BEHAVIORAL ECONOMICS IN THE SHIPPING INDUSTRY

A Thesis for “MSc in Shipping, Transport and International Trade”
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Behavioral Economics in the Shipping Industry

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Abstract

The current paper argues about herding effects in the shipping industry, employing proven and widely-used statistical tools and methods. Shipping is a key global industry, crucial to world trade and economic growth. We test for both herding behavior in shipping stock returns and herding spillover effects among shipping markets. Research finds indicate an absence of herding behavior in all markets and through all different time-periods taken into consideration. In addition, no evidence was produced for spillover effects among separate markets. Results point to a unique behavior character for shipping stocks, giving credit to the complexity and volatility of the sector.

Keywords: Behavioral economics, herding, spillovers, shipping, equity markets
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1. Introduction

The main reason behind the existence of economic science has always been the necessity to provide answers describing the mechanisms governing markets and financial activity in order to adjust those mechanisms, fully exploit the underlying economic potential and further improve life and well-being of all human population by optimally managing all available resources. Behavioral economics are an ambiguous branch of finance, formed in pursuit for insight into abnormal market behavior and stock fluctuations that standard economics failed to provide, while great effort has been channeled into the attempt to demystify investor behavior and the psychological factors that form the motives for investor decisions and investment sentiment. Recent years have witnessed a great number of scientific papers and articles employing statistical tools and methodology in order to detect behavioral economics phenomena in multiple sectors of economic activity, giving fuel to further understanding and utilization for investor psychology and market sentiment. Even with all that scientific effort though, there are still dark areas and economic sectors that haven’t been tested for behavioral economics, one such being the shipping sector.

In this paper, we will test shipping industry for behavioral economics appliances, and more specifically for herding behavior in equity markets. The shipping industry is a key industry, crucial for global trade and economy, while shipping companies employ people characterized by expertise and professionalism. So far though, despite the fact that the shipping industry has been the epicenter for many scientific researches, no effort has been made into providing evidence for behavioral economics patterns in this sector. Main objective of the current research is to fill the gap left by the available literature covering behavioral economics and bring further clarity to the workings of shipping stocks together with argument whether or not they are affected by market and investor sentiment. Moreover, further tests will check for herding induced fluctuations in shipping equity stocks and attempt to find spillover effects across markets. The main goal is to determine whether psychological reasons and market sentiment affect shipping stocks and test the possibility that fluctuations in shipping stocks in one market can affect shipping stocks in other markets by sentiment transfer. Better understanding for shipping stock swings and fluctuations is crucial for both investors wishing optimal return for their invested capital and shipping companies’ owners and managers who face multiple challenges in managing market and industry risks as well as the attempt of maximizing potential and future success for shipping companies.
The majority of herding research employs statistical tools and methodology as a means to determine the existence or absence of behavioral patterns in equity markets. We will follow that trend, using Cross Sectional Absolut Deviation (CSAD) methodology to detect herding in shipping stocks, followed by regression models to further test for herding effects and spillover effects among different markets, with the sample for the research consisting of a portfolio derived from global shipping equity stocks. Selection for statistical tools like CSAD and regression models has been founded on their great contribution in behavioral economics, their well-established reputation among distinguished researchers depicted in their throughout use in scientific articles and papers and the practicality and immediate clarity of the results they provide. Finds of the research are expected to determine the existence or absence of herding behavior and herding spillover effects, contributing in the available scientific literature about behavioral economics and forming the grounds for further future research in the industry in discussion, shipping.

Introduction was a guide towards the structure, purpose and contribution of the current paper, while section 2 acts as a brief view in the history and theory behind behavioral economics together with a presentation of a small part of the literature covering behavioral economics and their appearances in different sectors of the global economy. Section 3 will serve as a discussion for research data selection with the addition of the applied methodology description. Section 4 will state the results of the research followed by analysis and interpretation of the results from research calculations. Finally, there will be some further discussion and summary notes in the concluding section.

2. Behavioral Economics

2.1 Theory

The mainstream finance market theory claims that stock returns and fluctuations can be predicted and explained using the Efficient Market Hypothesis and the rationality of Homo Economicus. Homo Economicus by Persky\(^1\) is a concept describing humans as consistently rational and analytic beings who make use of all available information and make decisions in pursuit of their best interest seeking the maximum possible gain from

these decisions. Fama\textsuperscript{2} with the Efficient Market Theory supports the notion that the stock market and stock fluctuations are the result of free-flow of all available information and the corresponding adjustment of investor policies to the underlying value of stocks and their fundamentals, originating from the processing and utilization of all the available information.

Despite the great contribution of these theories, they lack the capability of explaining all fluctuations in stock markets, especially the most extreme of these. Phenomena like herding behavior and overreaction-underreaction of stock prices are well out of symphony with these theories and required a new branch of finance, behavioral finance, in order to unveil and interpret the workings of their behavior. Overreaction-underreaction is the concept that stock prices may move abnormally over or under their underlying value and their fundamentals as a consequence of new information released, moving then slowly backwards to their “correct” price in the following chronic period. Herding occurs when public information contradicts private information of investors, expressed in the choice of following the mainstream movement and investment pattern deriving from public information in violation of privately-held information.

