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An empirical investigation of herding in the U.S. stock market☆

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ABSTRACT

This paper proposes a new empirical testing method for detecting herding in stock markets. The traditional regression approach is extended to a vector autoregressive framework, in which the predictive power of squared index returns for the cross-sectional dispersion of equity returns is tested using a Granger causality test. Macroeconomic news announcements and the aggregate number of firm-level news items are treated as conditioning variables, while the average sentiment of firm-level news is treated as jointly determined. The testing algorithm allows the change points in the causal relationships between the cross-sectional dispersion of returns and squared index returns to be determined endogenously rather than being chosen arbitrarily a priori. Evidence of herding is detected in the constituent stocks of the Dow Jones Industrial Average at the onset of the subprime mortgage crisis, during the European debt and the U.S. debt-ceiling crises and the Chinese stock market crash of 2015. These results contrast with those obtained from the traditional methods where little evidence of herding is found in the US stock market.

1. Introduction

Herding in financial markets reflects similarity in decision making and subsequent trading and may be attributable to a range of reasons. These include differences in ability and protecting reputation (Trueman, 1994; Graham, 1999), waiting for information from informed investors to be revealed (Froot et al., 1992) and disregarding private information to follow the observed actions of others (Bikhchandani and Sharma, 2000; Welch, 1992). Irrespective of its underlying causes, there are two main reasons why research in this area is important. First, Bikhchandani and Sharma (2000) argue that intentionally following the actions of others may lead to market fragility, excess volatility and systemic risk. A better understanding of herding therefore will contribute to financial stability. Second, a great deal of research has been conducted in this area, both theoretical and empirical, however, the conclusions reached by the empirical studies vary widely. There is therefore, a clear motivation for further empirical work aimed at clarifying the issues and providing explanations for conflicting results.

While there is a large literature using micro-level holdings, or trade data, to examine herding between mutual funds (Lakonishok et al., 1992; Grinblatt et al., 1995; Wermers, 1999; Celiker et al., 2015), the strand of the empirical literature of interest here is that related to herding toward a market consensus (Chang et al., 2000; Galariotis et al., 2015). The analysis of Galariotis et al. (2015) is based on the cross-sectional standard deviation of returns, a commonly used measure proposed by Christie and Huang (1995). Chang et al. (2000) argue that herding implies a U-shaped relationship between the dispersion in returns and the market return. Herding will mitigate increases in the cross-sectional dispersion in returns as the market becomes more volatile leading to a non-linear relationship.

Empirical evidence in support of herding toward a market consensus is quite mixed. Neither Christie and Huang (1995) nor Gleason et al. (2004) find evidence of herding in the United States whereas Hwang and Salmon (2004) do. In a study of both Asian markets and the United States, Chang et al. (2000) find evidence of herding in South Korea, Taiwan and Japan but none in the United States. Chiang and Zheng (2010) find evidence of herding in a wide range of developed and Asian markets, but once again, not in the United States.

The unconditional full sample results of Galariotis et al. (2015) provide no evidence in support of herding in the United States. However, when a number of sub-periods are considered, they do find evidence of herding intermittently within these sub-periods. While the sub-periods chosen correspond to well known crises, the exact choice and timing of these sub-periods are somewhat arbitrary, enforcing changes in the relationships at these fixed dates. Klein (2013) also

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examines whether the non-linear relationship between dispersion and market returns changes over time within a two-regime Markov switching framework. The results show that while herding behaviour changes over time in response to market conditions, in contrast to many of the earlier results, they show that the degree of dispersion increases with market volatility.

This paper investigates the existence of herding towards the market consensus in the Dow Jones Industrial Average over the period of January 2003 to September 2016. The empirical analysis begins with traditional tests for herding over the entire sample period, and the subprime and recent Chinese crisis periods, controlling for the impact of the large scheduled macroeconomic announcements and individual firm level news flow. Next, after controlling for the effect of news flow, a two-regime Markov-switching model is used to endogenously determine change points in the relationship in a very similar fashion to Klein (2013). The results indicate that there is enough evidence of herding to prompt further investigation.

Recognising that herding is an intermittent phenomenon, and one which occurs in a complex system of possibly co-determined variables, this paper proposes a new empirical testing framework for herding towards market consensus. The econometric method employed embraces both the uncertainty of the timing of herding behaviour and the potential endogeneity of all the variables used in traditional tests of herding. Instead of investigating the contemporaneous relationship between market volatility and return dispersion as in the traditional approaches, the emphasis of the new framework is on the predictive power of market volatility for return dispersion, that is the presence of a Granger causal relationship running from market volatility to return dispersion, allowing for a delay in reaction to the market.

