 (0.03)***	0.196 (0.03)***
ω_2	0.914 (0.004)***	0.95 (0.012)***	0.428 (0.05)***	0.428 (0.05)***
n	3256	3256	3256	3256
Adj. R^2	0.16	0.24	0.15	0.15

Note: This table reports the daily regressions results for Borsa Istanbul (BIST) disaggregated sectors stock markets returns.
$CSAD_t = \alpha+\gamma_1|R_{m,t}|+\gamma_2(R_{m,t})_2+\varepsilon_t$, where $R_{m,t}$ is the equally weighted portfolio return at time *t*. $CSAD_t$ is the equally weighted cross sectional absolute deviation. The sample period is from 1/2/2002 to 6/242014. Numbers in parentheses are t-statistics based on Newey–West (1987) consistent standard errors. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 2
ESTIMATES OF HERDING BEHAVIOR IN RISING AND DECLINING MARKET

Panel A: Rising Markets

$CSAD_t^{UP} = \alpha + \gamma_1^{UP}\left|R_{m,t}^{UP}\right| + \gamma_2^{UP}(R_{m,t}^{UP})^2 + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	2.21 (0.046)	2.17 (0.036)***	2.21 (0.04)***	1.26 (0.04)***
γ_1	0.53 (0.041)***	0.36 (0.04)***	0.59 (0.047)***	0.62 (0.05)***
γ_2	-0.02 (0.006)***	-0.005 (0.008)	-0.035 (0.008)***	-0.03 (0.008)***
n	1718	1820	1732	1680
Adj. R^2	0.18	0.10	0.16	0.16

Panel B: Declining Markets

$CSAD_t^{DOWN} = \alpha + \gamma_1^{DOWN}\left|R_{m,t}^{DOWN}\right| + \gamma_2^{DOWN}(R_{m,t}^{DOWN})^2 + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	2.25 (0.046)	2.27 (0.042)***	2.27 (0.05)***	1.13 (0.04)***
γ_1	0.36 (0.043)***	0.27 (0.04)***	0.38 (0.045)***	0.22 (0.03)***
γ_2	-0.01 (0.006)*	-0.0005 (0.0053)	-0.017 (0.006)***	0.0005 (0.005)
n	1415	1313	1401	3256
Adj. R^2	0.14	0.10	0.11	0.10

Note: This table reports the daily regressions results for Borsa Istanbul (BIST) disaggregated sectors stock markets returns:

$CSAD_t^{UP} = \alpha + \gamma_1^{UP}\left|R_{m,t}^{UP}\right| + \gamma_2^{UP}(R_{m,t}^{UP})^2 + \varepsilon_t$; if $R_{m,t} > 0$

$CSAD_t^{DOWN} = \alpha + \gamma_1^{DOWN}\left|R_{m,t}^{DOWN}\right| + \gamma_2^{DOWN}(R_{m,t}^{DOWN})^2 + \varepsilon_t$; if $R_{m,t} < 0$

where $R_{m,t}^{UP}(R_{m,t}^{DOWN})$ is the equally weighted portfolio return during period t when the market is up (down). The sample period is from 1/2/2002 to 6/242014. Numbers in parentheses are t-statistics based on Newey–West (1987) consistent standard errors. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 3
ESTIMATES OF HERDING BEHAVIOR IN RISING AND DECLINING VOLATILITY

Panel A: High Volatility Markets

$CSAD_t^{\hat{\sigma}^2,HIGH} = \alpha + \gamma_1^{\hat{\sigma}^2,HIGH} \left|R_{m,t}^{\hat{\sigma}^2,HIGH}\right| + \gamma_2^{\hat{\sigma}^2,HIGH} (R_{m,t}^{\hat{\sigma}^2,HIGH})^2 + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	3.09	2.76	3.22	2.62
	(0.056)	(0.05)***	(0.06)***	(0.09)***
γ_1	0.31	0.26	0.34	0.39
	(0.046)***	(0.046)***	(0.048)***	(0.05)***
γ_2	-0.014	-0.009	-0.021	-0.02
	(0.006)***	(0.006)	(0.006)***	(0.006)***
n	1224	1306	1226	962
Adj. R^2	0.10	0.10	0.16	0.07

Panel B: Low Volatility Markets

$CSAD_t^{\hat{\sigma}^2,LOW} = \alpha + \gamma_1^{\hat{\sigma}^2,LOW} \left|R_{m,t}^{\hat{\sigma}^2,LOW}\right| + \gamma_2^{\hat{\sigma}^2,LOW} (R_{m,t}^{\hat{\sigma}^2,LOW})^2 + \varepsilon_t$

	Financials	Industrials	Services	Technology
α	1.61	1.6	2.27	0.92
	(0.028)	(0.026)***	(0.05)***	(0.023)***
γ_1	0.58	0.68	0.64	0.26
	(0.036)***	(0.04)***	(0.008)***	(0.023)***
γ_2	-0.038	-0.10	-0.064	-0.0021
	(0.007)	(0.011)	(0.008)***	(0.004)
n	2032	1950	2030	2294
Adj. R^2	0.22	0.17	0.21	0.08

Note: This table reports the daily regressions results for Borsa Istanbul (BIST) disaggregated sectors stock markets returns:

$CSAD_t^{\hat{\sigma}^2,HIGH} = \alpha + \gamma_1^{\hat{\sigma}^2,HIGH} \left|R_{m,t}^{\hat{\sigma}^2,HIGH}\right| + \gamma_2^{\hat{\sigma}^2,HIGH} (R_{m,t}^{\hat{\sigma}^2,HIGH})^2 + \varepsilon_t$

$CSAD_t^{\hat{\sigma}^2,LOW} = \alpha + \gamma_1^{\hat{\sigma}^2,LOW} \left|R_{m,t}^{\hat{\sigma}^2,LOW}\right| + \gamma_2^{\hat{\sigma}^2,LOW} (R_{m,t}^{\hat{\sigma}^2,LOW})^2 + \varepsilon_t$

where volatility, $\hat{\sigma}^{2,HIGH}$ is the stock return variance for financials, industrials, services, technology sector portfolios at time t. Return volatility is defined as being in a high state if it is larger than the previous 30-day moving average trading volume, and is considered to be low if it is below this average. The sample period is from 1/2/2002 to 6/242014. Numbers in parentheses are t-statistics based on Newey–West (1987) consistent standard errors. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.