Keynes\textsuperscript{3} in 1930 argued about the motivation to imitate and join the crowd to avoid risk in times of uncertainty. He believed that herding and joining the mainstream market trend are the easy solutions to hide lack of information and expertise. In later papers, Keynes\textsuperscript{4} in 1936 and Keynes\textsuperscript{5} in 1937 worked in the psychological factors driving consumption and savings as well as the optimism and pessimism that affect the market sentiment with the corresponding influence in the stock market. He also identified that investors are affected by sociological factors, the tendency to follow up the market sentiment and fluctuations. Kahneman and Tveesky\textsuperscript{6} in a paper studying how investors react to new information, came to the realization that investors tend to change their strategy and beliefs by adjusting to newly released information and data while underestimating the value of older and more compiled information and data. De Bondt and Thaler\textsuperscript{7} were

\textsuperscript{3} Keynes J. M., (1930). In A treatise on money. London, UK: Macmillan
\textsuperscript{4} Keynes J. M., (1936). In The general theory of employment, interest and money. London, UK: Macmillan
among the first to undoubtedly demonstrate that there is overreaction and underreaction in stock markets making use of cumulative abnormal returns and winning-losing portfolios.

Combining all theories, Tomasz Schabek⁸ classifies into three types of stock price driving forces. i) Market Factors, the financial characteristics of companies, including market capitalization, market to book value relations, liquidity and betas. Market factors are the result of a great volume of literature with more distinguished researchers in this field Fama and French, ii) Macroeconomic Factors, which describe the sensitivity of stock markets to local and global macroeconomic variables such as GDP, inflation, unemployment, consumption, production. Important literature in this field originates from Fama and Chen, iii) Behavioral Factors, the group of factors that can’t be described as rational. It involves parameters that influence investor psychology and sentiment, often driving them to irrational behavior, pointed out by irregular stock prices movement and fluctuations. Renowned researchers in this field are Thaler, Shleifer and Statman.

Devenow and Welch⁹ in a paper issued in 1996 believed that there are 3 views of herding behavior. i) the irrational view that negotiates with the psychology of investors and the fact that people tend to mimic each other blindly resulting in herd behavior, ii) the near-rational view that investors make use of easy and immediate heuristics ways to acquire and process information and as a consequence form similar opinions and beliefs over the fundamentals and underlying value of a stock, iii) the rational view that describes herd behavior as a conscious solution to the lack of information, investment experience or analytical capability to provide an individual with its own conclusions. In another paper, Bikhchandani and Sharma¹⁰ differentiated between spurious herding which is the result of changes in stock fundamentals and information leading in a change in investment policy and intentional herding where investors mimic each other as a conscious choice and a deliberate strategy to negotiate risk.


A different optic emerged by De Bondt and Teh\footnote{De Bondt F.M. W., Teh L. L., (1997). Herding behavior and stock returns: An exploratory investigation. Swiss Journal of Economics and Statistics, Vol. 133, Issue 2, pp. 293–324} who stated that investor managers might follow the same investment patterns and herd in the stock market due to their similar and standardized education and previous professional backgrounds that concentrate and narrow down their reactions. Supporting that idea were Bennett, Sias, and Starks\footnote{Bennett J. R., Sias R., Starks L., (2003). Greener pastures and the impact of dynamic institutional preferences. Review of Financial Studies, Vol. 16, Issue 4, pp. 1203–1238} stating that herding can also be attributed to the small variety of investment strategies most investors use and the rational and expected investment reactions to stock market fluctuations.
2.2 Literature Review

Recent years have seen many papers and studies emerge in the area of behavioral economics. Mobarek, Mollah, and Keasey\(^\text{19}\) in a herding research using cross-sectional data for the European stock markets concluded that insignificant herding patterns were found in pre-crisis similar European markets and that herding patterns intensified during external shocks caused by the global financial crisis. In their research, southern European markets were more affected by the global financial crisis while the rest of continental Europe was affected mainly by the Eurozone debt crisis. In their paper for four Mediterranean stock markets Economou, Kostakis, and Philippas\(^\text{20}\) stated that Italian, Greek and Portuguese stock markets exhibited herding, with more intensity during upward market trends for Italy and Greece and during downward market trends for Portugal. Moreover, in Italy herding was mostly present in high trading volume, in Portugal in low trading volume and in Greece in both high and low trading volume. All herding intensified during the global financial crisis.

In Chinese stock market, Demirer and Kutan\(^\text{21}\) tested for evidence for herding in both individual stock returns and sector returns, finding no herding patterns. Another paper though, by Tan, Chiang, Mason, and Nelling\(^\text{22}\) came to different conclusions. Analyzing dual listed Chinese stocks, A-shares traded by domestic investors and B-shares traded by foreign investors, they argued that both types of shares demonstrated herding behavior. The herding was also more intense for A-shares during upward movement of the market with no asymmetry found in B-shares. In a research considering REIT market, Philippas, Economou, Babalos, and Kostakis\(^\text{23}\) using daily returns found herding behavior correlated with deterioration in investors’ sentiment and macroeconomic shocks to REIT funding conditions. Surprisingly, the global financial crisis did not have any herding effect in REIT market.


Economou, Gavriilidis, Kallinterakis and Yordanov\textsuperscript{24} in a more recent study about frontier markets, found that fund managers herded in both Bulgaria and Montenegro stock markets, with herd behavior more intense in upward market trends. They also attributed the herding behavior in informational and professional payoffs, with herding more present in the after-crisis era. Holmes, Kallinterakis, and Leite Ferreira\textsuperscript{25} in a paper about institutional herding in Portugal, came to positive results for herding behavior and concluded that it was intentional, originating from the drive for good reputation among professional investors.