The econometric method employed to test for herding is a time-varying Granger causality test (Hurn et al., 2015), based on a vector autoregressive (VAR) model and a rolling window algorithm. There are three advantages to adopting this approach. First, and most importantly, the VAR model accounts for the potential endogeneity issue overlooked by the traditional framework, in particular between cross-sectional return dispersion and market volatility (or news sentiment). Second, the testing framework takes the potential conditional/unconditional heteroskedasticity of the data into consideration and hence reduces the chance of flawed inference. Third, the test involves a rolling window algorithm that enables endogenous dating of the change points in the predictive relationship. The advantage of the rolling algorithm over a Markov-switching model is discussed at the end of Section 3. This approach reveals how both the signs and statistical significance of the casual relationships change over time.

Very briefly, with the traditional approach, the results reveal no statistically significant evidence of herding in the 30 stocks that make up the Dow Jones Industrial Average Index when the entire sample is used. However, the Markov switching model provides enough evidence of herding in sub-periods of the data, with its presence being confirmed by the new VAR testing procedure described in the paper. The periods of herding which are identified correspond to the onset of economic crises, namely, the subprime mortgage crisis period, the European debt and US debt-ceiling crises, and the stock market crisis starting in August 2015 precipitated by the Chinese stock market crash. These results are at odds with the full sample results and provide strong support for the hypothesis that herding is episodic in nature.

2. Data

The empirical study here is based on the Dow Jones Industrial Average. Data on all constituents of the index, and the index itself were collected for the period from 28 January 2003 to 16 September 2016, T=3421 observations. Changes in the constituents of the index were taken into account. Daily returns for both the 30 constituent stocks and the index itself are used to construct the cross-sectional absolute deviation of returns, which is the metric used to examine herding behaviour towards the market consensus proposed by Christie and Huang (1995). Formally, the cross sectional absolute deviation is defined as

$$D_t = \frac{1}{N}\sum_{i=1}^{N} |r_{it} - r_{mt}|$$

in which r_{it} is the return on stock i and r_{mt} is the return on the index.

Fig. 1 plots the returns (top panel) and squared returns (middle panel) of the Dow Jones index together with the cross-sectional absolute deviation (bottom panel) of the constituents of the Dow Jones Index for the sample period. The pattern in the returns and squared returns is a very familiar one, with clustering in volatility and the enormous footprint of the global financial crisis (2008–2009) quite evident in the data. There are also bursts of volatility clustering around the European debt crisis (2010) and the U.S. debt ceiling crisis (late 2011). There is also significant evidence of increased turbulence in 2015–2016 precipitated by the Chinese stock market crash in June 2015.

The measure of cross-sectional dispersion of the constituents of the Dow Jones is relatively stable over time with bursts of increased dispersion that mirror the pattern in returns and squared returns. Interestingly, dispersion is quite stable during the lead up to the peak of the U.S. stock market in October 2007 when the Dow Jones index exceeded 14000 points. After this date, the United States stock market started to fall, a decline which accelerated in October 2008 and reached a trough of approximately 6600 in March 2009. It appears as though the increase in cross-sectional dispersion corresponds broadly with the declining stock market and not with the onset of the crisis.

In order to control for the effect of information on the cross-sectional dispersion of returns and hence the detection of herding behaviour, Galariotis et al. (2015) consider the impact of information in large scheduled macroeconomic announcements on the degree of herding to the market consensus. Following this approach, announcement dates for important macroeconomic events such as Federal Open Market Committee meetings and consumer price index, gross domestic product, industrial production and non-farm payroll are collected and a dummy variable Macro_t is defined, which takes value 1 on days when any of these macroeconomic announcement occur and zero otherwise.

It is clear, however, that scheduled macroeconomic news announcements are only part of the story when it comes to the impact of news or information on stock returns. Consequently, in addition to macroeconomic news, the impact of individual firm level news flow is also considered. To this end, pre-processed firm level news data from the Thomson Reuters News Analytics (TRNA) database relating to the individual Dow Jones constituents were also collected for each day in the sample period. All news items broadcast over the Reuters newswire are analysed with a range of fields and characteristics attached to each item. Based on the characteristics of the individual firm news items, a number of aggregate measures of news related specifically to the Dow Jones Index were constructed.

The first aggregate news measure is based on the total number of news items per day, denoted News_t, and is taken to reflect the volume of information flow. This measure includes all news items denoted as articles, representing fresh stories consisting of a headline and body text. Consequently, news items which are related to previous articles and alerts with no text body are ignored. The second aggregate news measure relates to the general tone or sentiment of the news, denoted Sent_t. The text of all news items broadcast over the Reuters network is analysed using a linguistic pattern recognition algorithm. The analysis produces a number of characteristics relating to each news item including relevance to the specific firm, sentiment and novelty. Sentiment for each news item is coded +1, 0, −1 for positive, neutral and negative tones respectively. The average sentiment across all the news items relating to all the Dow Jones constituent stocks is calculated for each day to capture the market wide tone of news flow.