Salamouris and Muradoglu\textsuperscript{26} checked for two forms of herding in analyst’s forecasting, the first form the possibility of herding in analysts’ forecasting towards the consensus feeling of the market and the second form in the possibility of herding in analysts’ compliance towards the forecasting of more experienced and accurate forecasters. They concluded that indeed analysts tended to herd by adjusting forecasting towards the market consensus and that they also tended to herd towards the best forecasters. In the process, they also discovered that forecasting accuracy increased positively with herding intensity. Peon Calvo and Antelo\textsuperscript{27} tested for herding in the bank sector and the creation of credit bubbles. Using biased banks, unbiased banks and excessive optimism they stated that optimistic banks lead the market, followed by unbiased banks herding rationally resulting in the creation of credit booms increasing risk, while arbitrage levels played a negative role in misallocations correction.

Searching for cross industry herding contagion and volatility spillovers, Ghorbel, Boujelbene and Boujelbene\textsuperscript{28} investigated returns for oil stocks, US stocks and oil importing/exporting countries’ stock markets during the oil shock of 2008/09. Their research showed an increase in time-varying correlation coefficients between prediction errors for oil stocks and market indices, attributing the effect to herding contagion between oil markets and stock markets during the oil shock time-period. They stated that investor sentiment and biased information lead to herding contagion increasing volatility transmission across markets and forecasting errors. Andrikopoulos, Hoefer and

**Kallinterakis**\(^{29}\) published a paper testing for herding behavior following stock market mergers into exchange groups. Analyzing before and after EURONEXT merger, their results pointed to a growth in herding significance in three out of four markets after the merger, but with a decline in momentum. The authors believed that increased transparency paved the way for investors to herd towards the more experienced and well-informed investors, while faster flow of information resulted in the decrease in herding behavior life-cycle.

**Galariotis, Rong, and Spyrou**\(^{30}\) concentrated in finding herding behavior when fundamental macroeconomic information is released. Their research in US and UK stock markets revealed that both markets exhibited herding behavior after fundamental information release and moreover that there were spillover effects from the US stock market to the UK stock market. During economic crisis, US stock market investors herded when new fundamental and non-fundamental information was released, while in the UK the effect was limited to only fundamental information and during only one crisis, the DotCom bubble. In an addition for bond markets, **Galariotis, Krokida and Spyrou**\(^{31}\) studied the yield-spreads in bonds across the Eurozone. They concluded that there was no herding behavior in bond markets but came to strong evidence than investors tended to herd in bond markets when fundamental information was released, a characteristic spurious herding, while there was also evidence for spillover effects in the Eurozone.

### 2.3 Shipping Sector

Despite the excessive literature on behavioral economics and their appliances, there are still many parts and sectors of the economy that haven’t been tested thorough. One such sector is the shipping industry and all related with it sectors. Shipping is a crucial link in the global economy and helps distribution and transportation of all kinds of commodities, goods and materials across the world. According to **UNCTAD**\(^{32}\), shipping is a global industry, transporting 9.84 billion tons of cargo across 160 countries in 2014, while it employs a fleet of 89,464 commercial ships with a total tonnage of 1.75 billion dwt.


One key characteristic of the shipping industry is that it is a derived demand, originating from the need for transportation services in order to produce commerce and manufactured goods, maximizing the potential of each region and each commodity. Shipping, being a derived demand, is affected by all fluctuations in the global economy as well as economic shocks. That, as a consequence, has branded shipping as a risky operation, with many investors unwilling to take up the challenge, resulting in a closed and mostly private industry until the shipping super-boom of 2004-2007 when there was a wave of shipping IPOs across the world.

The main force driving the prosperity and well-being of the shipping industry rests on the equilibrium of demand and supply for transport services. Supply is pretty straightforward, which is the global and local availability of ships and cargo capacity suitable for transport services. Demand for transport services however, is much more complicated and closely correlated with the world economic activity, including world GDP, trade growth, commodity availability and price, world production, external shocks etc. Stopford\textsuperscript{33} recognizes the equilibrium of supply and demand as the force behind the life-cycles of the shipping industry, with peaks, collapses, troughs and recoveries succeeding each other across the decades.

The shipping industry is divided into sectors, accordingly to the number of different types of cargoes it transports. Following that separation, it can be distinguished to these main sectors i) bulk shipping referring to products as iron ore, coal, grains, phosphates, sugar and others, ii) tanker shipping which transports liquid cargos such as oil, naphtha, oil products, chemicals, iii) container shipping that transports general cargo concentrated and loaded in containers, usually consumer and electronic goods, iv) LNG, LPG shipping that is used to transport liquefied natural gas and petroleum gases, v) other shipping sectors such as car/truck carriers (PCTC), cement carriers, forest product carriers, heavy load carriers etc. Beyond transport services, the shipping industry also includes sectors such as i) off-shore services to the petroleum industry, ii) shipyards and repair zones, iii) scrapping and demolition areas and iv) marine services including brokering, ship support services, cargo terminals/ports and others.

3. Data and Methodology

3.1 Data

Data for our research consists of daily returns for 94 shipping-related and publicly-listed companies across the world. That involves companies focused in transporting either bulk cargoes, liquid cargoes, gas cargoes, containers or car/truck cargoes as well as companies that offer parallel transport services for more than one of these types of cargoes. Moreover, we added companies that offer services and support to the off-shore industry, an ever increasing part of the shipping industry, while we also believe crucial is the addition of shipyard companies which are vitally linked to the fate and state of the shipping industry. Lastly, we complement our data with a few companies that focus on terminal operations and services to the shipping industry.

Data, as mentioned before, originates from public-listed companies from across the globe. That includes shipping companies from stock markets in Americas such as NYSE and NASDAQ stock exchanges, stock markets in Europe such as Oslo, Copenhagen and Brussels stock exchanges and finally stock markets in Asia, such as Hong Kong, Singapore, Korea, Tokyo and Shanghai stock exchanges. Total market capitalization for all 94 shipping companies in the sample was at the end of 2014 at 205.682 billion USD, almost ¼ of all shipping industry capitalization that was at 832 billion USD. The above figure can be divided to 33.890 billion USD market capitalization for the 26 shipping companies in Americas, 66.425 billion USD market capitalization for the 21 European
shipping companies and finally 105.365 billion USD market capitalization for the 47 Asian shipping companies. All information about the data structure can be found in Figure 1. For the purpose of our research, all stock return data is concentrated and divided into two major regions, western hemisphere and eastern hemisphere. Western markets include all Americas stock markets, mostly US, together with all European stock markets such as Oslo, Copenhagen, Brussels and London. On the other side, eastern markets include all Middle East stock markets together with all South and Southeast Asia stock markets like Tokyo, Shanghai, Korea, Singapore and Hong Kong.

Sample period for our data is a decade starting January 2005 and ending December 2014. Sample period will be strategically separated into three different sub-periods, covering three distinct chronic-periods in the shipping industry’s life-cycle. 2005-2007 covers an era of unprecedented growth and prosperity for the shipping industry, with shipping supply unable to follow shipping demand, resulting in huge profits for shipping companies and shipyards as a result of extended order lists. 2008-2010 is the chronic period of free-fall for the shipping industry, with global financial crisis curbing shipping demand and oversupply of ship capacity driving profits down, with many shipping companies facing liquidity problems and a significant drop in market capitalization. Finally, 2011-2014 is a period of on-going volatility for the shipping industry, originating from extended oversupply of ships as a result of the ship-building boom of previous years, while global demand was struggling to maintain a healthy pace with a negative outlook for most sectors of global economy. 2011-2014 was a stressful period for shipping companies, forcing them to adjust to new conditions and use unorthodox tactics in order to survive.

3.2 Methodology

Key research factor for herding analysis is cross-sectional statistical methodology. Cross-sectional analysis allows researchers to deduct results from a big pool of collected data, including different relevant variables over a specific time period. It is considered extremely useful in behavioral economics appliances as it allows informational data extraction describing investment attitude and behavior alterations expressed in investment changes. Christie and Huang[^34] believed that herding tends to appear more often and intense in chronic periods of market stress and volatility. That guided them to the separation to distinct chronic-periods in order to acquire better results through

research. They also argued that during sudden market fluctuations, more investors tend to herd around the average market consensus and as a consequence stock returns would most likely concentrate around the stock market average return, minimizing deviation from average market return. In the opposite situation, when no herding occurs, individual stock returns tend to distance themselves from the average stock market return as a result of rational investment policy for each individual stock following maximum utilization of available information.

The main tool Christie and Huang\(^{35}\) used in their research for herding in US stock market was Cross-Sectional Standard Deviation (CSSD). CSSD employs standard deviation as a benchmark in order to detect equities’ behavior and determine whether or not stocks returns are herding towards a market average or whether they follow separate trajectories based on their fundamentals. If stocks are engaged in herding behavior, they should yield similar returns grouped around the market average and therefore standard deviation describing return spreads should be minimizing, resulting in small CSSD values. Adding to that notion, Chang, Cheng and Khorana\(^{36}\) in their paper regarding herding in US, Hong Kong, Japan, South Korea and Taiwan stock markets decided to make use of Cross-Sectional Absolut Deviation (CSAD) of individual stock returns and market return. CSAD, instead of employing standard deviation as a benchmark, follows a more straightforward approach by utilizing absolute stock return deviation from market average return. By examining the behavior of CSAD values and market return, it is possible to determine if there are herding patterns. CSAD can be calculated using the following equation:

\[
CSAD_t = \frac{1}{N} \sum_{i=1}^{N} |R_{i,t} - R_{m,t}|
\]

N is the number of stocks

\(R_{i,t}\) is the return of stock i at time t

\(R_{m,t}\) is the cross-sectional average return of N stocks at time t.


In herding cases, all stocks exhibit almost identical return behavior, which leads in small stock return deviations from the average market return. Consequently, the absolute deviation $|R_{i,t} - R_{m,t}|$ between individual stocks’ return and average market return should be minimal at the appointed time of herding occurrence and as a result, CSAD measure should demonstrate an abnormal decrease in its values, hence justifying herding hypothesis. If stocks do not herd but instead demonstrate individually unique movements based on their fundamentals, then their returns should be loosely scattered away from market average, resulting in high absolute deviations $|R_{i,t} - R_{m,t}|$ described by high CSAD measurements.

Following the estimation of CSAD, we will use a method same to Galariotis, Krokida and Spyrou$^{37}$ in order to check for different patterns when the market is up and when the market is down, estimating the following regressions:

$$CSAD_{t}^{UP} = \beta_0 + \beta_1^{UP} |R_{m,t}^{UP}| + \beta_2^{UP} (R_{m,t}^{UP})^2 + \epsilon_t$$

$$CSAD_{t}^{DOWN} = \beta_0 + \beta_1^{DOWN} |R_{m,t}^{DOWN}| + \beta_2^{DOWN} (R_{m,t}^{DOWN})^2 + \epsilon_t$$

$CSAD_{t}^{UP}$, $CSAD_{t}^{DOWN}$ is the Cross Sectional Absolute Deviation of returns at time $t$ when the market is upward or downward.

$|R_{m,t}^{UP}|$, $|R_{m,t}^{DOWN}|$ is the absolute value of the positive or negative market portfolio return at day $t$.

$(R_{m,t}^{UP})^2$, $(R_{m,t}^{DOWN})^2$ is the squared positive or negative market return at day $t$.

Regression models are highly functional tools in detecting correlations among relevant variables. They are widely used to provide reliable data describing the relationship among dependent and independent variables, and more specifically whether a dependable variable is influenced by one or more independent variables and in what way, while also providing crucial information about how statistically important those results are. In

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behavioral economics, researchers like Chang, Cheng and Khorana\textsuperscript{38} have used regression models in their article about stock market herding in order to estimate whether CSSD and CSAD values are correlated with average market return, with positive results in their hypothesis whether herding does occur or not. Galariotis, Krokida and Spyrou\textsuperscript{39} also employed regression models to determine if CSAD values and consequently return yields for European bonds are influenced by market sentiment and investor psychology, determining that bond yields do exhibit herd behavior but only when fundamental information such as interest changes from central banks occur.

In cases of no herding behavior, relationship between average market portfolio returns and stock return deviations from market average (CSAD) should be linear and increasing. That can be attributed to efficient market theory and the notion that investors take into account all available information and decide individually for each stock, the movement of which expresses its underlying value and fundamentals. If market absolute average return increases, then individual stocks’ return deviations should also be increasing, resulting in a positive and linear correlation between CSAD values and absolute average market return. Chiang and Zheng\textsuperscript{40} argued that in extreme market conditions, investors tend to herd leading to similar investment strategies. As a consequence, they follow the average market sentiment and therefore stock return dispersions cluster close to the market average. As a result, using regression models, CSAD values should decrease when absolute market average and squared market average increase, a typical extreme market condition. That would lead to a negative and statistically important $\beta_2$ coefficient in the regression model. Separation to two groups aims in detecting asymmetries in stock behavior between days that the markets is positive and the market is negative, as a means to better describe how different market sentiment might influence stock behavior.

Validity and statistical importance for results occurring by the regression models will be decided using P-values, a statistical method to provide evidence against the null hypothesis, hypothesis being the assumption leading to a scientific research. In the current herding regressions null hypothesis is the absence of any herding effect, requiring small values for P-value to reject that hypothesis, thus determining the presence of herding effects.

Finally, in order to test for herding spillover effects, we use a method Chiang and Zheng\footnote{Chiang T. C., Zheng D., (2010). An empirical analysis of herd behavior in global stock markets. Journal of Banking and Finance, Vol. 34, Issue 8, pp. 1911–1921} first developed in their paper about US, Latin America and Asian stock markets and spillover effects among markets positively detecting such effects, by using the following regression:

\[
CSAD_{i,t} = \beta_0 + \beta_1 |R_{market\ i,t}| + \beta_2 R^2_{market\ i,t} + \beta_3 R^2_{market\ j,t} + \varepsilon_t
\]

\(CSAD_{i,t}\) is the Cross Sectional Absolute Deviation of returns in i “destination” market at time t

\(|R_{market\ i,t}|\) is the absolute value of average “destination” i market return at day t

\(R^2_{market\ i,t}\) is the squared average “destination” i market return at day t

\(R^2_{market\ j,t}\) is the squared average “origin” j market return at day t

In cases of one market causing herding behavior in the other, then coefficient \(\beta_3\) describing the relationship between “origin” market squared average returns and CSAD values in the affected market should be negative and statistically important. That would imply that increased volatility in the first market depicted in increased absolute average market return affects another market by forcing investors to herd and therefore minimize stock return dispersion around that market’s average return (CSAD). P-values will again be employed in order to decide results validity and significance, with null hypothesis being the absence of herding spillover effects, requiring again low p-values to reject null hypothesis and positively detect herding spillover effects.

### 4. Results

Figures 2 to 4 are the presentations for CSAD values over time for all markets, eastern markets and western markets respectively. It is easily noted that all three markets exhibit mostly the same behavior, with a distinctive spike in CSAD values for all three aggregate...
markets during the 2008-2009 global financial crisis. In figure 2, CSAD values that determine herding occurrence in worldwide shipping stocks are negative towards that hypothesis. In the figure in question, CSAD values remain mostly constant throughout the decade under investigation, with increased CSAD values in mid-2006, second half of 2007 and Q1 of 2008 while there is an immediately noticeable CSAD values spike in late 2008 and first half of 2009 that can be attributed to the global financial crisis. Moreover, global shipping stock CSAD values were also higher than normal during late 2011 and

![Figure 2. Cross Sectional Absolute Deviation (CSAD) over time, All markets, Source : Authors’ Calculations](image)

almost all through 2012 and 2013, the period of the Eurozone debt crisis climax with a significant increase in late 2014 as well. The main conclusion from this graph is that shipping stocks did not herd at any instance during the decade under investigation, while their CSAD values imply a better described as an anti‐herding behavior especially during the global financial crisis and Eurozone debt crisis. If any herding had occurred, CSAD values should have drastically decreased during the herding period, with no such evidence on the graph.

Eastern markets in figure 3 demonstrate some volatility in CSAD values in the pre-crisis time-period, mostly concentrated in Q2 2006 and all 2007 to mid-2009 with significantly increased values in early 2008 and late 2008 together with the first half of 2009. Those increased CSAD values can be linked to the volatility that affected most Asian stock markets during that time period while the global financial crisis resulted in a highly
increased dispersion in stock returns and consequently CSAD values in late 2008, a characteristic anti-herd behavior. A brief increase in CSAD values in early 2010 and a number of increased CSAD values during 2011 and early 2012 can be attributed to the global unrest and fear that the Eurozone debt crisis was causing in eastern stock markets, with the same conclusion that during stressful periods, investors mostly diversified strategies considering eastern shipping stocks instead of herding.

**Figure 3. Cross Sectional Absolute Deviation (CSAD) over time, Eastern Markets,**
**Source : Authors’ Calculations**

Results from CSAD equation
Eastern markets : Asia stock markets

Contrary to eastern markets, western markets depicted in figure 4 exhibit slightly higher CSAD variability after the 2008-2009 financial crisis era and not before it. More specifically, during the years of the European debt crisis lasting from H2 of 2011 up until early 2014, investors diversified investment strategies for western shipping stocks, resulting in increased dispersions from average market return and higher CSAD values, together with the distinctive rise in CSAD values during the global financial crisis in late 2008 and early 2009. Western shipping markets stock behavior can also be described as anti-herding during stressful periods. The main finding for all three aggregate markets’ CSAD values is that stock return deviations increased significantly during stress times such as the global financial crisis and the Eurozone debt crisis, indicating a diversification in investment strategies and surprisingly mostly anti-herd behavior as CSAD values increased instead of falling as they would be doing in herding events.
Figure 4. Cross Sectional Absolute Deviation (CSAD) over time, Western Markets,
Source: Authors’ Calculations

Results from CSAD equation
Western markets: Americas and Europe stock markets

Results from regressions also support that notion. Key indicator is coefficient $\beta_2$. Coefficient $\beta_2$ is the parameter describing the relationship between CSAD values and average market returns. If herding effects do exist, individual stock returns should tend to group close to the market average, minimizing deviation from market average and consequently exhibit low CSAD values. Therefore, in herding behavior, $\beta_2$ coefficient should be negative, following the notion that stock deviations lessen during herding and increase in normal conditions, a direct result of perfect markets and asset pricing models.

Table 1 groups results for positive markets while table 2 represents results for negative markets. In table 1, panel A are the results for regression CSAD$^{UP}$ using CSAD values for all markets and the aggregate market portfolio consists of all sample markets, panel B presents results for regression CSAD$^{UP}$ using CSAD values from eastern markets and the aggregate market portfolio consists of all sample markets and panel C presents results for regression CSAD$^{UP}$ using CSAD values from western markets and the aggregate market portfolio forms from all sample markets. Following those results, panel D concentrates results for regression CSAD$^{UP}$ with CSAD values for eastern markets and the aggregate market portfolio consists of eastern markets and panel E groups results for regression CSAD$^{UP}$ using CSAD values from western markets and the aggregate market portfolio consists of western markets. Western markets consist of American and European stock markets while eastern markets comprise of Asian stock markets.
Table 1. Herding in Positive Markets, Source: Authors' Calculations

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<td><strong>Panel A</strong></td>
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<tr>
<td>β₁</td>
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<td>β₁</td>
<td>β₂</td>
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<td>(0.0989)</td>
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<td>β₁</td>
<td>β₂</td>
<td>β₁</td>
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<td>(0.9691)</td>
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<td><strong>Panel C</strong></td>
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<td>(0.9623)</td>
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<td>P Value</td>
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<td>(0.2727)</td>
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Results from CSAD; supregression
All markets: Western & Eastern markets, Western markets: Americas and Europe stock markets, Eastern markets: Asia stock markets

In order to positively identify herding behavior, β₂ coefficient should be negative and statistically significant, indicating a negative relationship between squared average market return increases, implying extreme market conditions, and stock dispersions around the market average, thus herding. In positive market days, results do not reveal
any herding patterns at any chronic period or specific market. Most $\beta^2$ coefficient values are positive and between 0 and 0.1 indicating a linear and positive relationship between squared average market returns and CSAD values, not a herding behavior. There are some negative values for $\beta^2$ coefficient in western markets and aggregate market portfolio all markets for 2005-2007 (-0.0001) and 2008-2010 (-0.0060) time periods, but the results are statistically insignificant as p-values are high (0.9623 and 0.6871 respectively). Moreover, some negative $\beta^2$ coefficient values appear in 2005-2007 (-0.0041) and 2011-2014 (-0.0009) chronic periods for aggregate eastern market portfolio but again results are statistically insignificant as p-values are again high (0.8212 and 0.9691).

Regression results for negative markets are collected in table 2. Panel A groups results for regression $\text{CSAD}_{\text{DOWN}}$ using CSAD values for all markets and aggregate market portfolio is all markets, panel B presents results for regression $\text{CSAD}_{\text{DOWN}}$ with CSAD values for eastern markets and aggregate market portfolio all markets and panel C presents results for regression $\text{CSAD}_{\text{DOWN}}$ using CSAD values for western markets and aggregate market portfolio forms from all markets. Moreover, panel D collects results for regression $\text{CSAD}_{\text{DOWN}}$ with CSAD data from eastern markets and aggregate market portfolio consists of eastern markets and panel E presents results for regression $\text{CSAD}_{\text{DOWN}}$ using CSAD values of western markets and aggregate market portfolio forms from western markets. Western markets, as before, include American and European stock markets with eastern markets forming from Asian stock markets.

In order to successfully detect herding events, $\beta^2$ should be negative and statistically important, indicating that when absolute average market return and consequently squared average market return increases, described as extreme market conditions, then CSAD values decrease, a clustering effect towards the market average return. As in positive markets, results indicate no herding effects for negative markets as well. Again, most $\beta^2$ coefficient values are between 0 and 0.1, a positive and linear relationship between squared average market returns and CSAD values but not a herding behavior. Some negative values for $\beta^2$ coefficient for eastern markets and aggregate market portfolio all markets in 2008-2010 (-0.0022) and 2011-2014 (-0.0028) time periods and western markets and aggregate market portfolio all markets in 2005-2007 (-0.0013) time periods are again statistically insignificant as p-values are once more high (0.8628, 0.8519 and 0.9708 respectively). Also, negative values for $\beta^2$ coefficients in eastern markets with aggregate market portfolio eastern markets in 2008-2010 (-0.0016) and western market with aggregate market portfolio western markets in 2011-2014 (-0.0023) are statistically not significant with high p-values (0.8427 and 0.7899) and therefore ignored.
Table 2. Herding in Negative Markets, Source: Authors’ Calculations

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<thead>
<tr>
<th></th>
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<th>Eastern Markets</th>
<th>Western Markets</th>
</tr>
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<tbody>
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<td>Market Portfolio</td>
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<tr>
<td>All Markets</td>
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</tr>
<tr>
<td><strong>Panel B</strong></td>
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<td>Market Portfolio</td>
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<td>All Markets</td>
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<tr>
<td><strong>Panel C</strong></td>
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<tr>
<td>All Markets</td>
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</tr>
<tr>
<td><strong>Panel D</strong></td>
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<td>Eastern Markets</td>
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<td><strong>Panel E</strong></td>
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<td>Western Markets</td>
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<table>
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<th>β1</th>
<th>β2</th>
<th></th>
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<th>β2</th>
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<th>β2</th>
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<td>0.0147</td>
<td>2005-2014</td>
<td>0.3898</td>
<td>0.0099</td>
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<td>(0.0320)</td>
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<td>(0.0000)</td>
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<td>P Value</td>
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<td>2008-2010</td>
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<td>2008-2010</td>
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<td>P Value</td>
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<td>(0.1474)</td>
<td>P Value</td>
<td>(0.0000)</td>
<td>(0.8519)</td>
<td>P Value</td>
<td>(0.0002)</td>
<td>(0.0232)</td>
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</table>

Results from CSAD,\(^\text{DOWN}\) regression

All markets: Western & Eastern markets, Western markets: Americas and Europe stock markets, Eastern markets: Asia stock markets
Separation to positive and negative markets intended to detect asymmetries in market behavior in different situations and market movements. Following the negative results for herding behavior, in an attempt to further search for any herding effect for full samples, without the separation into positive and negative markets, we employed regression

\[ CSAD_t = \beta_0 + \beta_1 |R_{(m,t)}| + \beta_2 R_{(m,t)}^2 + \epsilon_t \]

used in previous researches for herding effects, such as one from Economou, Kostakis and Philippas\(^{42}\). Results for full sample regressions also failed to demonstrate any patterns for herding behavior, further supporting our results for regressions CSAD\(^{UP}\) and CSAD\(^{DOWN}\), indicating absence of herding effects.

In spillover regression results, table 3 groups all variations for herding spillover possibilities. Panel A is results for spillovers from eastern markets to all, employing CSAD data from all markets, aggregate market portfolio consists of all markets and spillover market third term is an eastern markets portfolio while panel B presents results for spillover effects from western markets to all, using CSAD data from all markets, aggregate market portfolio forms from all markets and spillover market third term is a western markets portfolio. Covering the other two possibilities, panel C provides data for herding spillovers from eastern markets to western, using CSAD data from western markets, aggregate market portfolio forms from western markets and the spillover third term consists of eastern markets portfolio while panel D is results for herding spillovers from western markets to eastern, employing CSAD data from eastern markets, aggregate market portfolio consists of eastern markets and the spillover third term forms from western markets portfolio. Once more, western markets are American and European stock markets and eastern markets consist of Asian stock markets.

Table 3. Herding Spill-overs, Source: Authors’ Calculations

<table>
<thead>
<tr>
<th>Panel A</th>
<th>Eastern Markets to All</th>
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<tr>
<td></td>
<td>β2</td>
<td>P Value</td>
<td>β3</td>
<td>P Value</td>
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<td>(0.0558)</td>
<td>0.0026</td>
<td>(0.5256)</td>
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<td>2005-2007</td>
<td>-0.0374</td>
<td>(0.1447)</td>
<td>0.0324</td>
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<td>2008-2010</td>
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<td>(0.7464)</td>
<td>0.0274</td>
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</table>

| Panel B                       | Western Markets to All |          |          |          |          |          |          |
|                               | β2                    | P Value  | β3       | P Value  |          |          |          |
| 2005-2014                     | -0.0083               | (0.3060) | -0.0041  | (0.2788) |          |          |          |
| 2005-2007                     | -0.0053               | (0.8027) | 0.0719   | (0.0000) |          |          |          |
| 2008-2010                     | -0.0183               | (0.0599) | 0.0171   | (0.0000) |          |          |          |
| 2011-2014                     | -0.0676               | (0.0000) | 0.0509   | (0.0000) |          |          |          |

| Panel C                       | Eastern Markets to Western |          |          |          |          |          |          |
|                               | β2                    | P Value  | β3       | P Value  |          |          |          |
| 2005-2014                     | -0.0041               | (0.4595) | -0.0002  | (0.9273) |          |          |          |
| 2005-2007                     | 0.0481                | (0.0129) | 0.0201   | (0.0000) |          |          |          |
| 2008-2010                     | 0.0010                | (0.8670) | 0.0259   | (0.0000) |          |          |          |
| 2011-2014                     | -0.0147               | (0.0746) | 0.0235   | (0.0001) |          |          |          |

| Panel D                       | Western Markets to Eastern |          |          |          |          |          |          |
|                               | β2                    | P Value  | β3       | P Value  |          |          |          |
| 2005-2014                     | -0.0061               | (0.2715) | -0.0014  | (0.5768) |          |          |          |
| 2005-2007                     | -0.0041               | (0.7661) | 0.0504   | (0.0000) |          |          |          |
| 2008-2010                     | 0.0011                | (0.8601) | 0.0167   | (0.0000) |          |          |          |
| 2011-2014                     | -0.0061               | (0.6478) | 0.0150   | (0.0004) |          |          |          |

Results from CSAD\textsubscript{1,t} regression
All markets: Western & Eastern markets, Western markets: Americas and Europe stock markets, Eastern markets: Asia stock markets

In spillover regression, key coefficient is β3. It describes the relationship between “origin” market and affected market in an attempt to detect herding spillover effects, and more specifically whether normal or abnormal market movements, such as herding, in one region have an impact or influence another region. In order to positively detect herding spillover effects, coefficient β3 should be negative and statistically important, implying that extreme market conditions depicted as squared market average increases in
“origin” market affect negatively CSAD values in the destination market, a typical clustering of stock returns around market average, a textbook herding behavior.

As depicted in table 3, no such evidence is produced in our research. Almost all $\beta_3$ coefficients are slightly positive above zero, indicating a linear and positive relationship between squared average market returns from “origin” markets and CSAD values in affected markets, not a herding spillover behavior. Two negative $\beta_3$ coefficient values in full sample regression for eastern to western (-0.0002) and western to eastern (-0.0014) herding spillover effects are statistically insignificant with high p-values (0.9273 and 0.5768) while a negative $\beta_3$ value for regression for western to all markets (-0.0041) is on the limit of being classified as statistically important and valid as it has a mid-low p-value (0.2788). As a conclusion, we determine that results do not reveal any herding spillover effects at any time-period tested.

Empirical finds and the absence of herding behavior and herding spillover effects are quite intriguing and raise interesting questions as why that happens. Authors have reached three major assumptions as why the shipping industry exhibits no herding behavior and no herding spillovers among markets.

i) The shipping industry is a global and derivative market. Shipping markets are separated in several unique and distinctive sub-regional markets and categorized in a great variety of possible cargoes and commodity transportation services. Economic shocks in a particular country or abnormal fluctuations in a specific commodity are not enough to upset the whole of the shipping industry. Shipping transportation services deal with global trade and operate across the world, granting them a certain level of immunity to economic events that drastically affect other industries. In the global economy, someone’s loss is someone else’s gain, thus need for transportation services is always present and of great importance, minimizing sudden stock shocks and therefore herding in the shipping industry.

ii) The main drive behind the fortune of shipping companies and shipping stocks movements is the balance of shipping capacity supply and world transportation demand, mainly depicted in fleet utilization rate. Both of these values are long-termed and cannot be drastically altered in a small period time, allowing shipping managers to successfully predict their future trajectory, adapt to them, recalibrate their strategy and move to correcting
actions in accordance to the future movement of shipping supply and demand. As a result, shipping companies and consequently shipping stocks are mainly well-prepared for the upcoming market trends, making them less likely to exhibit herding behavior.

iii) Shipping industry is a highly complex and heavily correlated market, taking into account a great number of market variables from all global regions and sub-regions and economic values and indexes originating from all sectors of the economy and world financial status. As a result, the shipping industry was long depicted as volatile and risky for the average investor, leading shipping stocks to not been classified in the first line of choice for investing and trading. Investing in shipping stocks was mainly left to highly qualified traders and specialized investment funds. Traders and managers specialized in shipping investment departments and funds are well-informed, highly qualified and usually long involved in the shipping industry and financial details. That builds up to long-term investment policies, taking into account all economic variables and fundamental information and therefore shipping stock traders and investors are less likely to be carried away and participate in herding behavior, the quite opposite of long-term and well-planned decision making, much needed and characteristic for the shipping industry.

5. Conclusions

Further understanding for the shipping sector in general and better description for shipping stock fluctuations specifically were the driving reasons behind the conduct of this paper. The main objective was to test whether shipping stocks are influenced by psychological factors and market sentiment or not and to what extent, in order to provide investors and managers detailed and useful results easing their work and allowing them to adapt to and predict future market movements. Moreover, the current paper was carefully organized and thoughtfully planned with the purpose of been a valuable addition to an extensive literature covering behavioral economics, attempting to shed light to an industry not yet researched for behavioral economics appliances and phenomena.
Towards that purpose, authors employed well-documented and widely used statistical tools such as CSAD estimations and regression models with the intent of checking shipping stocks for herding effects, abnormal stock movements derived by psychological and sentimental origins as well as spillover effects among markets caused by sentiment transfer among different stock markets with focus in shipping stocks. Results of the extensive research strongly indicate that no herding effects occurred in the shipping sector during the examined time-frame. Statistical tools and research methods such as CSAD indicator and regression analysis together with P-values provide a high level of confidence for the validity of the above results while empirical evidence determined that no herding behavior was detected in the full shipping sector sample or any of the two regional, eastern and western, samples at any chronic period. In addition, further analysis was negative in any herding spillover possibility for all origin-end market combinations. The absence of herding behavior may lie in unique features that characterize the shipping sector as an industry while the complexity and expertise in the shipping industry are certain factors behind stock market movements and stock return patterns.

Results are quite intriguing, revealing an entirely different to expectations anti-herd stock behavior, especially during extreme market conditions and stressful periods such as the global financial crisis. Previous equity markets articles have in most cases concluded about positive results in herding and spillover hypothesis, marking shipping industry as an odd divergent of the norm of previous researches. Consequently, finds of the current research lead to further questions, mostly concerning the possibility of an adjusted and more short-termed point of view to future tests including intraday shipping stock fluctuations and asymmetries in volume-oriented focus while commodity prices and fundamental information releases like interest rates and quantitative easing programs are interesting spillover test candidates.
6. References


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